PROPOSED NONPARAMETRIC TESTS FOR THE UMBRELLA ALTERNATIVE IN A MIXED DESIGN FOR BOTH KNOWN AND UNKNOWN PEAK

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The supervisory committee certifies that this dissertation complies with North Dakota State University's regulations and meets the accepted standards for the degree of

DOCTOR OF PHILOSOPHY

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ABSTRACT

In several situations, and among various treatment effects, researchers might test for an umbrella alternative. The need for an umbrella alternative arises in the evaluation of the reaction to drug dosage. For instance, the reaction might increase as the level of drug dosage increases, where after exceeding the optimal dosage a downturn may occur. A test statistic used for the umbrella alternative was proposed by Mack and Wolfe (1981) using a completely randomized design. Moreover, an extension of the Mack-Wolfe test for the randomized complete block design was proposed by Kim and Kim (1992), where the blocking factor was introduced. This thesis proposes two nonparametric test statistics for mixed design data with k treatments when the peak is known and four statistics when the peak is unknown. The data are a mixture of a CRD and an RCBD.

A Monte Carlo simulation is conducted to compare the power of the first two proposed tests when the peak is known, and each one of them has been compared to the tests that were proposed by Magel et al. (2010). Also, it is conducted to compare the power of the last four proposed tests when the peak is unknown. In this study, we consider the simulation from exponential, normal and t distributions with 3 degrees of freedom. For every distribution, equal sample sizes for the CRD portion are selected so that the sample size, n, is 6, 10, 16 and 20. The number of blocks for the RCBD are considered to be half, equal and twice the sample size for each treatment. Furthermore, a variety of location parameter configurations are considered for three, four and five populations. The powers were estimated for both cases, known and unknown peak.

In both cases, the results of the simulation study show that the proposed tests, in which we use the method of standardized first, generally perform better than those with standardized second. This thesis also shows that adding the distance modification to the Mack-Wolfe and Kim-Kim statistics provides more power to the proposed test statistics more than those without the application of the distance modification.

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DEDICATION

Losing one of your parents or both is a hard thing to deal with in this life. I lost my father more than seventeen years ago, but I live with his soul, which gives me all the support and inspiration. I dedicate this dissertation to my father (May Allah be merciful to him), and I hope this work makes you happy wherever you are. Also, this dissertation is lovingly dedicated to my beloved mother who motivates me all the time with her support, encouragement, prayers, lovely words and constant love, which have sustained me throughout my life. I hope that I make my mother happy too. I hope that I make both of my parents proud of me. I would like to dedicate my work to my brothers: Dr. Ahmad Alsohabi, Mr. Abadel Alghubaishi, Mr. Omar Alghubaishi, Dr. Ebrahim Alsohabi, all of my seven sisters, my nephews and my nieces for their unwavering support and encouragement since I have started my education's journey to the USA. Also, I would like to dedicate my work to my beloved wife Fatimah Alghanmi and my kids Rashed, Ahmed, Aseel, Omar, and Alma, and thank you for supporting me and for being patient. I also dedicate my work to my closest friend in this life Mr. Omar Almajdouie, for his ongoing support and encouragement.

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1. INTRODUCTION

Interest in testing for an umbrella alternative has increased for some researchers. There are many cases in which the researchers may want to use an umbrella alternative. For example, in testing the reaction or the effectiveness of increasing the dosage level of the drug, we might have positive reaction or outcomes, but after a certain dosage level, we might have positive outcomes that are less favorable than before. Another example of using the umbrella alternative is that with increasing age, someone's performance tends to improve, but after some point, advancing age tends to mean a diminishment in performance (Kim & Kim, 1992). Moreover, the need for an umbrella alternative appears in testing the effect of fertilization on the rate of crop yield or growth. Thus, when we increase the amount of fertilizer, there might an increase in the crop growth rate, but this rate of crop growth might decrease after reaching the maximum amount of fertilizer. In these instances, the null hypothesis of our interest is:

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k \tag{1.1}$$

against the alternative

$$H_1 : \mu_1 \leq ... \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq ... \geq \mu_k$$

with at least one strict inequality. Due to the pictorial configuration of the $\mu' s$ (the means $\mu' s$ have up and down ordering), the label of umbrella was given to this alternative by Mack and Wolfe (1981). Here, p is called the turning point or the peak point by Mack and Wolfe (1981). Of note, on one side of the peak p, the means are non-decreasing, and they are decreasing on the other side. Based on a completely randomized design, the procedure for testing the umbrella alternative for the nonparametric case, in which the underlying distributions are unknown, was developed by Mack and Wolfe (1981). The Mack-Wolfe test statistic uses the pairwise Mann and Whitney (1947) statistics. A more detailed discussion of the Mack-Wolfe test is given in Chapter 2.

In some cases when the blocking factor is introduced, the researchers maybe interested in testing for the umbrella alternative. Thus, a randomized complete block design is used. For instance, when we examine the effect of a drug, a blocking factor could be the patients. Similarly, in testing the impact of advancing age on someone's performance, the person, their weight or their athletic status could be a blocking factor. Furthermore, in examining the effectiveness of increasing the amount of fertilizer on the rate of crop growth, a location or plot might be introduced as a blocking factor. Based on randomized complete block design, the procedure for testing the umbrella alternative was proposed by Kim and Kim (1992). This procedure is an extension of the Mack-Wolfe test and will be discussed in detail in Chapter 2.

When performing an experiment and conducting a hypothesis test, researchers need to decide on the experimental design to be used (the design structure of the test). Usually, they prefer to deal with just one single design. However, it is possible that the researchers might start with one design structure for the test, but they may have to change the design structure for some reason or another before the experiment is completed. As a matter of fact, for researchers, changing the design structure makes challenges. One possible scenario where a research design might shift unexpectedly is investigating the effect of a variety of fertilizers on different locations. That would be an effort to improve the crop yield rate in every location. In this case, the researcher would plan on a randomized complete block design. However, the researcher would realize after a while that the design is too expensive (costing a lot of effort and money) to continue or the researcher could run out of blocks with enough experimental units, so at this point the researcher would switch from applying the variety of fertilizer on each location to randomly assigning fertilizers to crops. The portion of the crops in each location would form the RCBD portion, while the crops which were not related to any location would be the CRD portion of the study. In a case such as this we would end up with a mixed design, having an RCBD portion and a CRD portion. An example of such a mixed design is given in Figure 1. An "X" denotes that no observation is taken.

	Fertilizer1	Fertilizer2	Fertilizer3	Fertilizer4	Fertilizer5
Location 1	1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}
Location 2	1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}
Location 3	1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}
Location 4	1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}
Location 5	1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}
Location 6	X	X	3^{rd}	X	X
Location 7	1^{st}	X	X	X	X
Location 8	X	X	3^{rd}	X	X
Location 9	X	2^{nd}	X	X	X
Location 10	X	X	X	X	5^{th}
Location 11	X	X	X	4^{th}	X
Location 12	X	2^{nd}	X	X	X
Location 13	1^{st}	X	X	X	X
Location 14	X	X	X	X	5^{th}
Location 15	X	X	X	4^{th}	X

"X" represent a missing observation.

Figure 1.1. Example of mixed randomized complete block design and completely randomized design.

A complete randomized block design is required to perform Kim and Kim's (1992) test; however, in Figure 1, we do not have the RCBD. In the case that Kim and Kim's test were to be used, a portion of the observation would be ignored, particularly the extra observations from the completely randomized design. However, doing this can be a waste of resources, of your time and effort. However, most importantly, it is wasting data and information that are available at hand, which could change the result of the study.

The conception of the mixed design was proposed by Dubnicka, Blair, and Hettmansperger (2002). They proposed a test where the data are a mixture of a two-sample design, in which the design is a mixture of paired observations and independent samples. Basically, the idea of mixing two sample designs, which was suggested by Dubnicka et al. (2002), combines the Wilcoxon-signed rank test statistic for paired data and the Mann-Whitney test statistic for two independent samples.

Furthermore, Magel, Terpstra, Canonizado, and Park (2010) developed the idea of Dubnicka et al. (2002) to propose two test statistics for umbrella alternative, which are called non-modified tests in this thesis, in the situation where the peak p is known, considering 3 or more mixed samples of completely randomized design and randomized complete block design. In this thesis, in the case of having known umbrella peak, we compare our first two proposed tests, in which we apply the distance modification, with Magel et al. (2010)'s tests, which called Non-Modified tests.

Hettmansperger and Norton (1987) proposed a class of rank test versus the patterned alternative. Subsequently, Shi (1988) suggested a rank test statistic comparable to the test statistic proposed by Hettmansperger and Norton (1987) with the use of various weighting schemes. All test statistics mentioned above are designed for the known peak first; then, they have been developed in case of the unknown peak. Mack and Wolfe (1981) suggested an estimation of the peak to be at the population which maximizes the collection of combined Mann-Whitney statistics. Shi (1988) and Hettmansperger and Norton (1987) suggested an estimation of the peak to be at the population which maximizes their test statistics. There are several related works that can be considered as an extension of estimating the peak and can be found in Chen and Wolfe (1990), Chen (1991) and Buning and Kössler (1997). Milen and Wolfe (2005) used a simulation study to introduce a suggested modification of the Mack-Wolfe test, and they compared their test statistic with the test statistic proposed by Mack and Wolfe (1981), and with the test statistic proposed by Hettmansperger and Norton (1987).

Neuhauser, Liu, and Hothorn (1998) proposed a test statistic for the ordered alternative, considering the differential weighting of the Mann-Whitney statistic in the Jonckheere (1954) and Terpstra (1952)'s statistic. They found that their proposed test statistic is better in performance than the Jonckheere (1954) and Terpstra (1952) test statistic. Accordingly and motivated by the results of Neuhauser et al. (1998), Esra and Fikri (2016) developed tests for the umbrella alternative in the cases of the known and unknown peak for completely randomized design, in which they applied the distance modification to the Mack and Wolfe (1981)'s test statistics. Their proposed tests are based on linear ranks and are easy to apply in practice.

In this thesis, motivated by the idea of Dubnicka et al. (2002) and Magel et al. (2010) of combining test statistics and by the weighting modification suggested by Esra and Fikri (2016), we propose six different versions of the test statistics for the umbrella alternatives considering both cases, known and unknown peaks. For the situation of the unknown peak, we used the idea of estimating the peak that was proposed by Chen and Wolfe (1990) and Chen (1991), in which they suggested an estimation of the peak to be at the population which maximizes the standardized version of their test statistics. Power comparisons will be presented between the proposed test statistics.

In the next chapters of this thesis, we present a review of the literature on nonparametric statistical tests used in analyzing data, where the data layout is CRD, RCBD and mixed designs. In Chapter 3, the descriptions of the six proposed test statistics are given. In Chapter 4, there are details on the simulation study. In Chapter 5, the results obtained from the simulation study are illustrated using tables. Finally, Chapter 6 contains the discussion and conclusions about the proposed test statistics and when they should be used in relation to different situations.

2. REVIEW OF LITERATURE

A nonparametric test is one of the statistical tests that require no or few (very limited) assumptions to be made about the distribution of the data being studied. Due to that, nonparametric tests are occasionally called distribution-free tests. Rather than using the raw data in obtaining the test statistics, the ranks are used in obtaining the tests statistics. In this chapter, we present a review of some of the nonparametric tests in which the location parameter of three, four and five populations are compared. The general form of the null hypothesis (H_0) is where the effects of the samples (treatments) are assumed to be the same. $H_0 : \mu_1 = \mu_2 = ... = \mu_k$ where μ_i is the location parameter of the i^{th} population. The alternative hypothesis may take the form of the umbrella alternative: $H_1 : \mu_1 \leq ... \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq ... \geq \mu_k$ with at least one strict inequality.

Firstly, we present nonparametric statistical tests when we analyze data in a completely randomized design (CRD) layout. In CRD, we investigate the treatments' effect (only one factor). In this design, the observations (X_{ij}) are random and independent variables among the samples $i = 1, 2, ..., k$ and within the samples $j = 1, 2, ..., n_i$. In this study, we consider scenarios where there are no ties.

2.1. Jonckheere-Terpstra

One of the commonly used test statistics for a CRD layout is the Jonckheere Terpstra test statistic (Magel, Terpstra, & Wen, 2009). This test statistic is the first nonparametric test designed to analyze ordered data (Mack & Wolfe, 1981). It tests an alternative hypothesis in which we specify the order of the treatments' effect (stating the direction of the order to be increasing or decreasing) (Jonckheere, 1954; Terpstra, 1952). For example, in studies of dose responses, the experimenter or researcher might be interested in when the dose is beneficial (or harmful) by increasing (or decreasing) the dose level. The assumption here could be that by increasing (decreasing) the dose level, the benefit of the drug increases (decreases) as well. Therefore, the ordered (non-decreasing) alternative is tested using the following hypotheses

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k \tag{2.1}$$

against the alternative

$$H_1 : \mu_1 \leq \mu_2 \leq ... \leq \mu_k$$

with at least one strict inequality, where μ_i is a location parameter of the i^{th} sample. We sum all calculated $k(k-1)/2$ Mann-Whitney counts (U_{uv}) to compute the Jonckheere-Terpstra test statistic (J). Where

$$U_{uv} = \sum_{i=1}^{n_\mu} \sum_{j=1}^{n_\nu} \varphi(X_{iu}, X_{jv}), \quad 1 \leq u \leq v \leq k, \tag{2.2}$$

where

$$\varphi(a,b) = \begin{cases} 1 & \text{if } a < b \\ 0 & \text{otherwise} \end{cases}.$$

Thus, U_{uv} is the number of sample u before sample v precedence. The Jonckheere-Terpstra test statistic (J) is the sum of these $k(k-1)/2$ Mann-Whitney counts, given by

$$J = \sum_{u=1}^{v-1} \sum_{v=2}^{k} U_{uv}. \tag{2.3}$$

At α level of significance, we reject H_0 if $J \geq J_\alpha$; otherwise, we do not reject it. The Jonckheere-Terpstra test statistic (J) is approximately normally distributed as the number of observation gets large. Moreover, when the k samples have unequal variances, the Jonckheere-Terpstra test statistic (J) is not distribution-free anymore (Hollander & Wolfe, 1999). Under H_0 that all population means are equal, the expected value and variance of J are

$$E_0(J) = \frac{N^2 - \sum_{j=1}^{k} n_j^2}{4} \tag{2.4}$$

and

$$var_0(J) = \frac{N^2(2N+3) - \sum_{j=1}^{k} n_j^2(2n_j+3)}{72}. \tag{2.5}$$

2.2. Mack-Wolfe

Every so often, the effects of the treatments increase up to a particular point (p), called the peak, and then decrease after that point (Mack & Wolfe, 1981). In a suchlike case, Mack and

Wolfe (1981) developed a nonparametric test statistic in two forms: when the peak is known and when the peak is unknown. Mack and Wolfe (1981) were the first to consider such a nonparametric test for an umbrella alternative based on a simple random sample. The hypotheses being used in testing the umbrella alternative are given below

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k \tag{2.6}$$

against the umbrella alternative when the peak-known (at $p \in \{1, ..., k\}$)

$$H_1 : \mu_1 \leq ... \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq ... \geq \mu_k$$

with at least one strict inequality, where μ_i is a location parameter of the i^{th} sample. When the peak is known, the Mack-Wolfe test statistic (A_p) given in Eq. (2.7) is then the sum of the Mann-Whitney counts, which are on left side of the peak (U_{uv}), and the reverse Mann-Whitney counts, which are on right side of the peak (U_{vu}), (sum of two Jonckheere-Terpstra test statistics)(Daniel, 1990), namely,

$$A_p = \sum_{u=1}^{v-1} \sum_{v=2}^{p} U_{uv} + \sum_{u=p}^{v-1} \sum_{v=p+1}^{k} U_{vu}. \tag{2.7}$$

At α level of significance, we reject H_0 if $A_p \geq A_{p,\alpha}$; otherwise, we do not reject it. The Mann-Whitney test statistic is given in Eq. (2.23). The test statistic of Mack-Wolfe is increasingly powerful versus the restricted alternative (Hollander & Wolfe, 1999). The Mack-Wolfe test statistic (A_p) is approximately normally distributed as the number of observation gets large. Furthermore, when the k samples have unequal variances, the Mack-Wolfe test statistic (A_p) is not distribution-free anymore (Hollander & Wolfe, 1999). Under H_0 that all population means are equal, the expected value and variance of A_p Mack and Wolfe (1981) are

$$E_0(A_p) = \frac{N_1^2 + N_2^2 - \sum_{i=1}^{k} n_i^2 - n_p^2}{4} \tag{2.8}$$

and

$$var_0(A_p) = \frac{1}{72}\Bigg\{2(N_1^3 + N_2^3) + 3(N_1^2 + N_2^2) - \sum_{i=1}^{k} n_i^2(2n_i + 3)$$
$$- n_p^2(2n_p + 3) + 12n_pN_1N_2 - 12n_p^2N\Bigg\}, \tag{2.9}$$

where $N_1 = \sum_{i=1}^{p} n_i,\ N_2 = \sum_{i=p}^{k} n_i$ and $N = \sum_{i=1}^{k} n_i = N_1 + N_2 - n_p$. The standardized version of the Mack-Wolfe test (A_p^*) is given in Eq. (2.10)

$$A_p^* = \frac{A_p - E_0(A_p)}{\sqrt{var_0(A_p)}}. \tag{2.10}$$

When H_0 is true, and the samples sizes become large, the distribution of A_p^* is an asymptotically standard normal distribution. At α level of significance, we reject H_0 if $A_p^* \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1-\alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it.

In the case where the peak is unknown, let

$$U_{.q} = \sum_{i \neq q} U_{iq},\ \text{for } q = 1, ..., k \tag{2.11}$$

and

$$U_{.q}^* = \frac{U_{.q} - E_0(U_{.q})}{\sqrt{var_0(U_{.q})}}, \tag{2.12}$$

where $E_0(U_{.q}) = n_q(N - n_q)/2$ and $var_0(U_{.q}) = n_q(N - n_q)(N + 1)/12$ are the null mean and variance, respectively. Then, the Mack-Wolfe test for the umbrella alternative when the peak is unknown can be written as

$$A_{\hat{p}}^* = \frac{A_{\hat{p}} - E_0(A_{\hat{p}})}{\sqrt{var_0(A_{\hat{p}})}}, \tag{2.13}$$

where $\hat{p}$ denoted to the estimated peak for the umbrella corresponding to $U_{\hat{p}}^* = max(U_{.1}^*, U_{.2}^*, ..., U_{.k}^*)$, where $U_{.i}^*$ is given in Eq. (2.12) and $i = 1, 2, ..., k$. Here, $A_{\hat{p}}$ is the peak-known test statistic given in Eq. (2.7), $E_0(A_{\hat{p}})$ and $var_0(A_{\hat{p}})$ are the corresponding null mean and variance, respectively (as given in (2.8) and (2.9)). Accordingly, $A_{\hat{p}}^*$ is the standardized peak-known statistic with the peak at i^{th} group.

Secondly, we present a nonparametric statistical test where we analyze data in a randomized complete block design (RCBD) layout. In RCBD, we investigate the treatments' effects when the similar experimental units are grouped into blocks or homogeneous sub-populations (two factors). In such a design, the subjects are classified into homogeneous subgroups called blocks; then, the treatments are randomly and equally assigned to the experimental units in each block. We consider the scenarios where we have one observation in each cell ($n_{ij} = 1$), there is no interaction between the treatment and blocks, the observations are mutually independent and there are no ties.

2.3. Kim-Kim

Kim and Kim (1992) proposed a test statistic for testing the umbrella alternative in the RCBD layout for known peak. This test statistic is an extension of the Mack-Wolfe test statistic (1981) using a completely randomized design. Kim-Kim test statistics consider RCBD with b blocks, k treatments and with no interactions. The hypotheses of interest in the testing are given below

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k \tag{2.14}$$

against the umbrella alternative when the peak-known (at $p \in \{1, ..., k\}$)

$$H_1 : \mu_1 \leq ... \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq ... \geq \mu_k$$

with at least one strict inequality, where μ_i is a location parameter of the i^{th} sample. The Kim-Kim test statistics (A) is considered to be the sum of the Mack-Wolfe over all the blocks, namely,

$$\begin{gathered} A = \sum_{i=1}^{b} A_{ip}. \\ A_{ip} = \sum_{i=1}^{b} \Big\{ \sum_{u=1}^{v-1} \sum_{v=2}^{p} U_{iuv} + \sum_{u=p}^{v-1} \sum_{v=p+1}^{k} U_{ivu} \Big\}. \end{gathered} \tag{2.15}$$

where A_{ip} denotes the Mack-Wolfe test statistic of the i^{th} block, U_{iuv} is the Mann-Whitney test statistic that is applied to the observations in cell (i, u) and (i, v), k is the number of treatments, p is the known peak, and the number of blocks is b (Kim & Kim, 1992). At α level of significance, we reject H_0 for the large value of A since under the H_1, the A test statistic has large values. Under H_0 that all population means are equal, the expected value and variance of A Kim and Kim (1992) are

$$E_0(A) = \sum_{i=1}^{b} \left\{ N_{i1}^2 + N_{i2}^2 - \sum_{j=1}^{k} n_{ij}^2 - n_{ip}^2 \right\} / 4 \tag{2.16}$$

and

$$\begin{aligned} var_0(A) = \sum_{i=1}^{b} \Big\{ & 2(N_{i1}^3 + N_{i2}^3) + 3(N_{i1}^2 + N_{i2}^2) - \sum_{j=1}^{k} n_{ij}^2 (2n_{ij} + 3) \\ & - n_{ip}^2 (2n_{ip} + 3) + 12 n_{ip} N_{i1} N_{i2} - 12 n_{ip}^2 N \Big\} / 72, \end{aligned} \tag{2.17}$$

where $N_{i1} = \sum_{j=1}^{p} n_{ij}$, $N_{i2} = \sum_{j=p}^{k} n_{ij}$ and $N = \sum_{j=1}^{k} n_{ij}$. Kim and Kim (1992) proved that A is asymptotically normally distributed. In this research, we consider the case when $n_i = 1$. Magel et al. (2010) reduced the expected value and variance of A when $n_i = 1$ to the form given below

$$E_0(A) = b \left\{ p^2 + (k - p + 1)^2 - k - 1 \right\} / 4 \tag{2.18}$$

and

$$\begin{aligned} var_0(A) = b \Big\{ & 2[p^3 + (k - p + 1)^3] + 3[p^2 + (k - p + 1)^2] \\ & - 5k - 5 + 12p(k - p + 1) - 12k \Big\} / 72. \end{aligned} \tag{2.19}$$

The standardized version of the Kim-Kim test statistic (A^*) is given in Eq. (2.20). It has asymptotic standard normal distribution when the samples sizes become large, and the H_0 is true.

$$A^* = \frac{A - E_0(A)}{\sqrt{var_0(A)}}. \tag{2.20}$$

At α level of significance, we reject H_0 if $A^* \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1 - \alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it.

Thirdly, we present nonparametric statistical tests when we analyze data in the form of mixed design. While there is a lot of literature discussing the nonparametric statistical tests in analyzing data in single design form, there are not enough research studies certified in the area of mixed designs.

2.4. Dubnicka, Blair and Hettmansperger

Several researchers have developed statistical tests in nonparametric statistics using mixed design. Dubnicka et al. (2002) considered the case when the data are a mixture of two-sample design involving a random sample of paired data and independent random samples to develop a rank-based test. In the interest of two treatments, a clarification of using a mixed design is the most robust option that has been provided by Dubnicka et al. (2002). The test that Dubnicka et al. (2002) proposed tests the following hypothesis

$$H_0 : \Delta = 0 \tag{2.21}$$

against

$$H_1 : \Delta > 0,$$

where Δ is the difference between the treatments. The test statistic (T^+) that Dubnicka et al. (2002) developed, which is given in Eq. (2.22), sums two nonparametric test statistics, which are Wilcoxon Signed-Rank test statistic (paired data) and the Wilcoxon-Mann-Whitney test statistic (independent samples), namely,

$$T^+ = S^+(\Delta) + U^+(\Delta), \tag{2.22}$$

where $S^+(\Delta)$ is the Wilcoxon Signed-Rank test statistic, and $U^+(\Delta)$ is the Wilcoxon-Mann-Whitney test statistic. The Mann-Whitney test statistic given in Eq. (2.23) is the basic foundation of the Mack-Wolfe test statistic given in Eq. (2.7). That is

$$U^+ = \sum_{j=1}^{n_j} R_j - \frac{n_j(n_j+1)}{2}, \tag{2.23}$$

where R_j is the sum of the ranks from the first population where the ranks were obtained from the combination of the independent samples.

Under the H_0, and following from Hettmansperger and McKean (1998), the expected value and the variance of the test statistic (T^+) that was proposed by Dubnicka et al. (2002) are given below

$$E_0(T^+) = \frac{n(n+1)}{4} + \frac{n_1 n_2}{2} \tag{2.24}$$

and

$$var_0(T^+) = \frac{n(n+1)(2n+1)}{24} + \frac{n_1 n_2(n_1+n_2+1)}{12}. \tag{2.25}$$

Clearly, the expected value of (T^+) is a summation of the means of the Wilcoxon Signed-Rank test statistic and the Wilcoxon-Mann-Whitney test statistic, respectively. Then, as well, the variance of (T^+) is a summation of the variances of the Wilcoxon Signed-Rank test statistic and Wilcoxon-Mann-Whitney test statistic, respectively, where, n denotes the sample size of the paired data in the Wilcoxon signed-rank statistic, while n_1 and n_2 are the sample sizes of the independent samples in the Wilcoxon-Mann-Whitney statistic. The standardized version of Dubnicka el at.'s (2002) test statistic (T^+) is given in Eq. (2.26). It has asymptotic standard normal distribution when the samples sizes become large, and the H_0 is true.

$$T^* = \frac{T^+ - E_0(T^+)}{\sqrt{var_0(T^+)}}. \tag{2.26}$$

At α level of significance, we reject H_0 if $T^+ \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1-\alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it.

2.5. Magel, Terpstra, Canonizado and Park

Magel et al. (2010) developed several test statistics for testing the umbrella alternative when the data are a mixture of completely randomized design layout (CRD) and randomized complete block design layout (RCBD). We consider these tests as Non-Modified test statistics, and compare their powers to the proposed test statistics in this thesis. The hypotheses of interest in testing for Magel et al. (2010) are given below

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k \tag{2.27}$$

against the umbrella alternative when the peak-known (at $p \in \{1, ..., k\}$)

$$H_1 : \mu_1 \leq ... \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq ... \geq \mu_k$$

with at least one strict inequality, where μ_i is a location parameter of the i^{th} sample. Magel et al. (2010) considered a combination of two nonparametric test statistics for the umbrella alternative: the Mack-Wolfe test for a completely randomized design (1981) and the Kik-Kim test for a randomized complete block design (1992).

The first test considered by Magel et al. (2010) added the standardized version of the Mack-Wolfe test statistic A_p^* given in Eq. (2.10) and the standardized version of the Kim-Kim test statistic A^* given in Eq. (2.20), and then re-standardized it. Particularly, the combination of the standardized versions of Mack-Wolfe and Kim-Kim test statistics is

$$A_p^{**} = A_p^* + A^*. \tag{2.28}$$

Under the H_0, and since the distribution of each test statistics of A_p^* and A^* is an asymptotically standard normal distribution, the expected value and the variance of A_p^{**} are given below

$$E_0(A_p^{**}) = E_0(A_p^*) + E_0(A^*) = 0 + 0 = 0, \tag{2.29}$$

and

$$var_0(A_p^{**}) = var_0(A_p^*) + var_0(A^*) = 1 + 1 = 2. \tag{2.30}$$

Then, they re-standardized A_p^{**} that has a normal distribution with mean *zero* and variance 2 to obtain the first test statistic that they proposed, A^{**}, which has an asymptotic standard normal distribution.

$$A^{**} = \frac{A_p^{**} - E_0(A_p^{**})}{\sqrt{var_0(A_p^{**})}} = \frac{A_p^{**} - 0}{\sqrt{2}}. \tag{2.31}$$

At α level of significance, we reject H_0 if $A^{**} \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1-\alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it.

The second test proposed by Magel et al. (2010) added the unstandardized version of the Mack-Wolfe test statistic A_p given in Eq. (2.7) and the unstandardized version of the Kim-Kim test statistic A given in Eq. (2.15), and then standardized it. Particularly, the combination of the unstandardized versions of Mack-Wolfe and Kim-Kim test statistics is

$$A_p^{***} = A_p + A. \tag{2.32}$$

Under the H_0, the expected value and the variance of (A_p^{***}) are given below

$$E_0(A_p^{***}) = E_0(A_p) + E_0(A) \tag{2.33}$$

and

$$var_0(A_p^{***}) = var_0(A_p) + var_0(A). \tag{2.34}$$

Then, they standardized A_p^{***} to obtain the second test statistic, A^{***}, which has asymptotic standard normal distribution when the samples sizes become large, and the H_0 is true.

$$A^{***} = \frac{A_p^{***} - E_0(A_p^{***})}{\sqrt{var_0(A_p^{***})}}. \tag{2.35}$$

At α level of significance, we reject H_0 if $A^{***} \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1-\alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it. Magel et al. (2010) found that the first proposed test statistic mostly has higher power.

Lastly, we present some ideas of using different weighting schemes (modification) for non-parametric test statistics when we analyze data; also, we present how these tests can be developed for the unknown peaks. All test procedures for testing the umbrella alternative are first designed in the case of the known peak, and further implement some modifications with the purpose of improving the power or the performance of the test statistics. In the case of the unknown peak, many thoughts have been proposed for estimating the peaks for testing the umbrella alternative.

2.6. Hettmanspereger and Norton

Hettmansperger and Norton (1987) proposed tests for testing the umbrella alternatives for both known peak and unknown peak. Suppose that R_{ih} is the rank of X_{ih} among the $N = \sum_{i=1}^{k} n_i$ observations and let $\bar{R}_i = \sum_{h=1}^{n_i} R_{ih}/n_i$ be the average rank of the i^{th} sample.

In the case of the known peak p, let $c_i = i$, for $i = 1, ..., p$, and $c_i = 2p - i$, for $i = p+1, ..., k$. For this setting, Hettmansperger and Norton (1987) proposed their test statistic as the following

$$V_p = \sum_{i=1}^{k} \lambda_i (c_i - \bar{c}_w) \bar{R}_i, \tag{2.36}$$

where $\lambda_i = n_i/N,\ N = \sum_{i=1}^{k} n_i$ and $\bar{c}_w = \sum_{i=1}^{k} \lambda_i c_i$. Under H_0, Hettmansperger and Norton (1987) noted that the standardized version (V_p^*) of V_p has a limiting ($min(n_1, n_2, ..., n_k) \longrightarrow \infty$) distribution, which is standard normal, where

$$V_p^* = \frac{V_p}{\sqrt{var_0(V_p)}}, \tag{2.37}$$

with

$$var_0(V_p) = \frac{(N+1)}{12} \sum_{i=1}^{k} \lambda_i (c_i - \bar{c}_w)^2. \tag{2.38}$$

In the case of the unknown peak p, they proposed to reject H_0 for large values of

$$V_{max}^* = max(V_1^*, V_2^*, ..., V_k^*), \tag{2.39}$$

where V_i^* is given in Eq. (2.37) and $i = 1, 2, ..., k$. They showed the null covariance of V_s^* and V_t^* can be written as following

$$d_{s,t}^* = cov_0(V_s^*, V_t^*) = \frac{\sum_j \lambda_j (c_{sj} - \bar{c}_{sw})(c_{tj} - \bar{c}_{tw})}{\sqrt{\sum_j \lambda_j (c_{sj} - \bar{c}_{sw})^2 (c_{tj} - \bar{c}_{tw})^2}}. \tag{2.40}$$

Under the H_0, They proved that $V_{max}^* = (V_1^*, V_2^*, ..., V_k^*)$ has a limiting $MVN(0, D)$ distribution where $D = d_{s,t}^*$ is the null covariance matrix and $s = 1, 2, ..., p,\ \ t = 1, 2, ..., p$. By using a simulated sample from $MVN(0, D)$, we can obtain the critical values for the null distribution of $max(V^*)$.

2.7. Shi

Shi (1988) proposed rank tests based on the procedure of Hettmansperger and Norton (1987) for both known peak and unknown peaks. Shi's test statistic utilizes a different weighting scheme from that of Hettmansperger and Norton (1987).

In the case of the known peak p, the proposed test statistic by Shi (1988) is given below

$$T_p = \sqrt{\frac{12}{N+1}} \sum_{i=1}^{k} \lambda_i a_i \bar{R}_i, \tag{2.41}$$

where $a = (a_1, a_2, ..., a_k)$ is a vector satisfying $\sum_{i=1}^{k} \lambda_i a_i = 0$ and $\sum_{i=1}^{k} \lambda_i a_i^2 = 1$.

Let $S_i = \lambda_1 + \lambda_2 + ... + \lambda_i$, Shi defined a_i by

$$a_i = \frac{w_i}{\sqrt{\sum_{i=1}^{k} \lambda_i w_i^2}}, \tag{2.42}$$

where

$$w_i = \begin{cases} \upsilon_{i-1} - \upsilon_i & , i < p \\ \upsilon_{i-1} + \upsilon_i & , i = p \\ \upsilon_i - \upsilon_{i-1} & , i > p \end{cases}$$

and

$$\upsilon_i = \sqrt{S_i(S_k - S_i)}/\lambda_i.$$

Under H_0, Shi (1988) noted that the standardized version (T_p^*) of T_p has asymptotically $(min(n_1, n_2, ..., n_k) \longrightarrow \infty)$ standard normal distribution.

In the case of the unknown peak p, Shi proposed to reject H_0 for large values of

$$T_{max}^* = max(T_1^*, T_2^*, ..., T_k^*). \tag{2.43}$$

2.8. Milen and Wolfe

In the case of unknown peak p, Milen and Wolfe (2005) suggested a test for testing

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k \tag{2.44}$$

against the umbrella alternative when the peak is unknown

$$H_1 : \mu_1 \leq ... \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq ... \geq \mu_k$$

with at least one strict inequality. They proposed to reject H_0 for large values of

$$T_b = \sum_{i=1}^{k} b_i A_i, \tag{2.45}$$

where

$$A_i = \sum\sum_{1 \leq u < v \leq i} U_{uv} + \sum\sum_{1 \leq u < v \leq i} U_{vu} \ , \quad i = 1, ..., k$$

is the Mack-Wolfe statistic given in Eq. (2.7) in the case of the known peak. Also,

$$b_i = \frac{U_{.i}}{\sum\limits_{j=1}^{k} U_{.j}} \ , \quad i = 1, ..., k,$$

where $U_{.i}$ is the two-sample Mann-Whitney statistic computed between the i^{th} sample and the remaining $(k-1)$ samples, as given in Eq. (2.11).

2.9. Esra and Fikri

Esra and Fikri (2016) proposed test statistics for the umbrella alternative by suggesting a modification (distance modification) to the Mack-Wolfe test statistic. The hypotheses of interest in testing are given below

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k \tag{2.46}$$

against the umbrella alternative when the peak is known (at $p \in \{1, ..., k\}$)

$$H_1 : \mu_1 \leq ... \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq ... \geq \mu_k$$

with at least one strict inequality, where μ_i is a location parameter of the i^{th} sample, and k is the number of treatments. Esra and Fikri (2016) considered the umbrella alternative when the peak is known and when the peak is unknown.

In the case of a known peak, the modified Mack-Wolfe test statistic (mA_p) is then the sum of the weighted Mann-Whitney counts, which are on left side of the peak ($(v-u)U_{uv}$), and the reverse weighted Mann-Whitney counts, which are on right side of the peak ($(u-v)U_{vu}$), as investigated by Neuhauser et al. (1998). Basically, the modified Mack-Wolfe test is the sum of two modified Jonckheere statistics for ordered alternatives. In this modified test statistic, they give the weight 1 only to Mann-Whitney statistics between adjacent groups. Generally, the Mann-Whitney statistics U_{uv} and U_{vu} get the weights $(v-u)$ and $(u-v)$, respectively. That is

$$mA_p = \sum_{u=1}^{v-1} \sum_{v=2}^{p} (v-u) U_{uv} + \sum_{u=p}^{v-1} \sum_{v=p+1}^{k} (u-v) U_{vu}. \tag{2.47}$$

When the sample sizes are equal ($n_1 = n_2 = ... = n_k = n$) and under H_0 that all population means are equal, the expected value and variance of mA_p are

$$E_0(mA_p) = \frac{n^2}{2}\left[\binom{p+1}{3} + \binom{k-p+2}{3}\right] \tag{2.48}$$

and

$$\begin{aligned} var_0(mA_p) = & \frac{n^2p^2(p^2-1)(np+1) + n^2(k-p+1)^2[(k-p+1)^2-1][n(k-p+1)+1]}{144} \\ & + \frac{n^3p(p-1)(k-p)(k-p+1)}{24}. \end{aligned} \tag{2.49}$$

The standardized version of Esra and Fikri (2016) given in Eq. (2.50) has an asymptotic standard normal distribution under the H_0 when the sample size gets large. It follows the test statistic of Neuhauser et al. (1998), which is a member of the class of weighted nonparametric statistics that investigated by Tryon and Hettmansperger (1973).

$$mA_p^* = \frac{mA_p - E_0(mA_p)}{\sqrt{var_0(mA_p)}}. \tag{2.50}$$

At α level of significance, we reject H_0 if $mA_p^* \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1-\alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it.

In the case of an unknown peak, Esra and Fikri (2016) applied the method used by Mack and Wolfe (1981), in which the peak is estimated to be $U_{\hat{p}}^* = max(U_{.1}^*, U_{.2}^*, ..., U_{.k}^*)$, where $U_{.i}^*$ is given in (2.12) and $i = 1, 2, ..., k$. The standardized test statistic for the unknown peak can be written as

$$mA_{\hat{p}}^* = \frac{mA_{\hat{p}} - E_0(mA_{\hat{p}})}{\sqrt{var_0(mA_{\hat{p}})}}. \tag{2.51}$$

At α level of significance, we reject H_0 for the large value of $mA_{\hat{p}}^*$.

2.10. Chen and Wolfe

In section 2.2, we presented the Mack and Wolfe (1981) test for testing the umbrella alternative for both known and unknown peaks. Here, in the case where the peak of the umbrella is unknown, Chen and Wolfe (1990) proposed to reject H_0 for large values of

$$A_{max}^* = max(A_1^*, A_2^*, ..., A_k^*), \tag{2.52}$$

where A_i^* is the standardized version of the Mack-Wolfe test which given in Eq. (2.10) and $i = 1, 2, ..., k$.

With this background, we propose six test statistics in Chapter 3 for testing the umbrella alternative with both known and unknown peaks, when the data are a mixture of completely randomized design and randomized complete block design for three samples or more. In the two proposed test statistics for known peak, we suggest a distance modification (weight) of both Mack-Wolfe and Kim-Kim test statistics. The proposed test statistics are similar to those that were proposed by Magel et al. (2010), which called Non-Modified tests in this thesis. The suggestion of the distance modification (weight) is similar in quality to the weight was used in the test statistic proposed by Esra and Fikri (2016). Furthermore, in the situation of the unknown peak, we suggest four test statistics for testing the umbrella alternative when the data are a mixture of CRD and RCBD for three samples or more. The same distance modification that has been used for the known peak has been applied to two of these four tests, and the other two test statistics (Non-Modified tests) without applying the distance modification.

3. DESCRIPTION OF PROPOSED TESTS

In this chapter, six tests are proposed to test the umbrella alternative. Two tests are for when the peak of the umbrella is known, and the other four test statistics are for when the peak of the umbrella is unknown. We consider these for a mixed design experiment (completely randomized design and randomized complete block design) for situations with three or more samples in the mixed design. Generally, the umbrella alternative is tested using the following hypothesis

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k \tag{3.1}$$

against the umbrella alternative

$$H_1 : \mu_1 \leq ... \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq ... \geq \mu_k$$

with at least one strict inequality, where μ_i is a location parameter of the i^{th} sample.

3.1. Proposed Mixed Design Tests for Known Umbrella Peak

In the case of the known peak of the umbrella, the foundation of our first two proposed tests is to modify the Mack-Wolfe (1981) and Kim-Kim (1992) test statistics. Esra and Fikri (2016) suggested a modification of the Mack-Wolfe statistics given in section 2.9 and proposed a test of modified Mack-Wolfe mA_p and standardized modified Mack-Wolfe mA_p^* with their mean and variance, respectively. Similarly, we suggest a modification of the Kim-Kim (mA) as follows:

$$\begin{gathered} mA = \sum_{i=1}^{b} mA_{ip} \\ mA_{ip} = \sum_{i=1}^{b} \Big\{ \sum_{u=1}^{v-1} \sum_{v=2}^{p} (v-u) U_{iuv} + \sum_{u=p}^{v-1} \sum_{v=p+1}^{k} (u-v) U_{ivu} \Big\}, \end{gathered} \tag{3.2}$$

where mA_{ip} denotes the modified Mack-Wolfe test statistic of the i^{th} block, $(v-u)U_{iuv}$ is the weighted Mann-Whitney test statistic applied to the observations in cell (i, u) and (i, v), k is the number of treatments, p is the known peak and the number of blocks is b. Actually, the modified Kim-Kim statistic is just the sum of two modified Jonckheere statistics as investigated by Neuhauser et al. (1998) for the ordered alternatives over the blocks. At α level of significance, we reject H_0 for the large value of mA since under the H_1, the mA test statistic has large values. In this research, we consider the case when $n_{ij} = 1$ where $i \in \{1, ..., b\}$ and $j \in \{1, ..., k\}$. Therefore, when the sample sizes for each treatment in each block are equal ($n_{11} = ... = n_{bk} = n = 1$) and under H_0 in which all population means are equal, the expected value and variance of mA are

$$E_0(mA) = b\left\{\frac{n^2}{2}\left[\binom{p+1}{3} + \binom{k-p+2}{3}\right]\right\} \tag{3.3}$$

and

$$var_0(mA) = b\left\{\frac{n^2p^2(p^2-1)(np+1) + n^2(k-p+1)^2[(k-p+1)^2-1][n(k-p+1)+1]}{144}\right.$$
$$\left. + \frac{n^3p(p-1)(k-p)(k-p+1)}{24}\right\}. \tag{3.4}$$

The standardized version of the modified Kim-Kim test statistic (mA^*) is given in Eq. (3.5). It has asymptotic standard normal distribution when the samples sizes become large, and the H_0 is true.

$$mA^* = \frac{mA - E_0(mA)}{\sqrt{var_0(mA)}}. \tag{3.5}$$

At α level of significance, we reject H_0 if $mA^* \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1-\alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it.

We will now propose first two test statistics for the mixed design consisting of a randomized complete block design portion and a completely randomized design portion when the peak is known. The two test statistics will be a linear combination of the proposed modified versions of Mack-Wolfe and Kim-Kim's tests.

3.1.1. First Proposed Test

This proposed test statistic is the sum of the standardized test statistic for two tests, the modified Mack-Wolfe test statistic and Kim-Kim test statistic. They are each calculated separately. The standardized version of the modified Mack-Wolfe test statistic is calculated as (mA_p^*), obtained in Eq. (2.50). Also, the standardized modified Kim-Kim test statistic is calculated as (mA^*), obtained in Eq. (3.5). Particularly, the combination of the standardized versions of the modified

Mack-Wolfe and Kim-Kim test statistics is given in Eq. (3.6):

$$mA_p^{**} = mA_p^* + mA^*, \tag{3.6}$$

where mA_p^* is the standardized version of the modified Mack-Wofle test, which discussed in section 2.9, and mA^* is the standardized version of the modified Kim-Kim test, which discussed in section 3.1. Since mA_p^* and mA^* both have asymptotic standard normal distribution under the true H_0, the asymptotic distribution of mA_p^{**} should be normal with mean zero and variance 2 when the H_0 is true, namely,

$$E_0(mA_p^{**}) = E_0(mA_p^*) + E_0(mA^*) = 0 + 0 = 0 \tag{3.7}$$

and

$$var_0(mA_p^{**}) = var_0(mA_p^*) + var_0(mA^*) = 1 + 1 = 2. \tag{3.8}$$

The standardized version of the first proposed test statistic mA^{**}, is thus given in (3.9)

$$mA^{**} = \frac{mA_p^{**} - E_0(mA_p^{**})}{\sqrt{var_0(mA_p^{**})}} = \frac{mA_p^{**} - 0}{\sqrt{2}} = \frac{mA_p^* + mA^*}{\sqrt{2}} = \frac{1}{\sqrt{2}}mA_p^* + \frac{1}{\sqrt{2}}mA^*. \tag{3.9}$$

Under H_0 and when the sample size gets large, mA^{**} has an asymptotic standard normal distribution. At α level of significance, we reject H_0 if $mA^{**} \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1-\alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it.

To note, we infer that an equal weight of $\frac{1}{\sqrt{2}}$ is assigned to each one of the standardized modified test statistics, mA_p^* and mA^*. Also, the motivation behind the equal weight of $\frac{1}{\sqrt{2}}$ is the fact that the variance of a standard normal is one. The standard deviation of two standard normal distributions is the square root of the sum of the two variances and thus an equal weight of $\frac{1}{\sqrt{2}}$ assigned to the standardized versions of modified Mack-Wolfe test statistic and the standardized versions of modified Kim-Kim test statistic as can be noted in Eq. (3.9) above.

3.1.2. Second Proposed Test

This proposed test statistic is a standardized test statistic which is comprised of $(mA_p + mA)$, which is the sum of the unstandardized test statistic for two tests, the modified Mack-Wolfe test statistic and Kim-Kim test statistic. Each one of these tests is calculated separately. The unstandardized version of the modified Mack-Wolfe test statistic is calculated as (mA_p), obtained in Eq. (2.47). Also, the unstandardized version of the modified Kim-Kim test statistic is calculated as (mA), obtained in Eq. (3.2). Particularly, the combination of the unstandardized versions of modified Mack-Wolfe and Kim-Kim test statistics is given in Eq. (3.10):

$$mA_p^{***} = mA_p + mA, \tag{3.10}$$

where mA_p is the unstandardized version of the modified Mack-Wolfe test, discussed in section 2.9, and mA is the unstandardized version of the modified Kim-Kim test, discussed in section 3.1. The mean and variance of mA_p^{***} are given just the sum of the means and variance for the unstandardized modified Mack-Wolfe and unstandardized modified Kim-Kim test statistics. They are given below

$$E_0(mA_p^{***}) = E_0(mA_p) + E_0(mA) \tag{3.11}$$

and

$$var_0(mA_p^{***}) = var_0(mA_p) + var_0(mA), \tag{3.12}$$

where $E_0(mA_p)$, $E_0(mA)$, $var_0(mA_p)$ and $var_0(mA)$ are the expected values and variance of the modified Mack-Wolfe and modified Kim-Kim test statistics, and they are given in Eq. (2.48, 2.49, 3.3 and 3.4), respectively.

The standardized version of the second proposed test statistic is thus given in Eq. (3.13)

$$mA^{***} = \frac{mA_p^{***} - E_0(mA_p^{***})}{\sqrt{var_0(mA_p^{***})}}. \tag{3.13}$$

Under H_0 and when the sample size gets large, mA^{***} should have an asymptotic standard normal distribution. At α level of significance, we reject H_0 if $mA^{***} \geq z_\alpha$ where the z_α is the critical value of the upper tail probability ($(1-\alpha)$ 100%) of the standard normal distribution; otherwise, we do not reject it. To provide insight about the second proposed test statistic, we expanded Eq. (3.13) as summarized below:

$$
\begin{aligned}
mA^{***} &= \frac{(mA_p + mA) - E_0(mA_p + mA)}{\sqrt{var_0(mA_p) + var_0(mA)}} \\
&= \frac{mA_p - E_0(mA_p)}{\sqrt{var_0(mA_p) + var_0(mA)}} + \frac{mA - E_0(mA)}{\sqrt{var_0(mA_p) + var_0(mA)}} \\
&= \frac{\sqrt{var_0(mA_p)}}{\sqrt{var_0(mA_p) + var_0(mA)}} \left(\frac{mA_p - E_0(mA_p)}{\sqrt{var_0(mA_p)}} \right) \\
&+ \frac{\sqrt{var_0(mA)}}{\sqrt{var_0(mA_p) + var_0(mA)}} \left(\frac{mA - E_0(mA)}{\sqrt{var_0(mA)}} \right) \\
&= \frac{\sqrt{var_0(mA_p)}}{\sqrt{var_0(mA_p) + var_0(mA)}} mA_p^* + \frac{\sqrt{var_0(mA)}}{\sqrt{var_0(mA_p) + var_0(mA)}} mA^*. \qquad (3.14)
\end{aligned}
$$

The completely randomized design (CRD) portion has a greater weight than the randomized complete block design (RCBD) portion, as the variance for the modified Mack-Wolfe test statistic is greater than the variance for the modified Kim-Kim test statistic in the second proposed test statistic.

In the first proposed test statistics (standardized first), the modified Mack-Wolfe and modified Kim-Kim test statistics are standardized first and subsequently added together and then re-standardized again. In the second proposed test statistic (standardized last), the unstandardized version of modified Mack-Wolfe and modified Kim-Kim test statistics are added together and then standardized. Clearly, from Eq. (3.9) and Eq. (3.14), both the first and second proposed test statistics when the umbrella peak is known are weighted versions of the standardized modified Mack-Wolfe test (mA_p^*) and the standardized modified Kim-Kim test (mA^*). The first proposed test statistic assigns equal weights of $\frac{1}{\sqrt{2}}$ to both parts. In the second proposed test statistic, the weights largely rely on the variances of the unstandardized modified Mack-Wolfe test and the unstandardized modified Kim-Kim test. Consequently, when the variance of the unstandardized version of the modified Mack-Wolfe statistic becomes much larger than the variance of the unstandardized version of the modified Kim-Kim statistic, the modified Mack-Wolfe part of the statistic will be dominate (overpowering), and the contribution that comes from the modified Kim-Kim portion will be very little. Therefore, it is possible, at first, to see a decrease in the power of the second proposed test statistic as the sample sizes for the CRD portion increase while there is less emphasis given to the RCBD portion. Eventually, as the number of observations increases in the completely randomized portion, the power will start increasing again. To note, the second proposed test statistic (standardized last) would eventually be approximately equal to the modified Mack-Wolfe test statistic leaving out the RCBD portion.

In this thesis, we compare the powers between the first and second proposed test statistics, in which we apply the distance modification to the Mack-Wolfe and Kim-Kim statistics. Also, we compare the powers between these two tests and the test statistics that were proposed by Magel et al. (2010) (see Section 2.5), which we call the Non-Modified test statistics.

3.2. Proposed Mixed Design Tests for Unknown Umbrella Peak

In the case of the unknown peak of the umbrella which is of more practical interest, the foundation of our last four proposed test statistics is to use the two test statistics which were proposed by Magel et al. (2010) and given in section 2.5; also, the first two proposed test statistics that we proposed in section 3.1. Here, we assume the peak p is unknown, and we follow a proposal of Chen and Wolfe (1990) and Chen (1991) to estimate the peak for balanced designs, i.e. $n = n_1 = n_2 = ... = n_k$. The approach is basically based on calculating the maximum of the standardized test statistics for all known peaks p, $p = 1, ..., k$.

That means that the peak p is estimated by $\hat{p} = arg\ max(A_p^{**})$, $\hat{p} = arg\ max(A_p^{***})$, $\hat{p} = arg\ max(mA_p^{**})$ and $\hat{p} = arg\ max(mA_p^{***})$, and asymptotical critical values are estimated by simulation for all four statistics $A_{max}^{**} := \max\limits_{p=1,...,k} A_p^{**}$, $A_{max}^{***} := \max\limits_{p=1,...,k} A_p^{***}$, $mA_{max}^{**} := \max\limits_{p=1,...,k} mA_p^{**}$ and $mA_{max}^{***} := \max\limits_{p=1,...,k} mA_p^{***}$. The asymptotical critical values are estimated when the limiting sample size proportions for the CRD portion are all equal and the number of the blocks varies for the RCBD portion (see Table 3.1). After obtaining an empirical cumulative distribution of A_{max}^{**}, A_{max}^{***}, mA_{max}^{**} and mA_{max}^{***} based on a sample size of $10,000$ from the corresponding true distribution, the estimated critical values for the A_{max}^{**}, A_{max}^{***}, mA_{max}^{**} and mA_{max}^{***} tests then correspond to the appropriate 90^{th}, 95^{th} or 99^{th} percentile of this empirical distribution. For instance, when $k = 4$, $n = 10$ for each treatment and $b = 20$, the estimated 95^{th} percentile for the asymptotic null distribution of mA_{max}^{***} is 2.19922. At α level of significance, we reject H_0 if the proposed test statistic is greater than the corresponding critical value; otherwise, we do not reject it.

Table 3.1 represents the critical values for $\alpha = 0.10$, 0.05 and 0.01, $3 \leq k \leq 5$ where k is the number of treatments, equal sample sizes $n = 10$ for the CRD portion, the number of blocks $b = 5, 10$ and 20 for the RCBD portion. For the RCBD portion, we consider the case when $n_{ij} = 1$

where $i = 1, ..., b$ and $j = 1, ..., k$. These critical values are used in the power studies in section 5.2.

Table 3.1. Selected critical values for the null distribution of the peak unknown for the mixed design (completely randomized design and randomized complete block design):
$k = 3, 4, 5$; $n = n_1 = ... = n_k = 10$; $b = 5, 10, 20$ for each k.

				Non Modification		**Distance Modification**	
k	n	b	α	${A^{**}_{max}}^1$	${A^{***}_{max}}^2$	${mA^{**}_{max}}^3$	${mA^{***}_{max}}^4$
3	10	5	0.10	1.83212	1.83806	1.81517	1.81045
			0.05	2.11628	2.10494	2.11226	2.07612
			0.01	2.68855	2.63392	2.67566	2.58249
		10	0.10	1.81303	1.79223	1.82522	1.83595
			0.05	2.11801	2.07757	2.12702	2.14194
			0.01	2.66497	2.60640	2.68187	2.66649
		20	0.10	1.79106	1.80141	1.79818	1.82436
			0.05	2.10278	2.08499	2.09161	2.08499
			0.01	2.70744	2.64967	2.67678	2.63324
4	10	5	0.10	1.93094	1.89933	1.88579	1.91270
			0.05	2.20608	2.16538	2.18840	2.19500
			0.01	2.75170	2.76266	2.74728	2.76787
		10	0.10	1.95123	1.89479	1.92012	1.91183
			0.05	2.23968	2.20659	2.18965	2.19130
			0.01	2.80497	2.75824	2.72874	2.76554
		20	0.10	1.93784	1.91039	1.92245	1.92673
			0.05	2.24522	2.21680	2.20083	2.19922
			0.01	2.79538	2.77733	2.73082	2.74028
5	10	5	0.10	1.99224	1.99556	1.97741	1.96643
			0.05	2.27034	2.27303	2.26770	2.27803

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Table 3.1. Selected critical values for the null distribution of the peak unknown for the mixed design (completely randomized design and randomized complete block design):
$k = 3, 4, 5$; $n = n_1 = ... = n_k = 10$; $b = 5, 10, 20$ for each k. (Continued)

				Non Modification		**Distance Modification**	
k	n	b	α	A^{**}_{max} [1]	A^{***}_{max} [2]	mA^{**}_{max} [3]	mA^{***}_{max} [4]
			0.01	2.84581	2.84383	2.81598	2.78724
		10	0.10	2.00712	1.99179	1.97400	1.97778
			0.05	2.30617	2.28310	2.25669	2.25715
			0.01	2.85133	2.78444	2.83866	2.75517
		20	0.10	2.00175	1.99456	1.96384	1.96638
			0.05	2.26909	2.28294	2.24580	2.23072
			0.01	2.83609	2.81162	2.79685	2.69453

[1] Third proposed test: Standardized Mack-Wolfe and Kim-Kim first before summing them together; then, re-standardized the result.

[2] Fourth proposed test: Sum Mack-Wolfe and Kim-Kim first without standardization; then, standardized the result.

[3] Fifth proposed test: Standardized modified Mack-Wolfe and Kim-Kim first before summing them together; then, re-standardized the result.

[4] Sixth proposed test: Sum modified Mack-Wolfe and Kim-Kim first without standardization; then, standardized the result.

Now, we will propose the last four test statistics for the mixed design consisting of a randomized complete block design portion and a completely randomized design portion when the peak is unknown. The four test statistics will be a linear combination of the proposed unmodified (modified) versions of Mack-Wolfe and Kim-Kim's tests.

3.2.1. Mixed Design with no Modification

In the case of having a mixed design (CRD and RCBD), we propose two test statistics with no modification for testing the umbrella alternative when the peak is unknown.

3.2.1.1. Third Proposed Test

This test statistic is based on the maximum of the standardized test statistics calculated for all known peaks p, $p = 1, ..., k$. Here, we use the first test statistic that was proposed by Magel et al. (2010). Then, the third proposed test is given by

$$A^{**}_{max} = max(A^{**}_1, A^{**}_2, ..., A^{**}_k), \tag{3.15}$$

where A^{**}_i is the first proposed test of the Magel et al. (2010)'s tests which given in Eq. (2.31) and $i = 1, 2, ..., k$. We suggest rejecting H_0 for a large value of A^{**}_{max}.

3.2.1.2. Fourth Proposed Test

Similarly, the fourth proposed test follows from the third proposed test by calculating the maximum of the standardized test statistics for all known peaks p, $p = 1, ..., k$. However, here we use the second test statistic that was proposed by Magel et al. (2010). Then, the fourth proposed test is given by Eq. (3.16) below

$$A^{***}_{max} = max(A^{***}_1, A^{***}_2, ..., A^{***}_k), \tag{3.16}$$

where A^{***}_i is the second proposed test of the Magel et al. (2010)'s test, given in Eq. (2.35), and $i = 1, 2, ..., k$. H_0 is rejected for a large value of A^{***}_{max}.

3.2.2. Mixed Design with Modification

Now, we propose the last two test statistics by considering the distance modification for testing the umbrella alternative when the peak is unknown in the case of having a mixed design (CRD and RCBD).

3.2.2.1. Fifth Proposed Test

This proposed test statistic is also based on the maximum of the standardized test statistics calculated for all known peaks p, $p = 1, ..., k$. In this proposed test, we use the first test statistic that we proposed in section 3.1.1. The fifth proposed test is then given by

$$mA^{**}_{max} = max(mA^{**}_1, mA^{**}_2, ..., mA^{**}_k), \tag{3.17}$$

where mA^{**}_i is the first proposed test in this study, given in Eq. (3.6), and $i = 1, 2, ..., k$. Here, we suggest rejecting H_0 for a large value of mA^{**}_{max}.

3.2.2.2. Sixth Proposed Test

Similarly, the sixth proposed test follows from the previously proposed tests by calculating the maximum of the standardized test statistics for all known peaks p, $p = 1, ..., k$. However, here we used the second test statistic that we proposed in section 3.1.2. Then, the sixth proposed test is given by Eq. (3.18) below

$$mA^{***}_{max} = max(mA^{***}_1, mA^{***}_2, ..., mA^{***}_k), \tag{3.18}$$

where mA^{***}_i is the second proposed test in this study, given in Eq. (3.10), and $i = 1, 2, ..., k$. H_0 is rejected for a large value of mA^{***}_{max}.

3.3. Exact Mean and Variance for Every Peak

In section 2.9, Esra and Fikri derived a general formula of the exact mean and variance for the modified Mack-Wolfe test. Accordingly, in section 3.1, we derived a general formula of the exact mean and variance for the modified Kim-Kim test. These formulas are preferred in building the simulation code since they are in a general form. However, in some cases when the data are at hand and we need to calculate the mean and variance for a test statistic, it is complicated to use those formulas manually. Hence, we derived formulas of extracting the exact mean and variance for the modified Mack-Wolfe test and modified Kim-Kim test for every possible peak in three, four and five populations. In this study, we assume that all the sample sizes are equal $n = n_1 = n_2 = ... = n_k$ where k is the number of treatments in the completely randomized design portion. Also, in the randomized complete block design portion, we assume that $n = n_{ij} = 1$ when $i = 1, 2, ..., b$ and $j = 1, 2, ..., k$ where i is the number of blocks, and j is the number of treatments. To note, the means and variances when having three treatments where the peak is 1 are equal to those when the peak is 3. The mean and variance for four treatments where the peak is 1 are equal to those when the peak is 4; also, the same pattern happens when the peak is 3 or 4 in the four treatments. This fact of equality has been noted for five treatments where the peak is 1 or 5, and also, the same symmetry occurs when the peak is 2 or 4.

3.3.1. Three Populations with Peak at 1 or 3

Under the null distribution, the exact mean and variance of the modified Mack-Wolfe test are given below

$$E_0(A_1) = E_0(A_3) = 2n^2 \tag{3.19}$$

and

$$var_0(A_1) = var_0(A_3) = \frac{1}{2}[n^2(2n+1) + n^3], \tag{3.20}$$

where $n = n_1 = n_2 = ... = n_k$, and k is the number of treatments in the completely randomized design portion.

For the modified Kim-Kim test, the mean and variance are

$$E_0(A) = 2n^2 b \tag{3.21}$$

and

$$var_0(A) = \frac{1}{2}[n^2(2n+1) + n^3]b, \tag{3.22}$$

where $n = 1$, and b is the number of blocks in the randomized complete block design portion.

3.3.2. Three Populations with Peak at 2

Under the null distribution, the exact mean and variance of the modified Mack-Wolfe test are given below

$$E_0(A_2) = n^2 \tag{3.23}$$

and

$$var_0(A_2) = \frac{1}{6}[n^2(2n+1) + n^3], \tag{3.24}$$

where $n = n_1 = n_2 = ... = n_k$, and k is the number of treatments in the completely randomized design portion.

For the modified Kim-Kim test, the mean and variance are

$$E_0(A) = n^2 b \tag{3.25}$$

and

$$var_0(A) = \frac{1}{6}[n^2(2n+1) + n^3]b, \tag{3.26}$$

where $n = 1$, and b is the number of blocks in the randomized complete block design portion.

3.3.3. Four Populations with Peak at 1 or 4

Under the null distribution, the exact mean and variance of the modified Mack-Wolfe test are given below

$$E_0(A_1) = E_0(A_4) = 5n^2 \tag{3.27}$$

and

$$var_0(A_1) = var_0(A_4) = \frac{1}{3}[5n^2(2n+1) + 10n^3], \tag{3.28}$$

where $n = n_1 = n_2 = ... = n_k$, and k is the number of treatments in the completely randomized design portion.

For the modified Kim-Kim test, the mean and variance are

$$E_0(A) = 5n^2b \tag{3.29}$$

and

$$var_0(A) = \frac{1}{3}[5n^2(2n+1) + 10n^3]b, \tag{3.30}$$

where $n = 1$, and b is the number of blocks in the randomized complete block design portion.

3.3.4. Four Populations with Peak at 2 or 3

Under the null distribution, the exact mean and variance of the modified Mack-Wolfe test are given below

$$E_0(A_2) = E_0(A_3) = \frac{5}{2}n^2 \tag{3.31}$$

and

$$var_0(A_2) = var_0(A_3) = \frac{1}{12}[7n^2(2n+1) + 12n^3], \tag{3.32}$$

where $n = n_1 = n_2 = ... = n_k$, and k is the number of treatments in the completely randomized design portion.

For the modified Kim-Kim test, the mean and variance are

$$E_0(A) = \frac{5}{2}n^2b \tag{3.33}$$

and

$$var_0(A) = \frac{1}{12}[7n^2(2n+1) + 12n^3]b, \tag{3.34}$$

where $n = 1$, and b is the number of blocks in the randomized complete block design portion.

3.3.5. Five Populations with Peak at 1 or 5

Under the null distribution, the exact mean and variance of the modified Mack-Wolfe test are given below

$$E_0(A_1) = E_0(A_5) = 10n^2 \tag{3.35}$$

and

$$var_0(A_1) = var_0(A_5) = \frac{1}{6}[25n^2(2n+1) + 75n^3], \tag{3.36}$$

where $n = n_1 = n_2 = ... = n_k$, and k is the number of treatments in the completely randomized design portion.

For the modified Kim-Kim test, the mean and variance are

$$E_0(A) = 10n^2b \tag{3.37}$$

and

$$var_0(A) = \frac{1}{6}[25n^2(2n+1) + 75n^3]b, \tag{3.38}$$

where $n = 1$, and b is the number of blocks in the randomized complete block design portion.

3.3.6. Five Populations with Peak at 2 or 4

Under the null distribution, the exact mean and variance of the modified Mack-Wolfe test are given below

$$E_0(A_2) = E_0(A_4) = \frac{11}{2}n^2 \tag{3.39}$$

and

$$var_0(A_2) = var_0(A_4) = \frac{1}{12}[21n^2(2n+1) + 52n^3], \tag{3.40}$$

where $n = n_1 = n_2 = ... = n_k$, and k is the number of treatments in the completely randomized design portion.

For the modified Kim-Kim test, the mean and variance are

$$E_0(A) = \frac{11}{2}n^2 b \tag{3.41}$$

and

$$var_0(A) = \frac{1}{12}[21n^2(2n+1) + 52n^3]b, \tag{3.42}$$

where $n = 1$, and b is the number of blocks in the randomized complete block design portion.

3.3.7. Five Populations with Peak at 3

Under the null distribution, the exact mean and variance of the modified Mack-Wolfe test are given below

$$E_0(A_3) = 4n^2 \tag{3.43}$$

and

$$var_0(A_3) = \frac{1}{2}[2n^2(2n+1) + 5n^3], \tag{3.44}$$

where $n = n_1 = n_2 = ... = n_k$, and k is the number of treatments in the completely randomized design portion.

For the modified Kim-Kim test, the mean and variance are

$$E_0(A) = 4n^2 b \tag{3.45}$$

and

$$var_0(A) = \frac{1}{2}[2n^2(2n+1) + 5n^3]b, \tag{3.46}$$

where $n = 1$, and b is the number of blocks in the randomized complete block design portion.

3.4. Example

This is an example of how it would be possible that we could start an experiment with one design structure, and unexpectedly, for some reason and before the experiment is completed, we change the design structure to end up with a mixed design. Part of the considered data is taken from the literature in Mack-Wolfe (1981) and the rest of it is made-up to explain how to apply the proposed test statistics. Accordingly, it is believed that the ability to comprehend ideas and learn is an increasing function of age up to a certain point, and then it declines with increasing age. Suppose researchers would like to measure the intelligence of adult males in different four age ranges (treatments) as they get older. Here, the researchers would start by using a randomized complete block design and each male would be considered as a block. After a while, the researchers might start running out of money, or it could become too tedious to find an adult male to measure his intelligence in different age ranges, and the researchers soon could realize that the experiment could not be applied to each male. Instead of continuing using a randomized complete block design, they might decide to use a completely randomized design in the last part of the experiment and randomly assign adults males based on their ages to one of the four age groups. The data in Table 3.2 are values in the range typically obtained on the Wechsler Adult Intelligence Scale by males of various ages. Table 3.2 contains all the observations for both RCBD and CRD portions. An "X" denotes that no observation is taken.

Table 3.2. Wechsler adult intelligence scale score

	Age Group			
Adult Male	**16-19**	**20-34**	**35-54**	**$>$ 55**
1	10.26	13.63	12.85	11.25
2	12.86	13.29	13.24	13.24
3	8.75	8.65	8.29	8.13
4	13.03	13.92	14.99	15.05
5	13.12	13.11	13.01	13.01
6	8.23	8.99	9.67	9.67
7	9.58	10.31	11.09	10.31
8	10.28	11.75	12.76	11.75
9	7.51	7.51	7.50	7.50
10	12.36	12.41	13.15	13.15
11	10.66	X	X	X
12	11.05	X	X	X
13	10.06	X	X	X
14	11.97	X	X	X
15	10.58	X	X	X
16	7.78	X	X	X
17	8.34	X	X	X
18	9.83	X	X	X
19	11.76	X	X	X
20	9.16	X	X	X

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Table 3.2. Wechsler adult intelligence scale score. (Continued)

	Age Group			
Adult Male	**16-19**	**20-34**	**35-54**	**$>$ 55**
21	X	10.65	X	X
22	X	11.25	X	X
23	X	12.06	X	X
24	X	11.54	X	X
25	X	12.58	X	X
26	X	8.39	X	X
27	X	10.27	X	X
28	X	11.12	X	X
29	X	11.66	X	X
30	X	9.16	X	X
31	X	X	10.35	X
32	X	X	10.91	X
33	X	X	11.29	X
34	X	X	14.96	X
35	X	X	12.57	X
36	X	X	10.76	X
37	X	X	10.27	X
38	X	X	10.12	X
39	X	X	11.65	X
40	X	X	13.12	X
41	X	X	X	10.35
42	X	X	X	10.43
43	X	X	X	11.28
44	X	X	X	14.53
45	X	X	X	12.24
46	X	X	X	10.76
47	X	X	X	10.27
48	X	X	X	10.11
49	X	X	X	11.22
50	X	X	X	12.12

"X" represent a missing observation.

In this particular example, we supposed that there were 50 adult males participating. However, due to some constraints, we hypothetically assume that the intelligence was measured in the four different age ranges for only 10 adults males. The remaining 40 adults males were randomly assigned to one of the age ranges based on their ages. This example could be a clear example of a mixed four-sample design. The first portion of the data is a randomized complete block design and the second portion is a completely randomized design.

3.4.1. The Case of Known Umbrella Peak

Suppose the researchers wish to test the following hypothesis:

$$H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4 \tag{3.47}$$

against the umbrella alternative

$$H_1 : \mu_1 \leq \mu_2 \leq \mu_3 \geq \mu_4$$

with at least one strict inequality. In this case, there are 4 age groups with a peak at 3, 10 blocks for the RCBD portion and equal sample sizes of 10 for each treatment for the CRD portion.

Using the methods discussed in sections 2.5 and 3.1, the value of the unmodified Mack-Wolfe test, A_3, is 256.5. The value of the unmodified Kim-Kim test, A is 26. The expected values for the unmodifed Mack-Wolfe and Kim-Kim tests are 200 and 20, respectively. The variance for the unmodified Mack-Wolfe and Kim-Kim tests are 1200 and 15, respectively. The standardized unmodified Mack-Wolfe test, A_3^*, is 1.6310 ($p-value$=0.0514) and the standardized value of unmodified Kim-Kim test, A^*, is 1.5492 ($p-value$=0.0607). The value of the modified Mack-Wolfe test, mA_3, is 331.5. The value of the modified Kim-Kim test, mA is 33. Also, the expected values for the modified Mack-Wolfe and Kim-Kim tests are 250 and 25, respectively. The variance for the modified Mack-Wolfe and Kim-Kim tests are 2225 and 27.5, respectively. The standardized modified Mack-Wolfe test, mA_3^*, is 1.7278 ($p-value$=0.0420) and the standardized value of the modified Kim-Kim test, mA^*, is 1.5255 ($p-value$=0.0636). See Table 3.3 below:

Table 3.3. The results of Wechsler adult intelligence scale score example

	Nonmodification		**Distance Modification**	
	Test	E **and** var	**Test**	E **and** var
Mack-Wolfe	A_3=256.5	$E(A_3)$=200 $var(A_3)$=1200	mA_3=331.5	$E(mA_3)$=250 $var(mA_3)$=2225
Standardized Mack-Wolfe	A_3^*=1.6310		mA_3^*=1.7278	
Kim-Kim	A=26	$E(A)$=20 $var(A)$=15	mA=33	$E(mA)$=25 $var(mA)$=27.5
Standardized Kim-Kim	A^*=1.5492		mA^*=1.5255	

Thus, the first proposed test statistic value, mA_3^{**}, is 3.2533, and the standardized value, mA^{**}, is 2.3005 ($p-value$=0.0107). Moreover, the second proposed test statistic value, mA_3^{***}, is 364.5 and the standardized value, mA^{***}, is 1.8858 ($p-value$=0.0297). Clearly, both of the proposed test statistics in this research reject the null hypothesis at the $\alpha = 0.05$ level. We can see here that the $p-value$ of the first proposed test statistic is better than the second test.

Subsequently, the first previously proposed test statistic value, A_3^{**}, is 3.1802 and the standardized value, A^{**}, is 2.2488 ($p-value$=0.0123). Moreover, the second previous proposed test statistic value, A_3^{***}, is 282.5, and the standardized value, A^{***}, is 1.7931 ($p-value$=0.0365). It can be noted that both of the previous test statistics, which were proposed by Magel et al. (2010), reject the null hypothesis at the $\alpha = 0.05$ level. Also, the $p-value$ of the first previous proposed test statistic is better than the second test.

In this particular example, when the peak is known, by applying the distance modification, it can be seen that our first two proposed test statistics are slightly more powerful than the test statistics that were proposed by Magel et al. (2010), respectively. Also, it is clear that when we combine the two designs RCBD and CRD, we could have enough evidence to reject the null hypothesis. On the other hand, when we use just one single design, we lose some information about the data that are available at hand, and we might not have enough evidence to reject the null hypothesis.

3.4.2. The Case of Unknown Umbrella Peak

Suppose the researchers wish to test the following hypothesis:

$$H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4 \tag{3.48}$$

against the umbrella alternative

$$H_1 : \mu_1 \leq ... \leq \mu_p \geq ... \geq \mu_4, \quad \text{for some } \ p$$

with at least one strict inequality. In this case, there are 4 age groups (treatments) with unknown peak, 10 blocks for the randomized complete block portion, and equal sample sizes of 10 for each treatment for the completely randomized portion.

We start by using the two methods of no distance modification that were discussed in section 3.2 to compute the third and fourth test statistics (A^{***}_{max} and A^{**}_{max}). For this purpose, we begin by calculating the Mack-Wolfe statistics A_p's for the CRD portion:

$$A_1 = U_{21} + U_{31} + U_{41} + U_{32} + U_{42} + U_{43} = 32.5 + 25 + 27 + 42.5 + 46.5 + 56.5 = 230,$$

$$A_2 = U_{12} + U_{32} + U_{42} + U_{43} = 67.5 + 42.5 + 46.5 + 56.5 = 213,$$

$$A_3 = U_{12} + U_{13} + U_{23} + U_{43} = 67.5 + 75 + 57.5 + 56.5 = 256.5$$

and

$$A_4 = U_{12} + U_{13} + U_{14} + U_{23} + U_{24} + U_{34} = 67.5 + 75 + 73 + 57.5 + 53.5 + 43.5 = 270.$$

Then, we find the $E_0(A_p)$'s and $var_0(A_p)$'s to obtain the A^*_p's:

$$E_0(A_1) = E_0(A_4) = 300 \quad and \quad var_0(A_1) = var_0(A_4) = 1716.67,$$

$$E_0(A_2) = E_0(A_3) = 200 \quad and \quad var_0(A_2) = var_0(A_3) = 1200.$$

It implies that

$$A^*_1 = [A_1 - E_0(A_1)]/\sqrt{var_0(A_1)} = (230 - 300)/\sqrt{1716.67} = -1.6895,$$

$$A^*_2 = [A_2 - E_0(A_2)]/\sqrt{var_0(A_2)} = (213 - 200)/\sqrt{1200} = 0.3753,$$

$$A^*_3 = [A_3 - E_0(A_3)]/\sqrt{var_0(A_3)} = (256.5 - 200)/\sqrt{1200} = 1.6310$$

and

$$A^*_4 = [A_4 - E_0(A_4)]/\sqrt{var_0(A_4)} = (270 - 300)/\sqrt{1716.67} = 1.6895.$$

In this step, we calculate the Mack-Wolfe statistic for each possible peak over the blocks to calculate the Kim-Kim statistics A's for the RCBD portion.

For the first block:

$$A_1 = U_{21} + U_{31} + U_{41} + U_{32} + U_{42} + U_{43} = 0 + 0 + 0 + 1 + 1 + 1 = 3,$$

$$A_2 = U_{12} + U_{32} + U_{42} + U_{43} = 1 + 1 + 1 + 1 = 4,$$

$$A_3 = U_{12} + U_{13} + U_{23} + U_{43} = 1 + 1 + 0 + 1 = 3$$

and

$$A_4 = U_{12} + U_{13} + U_{14} + U_{23} + U_{24} + U_{34} = 1 + 1 + 1 + 0 + 0 + 0 = 3.$$

For the last block:

$$A_1 = U_{21} + U_{31} + U_{41} + U_{32} + U_{42} + U_{43} = 0 + 0 + 0 + 0 + 0 + 0.5 = 0.5,$$

$$A_2 = U_{12} + U_{32} + U_{42} + U_{43} = 1 + 0 + 0 + 0.5 = 1.5,$$

$$A_3 = U_{12} + U_{13} + U_{23} + U_{43} = 1 + 1 + 1 + 0.5 = 3.5$$

and

$$A_4 = U_{12} + U_{13} + U_{14} + U_{23} + U_{24} + U_{34} = 1 + 1 + 1 + 1 + 1 + 0.5 = 5.5.$$

To calculate the Kim-Kim statistics Ab_p's, we sum all Mack-Wolfe statistics A_p for each possible peak over the blocks:

$$Ab_1 = \sum_{i=1}^{b=10} A_1 = 3 + 2.5 + 6 + 0 + 5.5 + 0.5 + 1.5 + 1.5 + 5 + 0.5 = 26,$$

$$Ab_2 = \sum_{i=1}^{b=10} A_2 = 4 + 3.5 + 3 + 1 + 2.5 + 1.5 + 2.5 + 2.5 + 3 + 1.5 = 25,$$

$$Ab_3 = \sum_{i=1}^{b=10} A_3 = 3 + 2.5 + 1 + 3 + 0.5 + 3.5 + 4 + 4 + 1 + 3.5 = 26$$

and

$$Ab_4 = \sum_{i=1}^{b=10} A_4 = 3 + 3.5 + 0 + 6 + 0.5 + 5.5 + 4.5 + 4.5 + 1 + 5.5 = 34.$$

Then, we find the $E_0(Ab_p)$'s and $var_0(Ab_p)$'s to obtain the Ab_p^*'s:

$$E_0(Ab_1) = E_0(Ab_4) = 30 \quad and \quad var_0(Ab_1) = var_0(Ab_4) = 21.6667,$$

$$E_0(Ab_2) = E_0(Ab_3) = 20 \quad and \quad var_0(Ab_2) = var_0(Ab_3) = 15.$$

It implies that

$$Ab_1^* = [Ab_1 - E_0(Ab_1)]/\sqrt{var_0(Ab_1)} = (26 - 30)/\sqrt{21.6667} = -0.8593,$$

$$Ab_2^* = [Ab_2 - E_0(Ab_2)]/\sqrt{var_0(Ab_2)} = (25 - 20)/\sqrt{15} = 1.2910,$$

$$Ab_3^* = [Ab_3 - E_0(Ab_3)]/\sqrt{var_0(Ab_3)} = (26 - 20)/\sqrt{15} = 1.5492$$

and

$$Ab_4^* = [Ab_4 - E_0(Ab_4)]/\sqrt{var_0(Ab_4)} = (34 - 30)/\sqrt{21.6667} = 0.8593.$$

Now, we can calculate the third test statistic A_{max}^{**} for the mixed design by summing the standardized version of the Mack-Wolfe and Kim-Kim statistics; then, standardizing the summation:

$$A_1^{**} = [A_1^* + Ab_1^*]/\sqrt{2} = (-1.6895 + (-0.8593))/\sqrt{2} = -1.8023,$$

$$A_2^{**} = [A_2^* + Ab_2^*]/\sqrt{2} = (0.3753 + 1.2910)/\sqrt{2} = 1.1782,$$

$$A_3^{**} = [A_3^* + Ab_3^*]/\sqrt{2} = (1.6310 + 1.5492)/\sqrt{2} = 2.2488$$

and

$$A_4^{**} = [A_4^* + Ab_4^*]/\sqrt{2} = (1.6895 + 0.8593)/\sqrt{2} = 1.8023.$$

Therefore, $A_{max}^{**} = max(A_1^{**}, ..., A_4^{**}) = max(-1.8023, 1.1782, 2.2488, 1.8023) = 2.2488$. With $k = 4$, equal sample size proportions for the CRD and $n_i = 1$ for the RCBD, we know, from Table 3.1, that the estimated 95$^{\text{th}}$ percentile (critical value) for the asymptotic null distribution of A_{max}^{**}, when the number of the blocks is equal to the sample size of the CRD portion, is 2.2397. Since $A_{max}^{**} = 2.2488 \geq 2.2397$, there is a significant evidence for an umbrella patterned intelligence curve.

Also, we can calculate the fourth test statistic A_{max}^{***} for the mixed design by summing the unstandardized version of the Mack-Wolfe and Kim-Kim statistics; then, standardizing the summation:

$$A_1^{***} = [A_1 + Ab_1] - [E_0(A_1) + E_0(Ab_1)]/\sqrt{var_0(A_1) + var_0(Ab_1)} = -1.7749,$$

$$A_2^{***} = [A_2 + Ab_2] - [E_0(A_2) + E_0(Ab_2)]/\sqrt{var_0(A_1) + var_0(Ab_1)} = 0.5164,$$

$$A_3^{***} = [A_3 + Ab_3] - [E_0(A_3) + E_0(Ab_3)]/\sqrt{var_0(A_1) + var_0(Ab_1)} = 1.7931$$

and

$$A_4^{***} = [A_4 + Ab_4] - [E_0(A_4) + E_0(Ab_4)]/\sqrt{var_0(A_1) + var_0(Ab_1)} = 1.7749. \quad 00$$

Therefore, $A_{max}^{***} = max(A_1^{***}, ..., A_4^{***}) = max(-1.7749, 0.5164, 1.7931, 1.7749) = 1.7931$. With $k = 4$, equal sample size proportions for the CRD and $n_i = 1$ for the RCBD, we know, from Table 3.1, that the estimated 95$^{\text{th}}$ percentile (critical value) for the asymptotic null distribution of A_{max}^{***}, when the number of the blocks is equal to the sample size of the CRD portion, is 2.2066. Since $A_{max}^{***} = 1.7931 \leq 2.2066$, we fail to reject the null hypothesis and there is no significant evidence for an umbrella patterned intelligence curve. It has been seen how we can use the third and fourth test statistics to test the umbrella alternative when the peak is unknown. We found that the third test rejects the null hypothesis while the fourth test does not.

Next, we will use the fifth and sixth test statistics that were discussed in section 3.2, in which we apply the distance modification to the Mack-Wolfe and Kim-Kim statistics. For this purpose, we begin by calculating the modified Mack-Wolfe statistics mA_p's for the CRD portion:

$$mA_1 = (2-1)U_{21} + (3-1)U_{31} + (4-1)U_{41} + (3-2)U_{32} + (4-2)U_{42} + (4-3)U_{43}$$
$$= 32.5 + 50 + 81 + 42.5 + 93 + 56.5 = 355.5,$$

$$mA_2 = (2-1)U_{12} + (3-2)U_{32} + (4-2)U_{42} + (4-3)U_{43} = 67.5 + 42.5 + 93 + 56.5 = 259.5,$$

$$mA_3 = (2-1)U_{12} + (3-1)U_{13} + (3-2)U_{23} + (4-3)U_{43} = 67.5 + 150 + 57.5 + 56.5 = 331.5$$

and

$$mA_4 = (2-1)U_{12} + (3-1)U_{13} + (4-1)U_{14} + (3-2)U_{23} + (4-2)U_{24} + (4-3)U_{34}$$
$$= 67.5 + 150 + 219 + 57.5 + 107 + 43.5 = 644.5.$$

Then, we find the $E_0(mA_p)$'s and $var_0(mA_p)$'s to obtain the mA_p^*'s:

$$E_0(mA_1) = E_0(mA_4) = 500 \quad and \quad var_0(mA_1) = var_0(mA_4) = 6833.33,$$

$$E_0(mA_2) = E_0(mA_3) = 250 \quad and \quad var_0(mA_2) = var_0(mA_3) = 2225.$$

It implies that

$$mA_1^* = [mA_1 - E_0(mA_1)]/\sqrt{var_0(mA_1)} = (77.5 - 500)/\sqrt{6833.33} = -1.7480,$$

$$mA_2^* = [mA_2 - E_0(mA_2)]/\sqrt{var_0(mA_2)} = (75.5 - 250)/\sqrt{2225} = 0.2014,$$

$$mA_3^* = [mA_3 - E_0(mA_3)]/\sqrt{var_0(mA_3)} = (97.5 - 250)/\sqrt{2225} = 1.7278$$

and

$$mA_4^* = [mA_4 - E_0(mA_4)]/\sqrt{var_0(mA_4)} = (172.5 - 500)/\sqrt{6833.33} = 1.7480.$$

In this step, we calculate the modified Mack-Wolfe statistic for each possible peak over the blocks to calculate the modified Kim-Kim statistics mA's for the RCBD portion.

For the first block:

$$mA_1 = (2-1)U_{21} + (3-1)U_{31} + (4-1)U_{41} + (3-2)U_{32} + (4-2)U_{42} + (4-3)U_{43}$$
$$= 0 + 0 + 0 + 1 + 2 + 1 = 4,$$

$$mA_2 = (2-1)U_{12} + (3-2)U_{32} + (4-2)U_{42} + (4-3)U_{43} = 1 + 1 + 2 + 1 = 5,$$

$$mA_3 = (2-1)U_{12} + (3-1)U_{13} + (3-2)U_{23} + (4-3)U_{43} = 1 + 2 + 0 + 1 = 4$$

and

$$mA_4 = (2-1)U_{12} + (3-1)U_{13} + (4-1)U_{14} + (3-2)U_{23} + (4-2)U_{24} + (4-3)U_{34}$$
$$= 1 + 2 + 3 + 0 + 0 + 0 = 6.$$

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For the last block:

$$mA_1 = (2-1)U_{21} + (3-1)U_{31} + (4-1)U_{41} + (3-2)U_{32} + (4-2)U_{42} + (4-3)U_{43}$$
$$= 0 + 0 + 0 + 0 + 0 + 0.5 = 0.5,$$
$$mA_2 = (2-1)U_{12} + (3-2)U_{32} + (4-2)U_{42} + (4-3)U_{43} = 1 + 0 + 0 + 0.5 = 1.5,$$
$$mA_3 = (2-1)U_{12} + (3-1)U_{13} + (3-2)U_{23} + (4-3)U_{43} = 1 + 2 + 1 + 0.5 = 4.5$$

and

$$mA_4 = (2-1)U_{12} + (3-1)U_{13} + (4-1)U_{14} + (3-2)U_{23} + (4-2)U_{24} + (4-3)U_{34}$$
$$= 1 + 2 + 3 + 1 + 2 + 0.5 = 9.5.$$

To calculate the modified Kim-Kim statistics mAb_p's, we sum all modified Mack-Wolfe statistics mA_p for each possible peak over the blocks:

$$mAb_1 = \sum_{i=1}^{b=10} mA_1 = 4 + 3.5 + 10 + 0 + 9.5 + 0.5 + 2 + 2 + 9 + 0.5 = 41,$$
$$mAb_2 = \sum_{i=1}^{b=10} mA_2 = 5 + 4.5 + 4 + 1 + 3.5 + 1.5 + 3 + 3 + 4 + 1.5 = 31,$$
$$mAb_3 = \sum_{i=1}^{b=10} mA_3 = 4 + 3.5 + 1 + 4 + 0.5 + 4.5 + 5 + 5 + 1 + 4.5 = 33$$

and

$$mAb_4 = \sum_{i=1}^{b=10} mA_4 = 6 + 6.5 + 0 + 10 + 0.5 + 9.5 + 8 + 8 + 1 + 9.5 = 59.$$

Then, we find the $E_0(mAb_p)$'s and $var_0(mAb_p)$'s to obtain the mAb_p^*'s:

$$E_0(mAb_1) = E_0(mAb_4) = 50 \quad and \quad var_0(mAb_1) = var_0(mAb_4) = 83.3333,$$
$$E_0(mAb_2) = E_0(mAb_3) = 25 \quad and \quad var_0(mAb_2) = var_0(mAb_3) = 27.5.$$

It implies that

$$mAb_1^* = [mAb_1 - E_0(mAb_1)]/\sqrt{var_0(mAb_1)} = (41 - 50)/\sqrt{83.3333} = -0.9859,$$

$$mAb_2^* = [mAb_2 - E_0(mAb_2)]/\sqrt{var_0(mAb_2)} = (31 - 25)/\sqrt{27.5} = 1.1442,$$

$$mAb_3^* = [mAb_3 - E_0(mAb_3)]/\sqrt{var_0(mAb_3)} = (33 - 25)/\sqrt{27.5} = 1.5255$$

and

$$mAb_4^* = [mAb_4 - E_0(mAb_4)]/\sqrt{var_0(mAb_4)} = (59 - 50)/\sqrt{83.3333} = 0.9859.$$

Now, we can calculate the fifth test statistic mA^{**}_{max} for the mixed design by summing the standardized version of the modified Mack-Wolfe and modified Kim-Kim statistics; then, standardizing the summation:

$$mA_1^{**} = [mA_1^* + mAb_1^*]/\sqrt{2} = (-1.7480 + (-0.9859))/\sqrt{2} = -1.9332,$$

$$mA_2^{**} = [mA_2^* + mAb_2^*]/\sqrt{2} = (0.2014 + 1.1442)/\sqrt{2} = 0.9515,$$

$$mA_3^{**} = [mA_3^* + mAb_3^*]/\sqrt{2} = (1.7278 + 1.5255)/\sqrt{2} = 2.3005$$

and

$$mA_4^{**} = [mA_4^* + mAb_4^*]/\sqrt{2} = (1.7480 + 0.9859)/\sqrt{2} = 1.9332.$$

Therefore, $mA^{**}_{max} = max(mA_1^{**}, ..., mA_4^{**}) = max(-1.9332, 0.9515, 2.3005, 1.9332) = 2.3005$. With $k = 4$, equal sample size proportions for the CRD and $n_i = 1$ for the RCBD, we know, from Table 3.1, that the estimated 95^{th} percentile (critical value) for the asymptotic null distribution of mA^{**}_{max}, when the number of the blocks is equal to the sample size of the CRD portion, is 2.1897. Since $mA^{**}_{max} = 2.3005 \geq 2.1897$, we reject the null hypothesis and there is a significant evidence for an umbrella patterned intelligence curve.

Also, we can calculate the sixth test statistic mA^{***}_{max} for the mixed design by summing the unstandardized version of the modified Mack-Wolfe and modified Kim-Kim statistics; then, standardizing the summation:

$$mA_1^{***} = [mA_1 + mAb_1] - [E_0(mA_1) + E_0(mAb_1)]/\sqrt{var_0(mA_1) + var_0(mAb_1)} = -1.8457,$$

$$mA_2^{***} = [mA_2 + mAb_2] - [E_0(mA_2) + E_0(mAb_2)]/\sqrt{var_0(mA_1) + var_0(mAb_1)} = 0.3266,$$

$$mA_3^{***} = [mA_3 + mAb_3] - [E_0(mA_3) + E_0(mAb_3)]/\sqrt{var_0(mA_1) + var_0(mAb_1)} = 1.8858$$

and

$$mA_4^{***} = [mA_4 + mAb_4] - [E_0(mA_4) + E_0(mAb_4)]/\sqrt{var_0(mA_1) + var_0(mAb_1)} = 1.8457.$$

Therefore, $mA_{max}^{***} = max(mA_1^{***}, ..., mA_4^{***}) = max(-1.8457, 0.3266, 1.8858, 1.8457) = 1.8858$. With $k = 4$, equal sample size proportions for the CRD and $n_i = 1$ for the RCBD, we know, from Table 3.1, that the estimated 95^{th} percentile (critical value) for the asymptotic null distribution of mA_{max}^{***}, when the number of the blocks is equal to the sample size of the CRD portion, is 2.1913. Since $mA_{max}^{***} = 1.8858 \leq 2.1992$, we fail to reject the null hypothesis and there is no significant evidence for an umbrella-patterned intelligence curve. It has been seen how we can use the fifth and sixth test statistics to test the umbrella alternative when the peak is unknown. We found that the fifth test rejects the null hypothesis while the sixth test does not.

In this example, when the peak is unknown, it can be seen that the third and fifth proposed test statistics, in which we use the method of standardizing first, both reject the null hypothesis while the fourth and sixth test, in which we use the method of standardizing second, do not reject the null. Also, it can be noted that the fifth test, in which we applied the distance modification, is more powerful to reject the null better than the third test statistics that were proposed without applying the distance modification to the Mack-Wolfe and Kim-Kim statistics.

Generally, in this example, we notice that applying the distance modification to the Mack-Wolfe and Kim-Kim statistics provides more power to the test statistic mA_{max}^{**} to test the umbrella alternative in a mixed design for both known and unknown peaks.

4. DESCRIPTION OF THE SIMULATION STUDY

This chapter details the process of the simulations used in this research. The simulation study is designed via Monte Carlo Simulation and implemented in SAS version 9.4. It is conducted to investigate the type I error and the performance of the proposed test statistics. The observations are assumed to follow three different underlying distributions, which are included in this study: standard exponential, standard normal and t distribution with three degrees of freedom. To note, the normal and t distribution should be symmetric while the exponential should not. In this research, the data are generated from a mixed design consisting of a CRD portion and an RCBD portion.

All the simulations used to estimate the alpha values and powers are based on 5,000 iterations. The initial stage of the simulation is to estimate the level of significance of the proposed test statistics, namely where there is no location parameter was added. For all the proposed tests, the significance level (α) is stated to be 0.05, based on the asymptotic standard normal distribution of the test statistics under the null hypothesis. The estimated level of significance (α) is obtained by counting the number of times that the null hypothesis is rejected and then divided by the number of sample generated (5,000) for each test of the proposed test statistics. It is valued to compare the powers of the tests when the alpha values are approximately 0.05. Accordingly, when the estimated alpha values (α) approach 0.05, the test statistics are comparable to each other. The second stage of the simulation is to estimate and compare the power of the proposed test statistics under various situations (different location parameter configurations), namely after adding location parameters. For each situation, we also use 5,000 samples to estimate the power by counting the number of times that the proposed test statistic is rejected divided by the number of sample generated (5,000).

4.1. The Case of Known Umbrella Peak

In this case, three, four and five populations are considered with the assumption that the peak p is known. For three treatments, the peak is at the second population. For the four populations, the peaks are considered to be at the second and third populations. When there are five populations, the peaks are considered at the second, third and fourth populations. For every considered distribution, equal sample sizes for the CRD portion are selected so that the sample size, n, is 6, 10, 16 and 20. The number of blocks (complete blocks) for the RCBD is considered to be half, equal and twice the sample size for each treatment in the CRD. Also, for the estimated powers, a variety of location parameter configurations (treatment effects) are considered for three, four and five populations as the following:

4.1.1. Three Populations with Peak at 2

Under three treatments with the peak at two in the mixed design, the powers are estimated in the following cases:

1. The peak is distinct and there is equal spacing between parameters; for example, (0.0, 1.0, 0.0).

2. The peak is distinct and there is unequal spacing between parameters; for example, (0.0, 1.0, 0.5) and (0.5, 1.0, 0.0).

3. One additional parameter equals the peak; for example, (0.5, 0.5, 0.0) and (0.0, 0.5, 0.5).

4.1.2. Four Populations with Peak at 2

Under four treatments with the peak at two in the mixed design, the powers are estimated in the following cases:

1. The peak is distinct and the other parameters are the same; for example, (0.0, 0.5, 0.0, 0.0) and (0.5, 1.0, 0.5, 0.5).

2. Two population parameters are the same, but different from the peak and less than the first treatment; for example, (0.5, 1.0, 0.2, 0.2).

3. Two population parameters are the same, but different from the peak and greater than the last treatment; for example, (0.25, 0.5, 0.25, 0.0).

4. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other; for example, (0.5, 0.5, 0.0, 0.0) and (0.0, 0.5, 0.5, 0.0).

5. One additional parameter equals the peak and the other parameters are different from the peak and different from each other; for example, (0.5, 0.5, 0.2, 0.0).

6. Two additional parameters are equal to the peak; for example, (0.0, 0.5, 0.5, 0.5) and (0.5, 0.5, 0.5, 0.0).

7. There is unequal spacing between parameters; for example, (0.0, 1.0, 0.75, 0.2) and (0.0, 0.75, 0.5, 0.25).

4.1.3. Four Populations with Peak at 3

Under four treatments with the peak at three in the mixed design, the powers are estimated in the following cases:

1. The peak is distinct and the other parameters are the same; for example, (0.0, 0.0, 0.5, 0.0) and (0.5, 0.5, 1.0, 0.5).

2. Two population parameters are the same, but different from the peak and less than the last treatment; for example, (0.2, 0.2, 1.0, 0.5).

3. Two population parameters are the same, but different from the peak and greater than the first treatment; for example, (0.0, 0.25, 0.5, 0.25).

4. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other; for example, (0.0, 0.0, 0.5, 0.5) and (0.0, 0.5, 0.5, 0.0).

5. One additional parameter equals the peak and the other parameters are different from the peak and different from each other; for example, (0.0, 0.2, 0.5, 0.5).

6. Two additional parameter are equal to the peak; for example, (0.0, 0.5, 0.5, 0.5) and (0.5, 0.5, 0.5, 0.0).

7. There is unequal spacing between parameters; for example, (0.2, 0.75, 1.0, 0.0) and (0.25, 0.5, 0.75, 0.0).

4.1.4. Five Populations with Peak at 2

Under five treatments with the peak at two in the mixed design, the powers are estimated in the following cases:

1. The peak is distinct and the other parameters are the same; for example, (0.0, 0.5, 0.0, 0.0, 0.0).

2. The peak is distinct and each two of the other parameters are equal to each other; for example, (0.0, 0.5, 0.2, 0.2, 0.0) and (0.2, 0.5, 0.2, 0.0, 0.0).

3. The peak is distinct, two of the other parameters are equal to each other and the other two parameters are different from each other; for example, (0.0, 0.6, 0.4, 0.4, 0.2), (0.2, 0.6, 0.4, 0.4, 0.0), (0.0, 0.7, 0.4, 0.2, 0.2), (0.2, 0.7, 0.4, 0.0, 0.0), (0.0, 0.8, 0.5, 0.2, 0.0), (0.0, 0.8, 0.6, 0.4, 0.2), (0.2, 0.8, 0.6, 0.2, 0.0) and (0.4, 0.8, 0.4, 0.2, 0.0).

4. The peak is distinct, three of the other parameters are equal to each other where two of them on the edges; for example, (0.0, 0.5, 0.2, 0.0, 0.0).

5. The peak is distinct and the other parameters are different from each other; for example, (0.2, 0.8, 0.6, 0.4, 0.0), (0.0, 0.8, 0.6, 0.4, 0.2).

6. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other; for example, (0.5, 0.5, 0.0, 0.0, 0.0) and (0.2, 0.5, 0.5, 0.2, 0.2).

7. One additional parameter equals the peak, the two other parameters are equal to each other but not equal to the peak and one parameter is different; for example, (0.5, 0.5, 0.2, 0.2, 0.0), (0.5, 0.5, 0.2, 0.0, 0.0), (0.2, 0.5, 0.5, 0.0, 0.0), (0.0, 0.5, 0.5, 0.2, 0.2), (0.0, 0.5, 0.5, 0.2, 0.0) and (0.2, 0.5, 0.5, 0.2, 0.0).

8. One additional parameter equals the peak, and the other parameters are different from the peak and different from each other; for example, (0.8, 0.8, 0.5, 0.2, 0.0) and (0.2, 0.7, 0.7, 0.3, 0.0).

9. Two additional parameters are equal to the peak, and the other parameters are equal to each other; for example, (0.5, 0.5, 0.5, 0.0, 0.0) and (0.2, 0.5, 0.5, 0.5, 0.2).

10. Two additional parameters are equal to the peak, and the other parameters are different from each other; for example, (0.5, 0.5, 0.5, 0.2, 0.0), (0.0, 0.5, 0.5, 0.5, 0.2) and (0.2, 0.5, 0.5, 0.5, 0.0).

11. Three additional parameters are equal to the peak; for example, (0.5, 0.5, 0.5, 0.5, 0.0) and (0.0, 0.5, 0.5, 0.5, 0.5).

12. Three parameters are different from the peak but are equal to each other and less than the first treatment; for example, (0.2, 0.5, 0.0, 0.0, 0.0).

13. Three parameters are different from the peak but are equal to each other and greater than the first treatment; for example, (0.0, 0.6, 0.2, 0.2, 0.2).

4.1.5. Five Populations with Peak at 3

Under five treatments with the peak at three in the mixed design, the powers are estimated in the following cases:

1. The peak is distinct and the other parameters are the same; for example, (0.0, 0.0, 0.5, 0.0, 0.0).

2. The peak is distinct and each two of the other parameters are equal to each other; for example, (0.0, 0.0, 0.5, 0.2, 0.2), (0.2, 0.2, 0.5, 0.0, 0.0) and (0.0, 0.2, 0.5, 0.2, 0.0).

3. The peak is distinct, two of the other parameters are equal to each other and the other two parameters are different from each other; for example, (0.0, 0.4, 0.7, 0.2, 0.0), (0.0, 0.4, 0.7, 0.4, 0.2) and (0.2, 0.4, 0.7, 0.4, 0.0).

4. The peak is distinct and the other parameters are different from each other; for example, (0.0, 0.2, 0.8, 0.5, 0.3), (0.0, 0.8, 0.6, 0.4, 0.2).

5. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other; for example, (0.0, 0.5, 0.5, 0.0, 0.0) and (0.2, 0.5, 0.5, 0.2, 0.2).

6. One additional parameter equals the peak, two other parameters are equal to each other but not equal to the peak and one parameter is different; for example, (0.0, 0.5, 0.5, 0.2, 0.0) and (0.2, 0.5, 0.5, 0.2, 0.0).

7. One additional parameter equals the peak, and the other parameters are different from the peak and different from each other; for example, (0.0, 0.8, 0.8, 0.5, 0.2) and (0.2, 0.5, 0.8, 0.8, 0.0).

8. Two additional parameters are equal to the peak, and the other parameters are equal to each other; for example, (0.0, 0.5, 0.5, 0.5, 0.0), (0.5, 0.5, 0.5, 0.0, 0.0) and (0.0, 0.0, 0.5, 0.5, 0.5).

9. Two additional parameters are equal to the peak, and the other parameters are different from each other; for example, (0.0, 0.5, 0.5, 0.5, 0.2), (0.5, 0.5, 0.5, 0.2, 0.0) and (0.0, 0.2, 0.5, 0.5, 0.5).

10. Three additional parameters are equal to the peak; for example, (0.0, 0.5, 0.5, 0.5, 0.5) and (0.5, 0.5, 0.5, 0.5, 0.0).

4.1.6. Five Populations with Peak at 4

Under five treatments with the peak at four in the mixed design, the powers are estimated in the following cases:

1. The peak is distinct and the other parameters are the same; for example, (0.0, 0.0, 0.0, 0.5, 0.0).

2. The peak is distinct and each two of the other parameters are equal to each other; for example, (0.0, 0.2, 0.2, 0.5, 0.0) and (0.0, 0.0, 0.2, 0.5, 0.2).

3. The peak is distinct, two of the other parameters are equal to each other and the other two parameters are different from each other; for example, (0.2, 0.4, 0.4, 0.6, 0.0), (0.0, 0.4, 0.4, 0.6, 0.2), (0.2, 0.2, 0.4, 0.7, 0.0), (0.0, 0.0, 0.4, 0.7, 0.2), (0.0, 0.2, 0.5, 0.8, 0.0), (0.2, 0.4, 0.6, 0.8, 0.0), (0.0, 0.2, 0.6, 0.8, 0.2) and (0.0, 0.2, 0.4, 0.8, 0.4).

4. The peak is distinct, three of the other parameters are equal to each other where two of them on the edges; for example, (0.0, 0.0, 0.2, 0.5, 0.0).

5. The peak is distinct and the other parameters are different from each other; for example, (0.0, 0.4, 0.6, 0.8, 0.2), (0.2, 0.4, 0.6, 0.8, 0.0).

6. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other; for example, (0.0, 0.0, 0.0, 0.5, 0.5) and (0.2, 0.2, 0.5, 0.5, 0.2).

7. One additional parameter equals the peak, the two other parameters are equal to each other but not equal to the peak and one parameter is different; for example, (0.0, 0.2, 0.2, 0.5, 0.5), (0.0, 0.0, 0.2, 0.5, 0.5), (0.0, 0.0, 0.5, 0.5, 0.2), (0.2, 0.2, 0.5, 0.5, 0.0), (0.0, 0.2, 0.5, 0.5, 0.0) and (0.0, 0.2, 0.5, 0.5, 0.2).

8. One additional parameter equals the peak, and the other parameters are different from the peak and different from each other; for example, (0.0, 0.2, 0.5, 0.8, 0.8) and (0.0, 0.3, 0.7, 0.7, 0.2).

9. Two additional parameters are equal to the peak, and the other parameters are equal to each other; for example, (0.0, 0.0, 0.5, 0.5, 0.5) and (0.2, 0.5, 0.5, 0.5, 0.2).

10. Two additional parameters are equal to the peak, and the other parameters are different from each other; for example, (0.0, 0.2, 0.5, 0.5, 0.5), (0.2, 0.5, 0.5, 0.5, 0.0) and (0.0, 0.5, 0.5, 0.5, 0.2).

11. Three additional parameters are equal to the peak; for example, (0.0, 0.5, 0.5, 0.5, 0.5) and (0.5, 0.5, 0.5, 0.5, 0.0).

12. Three parameters are different from the peak but are equal to each other and less than the first treatment; for example, (0.0, 0.0, 0.0, 0.5, 0.2).

13. Three parameters are different from the peak but are equal to each other and greater than the first treatment; for example, (0.2, 0.2, 0.2, 0.6, 0.0).

4.2. The Case of Unknown Umbrella Peak

In this Case, three, four and five populations are considered with the assumption that the peak p is unknown. Here, the peak has to be estimated from each of the 5,000 simulated data. For every considered distribution, equal sample sizes for the CRD portion are selected so that the sample size, n, is 10. The number of blocks (complete blocks) for the RCBD is considered to be half, equal and twice the sample size for each treatment.

As we mentioned in section 3.2, the asymptotical critical values are estimated by Monte Carlo simulations for all four statistics $A^{**}_{max} := \max_{p=1,\ldots,k} A^{**}_p$, $A^{***}_{max} := \max_{p=1,\ldots,k} A^{***}_p$, $mA^{**}_{max} := \max_{p=1,\ldots,k} mA^{**}_p$ and $mA^{***}_{max} := \max_{p=1,\ldots,k} mA^{***}_p$. The asymptotical critical values are estimated when the limiting sample size proportions for the CRD portion are all equal and the number of the blocks for the RCBD portion varies (see Table 3.1). After obtaining an empirical cumulative distribution of A^{**}_{max}, A^{***}_{max}, mA^{**}_{max} and mA^{***}_{max} based on a sample size of $10,000$ from the corresponding true distribution, the estimated critical values for the A^{**}_{max}, A^{***}_{max}, mA^{**}_{max} and mA^{***}_{max} tests then correspond to the appropriate 90^{th}, 95^{th} or 99^{th} percentile of this empirical distribution. Regardless of the number of the blocks in the RCBD, the Monte Carlo simulations show that we could safely use the $n_1 = n_2 = ... = n_k = 10$ critical values to approximate the corresponding critical values for any sample size greater than or equal to 5 in the CRD portion and for any number of blocks greater than or equal to 5 in the RCBD portion.

To estimate the powers for the proposed tests in this case, a variety of location parameter configurations (treatment effects) are considered for three, four and five populations as the following:

4.2.1. Three Populations with Unknown Peak

Under three treatments with an unknown peak in the mixed design, the peak and powers are estimated in the following cases:

1. The peak is distinct and there is equal spacing between parameters; for example, (0.0, 0.5, 1.0) and (0.0, 0.7, 0.0).
2. The peak is distinct and there is unequal spacing between parameters; for example, (0.7, 0.5, 0.0), (0.0, 0.7, 0.5).
3. The peak is distinct and the other two parameters are equal to each other; for example, (0.5, 0.0, 0.0).
4. One additional parameter equals the peak; for example, (0.0, 0.5, 0.5).

4.2.2. Four Populations with Unknown Peak

Under four treatments with an unknown peak in the mixed design, the peak and powers are estimated in the following cases:

1. The peak is distinct and the other parameters are the same; for example, (1.0, 0.0, 0.0, 0.0).
2. The peak is distinct and there is equal spacing between parameters; for example, (1.0, 0.75, 0.5, 0.25) and (0.0, 0.25, 0.5, 0.25).
3. The peak is distinct and there is unequal spacing between parameters; for example, (0.8, 1.0, 0.75, 0.2).
4. Two population parameters are the same, but different from the peak; for example, (0.5, 1.0, 0.2, 0.2), (0.2, 0.75, 1.0, 0.75) and (0.0, 0.0, 0.25, 1.0).

5. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other; for example, (0.0, 0.0, 0.75, 0.75).

6. One additional parameter equals the peak and the other parameters are different from the peak and different from each other; for example, (0.75, 0.75, 0.5, 0.0) and (0.0, 0.5, 0.75, 0.75).

7. Two additional parameters are equal to the peak; for example, (0.5, 0.5, 0.5, 0.0).

4.2.3. Five Populations with Unknown Peak

Under five treatments with an unknown peak in the mixed design, the peak and powers are estimated in the following cases:

1. The peak is distinct and the other parameters are the same; for example, (1.0, 0.0, 0.0, 0.0, 0.0).

2. The peak is distinct and each two of the other parameters are equal to each other; for example, (0.2, 0.2, 0.5, 0.0, 0.0).

3. The peak is distinct and three of the other parameters are equal to each other; for example, (1.0, 0.2, 0.2, 0.2, 0.0) and (0.0, 0.0, 0.0, 0.5, 1.0).

4. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other; for example, (0.0, 0.0, 0.0, 0.5, 0.5).

5. One additional parameter equals the peak, the two other parameters are equal to each other but not equal to the peak and one parameter is different; for example, (0.5, 0.5, 0.2, 0.2, 0.0) and (0.5, 0.5, 0.2, 0.0, 0.0).

6. One additional parameter equals the peak, and the other parameters are different from the peak and different from each other; for example, (0.8, 0.8, 0.5, 0.2, 0.0).

7. Two additional parameters are equal to the peak, and the other parameters are equal to each other; for example, (0.5, 0.5, 0.5, 0.0, 0.0) and (0.0, 0.0, 0.5, 0.5, 0.5).

5. RESULTS

This chapter presents results from the simulation study describing the properties of the six proposed test statistics which were described in Chapter 3. The proposed test statistics are for analyzing data in a mixed design comprising a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion. The tables present the estimated alpha values, obtained when all the populations' location parameters were zero, namely no location parameter was added, to examine if the test statistics maintain their level of significance (α=0.05) or not, and after that estimated powers, namely after adding location parameters, by assuming three underlying distributions: exponential, normal and t distribution with three degrees of freedom. In addition, the tables show the results when the number of the blocks in the randomized complete block design is half, equal or twice the sample size for each treatment in the completely randomized design.

In the tables, Non Modification and Distance Modification denote the Non-modified tests, which proposed by Magel et al. (2010) (see Section 2.5), and modified test statistics, which are proposed in this research (see Chapter 3), respectively. The number of treatments and blocks are obvious from the tables, and n denotes the sample size for each treatment in the CRD. In this research, for the RCBD, we consider the case when $n_i = 1$ where $i = 1, 2, ..., k$ and k is the number of treatments. Location Parameters denotes the location parameter configurations (treatment effects) which are considered in this study. Furthermore, Standardized First denotes the standardization of the combination of the standardized of unmodified (modified) Mack-Wolfe and Kim-Kim test statistics. Also, Standardized Second denotes the standardization of the combination of the unstandardized of unmodified (modified) Mack-Wolfe and Kim-Kim test statistics. Powers are estimated for each of the proposed test statistics for different configurations in the location parameters. Illustrated are the effects when the number of blocks for the RCBD portion is equal to the sample size for the CRD portion, and then varying the number of blocks for the RCBD portion and holding the sample size for the CRD portion constant.

On the whole, without regard to the underlying distribution, number of blocks and number of treatments, the Standardized First is generally better than Standardized Second for both unmodified and modified test statistics. Additionally, by holding the sample size for the CRD portion constant for each selected sample size and increasing the number of the blocks for the RCBD portion, there is a power improvement for all the test statistics. Finally, the levels of significance are found to all be around 0.05, which is the stated significance level that is always considered.

In all the tables, the alpha values are estimated by counting the number of times that the null hypothesis is rejected and then divided by the number of sample generated (5,000) for each test of the proposed test statistics. Also, we use 5,000 samples to estimate the power by counting the number of times that the proposed test statistic is rejected divided by the number of sample generated (5,000).

5.1. The Case of Known Umbrella Peak

In this section, we present results for the first two proposed test statistics (modified tests) in this research and the two test statistics that were proposed by Magel et al. (2010) (non-modified tests), which are described in section 2.5. These test statistics are for analyzing data in a mixed design comprised of a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion in the situation of having a known umbrella peak. In an equivalent manner, by conducting the simulation study, the results in this research, as far as how the first two proposed tests performed relative to one another for all the underlying distributions, are similar to Magel et al. (2010)'s results. The asymptotic distribution of these test statistics are all standard normal under the null hypothesis, and the stated alpha value for each test conducted is 0.05.

5.1.1. Three Populations with Peak at 2

Tables in Appendix A present the estimated alpha values and powers when there are three treatments in the study and the known peak is at the second population. These results are shown for the same location parameter configurations when the underlying distribution is exponential, normal and t distribution with three degrees of freedom. Among all the tables, the estimated alpha values are around 0.05, and it is noted that the Standardized First is more powerful than the Standardized Second for both proposed tests and Magel et al. (2010)'s test statistics. It should be noted, however, the estimated powers are high for both Standardized First and Standardized Second in both studies when the known peak is distinct regardless of the underlying distribution, the sample size for each treatment in the CRD, and the number of blocks in the RCBD portion.

Importantly, in the case of having three treatments and the known peak is at the second population, we find that neither of the proposed tests (modified tests) in this research are better than the test statistics proposed by Magel et al. (2010) (non-modified tests) since the associated weight (distance modification) for both the Mack-Wolfe (1981) and Kim-Kim (1992) test statistics is just 1 in the two proposed tests of this research. Generally, they are exactly the same.

The results in Tables 5.1 through 5.3 present the estimated alpha values and the estimated powers when the number of blocks in the RCBD portion is half, equal and twice the sample size for each treatment in the CRD portion based on the normal distribution. The following tables show some representative results, and other tables presenting similar results for different underlying distributions can be found in Appendix A.

Table 5.1. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0512	0.0512
	Second	0.0486	0.0486
(0.0 , 1.0 , 0.0)	First	0.8786	0.8786
	Second	0.8232	0.8232
(0.5 , 1.0 , 0.0)	First	0.6694	0.6694
	Second	0.6046	0.6046
(0.0 , 0.5 , 0.5)	First	0.1694	0.1694
	Second	0.1554	0.1554

Table 5.2. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0522	0.0522
	Second	0.0556	0.0556
(0.0 , 1.0 , 0.0)	First	0.9436	0.9436
	Second	0.8534	0.8534
(0.5 , 1.0 , 0.0)	First	0.7792	0.7792
	Second	0.6430	0.6430
(0.0 , 0.5 , 0.5)	First	0.1988	0.1988
	Second	0.1636	0.1636

Table 5.3. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0540	0.0540
	Second	0.0532	0.0532
(0.0 , 1.0 , 0.0)	First	0.9876	0.9876
	Second	0.9066	0.9066
(0.5 , 1.0 , 0.0)	First	0.8966	0.8966
	Second	0.7114	0.7114
(0.0 , 0.5 , 0.5)	First	0.2358	0.2358
	Second	0.1720	0.1720

In the study, when there are three treatments with known peak at the second population for analyzing data in a mixed design comprised a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion, we found that Standardized First has more power than Standardized Second for both unmodified and modified test statistics. The power estimates for both Standardized First and Standardized Second are increased when the known peak is distinct regardless of the spacing between the known peak at two and the other two parameter configurations, the underlying distribution, the sample size for each treatment in the CRD portion and the number of blocks in the RCBD portion. In general, the Standardized First of both unmodified and modified test statistics are exactly the same since the associated weight (distance modification) for both Mack-Wolfe (1981) and Kim-Kim (1992) test statistics is just 1. Also, the same notice for Standardized Second of both unmodified and modified test statistics. Finally, since the distance modification does not contribute any differences in this case, we can consider the non-modified Standardized First, A^{**}, is the test that has the highest power among all the test statistics.

5.1.2. Four Populations with Peak at 2

In Tables 5.4 through 5.12, we present results for the estimated alpha values and estimated powers when the study comprised of four treatments and the known peak is considered to be at the second population. When the underlying distributions are exponential, normal and t distribution with three degrees of freedom, the results are shown for the same locations parameter configurations. For all three underlying distribution presented, the estimated alpha values for all test statistics are approximately around 0.05, the Standardized First is more powerful than the Standardized Second for both proposed tests and Magel et al. (2010)'s tests statistics, and the results are consistent by changing the proportions between the number of blocks in the RCBD and sample size for each treatment in the CRD.

It is important to note that for each of the considered proportions between the sample size in the CRD and the number of blocks in the RCBD, we find that the first two proposed test statistics (modified tests) in this research provide the highest values of the estimated powers compared to the Magel et al. (2010)'s test statistics (non-modified tests) in the following cases:

1. Two population parameters are the same, but different from the peak and less than the first parameter on the left, such as: (0.5, 1.0, 0.2, 0.2).

2. One additional parameter equals the peak, and the other parameters are different from the peak, but equal to each other and on the right side of the peak, such as: (0.5, 0.5, 0.0, 0.0).

3. One additional parameter equals the peak, and the other parameters are different from the peak, different from each other and less than the first parameter on the left, such as: (0.5, 0.5, 0.2, 0.0).

4. When the peak is distinct and there is equal spacing between parameters, such as: (0.25, 0.5, 0.25, 0.0).

5. Two additional parameters are equals to the peaks, and both of them stratify the peak, such as: (0.5, 0.5, 0.5, 0.0). However, there is an exception when the two additional parameters are equal to the peaks, but one the right side of the peak, such as: (0.0, 0.5, 0.5, 0.5); in this exceptional case, Magel et al. (2010)'s test statistics for both Standardized First and Standardized Second perform better.

Tables 5.4 through 5.6 present the estimated alpha values (level of significance) and the estimated powers when the number of blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion based on the three underlying distributions. The following tables show some representative results, and more tables present other configurations considered; similar results of estimated alpha values and estimated powers can be found in the Appendix B.

Table 5.4. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0486	0.0464
	Second	0.0436	0.0434
(0.5 , 1.0 , 0.2 , 0.2)	First	0.8652	0.8680
	Second	0.7918	0.7972
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3416	0.4128
	Second	0.2928	0.3582
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3934	0.4520
	Second	0.3436	0.3976
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1516	0.1064
	Second	0.1246	0.1038
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3702	0.4338
	Second	0.3226	0.3800
(0.25 , 0.5 , 0.25 , 0.0)	First	0.5518	0.5778
	Second	0.4798	0.5072
(0.5 , 1.0 , 0.5 , 0.5)	First	0.6612	0.6290
	Second	0.5754	0.5484
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9548	0.9372
	Second	0.9134	0.8900
(0.0 , 0.75 , 0.5 , 0.25)	First	0.7742	0.7270
	Second	0.6950	0.6534

Table 5.5. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0486	0.0480
	Second	0.0514	0.0506
(0.5 , 1.0, 0.2 , 0.2)	First	0.6112	0.6348
	Second	0.5430	0.5598
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2338	0.2614
	Second	0.1968	0.2268
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2320	0.2666
	Second	0.1980	0.2302
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1210	0.0888
	Second	0.1052	0.0814
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2332	0.2626
	Second	0.2022	0.2238
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3336	0.3246
	Second	0.2778	0.2916
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4012	0.3944
	Second	0.3512	0.3420
(0.0 , 1.0 , 0.75 , 0.2)	First	0.7760	0.7520
	Second	0.6994	0.6776
(0.0 , 0.75 , 0.5 , 0.25)	First	0.4996	0.4472
	Second	0.4316	0.4000

Table 5.6. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0480
	Second	0.0428	0.0506
(0.5 , 1.0 , 0.2 , 0.2)	First	0.4670	0.4662
	Second	0.4072	0.4134
(0.5 , 0.5 , 0.0 , 0.0)	First	0.1848	0.2046
	Second	0.1566	0.1794
(0.5 , 0.5 , 0.2 , 0.0)	First	0.1822	0.2138
	Second	0.1714	0.1866
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1056	0.0950
	Second	0.0938	0.0934
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1804	0.2042
	Second	0.1630	0.1852
(0.25 , 0.5 , 0.25 , 0.0)	First	0.2406	0.2486
	Second	0.2144	0.2278
(0.5 , 1.0 , 0.5 , 0.5)	First	0.3038	0.2848
	Second	0.2648	0.2530
(0.0 , 1.0 , 0.75 , 0.2)	First	0.6126	0.5842
	Second	0.5452	0.5082
(0.0 , 0.75 , 0.5 , 0.25)	First	0.3730	0.3414
	Second	0.3220	0.2928

Tables 5.7 through 5.9 present the results when the number of blocks in the RCBD portion is equal to the sample size for each treatment in the CRD portion. In this case, we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. To note, there is an increase in the power when the number of blocks in the RCBD increases to be equal to the sample size for each treatment in the CRD portion, compared to the case when the number of the blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion. More tables presenting the estimated alpha values and powers can be found in Appendix B.

Table 5.7. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0502
	Second	0.0526	0.0506
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9416	0.9464
	Second	0.8224	0.8270
(0.5 , 0.5 , 0.0 , 0.0)	First	0.4528	0.5274
	Second	0.3246	0.3928
(0.5 , 0.5 , 0.2 , 0.0)	First	0.4912	0.5470
	Second	0.3616	0.4160
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1718	0.1360
	Second	0.1326	0.1044
(0.5 , 0.5 , 0.5 , 0.0)	First	0.4572	0.5204
	Second	0.3408	0.3918
(0.25 , 0.5 , 0.25 , 0.0)	First	0.6764	0.6848
	Second	0.5204	0.5274
(0.5 , 1.0 , 0.5 , 0.5)	First	0.7764	0.7572
	Second	0.6110	0.5948
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9842	0.9810
	Second	0.9254	0.9130
(0.0 , 0.75 , 0.5 , 0.25)	First	0.8772	0.8402
	Second	0.7218	0.6752

Table 5.8. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0524	0.0482
	Second	0.0484	0.0494
(0.5 , 1.0, 0.2 , 0.2)	First	0.7206	0.7400
	Second	0.5550	0.5868
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2764	0.3324
	Second	0.2156	0.2506
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2968	0.3366
	Second	0.2222	0.2450
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1292	0.0974
	Second	0.1114	0.0838
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2804	0.3334
	Second	0.2164	0.2438
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3780	0.4018
	Second	0.2788	0.3002
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4900	0.4814
	Second	0.3662	0.3728
(0.0 , 1.0 , 0.75 , 0.2)	First	0.8694	0.8566
	Second	0.7278	0.7042
(0.0 , 0.75 , 0.5 , 0.25)	First	0.5958	0.5462
	Second	0.4528	0.4126

Table 5.9. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0488
	Second	0.0516	0.0498
(0.5 , 1.0 , 0.2 , 0.2)	First	0.5608	0.5924
	Second	0.4158	0.4506
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2130	0.2372
	Second	0.1752	0.1838
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2252	0.2448
	Second	0.1790	0.1896
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1102	0.0864
	Second	0.0998	0.0762
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2170	0.2510
	Second	0.1726	0.1912
(0.25 , 0.5 , 0.25 , 0.0)	First	0.2980	0.2946
	Second	0.2268	0.2264
(0.5 , 1.0 , 0.5 , 0.5)	First	0.3616	0.3682
	Second	0.2770	0.2720
(0.0 , 1.0 , 0.75 , 0.2)	First	0.7276	0.6924
	Second	0.5712	0.5310
(0.0 , 0.75 , 0.5 , 0.25)	First	0.4448	0.4238
	Second	0.3314	0.3140

Tables 5.10 through 5.12 present the results when we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. The results are shown when the number of blocks in the RCBD is twice the sample size for each treatment in the CRD. We noticed here that there is an improvement in the power estimates. Some representative results are shown in the following tables. Also, the reader can refer to Appendix B for further tables of alpha values and power results considering different numbers of the blocks in the RCBD portion and different sample sizes in the CRD portion.

Table 5.10. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0488	0.0472
	Second	0.0472	0.0460
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9878	0.9878
	Second	0.8848	0.8768
(0.5 , 0.5 , 0.0 , 0.0)	First	0.5836	0.6598
	Second	0.3622	0.4280
(0.5 , 0.5 , 0.2 , 0.0)	First	0.6162	0.6846
	Second	0.4170	0.4672
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2234	0.1584
	Second	0.1496	0.1116
(0.5 , 0.5 , 0.5 , 0.0)	First	0.5864	0.6608
	Second	0.3868	0.4510
(0.25 , 0.5 , 0.25 , 0.0)	First	0.8230	0.8256
	Second	0.5868	0.5862
(0.5 , 1.0 , 0.5 , 0.5)	First	0.8920	0.8922
	Second	0.6794	0.6770
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9988	0.9966
	Second	0.9608	0.9456
(0.0 , 0.75 , 0.5 , 0.25)	First	0.9590	0.9368
	Second	0.7908	0.7412

Table 5.11. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0484	0.0500
	Second	0.0516	0.0454
(0.5 , 1.0, 0.2 , 0.2)	First	0.8548	0.8722
	Second	0.6372	0.6626
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3488	0.4114
	Second	0.2362	0.2728
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3524	0.4170
	Second	0.2430	0.2866
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1564	0.1178
	Second	0.1174	0.0974
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3606	0.4054
	Second	0.2530	0.2802
(0.25 , 0.5 , 0.25 , 0.0)	First	0.4862	0.5048
	Second	0.3294	0.3390
(0.5 , 1.0 , 0.5 , 0.5)	First	0.6032	0.6062
	Second	0.4078	0.4190
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9584	0.9432
	Second	0.7980	0.7738
(0.0 , 0.75 , 0.5 , 0.25)	First	0.7366	0.6940
	Second	0.5126	0.4800

Table 5.12. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0512
	Second	0.0500	0.0450
(0.5 , 1.0 , 0.2 , 0.2)	First	0.6976	0.7222
	Second	0.4812	0.5046
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2660	0.3088
	Second	0.1796	0.2118
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2720	0.3224
	Second	0.1908	0.2254
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1200	0.1086
	Second	0.1014	0.0780
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2758	0.3232
	Second	0.1966	0.2144
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3786	0.3844
	Second	0.2560	0.2628
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4708	0.4576
	Second	0.3212	0.3094
(0.0 , 1.0 , 0.75 , 0.2)	First	0.8502	0.8292
	Second	0.6394	0.5992
(0.0 , 0.75 , 0.5 , 0.25)	First	0.5720	0.5198
	Second	0.3866	0.3498

In the case of having four treatments and a known peak at the second population for analyzing data in a mixed design comprising a completely randomized design (CRD) and a randomized complete block design (RCBD), we found that Standardized First has more power than Standardized Second for both unmodified and modified tests regardless of the underlying distribution, the sample size for each treatment in the CRD portion, and the number of blocks in the RCBD portion. Importantly, the first two proposed test statistics (modified tests) provide the highest values of the estimated powers, more than the Magel et al. (2010)'s test statistics (non-modified tests) in the cases mentioned previously. namely, the modified Standardized First, mA^{**}, has the highest power in those cases since the Standardized First is better than Standardized second. Other than those cases, we can consider the non-modified Standardized First, A^{**}, is the test which has the highest power among all the test statistics.

5.1.3. Four Populations with Peak at 3

The presented results in Tables 5.13 through 5.21 are for the estimated alpha values and estimated powers when the study is comprised of four treatments and the known peak at the third population. The results are shown for the same location parameter configurations when the underlying distributions are exponential, normal and t distribution with three degrees of freedom. For all three underlying distributions presented, the estimated alpha values for all test statistics are approximately around 0.05, the Standardized First is more powerful than the Standardized Second for both proposed tests and Magel et al. (2010)'s tests statistics, and the results are consistent by changing the proportions between the number of blocks in the RCBD and sample size for each treatment in the CRD.

For each of the considered proportions between the sample size in the CRD and the number of the blocks in the RCBD, the first two proposed test statistics (modified tests) provide the highest values of the estimated powers compared to Magel et al. (2010)'s test statistics (non-modified tests) in the following cases:

1. Two population parameters are the same, but different from the peak and less than the last parameter on the right, such as: (0.2, 0.2, 1.0, 0.5).

2. One additional parameter equals the peak, and the other parameters are different from the peak, but equal to each other and on the left side of the peak, such as: (0.0, 0.0, 0.5, 0.5).

3. One additional parameter equals the peak, and the other parameters are different from the peak, different from each other and less than the last parameter on the right, such as: (0.0, 0.2, 0.5, 0.5).

4. When the peak is distinct and there is equal spacing between parameters, such as: (0.0, 0.25, 0.5, 0.25).

5. Two additional parameters are equals to the peaks, and both of them stratify the peak, such as: (0.0, 0.5, 0.5, 0.5). However, there is an exception when the two additional parameters are equal to the peaks, but one the right side of the peak, such as: (0.5, 0.5, 0.5, 0.0); in this exceptional case, the Magel et al. (2010)'s test statistics for both standardized first and standardized second perform better.

Tables 5.13 through 5.15 present the estimated alpha values (level of significance) and the estimated powers when the number of blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion. To note, the following presented results are similar to those which are presented in the first case, when the number of the blocks in the RCBD portion is half of the sample size in the CRD portion, of the previous section 5.1.2 with respect to the reverse order of the location parameter configurations. More tables present other configurations considered and similar results of estimated alpha values and estimated powers can be found in the Appendix C.

Table 5.13. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0484
	Second	0.0520	0.0490
(0.2 , 0.2 , 1.0 , 0.5)	First	0.8692	0.8682
	Second	0.7988	0.7920
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3554	0.4142
	Second	0.3072	0.3694
(0.0 , 0.2 , 0.5 , 0.5)	First	0.4006	0.4428
	Second	0.3400	0.3890
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1586	0.1098
	Second	0.1354	0.1048
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3720	0.4212
	Second	0.3270	0.3698
(0.0 , 0.25 , 0.5 , 0.25)	First	0.5570	0.5754
	Second	0.4798	0.4976
(0.5 , 0.5 , 1.0 , 0.5)	First	0.6554	0.6440
	Second	0.5734	0.5594
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9540	0.9334
	Second	0.9056	0.8850
(0.25 , 0.5 , 0.75 , 0.0)	First	0.7770	0.7368
	Second	0.6960	0.6414

Table 5.14. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0560	0.0522
	Second	0.0524	0.0486
(0.2 , 0.2 , 1.0 , 0.5)	First	0.6208	0.6216
	Second	0.5432	0.5570
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2342	0.2542
	Second	0.1942	0.2270
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2338	0.2682
	Second	0.1972	0.2366
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1122	0.0972
	Second	0.0984	0.0888
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2324	0.2596
	Second	0.1986	0.2288
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3216	0.3288
	Second	0.2716	0.2916
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4038	0.3960
	Second	0.3520	0.3474
(0.2 , 0.75 , 1.0 , 0.0)	First	0.7780	0.7438
	Second	0.7078	0.6690
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5074	0.4552
	Second	0.4364	0.4064

Table 5.15. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0430
	Second	0.0486	0.0454
(0.2 , 0.2 , 1.0 , 0.5)	First	0.4794	0.4650
	Second	0.4152	0.3968
(0.0 , 0.0 , 0.5 , 0.5)	First	0.1848	0.2150
	Second	0.1642	0.1930
(0.0 , 0.2 , 0.5 , 0.5)	First	0.1910	0.2138
	Second	0.1574	0.1906
(0.5 , 0.5 , 0.5 , 0.0)	First	0.0978	0.0864
	Second	0.0942	0.0812
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1826	0.2046
	Second	0.1636	0.1840
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2448	0.2484
	Second	0.2114	0.2090
(0.5 , 0.5 , 1.0 , 0.5)	First	0.3068	0.2956
	Second	0.2662	0.2548
(0.2 , 0.75 , 1.0 , 0.0)	First	0.6216	0.5886
	Second	0.5468	0.5068
(0.25 , 0.5 , 0.75 , 0.0)	First	0.3554	0.3448
	Second	0.3182	0.3050

Tables 5.16 through 5.18 present the results when the number of blocks in the RCBD portion is equal to the sample size for each treatment in the CRD portion. In this case, we find that there is an increase in the power compared to the case when the number of the blocks in the RCBD is half of the sample size for each treatment in the CRD.

Again, the presented results in the tables 5.16 through 5.18 are similar to those which are presented in the second case, when the number of the blocks in the RCBD portion is equal to the sample size in the CRD portion, of the previous section 5.1.2 with respect to the reverse order of the location parameter configurations. More tables can be found in Appendix C.

Table 5.16. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0522	0.0530
	Second	0.0488	0.0568
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9454	0.9396
	Second	0.8264	0.8220
(0.0 , 0.0 , 0.5 , 0.5)	First	0.4588	0.5228
	Second	0.3252	0.3790
(0.0 , 0.2 , 0.5 , 0.5)	First	0.4904	0.5662
	Second	0.3686	0.4188
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1828	0.1350
	Second	0.1350	0.1052
(0.0 , 0.5 , 0.5 , 0.5)	First	0.4508	0.5232
	Second	0.3394	0.3994
(0.0 , 0.25 , 0.5 , 0.25)	First	0.6810	0.6892
	Second	0.5168	0.5278
(0.5 , 0.5 , 1.0 , 0.5)	First	0.7762	0.7682
	Second	0.6022	0.5908
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9860	0.9816
	Second	0.9324	0.9142
(0.25 , 0.5 , 0.75 , 0.0)	First	0.8792	0.8370
	Second	0.7290	0.6800

Table 5.17. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0554	0.0498
	Second	0.0526	0.0480
(0.2 , 0.2 , 1.0 , 0.5)	First	0.7342	0.7438
	Second	0.5774	0.5826
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2876	0.3236
	Second	0.2246	0.2318
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2930	0.3228
	Second	0.2288	0.2488
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1270	0.0998
	Second	0.1006	0.0852
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2838	0.3280
	Second	0.2130	0.2360
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3874	0.4012
	Second	0.2946	0.2896
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4950	0.4824
	Second	0.3800	0.3664
(0.2 , 0.75 , 1.0 , 0.0)	First	0.8782	0.8526
	Second	0.7344	0.7040
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5984	0.5554
	Second	0.4544	0.4252

Table 5.18. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0490	0.0526
	Second	0.0506	0.0510
(0.2 , 0.2 , 1.0 , 0.5)	First	0.5716	0.5786
	Second	0.4298	0.4338
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2224	0.2398
	Second	0.1772	0.1840
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2198	0.2492
	Second	0.1734	0.1936
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1698	0.0880
	Second	0.0964	0.0778
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2384	0.2472
	Second	0.1778	0.1938
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2930	0.3060
	Second	0.2308	0.2370
(0.5 , 0.5 , 1.0 , 0.5)	First	0.3820	0.3696
	Second	0.2952	0.2726
(0.2 , 0.75 , 1.0 , 0.0)	First	0.7236	0.6994
	Second	0.5690	0.5532
(0.25 , 0.5 , 0.75 , 0.0)	First	0.4526	0.4268
	Second	0.3416	0.3150

Tables 5.19 through 5.21 present the estimated alpha values and the power estimates when we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. The results are shown when the number of blocks in the RCBD portion is twice the sample size for each treatment in the CRD portion. The presented results are similar to those which are presented in the third case, when the number of the blocks in the RCBD portion is twice the sample size in the CRD portion, of the previous section 5.1.2 with respect to the reverse order of the location parameter configurations. The reader can refer to Appendix C for further tables of alpha values and power results considering different number of blocks for the RCBD portion and different sample sizes for the CRD portion.

Table 5.19. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0414
	Second	0.0500	0.0454
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9898	0.9870
	Second	0.8760	0.8944
(0.0 , 0.0 , 0.5 , 0.5)	First	0.5914	0.6672
	Second	0.3774	0.4348
(0.0 , 0.2 , 0.5 , 0.5)	First	0.6306	0.7008
	Second	0.4112	0.4784
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2224	0.1496
	Second	0.1506	0.1102
(0.0 , 0.5 , 0.5 , 0.5)	First	0.5846	0.6604
	Second	0.3974	0.4502
(0.0 , 0.25 , 0.5 , 0.25)	First	0.8140	0.8250
	Second	0.5778	0.5940
(0.5 , 0.5 , 1.0 , 0.5)	First	0.8986	0.8896
	Second	0.6862	0.6712
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9990	0.9970
	Second	0.9614	0.9474
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9622	0.9318
	Second	0.7974	0.7394

Table 5.20. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0508
	Second	0.0500	0.0522
(0.2 , 0.2 , 1.0 , 0.5)	First	0.8596	0.8738
	Second	0.6348	0.6558
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3548	0.4074
	Second	0.2344	0.2706
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3668	0.4032
	Second	0.2430	0.2792
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1584	0.1212
	Second	0.1176	0.0930
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3670	0.4174
	Second	0.2504	0.2726
(0.0 , 0.25 , 0.5 , 0.25)	First	0.4864	0.5192
	Second	0.3308	0.3400
(0.5 , 0.5 , 1.0 , 0.5)	First	0.5980	0.6066
	Second	0.4036	0.4044
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9550	0.9440
	Second	0.8018	0.7520
(0.25 , 0.5 , 0.75 , 0.0)	First	0.7252	0.6988
	Second	0.5130	0.4742

Table 5.21. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0456	0.0510
	Second	0.0502	0.0508
(0.2 , 0.2 , 1.0 , 0.5)	First	0.7040	0.7166
	Second	0.4828	0.4936
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2776	0.3130
	Second	0.1904	0.2114
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2798	0.3154
	Second	0.1984	0.2188
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1324	0.1034
	Second	0.1050	0.0830
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2730	0.3126
	Second	0.1826	0.2124
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3740	0.3844
	Second	0.2508	0.2570
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4560	0.4518
	Second	0.3112	0.3014
(0.2 , 0.75 , 1.0 , 0.0)	First	0.8546	0.8306
	Second	0.6486	0.6104
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5730	0.5352
	Second	0.3892	0.3610

Overall, in the case of having four treatments and a known peak at the third population for analyzing data in a mixed design comprised of a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion, we found that the results are similar to those when we have four treatments and the peak at the second population with respect to the reverse order of the location parameter configurations.

5.1.4. Five Populations with Peak at 2

In Tables 5.22 through 5.30, we present results for the estimated alpha values and estimated powers when the study comprised of five treatments and a known peak is considered to be at the second population. When the underlying distributions are exponential, normal and t distribution with three degrees of freedom, the results are shown for the same location parameter configurations. For all three underlying distributions presented, the estimated alpha values for all test statistics are approximately around 0.05, the Standardized First was more powerful than the Standardized Second for both proposed tests and Magel et al. (2010)'s tests statistics.

It is important to note, the first two proposed test statistics (modified tests) provide the highest values of the estimated powers compared to the Magel et al. (2010)'s test statistics (non-modified tests) in the following cases:

1. Two population parameters are the same, but different from the peak, such as: (0.2, 0.7, 0.4, 0.0, 0.0) and (0.4, 0.8, 0.4, 0.2, 0.0) where the last two treatments are less than the first parameter on the left.

2. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other, such as: (0.5, 0.5, 0.0, 0.0, 0.0).

3. One additional parameter equals the peak and the other parameters are different from the peak and different from each other, such as: (0.8, 0.8, 0.5, 0.2, 0.0).

4. one additional parameter is equal to the peak, the two other parameters are equal to each other but not the peak and one parameter is different, such as: (0.5, 0.5, 0.2, 0.2, 0.0), (0.5, 0.5, 0.2, 0.0, 0.0), (0.2, 0.5, 0.5, 0.0, 0.0), (0.2, 0.5, 0.5, 0.2, 0.0) and (0.2, 0.7, 0.7, 0.3, 0.0) where the last treatment is less than the first one.

5. Two additional parameters are equal to the peak and stratify the peak, such as: (0.5, 0.5, 0.5, 0.0, 0.0) and (0.5, 0.5, 0.5, 0.2, 0.0).

6. Three additional parameters are equal to the peak and two of them are stratify the peak, such as: (0.5, 0.5, 0.5, 0.5, 0.0). However, there is an exception when the three additional parameters are equal to the peaks, but all of them are on the right side of the peak, such as: (0.0, 0.5, 0.5, 0.5, 0.5); in this exceptional case, Magel et al. (2010)'s tests for both Standardized First and Standardized Second perform better than first two proposed tests.

Tables 5.22 through 5.24 present the estimated alpha values and the estimated powers when the number of blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion for all three underlying distribution presented. The following tables show some representative results, and more tables can be found in the Appendix D.

Table 5.22. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0560
	Second	0.0522	0.0546
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9466	0.9424
	Second	0.9036	0.8896
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9020	0.9032
	Second	0.8474	0.8392
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3972	0.4638
	Second	0.3362	0.4002
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4464	0.4932
	Second	0.3854	0.4084
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5154	0.5778
	Second	0.4310	0.4894
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8276	0.8744
	Second	0.7568	0.7992
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5980	0.6742
	Second	0.5198	0.5942
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5478	0.6192
	Second	0.4824	0.5536
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4032	0.4726
	Second	0.3530	0.4102
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5512	0.5118
	Second	0.4668	0.4508
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3358	0.3250
	Second	0.2970	0.3006
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4130	0.3494
	Second	0.3614	0.3088
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4678	0.4510
	Second	0.4076	0.3856
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7196	0.7286
	Second	0.6446	0.6598
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5184	0.5076
	Second	0.4426	0.4386
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7470	0.7136
	Second	0.6674	0.6232
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6678	0.6866
	Second	0.5912	0.6060
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8884	0.8846
	Second	0.8314	0.8120

Table 5.23. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0482	0.0534
	Second	0.0444	0.0516
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.7276	0.7244
	Second	0.6498	0.6432
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.6334	0.6620
	Second	0.5546	0.5766
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2594	0.2888
	Second	0.2158	0.2490
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2440	0.2830
	Second	0.2178	0.2474
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3064	0.3510
	Second	0.2730	0.3048
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5564	0.6306
	Second	0.4934	0.5522
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3544	0.4258
	Second	0.3116	0.3500
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3276	0.3656
	Second	0.2832	0.3108
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2592	0.2922
	Second	0.2228	0.2536
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3262	0.3146
	Second	0.2890	0.2768
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1880	0.1918
	Second	0.1618	0.1722
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2356	0.2062
	Second	0.1966	0.1814
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2586	0.2598
	Second	0.2280	0.2284
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4478	0.4692
	Second	0.3864	0.3988
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2928	0.2704
	Second	0.2636	0.2418
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4508	0.4380
	Second	0.3878	0.3744
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4074	0.4146
	Second	0.3422	0.3608
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.6348	0.6370
	Second	0.5610	0.5578

Table 5.24. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0468	0.0488
	Second	0.0468	0.0424
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.5714	0.5692
	Second	0.5094	0.4930
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.4772	0.5068
	Second	0.4168	0.4282
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2068	0.2262
	Second	0.1768	0.1978
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.1980	0.2198
	Second	0.1718	0.1872
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2340	0.2558
	Second	0.1934	0.2298
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.4194	0.4706
	Second	0.3630	0.4046
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2924	0.3270
	Second	0.2480	0.2926
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2372	0.2826
	Second	0.2178	0.2406
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1984	0.2108
	Second	0.1782	0.1918
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2490	0.2514
	Second	0.2142	0.2148
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1670	0.1538
	Second	0.1512	0.1378
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1906	0.1722
	Second	0.1736	0.1556
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2110	0.2074
	Second	0.1934	0.1780
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3364	0.3608
	Second	0.2872	0.3066
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2334	0.2208
	Second	0.2038	0.1942
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3366	0.3248
	Second	0.2948	0.2862
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3000	0.3102
	Second	0.2594	0.2662
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.4894	0.4872
	Second	0.4228	0.4204

Tables 5.25 through 5.27 present the results when the number of blocks in the RCBD portion is equal to the sample size for each treatment in the CRD portion. It is noted that there is an improvement in the power when the number of blocks in the RCBD increases to be equal to the sample size for each treatment in the CRD portion comparing to the case when the number of the blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion. More tables presenting the estimated alpha values and powers can be found in Appendix D.

Table 5.25. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0548	0.0518
	Second	0.0528	0.0528
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9844	0.9788
	Second	0.9276	0.9098
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9682	0.9592
	Second	0.8858	0.8564
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4952	0.5844
	Second	0.3626	0.4364
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5544	0.6144
	Second	0.4192	0.4624
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6314	0.6952
	Second	0.4918	0.5380
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9204	0.9434
	Second	0.7848	0.8252
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7180	0.7958
	Second	0.5654	0.6382
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6492	0.7226
	Second	0.4960	0.5720
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4856	0.5664
	Second	0.3790	0.4192
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6394	0.6406
	Second	0.5008	0.4902
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4218	0.3996
	Second	0.3224	0.3002
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5072	0.4460
	Second	0.3824	0.3332
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5730	0.5700
	Second	0.4404	0.4212
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8324	0.8538
	Second	0.6848	0.6996
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.6428	0.6014
	Second	0.5002	0.4538
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8490	0.8262
	Second	0.6984	0.6774
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7910	0.7966
	Second	0.6330	0.6390
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9546	0.9478
	Second	0.8556	0.8428

Table 5.26. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0520
	Second	0.0498	0.0508
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8410	0.8378
	Second	0.6922	0.6858
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.7428	0.7634
	Second	0.5754	0.5960
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3074	0.3396
	Second	0.2330	0.2630
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3006	0.3510
	Second	0.2300	0.2724
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3708	0.4026
	Second	0.2740	0.3086
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6574	0.7372
	Second	0.5102	0.5740
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4542	0.5232
	Second	0.3450	0.3876
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3900	0.4528
	Second	0.2980	0.3448
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3044	0.3426
	Second	0.2438	0.2572
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3912	0.3968
	Second	0.2996	0.2998
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2304	0.2168
	Second	0.1878	0.1716
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2824	0.2532
	Second	0.2154	0.1976
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3158	0.3072
	Second	0.2374	0.2386
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5708	0.5656
	Second	0.4276	0.4184
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3608	0.3370
	Second	0.2742	0.2594
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5540	0.5300
	Second	0.4280	0.4010
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4886	0.5092
	Second	0.3742	0.3860
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.7424	0.7558
	Second	0.5894	0.5920

Table 5.27. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0472
	Second	0.0506	0.0484
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.6764	0.6796
	Second	0.5284	0.5250
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.5808	0.6106
	Second	0.4594	0.4536
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2404	0.2790
	Second	0.1924	0.2056
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2450	0.2674
	Second	0.1924	0.2090
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2778	0.3054
	Second	0.2096	0.2324
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5198	0.5854
	Second	0.3864	0.4448
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3484	0.3982
	Second	0.2568	0.2972
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3120	0.3352
	Second	0.2280	0.2452
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2398	0.2682
	Second	0.1908	0.1974
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3082	0.3114
	Second	0.2304	0.2298
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1850	0.1806
	Second	0.1558	0.1476
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2210	0.1990
	Second	0.1820	0.1620
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2410	0.2306
	Second	0.1986	0.1828
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4056	0.4410
	Second	0.3130	0.3284
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2714	0.2600
	Second	0.2136	0.1998
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4234	0.3948
	Second	0.3304	0.2972
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3644	0.3932
	Second	0.2744	0.2956
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.5808	0.5976
	Second	0.4564	0.4524

Tables 5.28 through 5.30 present the power estimates when we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. The results are shown when the number of blocks in the RCBD portion is twice the sample size for each treatment in the CRD portion. We notice here that there is an increase in the power estimates in this case. Some representative results are shown in the following tables. Also, the reader can refer to Appendix D for further tables of alpha values and power results considering different number of blocks for the RCBD portion and different sample sizes for the CRD portion.

Table 5.28. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0524	0.0480
	Second	0.0546	0.0486
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9978	0.9990
	Second	0.9596	0.9476
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9948	0.9930
	Second	0.9182	0.9166
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6370	0.7128
	Second	0.4036	0.4690
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6828	0.7472
	Second	0.4574	0.5186
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7746	0.8230
	Second	0.5320	0.5814
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9764	0.9888
	Second	0.8438	0.8780
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8490	0.9018
	Second	0.6234	0.6862
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7974	0.8620
	Second	0.5728	0.6430
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6194	0.7006
	Second	0.4096	0.4852
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7708	0.7762
	Second	0.5556	0.5384
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5396	0.5074
	Second	0.3524	0.3384
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6158	0.5556
	Second	0.4138	0.3662
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.6984	0.6896
	Second	0.4734	0.4654
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9302	0.9436
	Second	0.7404	0.7598
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.7856	0.7328
	Second	0.5422	0.5074
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9408	0.9268
	Second	0.7492	0.7332
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9036	0.9028
	Second	0.7002	0.7010
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9914	0.9876
	Second	0.8984	0.8878

Table 5.29. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0464	0.0530
	Second	0.0494	0.0506
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9350	0.9362
	Second	0.7500	0.7388
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.8688	0.8902
	Second	0.6512	0.6784
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3844	0.4592
	Second	0.2532	0.3014
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3916	0.4534
	Second	0.2546	0.2940
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4844	0.5280
	Second	0.3134	0.3490
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7966	0.8654
	Second	0.5632	0.6490
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5738	0.6456
	Second	0.3738	0.4520
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4976	0.5794
	Second	0.3274	0.3870
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3864	0.4594
	Second	0.2588	0.3018
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4930	0.5100
	Second	0.3166	0.3362
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3004	0.2708
	Second	0.2018	0.1924
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3554	0.3194
	Second	0.2346	0.2148
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3992	0.3872
	Second	0.2680	0.2588
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6810	0.6986
	Second	0.4716	0.4820
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4630	0.4426
	Second	0.3136	0.2980
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6902	0.6850
	Second	0.4610	0.4842
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6214	0.6452
	Second	0.4160	0.4274
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8656	0.8662
	Second	0.6584	0.6442

Table 5.30. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0500
	Second	0.0530	0.0500
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8284	0.8154
	Second	0.5922	0.5966
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.7198	0.7428
	Second	0.4974	0.5192
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2988	0.3370
	Second	0.2062	0.2356
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2950	0.3404
	Second	0.2040	0.2240
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3462	0.4012
	Second	0.2316	0.2632
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6444	0.7080
	Second	0.4390	0.4908
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4334	0.4866
	Second	0.2888	0.3332
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3922	0.4336
	Second	0.2560	0.2888
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2908	0.3246
	Second	0.2012	0.2178
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3910	0.3972
	Second	0.2558	0.2684
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2360	0.2228
	Second	0.1624	0.1648
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2726	0.2410
	Second	0.1844	0.1746
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3082	0.3026
	Second	0.2150	0.2144
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5168	0.5576
	Second	0.3430	0.3766
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3700	0.3324
	Second	0.2452	0.2228
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5354	0.5132
	Second	0.3506	0.3480
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4676	0.4906
	Second	0.3116	0.3192
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.7198	0.7220
	Second	0.4904	0.5120

In the study with five treatments and a known peak at the second population for analyzing data in a mixed design comprised of a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion, we found that Standardized First has more power than Standardized Second for both unmodified and modified test statistics regardless of the underlying distribution, the sample size for each treatment in the CRD portion and the number of blocks in the RCBD portion. Importantly, the first two proposed test statistics (modified tests) provide the highest values of the estimated powers, more than Magel et al. (2010)'s test statistics (non-modified tests) in the cases mentioned previously. namely, the modified Standardized First, mA^{**}, has the highest power in those cases since the Standardized First is better than Standardized second. Other than those cases, we can consider the non-modified Standardized First, A^{**}, is the test which has the highest power among all the test statistics.

5.1.5. Five Populations with Peak at 3

Tables 5.31 through 5.39 present the estimated alpha values and powers when the study comprised of five treatments and the known peak is at the third population. These results are shown for the same location parameter configurations when the underlying distributions are exponential, normal and t distribution with three degrees of freedom. Among all the tables, the estimated alpha values are around 0.05, and it is noted that the Standardized First is more powerful than the Standardized Second for both proposed tests and Magel et al. (2010)'s tests statistics. It should be noted however, the estimated powers are high for both standardized first and standardized second when the known peak is distinct regardless of the underlying distribution, the sample size for each treatment in the CRD portion, and the number of blocks in the RCBD portion. When one or two additional parameters are equal to the peak and stratify the peak, there is an improvement in the power for both Standardized First and Standardized Second.

Importantly, the results from the first two proposed tests (modified tests) and the test statistics proposed by Magel et al. (2010) (non-modified tests) vary from configuration to one another and from distribution to one another. Accordingly, it is difficult to emphasize whether the distance modification provides highest power for the tests statistics or not.

The results in Tables 5.31 through 5.33 present the estimated alpha values and powers when the number of blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion. The following tables show some representative results, and other tables showing similar results are in Appendix E.

Table 5.31. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0544	0.0462
	Second	0.0536	0.0490
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.5190	0.5292
	Second	0.4458	0.4524
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.7146	0.7130
	Second	0.6284	0.6274
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9132	0.9078
	Second	0.8598	0.8454
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6710	0.6748
	Second	0.5928	0.5936
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6972	0.6886
	Second	0.6138	0.6094
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8706	0.8918
	Second	0.7998	0.8164
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6660	0.6654
	Second	0.5804	0.5878
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5222	0.5232
	Second	0.4558	0.4594
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2488	0.2542
	Second	0.2144	0.2142
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2686	0.2670
	Second	0.2390	0.2240

Table 5.32. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0498	0.0520
	Second	0.0544	0.0528
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3102	0.3100
	Second	0.2700	0.2774
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.4150	0.4212
	Second	0.3470	0.3630
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.6524	0.6468
	Second	0.5728	0.5768
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3984	0.4100
	Second	0.3428	0.3542
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4300	0.4272
	Second	0.3704	0.3638
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.6328	0.6464
	Second	0.5664	0.5628
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4154	0.4108
	Second	0.3596	0.3624
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2998	0.3012
	Second	0.2712	0.2662
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1678	0.1708
	Second	0.1528	0.1486
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1688	0.1690
	Second	0.1600	0.1612

Table 5.33. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0470	0.0484
	Second	0.0510	0.0492
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2362	0.2396
	Second	0.2094	0.2138
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.2958	0.3238
	Second	0.2708	0.2782
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.5010	0.4908
	Second	0.4314	0.4364
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3154	0.3076
	Second	0.2770	0.2674
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3136	0.3142
	Second	0.2706	0.2720
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.4856	0.4904
	Second	0.4232	0.4290
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3150	0.3112
	Second	0.2784	0.2704
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2414	0.2312
	Second	0.2120	0.2180
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1400	0.1426
	Second	0.1292	0.1254
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1406	0.1412
	Second	0.1302	0.1370

Tables 5.34 through 5.36 present the results when the number of blocks in the RCBD portion is equal to the sample size for each treatment in the CRD portion. In this case, we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. It is noted that there is an increase in the power when the number of blocks in the RCBD increases to be equal to the sample size for each treatment in the CRD portion compared to the case when the number of the blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion. The following tables show some representative results for all three underlying distribution, and other results can be found in Appendix E.

Table 5.34. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0526	0.0532
	Second	0.0504	0.0520
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.6502	0.6364
	Second	0.4910	0.4680
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.8372	0.8318
	Second	0.6822	0.6760
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9678	0.9604
	Second	0.8832	0.8768
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7888	0.7912
	Second	0.6280	0.6332
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8100	0.8022
	Second	0.6398	0.6308
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9468	0.9506
	Second	0.8388	0.8340
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7722	0.7900
	Second	0.6236	0.6272
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6112	0.6382
	Second	0.4756	0.4802
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2962	0.3102
	Second	0.2072	0.2192
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3334	0.3202
	Second	0.2502	0.2482

Table 5.35. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0476
	Second	0.0496	0.0464
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3742	0.3906
	Second	0.2916	0.2852
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.5052	0.5230
	Second	0.3844	0.3932
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.7594	0.7604
	Second	0.6020	0.6122
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5126	0.5138
	Second	0.3902	0.3838
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5118	0.5228
	Second	0.3834	0.3824
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.7442	0.7556
	Second	0.5946	0.5954
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5178	0.4962
	Second	0.3928	0.3768
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3612	0.3806
	Second	0.2928	0.2882
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2086	0.2082
	Second	0.1606	0.1610
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1938	0.2030
	Second	0.1518	0.1572

Table 5.36. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0450	0.0498
	Second	0.0494	0.0528
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2862	0.2936
	Second	0.2254	0.2206
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.3894	0.3932
	Second	0.2940	0.2844
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.6090	0.6006
	Second	0.4624	0.4576
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3834	0.3910
	Second	0.2962	0.2988
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3928	0.3856
	Second	0.3090	0.2934
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.5928	0.5972
	Second	0.4482	0.4492
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3674	0.3988
	Second	0.2826	0.3014
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2924	0.2782
	Second	0.2264	0.2104
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1664	0.1638
	Second	0.1348	0.1344
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1616	0.1638
	Second	0.1308	0.1354

Tables 5.37 through 5.39 present the results of the estimated alpha values and power estimates when we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. The results are shown when the number of blocks in the RCBD portion is twice the sample size for each treatment in the CRD portion. In this case, we notice that there is an increase in the power compared to the previous considered proportion between the sample size in the CRD and the number of the blocks in the RCBD portion. The reader can refer to Appendix E for further tables of power results.

Table 5.37. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0578
	Second	0.0470	0.0538
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.7882	0.7908
	Second	0.5356	0.5402
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.9308	0.9426
	Second	0.7342	0.7406
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9944	0.9936
	Second	0.9218	0.9208
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9058	0.9158
	Second	0.6826	0.7018
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9044	0.9142
	Second	0.7084	0.7142
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9882	0.9898
	Second	0.8890	0.8956
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8896	0.9056
	Second	0.6732	0.6954
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7514	0.7766
	Second	0.5384	0.5406
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3864	0.3972
	Second	0.2368	0.2644
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.4298	0.4292
	Second	0.2744	0.2794

Table 5.38. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0476	0.0474
	Second	0.0498	0.0450
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4730	0.4870
	Second	0.3160	0.3174
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.6402	0.6504
	Second	0.4370	0.4538
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.8776	0.8782
	Second	0.6594	0.6688
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6386	0.6376
	Second	0.4326	0.4292
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6340	0.6500
	Second	0.4274	0.4444
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8748	0.8754
	Second	0.6552	0.6576
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6292	0.6332
	Second	0.4174	0.4232
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4744	0.4818
	Second	0.3140	0.3134
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2566	0.2574
	Second	0.1816	0.1894
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2544	0.2480
	Second	0.1836	0.1808

Table 5.39. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0486
	Second	0.0458	0.0516
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3598	0.3706
	Second	0.2448	0.2508
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.4918	0.4892
	Second	0.3384	0.3240
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.7248	0.7382
	Second	0.5104	0.5080
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4900	0.5102
	Second	0.3242	0.3306
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4940	0.5018
	Second	0.3284	0.3368
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.7250	0.7316
	Second	0.4928	0.5092
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4920	0.5036
	Second	0.3296	0.3342
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3622	0.3610
	Second	0.2460	0.2492
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1874	0.2090
	Second	0.1392	0.1540
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1980	0.2046
	Second	0.1472	0.1460

In the case of having five treatments and a known peak at three for a mixed design comprised of a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion, we find that Standardized First has more power than Standardized Second for both non-modified and modified test statistics. Regardless of the spacing between the known peak at two and the other two parameter configurations, the underlying distribution, the sample size for each treatment in the CRD portion and the number of blocks in the RCBD portion, the power estimates for both Standardized First and Standardized Second are increased when the known peak is distinct, one additional parameter equals the peak or two additional parameters are equal to the peak and stratify the peak. Importantly, the results from the first two proposed tests (modified tests) and the test statistics proposed by Magel et al. (2010) (non-modified tests) vary from configuration to one another and from distribution to one another. Accordingly, it is difficult to emphasize whether the distance modification improves the power of the test statistics or not.

5.1.6. Five Populations with Peak at 4

The presented results in tables 5.40 through 5.48 are for the estimated alpha values and estimated powers when the study is comprised of five treatments and the known peak is at the fourth population. The results are shown for the same location parameter configurations when the underlying distributions are exponential, normal and t distribution with three degrees of freedom. For all three underlying distributions presented, the estimated alpha values for all test statistics are approximately around 0.05, and the Standardized First was more powerful than the Standardized Second for both proposed tests and Magel et al. (2010)'s tests statistics.

For each of the considered proportions between the sample size in the CRD and the number of the blocks in the RCBD, the first two proposed tests (modified tests) provide the highest values of the estimated powers compared to Magel et al. (2010)'s test statistics (non-modified tests) in the following cases:

1. Two population parameters are the same, but different from the peak, such as: (0.0, 0.0, 0.4, 0.7, 0.2) and (0.0, 0.2, 0.4, 0.8, 0.4) where the first two parameters are less than the last parameter.

2. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other, such as: (0.0, 0.0, 0.0, 0.5, 0.5).

3. One additional parameter equals the peak and the other parameters are different from the peak and different from each other, such as: (0.0, 0.2, 0.5, 0.8, 0.8).

4. One additional parameter is equal to the peak, the two other parameters are equal to each other but not the peak and one parameter is different, such as: (0.0, 0.2, 0.2, 0.5, 0.5), (0.0, 0.0, 0.2, 0.5, 0.5), (0.0, 0.0, 0.5, 0.5, 0.2), (0.0, 0.2, 0.5, 0.5, 0.2) and (0.0, 0.3, 0.7, 0.7, 0.2) where the first treatment is less than the last one.

5. Two additional parameters are equal to the peak and stratify the peak, such as: (0.0, 0.0, 0.5, 0.5, 0.5) and (0.0, 0.2, 0.5, 0.5, 0.5).

6. Three additional parameters are equal to the peak and two of them stratify the peak, such as: (0.0, 0.5, 0.5, 0.5, 0.5). However, there is an exception when the three additional parameters are equal to the peaks, but all of them are on the left side of the peak, such as: (0.5, 0.5, 0.5, 0.5, 0.0); in this exceptional case, Magel et al. (2010)'s test statistics for both Standardized First and Standardized Second perform better than our first two proposed tests.

Tables 5.40 through 5.42 present the estimated alpha values and the estimated powers when the number of blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion. To note, the following presented results are similar to those which are presented in the first case, when the number of the blocks in the RCBD portion is half of the sample size in the CRD portion, of the previous section 5.1.4 with respect to the reverse order of the location parameter configurations. More tables that present similar results of the estimated alpha values and powers can be found in Appendix F.

Table 5.40. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0546
	Second	0.0480	0.0510
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9544	0.9330
	Second	0.8996	0.8770
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9074	0.8972
	Second	0.8494	0.8388
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3886	0.4568
	Second	0.3332	0.3816
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.4614	0.5086
	Second	0.3926	0.4302
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.5248	0.5846
	Second	0.4522	0.5068
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.8310	0.8686
	Second	0.7570	0.7980
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.6058	0.6896
	Second	0.5254	0.5962
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5452	0.6110
	Second	0.4778	0.5492
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4122	0.4618
	Second	0.3488	0.4108
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3414	0.3244
	Second	0.3018	0.2860
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5290	0.5380
	Second	0.4598	0.4682
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4518	0.4538
	Second	0.3878	0.3968
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.7250	0.7364
	Second	0.6448	0.6584
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5374	0.4976
	Second	0.4668	0.4302
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7418	0.7092
	Second	0.6556	0.6300
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6746	0.6868
	Second	0.5894	0.6160
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8860	0.8830
	Second	0.8262	0.8042

Table 5.41. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0516	0.0460
	Second	0.0456	0.0456
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.7174	0.7334
	Second	0.6498	0.6526
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.6340	0.6554
	Second	0.5598	0.5720
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2560	0.2762
	Second	0.2208	0.2482
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.2618	0.2918
	Second	0.2226	0.2476
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2992	0.3432
	Second	0.2616	0.3020
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.5442	0.6184
	Second	0.4764	0.5346
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3658	0.4170
	Second	0.3026	0.3644
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3254	0.3614
	Second	0.2790	0.3218
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2472	0.2818
	Second	0.2356	0.2510
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2320	0.2026
	Second	0.2036	0.1852
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2010	0.1904
	Second	0.1740	0.1700
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3140	0.3232
	Second	0.2766	0.2750
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2556	0.2654
	Second	0.2268	0.2282
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.4542	0.4746
	Second	0.3860	0.4118
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2886	0.2824
	Second	0.2548	0.2482
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4482	0.4336
	Second	0.3884	0.3778
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4110	0.4136
	Second	0.3516	0.3534
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.6348	0.6354
	Second	0.5680	0.5534

Table 5.42. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0526	0.0514
	Second	0.0484	0.0490
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.5838	0.5690
	Second	0.5048	0.5020
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.4800	0.5162
	Second	0.4248	0.4410
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.1926	0.2122
	Second	0.1768	0.1934
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.1942	0.2240
	Second	0.1684	0.2070
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2374	0.2528
	Second	0.2070	0.2210
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.4116	0.4822
	Second	0.3676	0.4192
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2870	0.3252
	Second	0.2402	0.2762
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2498	0.2796
	Second	0.2188	0.2490
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2000	0.2168
	Second	0.1664	0.1854
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1826	0.1674
	Second	0.1614	0.1558
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1596	0.1540
	Second	0.1452	0.1402
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2420	0.2432
	Second	0.2186	0.2208
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2044	0.1898
	Second	0.1838	0.1680
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.3434	0.3514
	Second	0.2992	0.3036
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2400	0.2268
	Second	0.2078	0.1952
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3402	0.3422
	Second	0.2960	0.2928
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2946	0.3138
	Second	0.2596	0.2652
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.4796	0.4860
	Second	0.4062	0.4194

Tables 5.43 through 5.45 present the results when the number of blocks in the RCBD portion is equal to the sample size for each treatment in the CRD portion. In this case, we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. We find that there is an increase in the power when the number of blocks in the RCBD increases to be equal to the sample size for each treatment in the CRD portion, compared to the case when the number of the blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion.

Again, the presented results in the Tables 5.43 through 5.45 are similar to those which are presented in the second case, when the number of the blocks in the RCBD portion is equal to the sample size in the CRD portion, of the previous section 5.1.4 with respect to the reverse order of the location parameter configurations. More tables presenting similar results can be found in Appendix F.

Table 5.43. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0492	0.0492
	Second	0.0490	0.0546
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9846	0.9778
	Second	0.9226	0.9052
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9674	0.9622
	Second	0.8842	0.8694
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.4982	0.5748
	Second	0.3634	0.4244
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.5534	0.6062
	Second	0.4146	0.4474
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.6240	0.6992
	Second	0.4824	0.5364
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9204	0.9406
	Second	0.7924	0.8362
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.7210	0.7806
	Second	0.5656	0.6318
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.6486	0.7218
	Second	0.5172	0.5658
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4900	0.5674
	Second	0.3716	0.4190
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4976	0.4362
	Second	0.3742	0.3250
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4122	0.3956
	Second	0.3094	0.3016
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6444	0.6362
	Second	0.5024	0.4828
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.5796	0.5416
	Second	0.4394	0.3958
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.8370	0.8458
	Second	0.6816	0.6902
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6436	0.5910
	Second	0.4940	0.4408
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.8408	0.8226
	Second	0.6950	0.6722
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7724	0.7938
	Second	0.6328	0.6318
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9506	0.9492
	Second	0.8592	0.8402

Table 5.44. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0456
	Second	0.0540	0.0502
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.8308	0.8492
	Second	0.6788	0.6898
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.7580	0.7576
	Second	0.5988	0.5992
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3138	0.3374
	Second	0.2480	0.2578
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3092	0.3586
	Second	0.2376	0.2684
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3660	0.4150
	Second	0.2874	0.3122
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.6468	0.7398
	Second	0.4958	0.5722
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4530	0.5238
	Second	0.3482	0.3908
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3902	0.4466
	Second	0.2990	0.3342
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2946	0.3520
	Second	0.2380	0.2598
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2776	0.2462
	Second	0.2202	0.1886
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2348	0.2190
	Second	0.1916	0.1808
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3912	0.4008
	Second	0.2948	0.3038
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3176	0.3104
	Second	0.2500	0.2372
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.5504	0.5788
	Second	0.4110	0.4324
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3664	0.3340
	Second	0.2920	0.2480
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5428	0.5418
	Second	0.4116	0.4020
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4908	0.5040
	Second	0.3854	0.3848
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.7370	0.7640
	Second	0.5842	0.5986

Table 5.45. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0516	0.0482
	Second	0.0524	0.0508
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.6808	0.6816
	Second	0.5394	0.5304
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.5840	0.5924
	Second	0.4424	0.4394
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2402	0.2608
	Second	0.1924	0.2046
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.2372	0.2672
	Second	0.1852	0.2022
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2782	0.3172
	Second	0.2234	0.2372
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.5088	0.5798
	Second	0.3928	0.4392
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3418	0.4010
	Second	0.2564	0.3010
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2992	0.3302
	Second	0.2262	0.2488
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2332	0.2798
	Second	0.1900	0.2072
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2120	0.1888
	Second	0.1756	0.1530
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1860	0.1740
	Second	0.1544	0.1340
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3122	0.2978
	Second	0.2418	0.2338
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2418	0.2280
	Second	0.1966	0.1868
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.4026	0.4398
	Second	0.3140	0.3084
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2740	0.2496
	Second	0.2220	0.1942
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4082	0.3998
	Second	0.3208	0.3064
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3596	0.3780
	Second	0.2802	0.2794
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.5896	0.6040
	Second	0.4580	0.4512

Tables 5.46 through 5.48 present the power estimates when we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. The results are shown when the number of blocks in the RCBD portion is twice the sample size for each treatment in the CRD portion. The presented results are similar to those which are presented in the third case, when the number of the blocks in the RCBD portion is twice the sample size in the CRD portion, of the previous section 5.1.4 with respect to the reverse order of the location parameter configurations. The reader can refer to Appendix F for further tables of alpha values and power results considering different number of blocks for the RCBD portion and different sample sizes for the CRD portion.

Table 5.46. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0522	0.0490
	Second	0.0522	0.0492
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9982	0.9962
	Second	0.9578	0.9398
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9948	0.9938
	Second	0.9234	0.9044
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.6460	0.7184
	Second	0.4220	0.4768
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.6908	0.7492
	Second	0.4692	0.5206
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.7812	0.8296
	Second	0.5330	0.5868
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9768	0.9866
	Second	0.8326	0.8854
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.8488	0.9002
	Second	0.6102	0.6970
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.7974	0.8576
	Second	0.5680	0.6400
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.6178	0.7062
	Second	0.4304	0.4814
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6146	0.5618
	Second	0.4150	0.3672
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5290	0.5088
	Second	0.3464	0.3332
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7714	0.7706
	Second	0.5592	0.5482
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7006	0.6872
	Second	0.4582	0.4716
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.9344	0.9428
	Second	0.7376	0.7636
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7764	0.7406
	Second	0.5484	0.5230
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9356	0.9268
	Second	0.7522	0.7350
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.9130	0.8992
	Second	0.6982	0.6910
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9900	0.9890
	Second	0.9016	0.8936

Table 5.47. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0462	0.0482
	Second	0.0476	0.0508
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9340	0.9312
	Second	0.7448	0.7396
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.8632	0.8794
	Second	0.6368	0.6588
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3812	0.4436
	Second	0.2498	0.2852
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3966	0.4440
	Second	0.2576	0.3030
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.4686	0.5352
	Second	0.3080	0.3512
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.7962	0.8560
	Second	0.5698	0.6386
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5746	0.6532
	Second	0.3816	0.4360
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5020	0.5844
	Second	0.3290	0.3954
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3890	0.4408
	Second	0.2574	0.2956
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3628	0.3096
	Second	0.2382	0.2140
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2896	0.2798
	Second	0.1970	0.1860
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5076	0.5066
	Second	0.3294	0.3362
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4136	0.3910
	Second	0.2698	0.2646
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.6668	0.6982
	Second	0.4604	0.4834
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4754	0.4466
	Second	0.3110	0.2964
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6816	0.6852
	Second	0.4680	0.4576
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6146	0.6366
	Second	0.4196	0.4228
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8702	0.8724
	Second	0.6570	0.6556

Table 5.48. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0480	0.0512
	Second	0.0508	0.0490
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.8122	0.8170
	Second	0.5820	0.5836
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.7230	0.7308
	Second	0.4978	0.5064
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3016	0.3322
	Second	0.2026	0.2218
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3106	0.3462
	Second	0.2074	0.2352
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3392	0.3932
	Second	0.2246	0.2594
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.6318	0.7114
	Second	0.4266	0.4818
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4242	0.4836
	Second	0.2792	0.3230
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3934	0.4342
	Second	0.2536	0.2882
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2928	0.3356
	Second	0.1904	0.2306
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2884	0.2474
	Second	0.1964	0.1770
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2256	0.2102
	Second	0.1628	0.1596
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3812	0.3824
	Second	0.2506	0.2530
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3122	0.2972
	Second	0.2048	0.2032
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.5324	0.5642
	Second	0.3562	0.3712
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3528	0.3306
	Second	0.2356	0.2228
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5386	0.5134
	Second	0.3534	0.3424
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4748	0.4868
	Second	0.3220	0.3280
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.7222	0.7226
	Second	0.4904	0.4880

In the study when there are five treatments and a known peak at the fourth population for analyzing data in a mixed design comprised of a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion, we found that the results are similar to those when we have five treatments and the peak at the second population with respect to the reverse order of the location parameter configurations.

5.2. The Case of the Unknown Umbrella Peak

In this section, we present results of the estimated alpha values and the power estimates for the last four proposed test statistics in this research. The proposed tests statistics are for analyzing data in a mixed design comprised of a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion when the peak is unknown, which is of more practical interest. For each test conducted in this study, the stated alpha value is 0.05.

5.2.1. Three Populations with Unknown Peak

Tables 5.49 through 5.57 present results for three treatments when the peak is unknown. These results are shown for the same locations parameter configurations when the underlying distributions are exponential, normal and t distribution with three degrees of freedom. Among all the tables, the estimated alpha values are around 0.05, and it is noted that the Standardized First was more powerful than the Standardized Second for both non-modified and modified proposed test statistics. However, we noticed that Standardized Second with no modification is better than that with distance modification. Also, it is noticed that the Standardized First for both non-modified and modified test statistics are equivalent in the performance.

The results in Tables 5.49 through 5.51 present the estimated alpha values (level of significance) and the estimated powers when the number of blocks in the RCBD portion is half of the sample size for each treatment in the CRD portion.

Table 5.49. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0522	0.0438
	Second	0.0522	0.0406
(0.5 , 0.0 , 0.0)	First	0.3378	0.3286
	Second	0.2986	0.2678
(0.7 , 0.5 , 0.0)	First	0.6246	0.5982
	Second	0.5732	0.5188
(0.0 , 0.5 , 1.0)	First	0.8624	0.8522
	Second	0.8104	0.7724
(0.0 , 0.5 , 0.5)	First	0.4086	0.4146
	Second	0.3734	0.3610
(0.0 , 0.7 , 0.0)	First	0.7184	0.7198
	Second	0.6590	0.6234
(0.0 , 0.7 , 0.5)	First	0.5368	0.5180
	Second	0.4762	0.4390

Table 5.50. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0490	0.0446
	Second	0.0548	0.0478
(0.5 , 0.0 , 0.0)	First	0.1788	0.1836
	Second	0.1552	0.1524
(0.7 , 0.5 , 0.0)	First	0.3452	0.3616
	Second	0.3072	0.2806
(0.0 , 0.5 , 1.0)	First	0.6182	0.6014
	Second	0.5522	0.5146
(0.0 , 0.5 , 0.5)	First	0.2284	0.2394
	Second	0.2124	0.1926
(0.0 , 0.7 , 0.0)	First	0.4526	0.4410
	Second	0.4024	0.3744
(0.0 , 0.7 , 0.5)	First	0.3248	0.3192
	Second	0.2920	0.2606

Table 5.51. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0432	0.0480
	Second	0.0544	0.0490
(0.5 , 0.0 , 0.0)	First	0.1230	0.1226
	Second	0.1188	0.1108
(0.7 , 0.5 , 0.0)	First	0.2476	0.2544
	Second	0.2252	0.2122
(0.0 , 0.5 , 1.0)	First	0.4282	0.4100
	Second	0.3906	0.3558
(0.0 , 0.5 , 0.5)	First	0.1840	0.1624
	Second	0.1692	0.1424
(0.0 , 0.7 , 0.0)	First	0.3122	0.3016
	Second	0.2704	0.2592
(0.0 , 0.7 , 0.5)	First	0.2400	0.2260
	Second	0.2196	0.2012

Tables 5.52 through 5.54 present the estimated alpha values and the estimated powers when the number of blocks in the RCBD portion is equal to the sample size for each treatment in the CRD portion. In this case, we fix the sample size for the CRD and increase the number of blocks for the RCBD. We find that there is an increase in the power when the number of blocks increase to be equal to the sample size for each treatment in the CRD portion, compared to the case when the number of the blocks in the RCBD is half of the sample size for each treatment in the CRD.

Table 5.52. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0488	0.0506
	Second	0.0558	0.0458
(0.5 , 0.0 , 0.0)	First	0.4500	0.4436
	Second	0.3174	0.3014
(0.7 , 0.5 , 0.0)	First	0.7494	0.7476
	Second	0.5864	0.5744
(0.0 , 0.5 , 1.0)	First	0.9504	0.9392
	Second	0.8462	0.8188
(0.0 , 0.5 , 0.5)	First	0.5370	0.5468
	Second	0.4130	0.4002
(0.0 , 0.7 , 0.0)	First	0.8668	0.8540
	Second	0.7088	0.6690
(0.0 , 0.7 , 0.5)	First	0.6622	0.6640
	Second	0.5064	0.4804

Table 5.53. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0504	0.0494
	Second	0.0496	0.0454
(0.5 , 0.0 , 0.0)	First	0.2226	0.2182
	Second	0.1612	0.1528
(0.7 , 0.5 , 0.0)	First	0.4610	0.4452
	Second	0.3354	0.3142
(0.0 , 0.5 , 1.0)	First	0.7490	0.7494
	Second	0.5868	0.5638
(0.0 , 0.5 , 0.5)	First	0.3012	0.3064
	Second	0.2330	0.2088
(0.0 , 0.7 , 0.0)	First	0.5792	0.5612
	Second	0.4304	0.3734
(0.0 , 0.7 , 0.5)	First	0.4204	0.4084
	Second	0.3166	0.2920

Table 5.54. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0506	0.0410
	Second	0.0532	0.0425
(0.5 , 0.0 , 0.0)	First	0.1564	0.1604
	Second	0.1228	0.1178
(0.7 , 0.5 , 0.0)	First	0.3268	0.3172
	Second	0.2388	0.2270
(0.0 , 0.5 , 1.0)	First	0.5534	0.5452
	Second	0.4122	0.3808
(0.0 , 0.5 , 0.5)	First	0.2232	0.2104
	Second	0.1684	0.1510
(0.0 , 0.7 , 0.0)	First	0.4030	0.3912
	Second	0.3078	0.2664
(0.0 , 0.7 , 0.5)	First	0.3008	0.2992
	Second	0.2300	0.2136

Tables 5.55 through 5.57 present the estimated alpha values and the estimated powers when the number of blocks in the RCBD is twice the sample size for each treatment in the CRD based on the three underlying distributions presented. In this case, there is an increase in the powers.

Table 5.55. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0486	0.0484
	Second	0.0568	0.0414
(0.5 , 0.0 , 0.0)	First	0.6066	0.6154
	Second	0.3668	0.3608
(0.7 , 0.5 , 0.0)	First	0.8954	0.8786
	Second	0.6778	0.6294
(0.0 , 0.5 , 1.0)	First	0.9914	0.9888
	Second	0.8910	0.8780
(0.0 , 0.5 , 0.5)	First	0.6758	0.6830
	Second	0.4534	0.4242
(0.0 , 0.7 , 0.0)	First	0.9562	0.9624
	Second	0.7928	0.7534
(0.0 , 0.7 , 0.5)	First	0.8164	0.8206
	Second	0.5990	0.5378

Table 5.56. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0436	0.0476
	Second	0.0516	0.0420
(0.5 , 0.0 , 0.0)	First	0.3182	0.3208
	Second	0.1974	0.1776
(0.7 , 0.5 , 0.0)	First	0.6020	0.6282
	Second	0.3846	0.3800
(0.0 , 0.5 , 1.0)	First	0.8932	0.8836
	Second	0.6592	0.6340
(0.0 , 0.5 , 0.5)	First	0.4122	0.4114
	Second	0.2762	0.2490
(0.0 , 0.7 , 0.0)	First	0.7382	0.7410
	Second	0.5052	0.4650
(0.0 , 0.7 , 0.5)	First	0.5520	0.5586
	Second	0.3620	0.3404

Table 5.57. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0526	0.0470
	Second	0.0570	0.0448
(0.5 , 0.0 , 0.0)	First	0.2212	0.2142
	Second	0.1516	0.1208
(0.7 , 0.5 , 0.0)	First	0.4454	0.4348
	Second	0.2886	0.2476
(0.0 , 0.5 , 1.0)	First	0.7160	0.7282
	Second	0.4798	0.4558
(0.0 , 0.5 , 0.5)	First	0.2874	0.2862
	Second	0.1962	0.1742
(0.0 , 0.7 , 0.0)	First	0.5412	0.5390
	Second	0.3496	0.3230
(0.0 , 0.7 , 0.5)	First	0.3914	0.4118
	Second	0.2722	0.2452

In the case of having three treatments and an unknown peak for analyzing data in a mixed design comprising a completely randomized design (CRD) and a randomized complete block design (RCBD), we find that Standardized First has more power than Standardized Second for both non-modified and modified test statistics, regardless of the underlying distribution, the sample size for each treatment in the CRD and the number of blocks in the RCBD. Importantly, we notice that the test of Standardized Second with no modification, A^{***}_{max}, is better than that with distance modification, mA^{***}_{max}. Also, it is noticed that the Standardized First for both non-modified and modified test statistics (A^{**}_{max} and mA^{**}_{max}, respectively) are equivalent in the performance.

5.2.2. Four Populations with Unknown Peak

Tables 5.58 through 5.66 present results for four treatments when the peak is unknown. These results are shown for the same locations parameter configurations when the underlying distributions are exponential, normal and t distribution with three degrees of freedom. Among all the tables, the estimated alpha values are around 0.05, and it is noted that the standardized first was more powerful than the standardized second for both non-modified and modified test statistics. However, we notice that Standardized First with distance modification is better than that with no modification. Also, it is noticed that the Standardized Second for both non-modified and modified test statistics are equivalent in the performance.

The results in Tables 5.58 through 5.60 present the estimated alpha values and powers when the number of blocks in the RCBD is half of the sample size for each treatment in the CRD.

Table 5.58. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0528
	Second	0.0462	0.0544
(1.0 , 0.0 , 0.0 , 0.0)	First	0.6994	0.7374
	Second	0.6082	0.6222
(1.0 , 0.75 , 0.5 , 0.25)	First	0.7244	0.7096
	Second	0.6420	0.6242
(0.75 , 0.75 , 0.5 , 0.0)	First	0.7298	0.7358
	Second	0.6530	0.6452
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3968	0.4184
	Second	0.3516	0.3544
(0.5 , 1.0 , 0.2 , 0.2)	First	0.6930	0.7288
	Second	0.6142	0.6258
(0.8 , 1.0 , 0.75 , 0.2)	First	0.6842	0.7074
	Second	0.6138	0.6194
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3812	0.3948
	Second	0.3484	0.3388
(0.2 , 0.75 , 1.0 , 0.75)	First	0.6902	0.7024
	Second	0.6172	0.6096
(0.0 , 0.5 , 0.75 , 0.75)	First	0.7348	0.7460
	Second	0.6582	0.6434
(0.0 , 0.0 , 0.25 , 1.0)	First	0.8506	0.8576
	Second	0.7802	0.7752
(0.0 , 0.0 , 0.75 , 0.75)	First	0.8158	0.8420
	Second	0.7470	0.7538

Table 5.59. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0470	0.0534
	Second	0.0504	0.0518
(1.0 , 0.0 , 0.0 , 0.0)	First	0.4688	0.5070
	Second	0.4122	0.4250
(1.0 , 0.75 , 0.5 , 0.25)	First	0.3966	0.4308
	Second	0.3404	0.3574
(0.75 , 0.75 , 0.5 , 0.0)	First	0.4348	0.4850
	Second	0.3852	0.4124
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2220	0.2492
	Second	0.1978	0.2046
(0.5 , 1.0 , 0.2 , 0.2)	First	0.4236	0.4520
	Second	0.3744	0.3868
(0.8 , 1.0 , 0.75 , 0.2)	First	0.4330	0.4656
	Second	0.3826	0.3952
(0.0 , 0.25 , 0.5 , 0.25)	First	0.1962	0.2150
	Second	0.1854	0.1698
(0.2 , 0.75 , 1.0 , 0.75)	First	0.4274	0.4540
	Second	0.3792	0.3796
(0.0 , 0.5 , 0.75 , 0.75)	First	0.4554	0.4974
	Second	0.4008	0.4126
(0.0 , 0.0 , 0.25 , 1.0)	First	0.5854	0.6102
	Second	0.5080	0.5054
(0.0 , 0.0 , 0.75 , 0.75)	First	0.5678	0.6022
	Second	0.4838	0.5002

Table 5.60. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0516	0.0542
	Second	0.0448	0.0560
(1.0 , 0.0 , 0.0 , 0.0)	First	0.3194	0.3356
	Second	0.2708	0.2704
(1.0 , 0.75 , 0.5 , 0.25)	First	0.2646	0.2956
	Second	0.2382	0.2490
(0.75 , 0.75 , 0.5 , 0.0)	First	0.3264	0.3420
	Second	0.2818	0.2874
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1668	0.1862
	Second	0.1598	0.1590
(0.5 , 1.0 , 0.2 , 0.2)	First	0.2986	0.3228
	Second	0.2610	0.2638
(0.8 , 1.0 , 0.75 , 0.2)	First	0.3052	0.3342
	Second	0.2794	0.2820
(0.0 , 0.25 , 0.5 , 0.25)	First	0.1552	0.1652
	Second	0.1462	0.1362
(0.2 , 0.75 , 1.0 , 0.75)	First	0.2974	0.3276
	Second	0.2624	0.2728
(0.0 , 0.5 , 0.75 , 0.75)	First	0.3198	0.3402
	Second	0.2810	0.2760
(0.0 , 0.0 , 0.25 , 1.0)	First	0.3912	0.4178
	Second	0.3390	0.3374
(0.0 , 0.0 , 0.75 , 0.75)	First	0.4028	0.4306
	Second	0.3566	0.3594

Tables 5.61 through 5.63 present the estimated alpha values and the estimated powers when the number of blocks in the RCBD is equal to the sample size for each treatment in the CRD. We find that there is an increase in the power compared to the case when the number of the blocks in the RCBD is half of the sample size for each treatment in the CRD.

Table 5.61. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0484	0.0474
	Second	0.0522	0.0528
(1.0 , 0.0 , 0.0 , 0.0)	First	0.8462	0.8744
	Second	0.6420	0.6684
(1.0 , 0.75 , 0.5 , 0.25)	First	0.8442	0.8562
	Second	0.6732	0.6728
(0.75 , 0.75 , 0.5 , 0.0)	First	0.8476	0.8596
	Second	0.6886	0.6918
(0.5 , 0.5 , 0.5 , 0.0)	First	0.4948	0.5262
	Second	0.3724	0.3772
(0.5 , 1.0 , 0.2 , 0.2)	First	0.8466	0.8614
	Second	0.6758	0.6552
(0.8 , 1.0 , 0.75 , 0.2)	First	0.8192	0.8398
	Second	0.6616	0.6614
(0.0 , 0.25 , 0.5 , 0.25)	First	0.4888	0.5128
	Second	0.3688	0.3644
(0.2 , 0.75 , 1.0 , 0.75)	First	0.8152	0.8380
	Second	0.6568	0.6610
(0.0 , 0.5 , 0.75 , 0.75)	First	0.8470	0.8602
	Second	0.6860	0.6840
(0.0 , 0.0 , 0.25 , 1.0)	First	0.9518	0.9528
	Second	0.8250	0.8116
(0.0 , 0.0 , 0.75 , 0.75)	First	0.9186	0.9350
	Second	0.7696	0.7796

Table 5.62. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0432	0.0486
	Second	0.0532	0.0446
(1.0 , 0.0 , 0.0 , 0.0)	First	0.6082	0.6578
	Second	0.4338	0.4544
(1.0 , 0.75 , 0.5 , 0.25)	First	0.5148	0.5488
	Second	0.3732	0.3884
(0.75 , 0.75 , 0.5 , 0.0)	First	0.5854	0.6098
	Second	0.4338	0.4446
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2732	0.3138
	Second	0.2122	0.2232
(0.5 , 1.0 , 0.2 , 0.2)	First	0.5504	0.5918
	Second	0.4032	0.4154
(0.8 , 1.0 , 0.75 , 0.2)	First	0.5468	0.5742
	Second	0.4080	0.4134
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2562	0.2644
	Second	0.1940	0.1890
(0.2 , 0.75 , 1.0 , 0.75)	First	0.5314	0.5730
	Second	0.4008	0.4046
(0.0 , 0.5 , 0.75 , 0.75)	First	0.5754	0.6076
	Second	0.4440	0.4336
(0.0 , 0.0 , 0.25 , 1.0)	First	0.7176	0.7522
	Second	0.5360	0.5436
(0.0 , 0.0 , 0.75 , 0.75)	First	0.7002	0.7364
	Second	0.5296	0.5550

Table 5.63. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0420	0.0532
	Second	0.0452	0.0494
(1.0 , 0.0 , 0.0 , 0.0)	First	0.4122	0.4610
	Second	0.2852	0.3060
(1.0 , 0.75 , 0.5 , 0.25)	First	0.3596	0.3880
	Second	0.2580	0.2586
(0.75 , 0.75 , 0.5 , 0.0)	First	0.4234	0.4488
	Second	0.2956	0.3166
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1982	0.2290
	Second	0.1544	0.1702
(0.5 , 1.0 , 0.2 , 0.2)	First	0.3968	0.4256
	Second	0.2948	0.3048
(0.8 , 1.0 , 0.75 , 0.2)	First	0.3914	0.4224
	Second	0.2980	0.2996
(0.0 , 0.25 , 0.5 , 0.25)	First	0.1758	0.2008
	Second	0.1482	0.1508
(0.2 , 0.75 , 1.0 , 0.75)	First	0.3650	0.3946
	Second	0.2836	0.2804
(0.0 , 0.5 , 0.75 , 0.75)	First	0.4086	0.4340
	Second	0.3044	0.3024
(0.0 , 0.0 , 0.25 , 1.0)	First	0.5284	0.5500
	Second	0.3676	0.3690
(0.0 , 0.0 , 0.75 , 0.75)	First	0.5142	0.5502
	Second	0.3780	0.3818

Tables 5.64 through 5.66 present the estimated alpha values and powers when we fix the sample size for the CRD portion and increase the number of blocks for the RCBD portion. The results are presented when the number of blocks in the RCBD portion is twice the sample size for each treatment in the CRD portion based on the three underlying distributions presented. In this case, we notice that there is an increase in the estimated power.

Table 5.64. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0434	0.0516
	Second	0.0468	0.0520
(1.0 , 0.0 , 0.0 , 0.0)	First	0.9556	0.9706
	Second	0.7320	0.7572
(1.0 , 0.75 , 0.5 , 0.25)	First	0.9550	0.9532
	Second	0.7730	0.7416
(0.75 , 0.75 , 0.5 , 0.0)	First	0.9496	0.9560
	Second	0.7544	0.7622
(0.5 , 0.5 , 0.5 , 0.0)	First	0.6508	0.6776
	Second	0.4284	0.4266
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9570	0.9582
	Second	0.7538	0.7530
(0.8 , 1.0 , 0.75 , 0.2)	First	0.9300	0.9424
	Second	0.7276	0.7436
(0.0 , 0.25 , 0.5 , 0.25)	First	0.6746	0.6806
	Second	0.4292	0.4368
(0.2 , 0.75 , 1.0 , 0.75)	First	0.9236	0.9358
	Second	0.7130	0.7238
(0.0 , 0.5 , 0.75 , 0.75)	First	0.9470	0.9572
	Second	0.7624	0.7594
(0.0 , 0.0 , 0.25 , 1.0)	First	0.9954	0.9938
	Second	0.8864	0.8736
(0.0 , 0.0 , 0.75 , 0.75)	First	0.9830	0.9848
	Second	0.8522	0.8542

Table 5.65. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0554
	Second	0.0486	0.0528
(1.0 , 0.0 , 0.0 , 0.0)	First	0.8026	0.8240
	Second	0.5256	0.5284
(1.0 , 0.75 , 0.5 , 0.25)	First	0.6916	0.7268
	Second	0.4280	0.4458
(0.75 , 0.75 , 0.5 , 0.0)	First	0.7440	0.7892
	Second	0.5020	0.5018
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3874	0.4080
	Second	0.2494	0.2432
(0.5 , 1.0 , 0.2 , 0.2)	First	0.7322	0.7438
	Second	0.4728	0.4812
(0.8 , 1.0 , 0.75 , 0.2)	First	0.7204	0.7364
	Second	0.4598	0.4746
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3370	0.3664
	Second	0.2080	0.2288
(0.2 , 0.75 , 1.0 , 0.75)	First	0.6998	0.7172
	Second	0.4606	0.4662
(0.0 , 0.5 , 0.75 , 0.75)	First	0.7458	0.7796
	Second	0.4920	0.5114
(0.0 , 0.0 , 0.25 , 1.0)	First	0.8790	0.8970
	Second	0.6266	0.6296
(0.0 , 0.0 , 0.75 , 0.75)	First	0.8574	0.8820
	Second	0.6072	0.6174

Table 5.66. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0534
	Second	0.0534	0.0532
(1.0 , 0.0 , 0.0 , 0.0)	First	0.6078	0.6524
	Second	0.3670	0.3690
(1.0 , 0.75 , 0.5 , 0.25)	First	0.4972	0.5308
	Second	0.2934	0.3130
(0.75 , 0.75 , 0.5 , 0.0)	First	0.5546	0.5890
	Second	0.3474	0.3542
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2822	0.2950
	Second	0.1998	0.1854
(0.5 , 1.0 , 0.2 , 0.2)	First	0.5184	0.5550
	Second	0.3174	0.3414
(0.8 , 1.0 , 0.75 , 0.2)	First	0.5086	0.5750
	Second	0.3220	0.3468
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2444	0.2582
	Second	0.1648	0.1706
(0.2 , 0.75 , 1.0 , 0.75)	First	0.5222	0.5402
	Second	0.3220	0.3320
(0.0 , 0.5 , 0.75 , 0.75)	First	0.5472	0.5966
	Second	0.3466	0.3624
(0.0 , 0.0 , 0.25 , 1.0)	First	0.7016	0.7294
	Second	0.4288	0.4366
(0.0 , 0.0 , 0.75 , 0.75)	First	0.6736	0.7146
	Second	0.4272	0.4474

In the study where there are four treatments and the peak is unknown for analyzing data in a mixed design comprised of a completely randomized design (CRD) portion and a randomized complete block design (RCBD) portion, we find that Standardized First has more power than Standardized Second for both non-modified and modified test statistics regardless of the underlying distribution, the sample size for each treatment in the CRD portion and the number of blocks in the RCBD portion. Importantly, we notice that the test of Standardized first with distance modification, mA^{**}_{max}, is better than that with no modification, A^{**}_{max}. Also, it is noticed that the Standardized Second for both non-modified and modified (A^{***}_{max} and mA^{***}_{max}, respectively) are equivalent in the performance.

5.2.3. Five Populations with Unknown Peak

Tables 5.67 through 5.75 present results for five treatments when the peak is unknown. These results are shown for the same location parameter configurations when the underlying distributions are exponential, normal and t distribution with three degrees of freedom. Among all the tables, the estimated alpha values are around 0.05, and it is noted that the standardized first was more powerful than the standardized second for both non-modified and modified test statistics. However, we notice that Standardized First with distance modification is better than that with no modification. Also, it is noticed that the Standardized Second for both non-modified and modified test statistics are equivalent in the performance.

The results in Tables 5.67 through 5.69 present the estimated alpha values and powers when the number of blocks in the RCBD is half of the sample size for each treatment in the CRD.

Table 5.67. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0450	0.0524
	Second	0.0530	0.0476
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.5990	0.6456
	Second	0.4932	0.5096
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.7138	0.7424
	Second	0.6114	0.6184
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8842	0.8846
	Second	0.8130	0.7968
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4872	0.5076
	Second	0.4196	0.4142
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5834	0.6212
	Second	0.5134	0.5058
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6148	0.6340
	Second	0.5358	0.5276
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3326	0.3614
	Second	0.2912	0.2964
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.5498	0.5586
	Second	0.4614	0.4678
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.6044	0.6364
	Second	0.5320	0.5504
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.9180	0.9184
	Second	0.8452	0.8392

Table 5.68. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0460	0.0494
	Second	0.0538	0.0474
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.3988	0.4314
	Second	0.3230	0.3486
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.4212	0.4546
	Second	0.3530	0.3546
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6036	0.6430
	Second	0.5188	0.5500
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2268	0.2494
	Second	0.1940	0.2124
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3020	0.3358
	Second	0.2562	0.2798
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3406	0.3736
	Second	0.2992	0.3050
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.1920	0.2088
	Second	0.1736	0.1708
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2800	0.2934
	Second	0.2386	0.2344
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3468	0.3874
	Second	0.2906	0.3122
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.6534	0.6794
	Second	0.5558	0.5762

Table 5.69. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at an unknown peak: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0462	0.0496
	Second	0.0510	0.0442
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.2644	0.2808
	Second	0.2172	0.2230
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.2750	0.2988
	Second	0.2268	0.2312
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.4280	0.4600
	Second	0.3728	0.3788
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.1790	0.1750
	Second	0.1554	0.1610
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2064	0.2246
	Second	0.1814	0.1830
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2378	0.2802
	Second	0.2114	0.2350
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.1370	0.1648
	Second	0.1310	0.1338
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.1922	0.2170
	Second	0.1690	0.1780
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2406	0.2638
	Second	0.2166	0.2190
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.4494	0.4732
	Second	0.3782	0.3878

Tables 5.70 through 5.72 present the estimated alpha values and the estimated powers when the number of blocks in the RCBD is equal to the sample size for each treatment in the CRD. We find that there is an increase in the power compared to the case when the number of the blocks in the RCBD is half of the sample size for each treatment in the CRD.

Table 5.70. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0510
	Second	0.0484	0.0480
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.7592	0.8050
	Second	0.5266	0.5642
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.8542	0.8766
	Second	0.6450	0.6728
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9606	0.9654
	Second	0.8556	0.8396
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6264	0.6426
	Second	0.4546	0.4474
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7380	0.7542
	Second	0.5560	0.5526
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7526	0.7664
	Second	0.5656	0.5802
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4428	0.4874
	Second	0.3002	0.3288
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.7028	0.7244
	Second	0.4984	0.5014
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.7452	0.7686
	Second	0.5554	0.5900
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.9820	0.9804
	Second	0.8870	0.8734

Table 5.71. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0532
	Second	0.0526	0.0508
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.5354	0.5778
	Second	0.3534	0.3626
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.5712	0.6102
	Second	0.3988	0.3972
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7468	0.7806
	Second	0.5564	0.5834
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3052	0.3472
	Second	0.2142	0.2452
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4040	0.4300
	Second	0.2734	0.2836
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4442	0.4894
	Second	0.3216	0.3376
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2332	0.2606
	Second	0.1748	0.1884
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3822	0.4074
	Second	0.2620	0.2736
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4438	0.4788
	Second	0.3146	0.3264
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.8108	0.8250
	Second	0.6126	0.6136

Table 5.72. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at an unknown peak: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0500	0.0562
	Second	0.0494	0.0534
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.3782	0.4016
	Second	0.2442	0.2546
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.3692	0.4054
	Second	0.2416	0.2594
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5484	0.5886
	Second	0.3900	0.4102
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2164	0.2404
	Second	0.1528	0.1612
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2754	0.3050
	Second	0.1884	0.2072
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3154	0.3488
	Second	0.2266	0.2392
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.1740	0.1964
	Second	0.1364	0.1458
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2568	0.2750
	Second	0.1766	0.1842
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3050	0.3540
	Second	0.2114	0.2446
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.5974	0.6332
	Second	0.4134	0.4350

Tables 5.73 through 5.75 present the estimated alpha values and powers when the number of blocks in the RCBD is twice the sample size for each treatment in the CRD based on the three underlying distributions presented. Here, we notice that there is an increase in the estimated power.

Table 5.73. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0464	0.0530
	Second	0.0474	0.0552
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.9190	0.9426
	Second	0.6188	0.6766
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.9600	0.9676
	Second	0.7470	0.7608
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9930	0.9968
	Second	0.8986	0.8940
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.7888	0.8060
	Second	0.5242	0.5270
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8870	0.9002
	Second	0.6278	0.6306
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8860	0.9062
	Second	0.6358	0.6514
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.6162	0.6622
	Second	0.3476	0.3852
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.8694	0.8752
	Second	0.5724	0.5906
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.8846	0.9058
	Second	0.6300	0.6534
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.9990	0.9980
	Second	0.9418	0.9266

Table 5.74. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0502
	Second	0.0472	0.0466
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.7336	0.7574
	Second	0.4180	0.4454
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.7554	0.7928
	Second	0.4494	0.4728
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9012	0.9184
	Second	0.6336	0.6612
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4476	0.4826
	Second	0.2642	0.2760
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5468	0.5800
	Second	0.3240	0.3444
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6016	0.6382
	Second	0.3678	0.3884
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3124	0.3522
	Second	0.1862	0.2132
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.5166	0.5592
	Second	0.2916	0.3170
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5946	0.6458
	Second	0.3548	0.3858
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.9318	0.9446
	Second	0.6882	0.6932

Table 5.75. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at an unknown peak: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0466	0.0478
	Second	0.0484	0.0490
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.5304	0.5562
	Second	0.2806	0.2896
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.5610	0.5734
	Second	0.3084	0.3178
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7198	0.7546
	Second	0.4584	0.4756
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2986	0.3118
	Second	0.1818	0.1802
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3686	0.4164
	Second	0.2152	0.2380
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4308	0.4800
	Second	0.2538	0.2766
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2256	0.2530
	Second	0.1442	0.1630
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3588	0.3934
	Second	0.2068	0.2174
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4360	0.4808
	Second	0.2580	0.2796
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.7710	0.7946
	Second	0.4800	0.4960

In the case of the study where we have five treatments and the peak is unknown for analyzing data in a mixed design comprising CRD and RCBD portions, we find that Standardized first has more power than Standardized Second for both non-modified and modified test statistics, regardless of the underlying distribution, the sample size for each treatment in the CRD portion and the number of blocks in the RCBD portion. Importantly, we notice that the test of Standardized first with distance modification, mA^{**}_{max}, is better than that with no modification, A^{**}_{max}. Also, it is noticed that the Standardized Second for both non-modified and modified (A^{***}_{max} and mA^{***}_{max}, respectively) are equivalent in the performance.

6. DISCUSSION AND CONCLUSION

This research proposes six test statistics for testing umbrella alternatives in a mixed design formed by combining a completely randomized design (CRD) and a randomized complete block design (RCBD) when three or more treatments are introduced. mA^{**} and mA^{***} for testing the umbrella alternatives when the peak is known in a mixed three-sample or higher designs. A^{**}_{max}, A^{***}_{max}, mA^{**}_{max} and mA^{***}_{max} for testing the umbrella alternatives when the peak is unknown in a mixed three-sample or higher designs. In this research, we generate random data from three underlying distributions: exponential, normal and t distribution with three degrees of freedom.

In the case of the known umbrella peak, the simulations are run for three treatments with a peak at the second population, four treatments with a peak at the second and third population, and five treatments with a peak at the second, third and fourth population. For every distribution, equal sample sizes for the CRD portion are selected so that the sample size, n, is 6, 10, 16 and 20. The number of blocks for the RCBD is considered to be half, equal and twice the sample size for each treatment. Furthermore, a variety of location parameter configurations are considered for three, four and five populations. The estimated rejection percentages are presented for the first two proposed tests (the modified test statistics) along with the two proposed tests introduced by Magel et al. (2010) (the non-modified test statistics), which consider a combination of the CRD and RCBD without applying the distance modification to the Mack-Wolfe (1981) and Kim-Kim (1992) test statistics (see Section 2.5).

In the case of the unknown umbrella peak, the simulations are run for three, four and five treatments when the peak is unknown. For every distribution, equal sample sizes for the completely randomized design portion are selected so that the sample size, n, is 10. The number of blocks for the randomized complete block design is considered to be half, equal and twice the sample size for each treatment. Furthermore, a variety of location parameter configurations are considered for three, four and five populations. The estimated rejection percentages are presented for the last four proposed tests statistics.

6.1. The Case of the Known Umbrella Peak

Results show that regardless of the underlying distribution, the sample size for each treatment in the CRD portion, the number of blocks in the RCBD portion and the peak p, the Standardized First (A^{**} and mA^{**}) is generally better than the Standardized Second (A^{***} and mA^{***}) for both unmodified and modified test statistics, respectively. Also, the estimated alpha values for the first two proposed tests and Magel et al. (2010)'s tests are around 0.05. In an equivalent manner, the results for the first two proposed tests, as far as how these two tests perform relative to one another for all the underlying distributions, are similar to Magel et al. (2010)'s results. Additionally, by holding the sample size for each treatment in the CRD portion constant and increasing the number of blocks for the RCBD portion, we notice that there is an improvement in the powers for all the proposed test statistics.

6.1.1. Three Populations with Peak at 2

While the study is comprised of three treatments with known peak at the second population, the power estimates for both unmodified and modified test statistics are increased when the known peak is distinct, regardless of the spacing between the known peak at two and the other two parameter configurations, the underlying distribution, the sample size for each treatment in the CRD portion and the number of blocks in the RCBD portion.

Importantly, in this case of the study, we find that neither of the first two proposed tests (modified tests) are better than the two test statistics proposed by Magel et al. (2010) (non-modified test), since the associated weight (distance modification) for Mack-Wolfe (1981) and Kim-Kim (1992) test statistics is just 1. Generally, they are exactly the same. Since the distance modification does not contribute any differences in this case, we can consider the non-modified Standardized First, A^{**}, is the test that has the highest power among all the test statistics. As an illustration, suppose we have a normal population, 3 treatments with peak 2, 5 blocks for the RCBD portion and sample size of 10 for each treatment are considered for the CRD portion. Graphs of the estimated rejection percentages for varying location parameter configurations are presented in Figure 6.1. Figure 6.2 shows that there is an improvement in the power for the proposed test statistics when we hold the sample size for each treatment in the CRD portion constant and increase the number of the blocks in the RCBD portion.

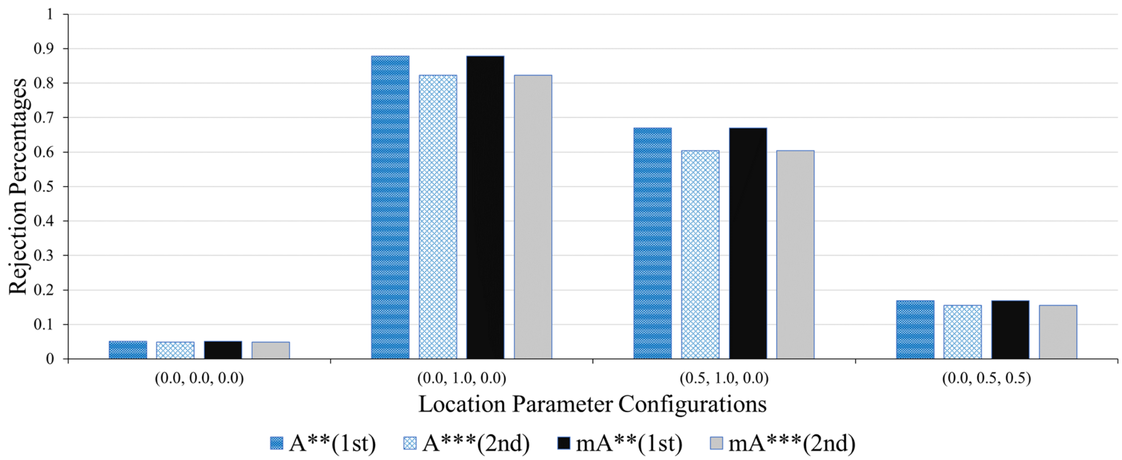

Figure 6.1. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 3 treatments at peak 2: Blocks= 5, n=10 and normal distribution.

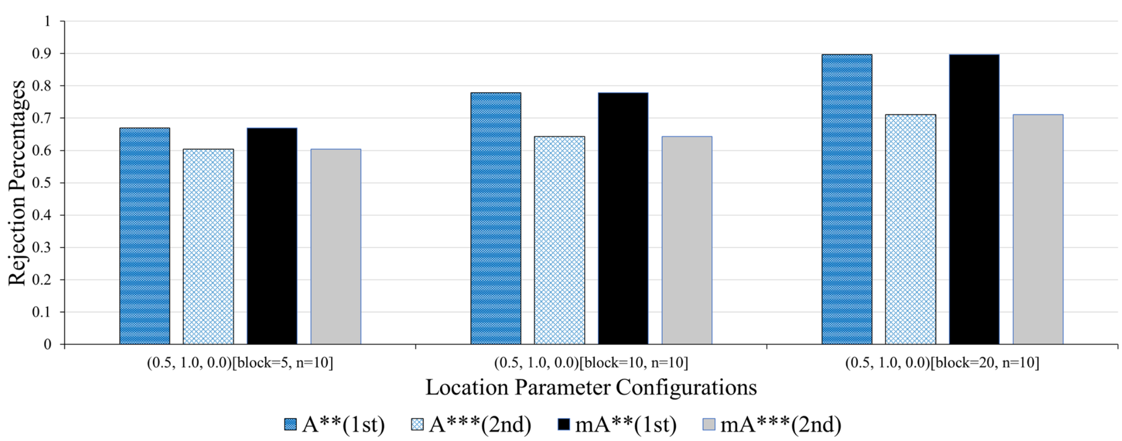

Figure 6.2. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 3 treatments at peak 2: Blocks= 5, 10 and 20, n=10 and normal distribution.

6.1.2. Four Populations with Peak at 2 or 3

While the study is comprised of four treatments with a known peak at the second population, the power estimates for both unmodified and modified test statistics are increased when the known peak is distinct, regardless of the spacing between the known peak at two and the other parameter configurations, the equality between the other configurations, the underlying distribution, the sample size for each treatment in the CRD and the number of blocks in the RCBD.

It is important to note that for each of the considered proportions between the sample size in the CRD and the number of blocks in the RCBD, we find that the first two proposed test statistics (modified tests) in this research provide the highest values of the estimated powers, compared to the Magel et al. (2010)'s test statistics (non-modified test) in the following cases:

1. Two population parameters are the same, but different from the peak and less than the first parameter on the left, such as: (0.5, 1.0, 0.2, 0.2).

2. One additional parameter equals the peak, and the other parameters are different from the peak, but equal to each other and on the right side of the peak, such as: (0.5, 0.5, 0.0, 0.0).

3. One additional parameter equals the peak, and the other parameters are different from the peak, different from each other and less than the first parameter on the left, such as: (0.5, 0.5, 0.2, 0.0).

4. When the peak is distinct and there is equal spacing between parameters, such as: (0.25, 0.5, 0.25, 0.0).

5. Two additional parameters are equal to the peaks, and both of them stratify the peak, such as: (0.5, 0.5, 0.5, 0.0).

In general, the modified Standardized First, mA^{**}, has the highest power in those cases since the Standardized First is better than Standardized second. Other than those cases, we can consider the non-modified Standardized First, A^{**}, is the test which has the highest power among all the test statistics. To illustrate this, suppose we have a normal population, 4 treatments with peak 2, 10 blocks for the RCBD portion and a sample size of 10 for each treatment considered for the CRD portion. Graphs of the estimated rejection percentages for varying location parameter configurations are presented in Figure 6.3.

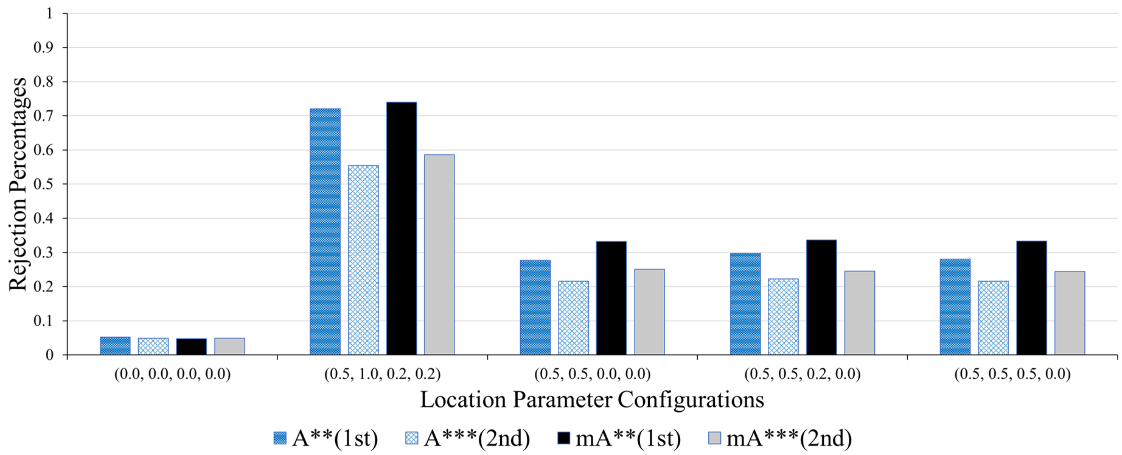

Figure 6.3. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 4 treatments at peak 2: Blocks= 10, n=10 and normal distribution.

When the study is comprised of four treatments with a known peak at the third population, the results are similar to those when we have four treatments and peaks at the second population with respect to the reverse order of the location parameter configurations (see Figure 6.4).

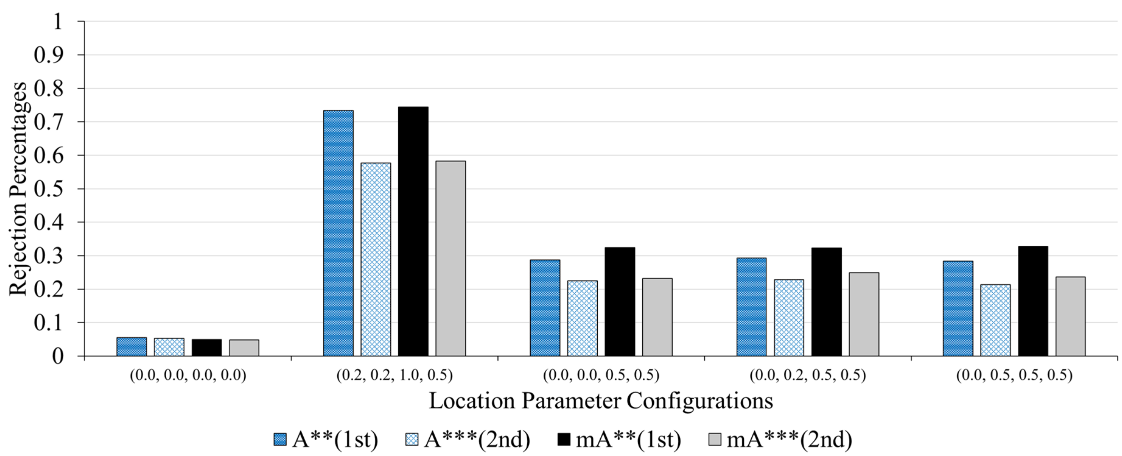

Figure 6.4. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 4 treatments at peak 3: Blocks= 10, n=10 and normal distribution.

6.1.3. Five Populations with Peak at 2 or 4

While the study is comprised of five treatments with a known peak at the second population, the power estimates for both unmodified and modified test statistics are increased when the known peak is distinct, regardless of the spacing between the other parameter configurations, the underlying distribution, the sample size for each treatment in the CRD and the number of blocks in the RCBD.

It is important to note, regardless of the considered proportions between the sample size in the CRD and the number of blocks in the RCBD, that the first two proposed test statistics (modified tests) provide the highest values of the estimated powers, compared to Magel et al. (2010)'s test statistics (non-modified test) in the following cases:

1. Two population parameters are the same, but different from the peak, such as: (0.2, 0.7, 0.4, 0.0, 0.0) and (0.4, 0.8, 0.4, 0.2, 0.0) where the last two treatments are less than the first parameter on the left.

2. One additional parameter equals the peak and the other parameters are different from the peak, but equal to each other, such as: (0.5, 0.5, 0.0, 0.0, 0.0).

3. One additional parameter equals the peak and the other parameters are different from the peak and different from each other, such as: (0.8, 0.8, 0.5, 0.2, 0.0).

4. One additional parameter is equal to the peak, the two other parameters are equal to each other but not the peak, and one parameter is different, such as: (0.5, 0.5, 0.2, 0.2, 0.0), (0.5, 0.5, 0.2, 0.0, 0.0), (0.2, 0.5, 0.5, 0.0, 0.0), (0.2, 0.5, 0.5, 0.2, 0.0) and (0.2, 0.7, 0.7, 0.3, 0.0) where the last treatment is less than the first one.

5. Two additional parameters are equal to the peak and stratify the peak, such as: (0.5, 0.5, 0.5, 0.0, 0.0) and (0.5, 0.5, 0.5, 0.2, 0.0).

6. Three additional parameters are equal to the peak, and two of them stratify the peak, such as: (0.5, 0.5, 0.5, 0.5, 0.0).

Generally, the modified Standardized First, mA^{**}, has the highest power in those cases. Other than those cases, we can consider the non-modified Standardized First, A^{**}, is the test which has the highest power among all the test statistics. For example, suppose we have a normal population, 5 treatments with peak 2, 20 blocks and a sample size of 10 for each treatment is considered for the CRD portion. Graphs of the estimated rejection percentages for varying location parameter configurations are presented in Figure 6.5.

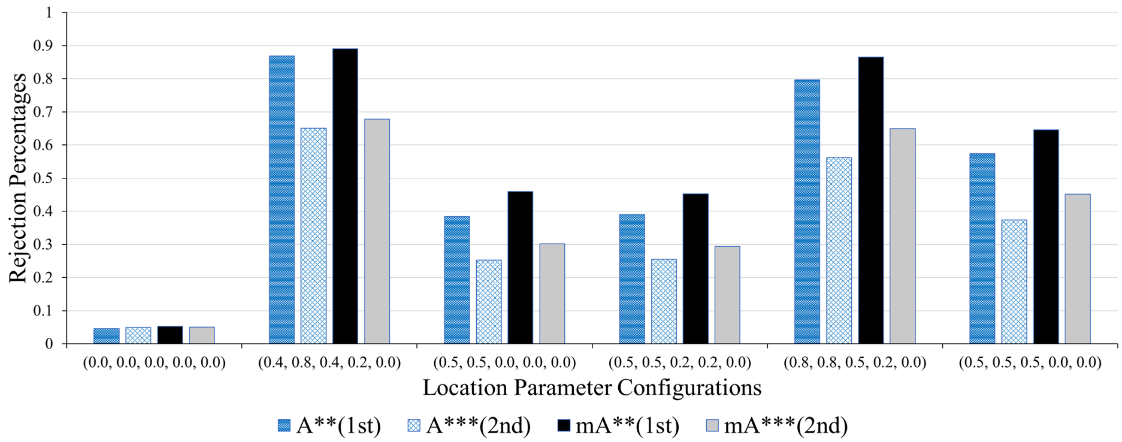

Figure 6.5. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 5 treatments at peak 2: Blocks= 20, n=10 and normal distribution.

When the study is comprised of five treatments with known peak at the fourth population, the results are similar to those when the peaks at the second population with respect to the reverse order of the location parameter configurations (see Figure 6.6).

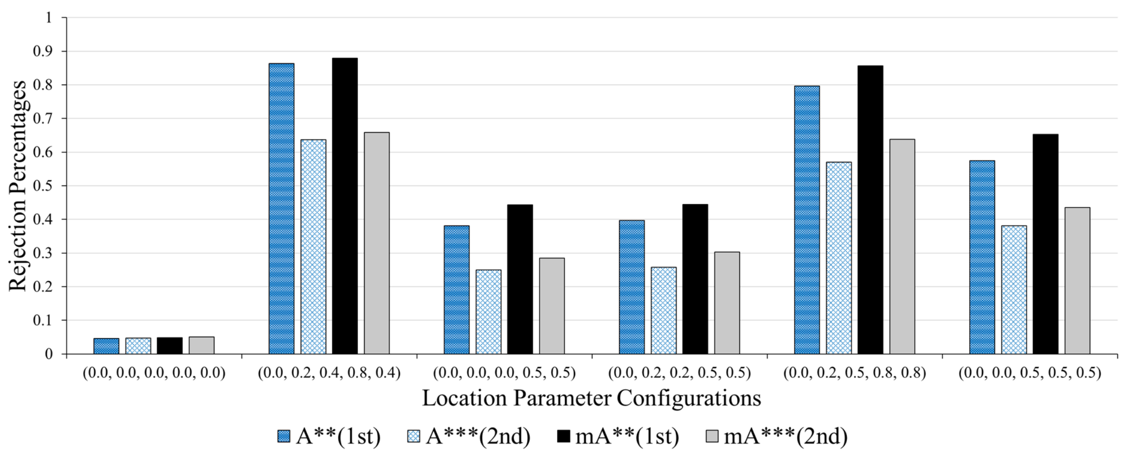

Figure 6.6. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 5 treatments at peak 4: Blocks= 20, n=10 and normal distribution.

6.1.4. Five Populations with Peak at 3

While the study is comprised of five treatments with a known peak at the third population, the power estimates for both unmodified and modified test statistics are increased when the known peak is distinct, regardless of the spacing between the other parameter configurations, the underlying distribution, the sample size for each treatment in the CRD portion and the number of blocks in the RCBD portion.

Importantly, the results from the first two proposed tests (modified tests) and the test statistics proposed by Magel et al. (2010) (non-modified tests) vary from configuration to one another and from distribution to one another. Accordingly, it is difficult to emphasize whether the distance modification provide highest power or not. As an illustration, suppose we have a normal population, 5 treatments with peak 3, 20 blocks for the RCBD portion, and a sample size of 10 for each treatment is considered for the CRD portion. Graphs of the estimated rejection percentages for varying location parameter configurations are presented in Figure 6.7.

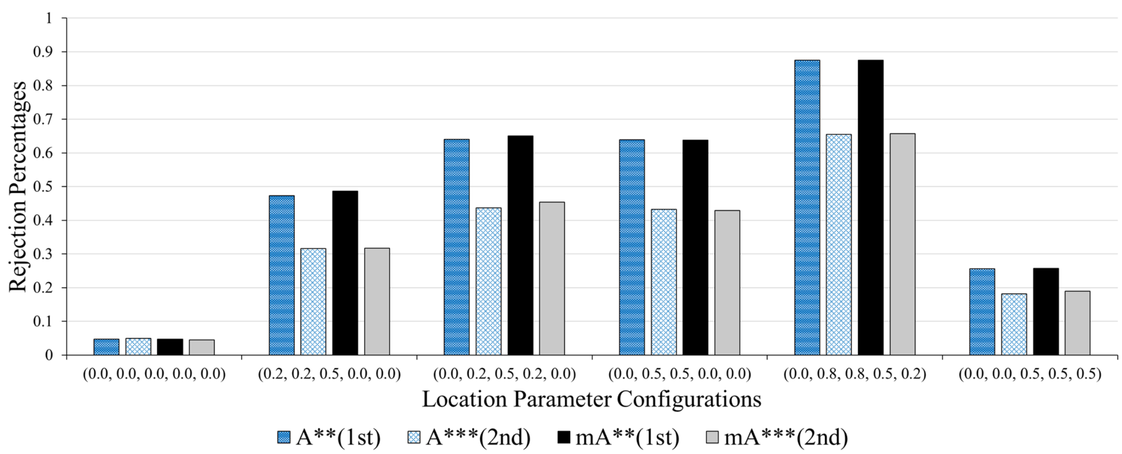

Figure 6.7. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 5 treatments at peak 3: Blocks= 20, n=10 and normal distribution.

6.2. The Case of Unknown Umbrella Peak

Results show that regardless of the underlying distribution, the sample size for each treatment in the CRD portion, the number of blocks in the RCBD portion and the peak p, the Standardized First (A^{**}_{max} and mA^{**}_{max}) are generally better than the Standardized Second (A^{***}_{max} and mA^{***}_{max}) for both unmodified and modified test statistics, respectively. Also, the estimated alpha values for the last four proposed tests are around 0.05.

6.2.1. Three Populations with Unknown Peak

While the study is comprised of three treatments with an unknown peak, we notice that the test of Standardized Second with no modification (A^{***}_{max}) is better than that with distance modification (mA^{***}_{max}). Also, it is noticed that the Standardized First for both non-modified and modified test statistics (A^{**}_{max} and mA^{**}_{max}, respectively) are similar in the performance. Generally, we could consider the un-modified Standardized First, A^{**}_{max}, is the test that has the highest power among all the last four test statistics. To illustrate this, suppose we have a normal population, 3 treatments with peak unknown, 20 blocks for the RCBD portion, and a sample size of 10 for each treatment is considered for the CRD portion. Graphs of the estimated rejection percentages for varying location parameter configurations are presented in Figure 6.8.

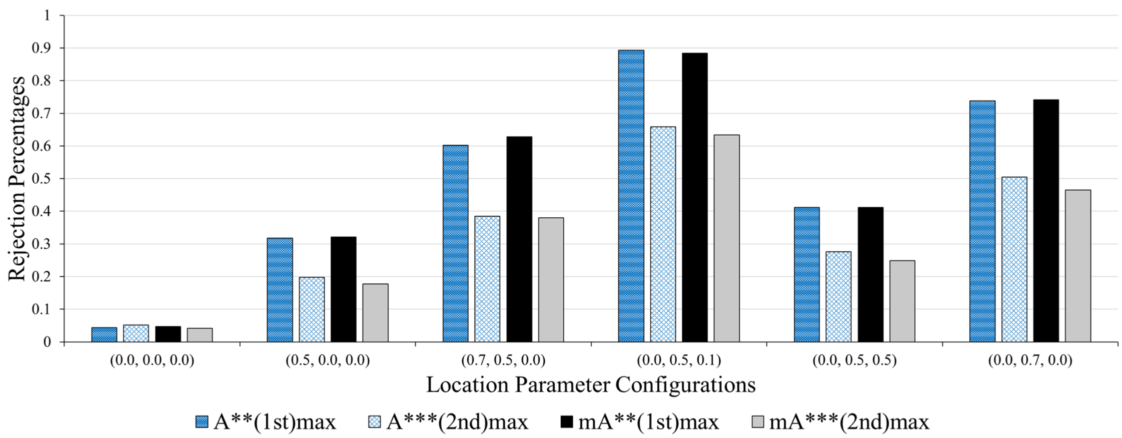

Figure 6.8. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 3 treatments and unknown peak: Blocks= 20, n=10 and normal distribution.

6.2.2. Four Populations with Unknown Peak

While the study is comprised of four treatments with an unknown peak, the test of Standardized First with distance modification (mA^{**}_{max}) is better than that with no modification (A^{**}_{max}). Also, it is noticed that the Standardized Second for both non-modified and modified test statistics (A^{***}_{max} and mA^{***}_{max}, respectively) are similar in the performance. Generally, the modified Standardized First, mA^{**}_{max}, has the highest power among all the last four test statistics. For illustration, suppose we have a normal population, 4 treatments with an unknown peak, 20 blocks for the RCBD portion, and a sample size of 10 for each treatment is considered for the CRD portion. Graphs of the estimated rejection percentages for varying location parameter configurations are presented in Figure 6.9.

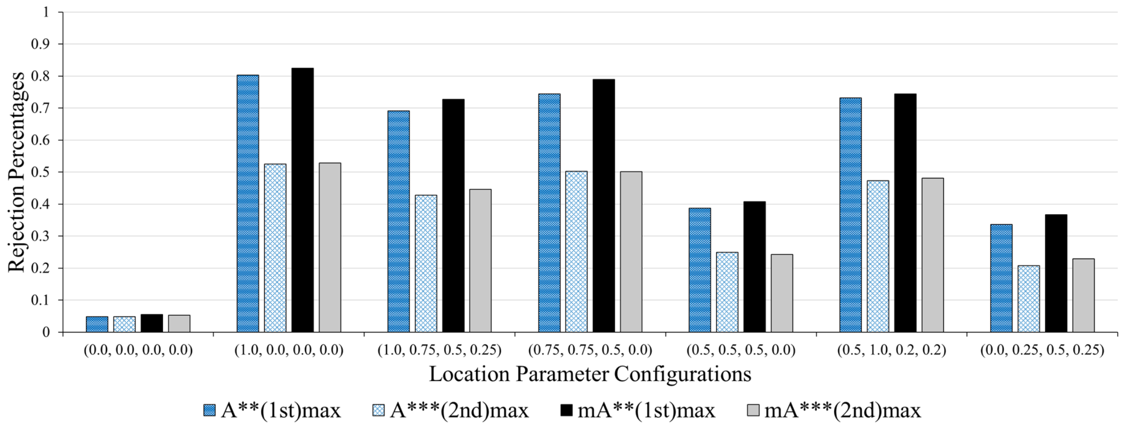

Figure 6.9. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 4 treatments and unknown peak: Blocks= 20, n=10 and normal distribution.

6.2.3. Five Populations with Unknown Peak

In this case, the results are the same as when the study is comprised of four treatments with an unknown peak. As an illustration, suppose we have a normal population, 5 treatments with an unknown peak, 20 blocks for the RCBD portion, and a sample size of 10 for each treatment is considered for the CRD portion. Graphs of the estimated rejection percentages for varying location parameter configurations are presented in Figure 6.9.

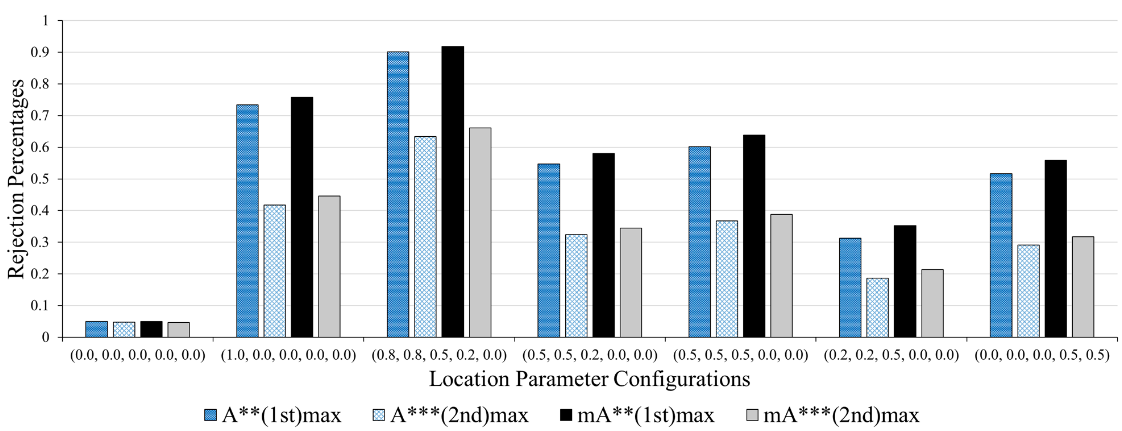

Figure 6.10. Estimated rejection percentages of Magel et al. (2010)'s tests and the first two proposed test statistics for mixed design with 5 treatments and unknown peak: Blocks= 20, n=10 and normal distribution.

6.3. Conclusion

We propose six test statistics for testing the umbrella alternatives in a mixed three-sample or higher design. The mixed design is a combination of a completely randomized design (CRD) and a randomized complete block design (RCBD). The first two test statistics (mA^{**} and mA^{***}) are to test the umbrella alternatives when the peak is known. The last four test statistics (A^{**}_{max}, A^{***}_{max}, mA^{**}_{max} and mA^{***}_{max}) are to test the umbrella alternatives when the peak is unknown. The asymptotic distribution of the proposed test statistics with known peak could be used since the estimated alpha values of all proposed tests of the mixed three-sample or higher design are 0.05. The simulation study entails the number of blocks in the RCBD portion to be half, equal and twice the sample size for each treatment in the CRD portion.

Overall, regardless of the underlying distribution, the proportions between the CRD and RCBD portions in the mixed design and the situation of the peak p (known or unknown), alpha values for all test statistics are approximately 0.05 and we conclude that the Standardized First, which standardizes the unmodified (modified) Mack-Wolfe test and the unmodified (modified) Kim-Kim test and then adds them together and thereafter re-standardizes them, is generally better than Standardized Second, which adds the unmodified (modified) Mack-Wolfe test and unmodified (modified) Kim-Kim test together and subsequently standardizes them.

In the case of the known umbrella peak in a mixed design formed by combining CRD and RCBD, adding the distance modification to the Mack-Wolfe (1981) and Kim-Kim (1992) test statistics improves the power for both Standardized First and Second (mA^{**} and mA^{***}) when the study is comprised of four treatments with a known peak at the second and third population. Also, there is an improvement in the power for both Standardized First and Second when the study is comprised of five treatments with a known peak at the second and fourth population. On the other hand, when the study is comprised of three treatments with a known peak at the second population, there is no improvement in the power for both Standardized First and Second when we add the distance modification to the Mack-Wolfe (1981) and Kim-Kim (1992) test statistics. When the study is comprised of five treatments with a known peak at the third population, it is difficult to emphasize whether the distance modification provides highest power or not.

Hence, in situations when the peak is known without any information about the other location parameter configurations, it is recommended to use the first test statistic (A^{**}), non-modified Standardized First, which proposed by Magel et al. (2010) since it has a higher power. However, if there are prior information about the location parameter configurations when the peak is known and match some of the particular situations as explained in Chapter 5, it is appropriate to use the first proposed test statistics (mA^{**}), modified Standardized First, in this research.

In the case of the unknown umbrella peak in a mixed design formed by combining CRD and RCBD, and when the study comprised of three treatments, we find that the test of Standardized Second with no modification (A^{***}_{max}) is better than that with distance modification (mA^{***}_{max}). Also, it is noticed that the Standardized First for both non-modified and modified test statistics (A^{**}_{max} and mA^{**}_{max}, respectively) are similar in the performance. Generally, we could consider the unmodified Standardized First, A^{**}_{max}, is the test that has the highest power among all the last four test statistics. On the other hand, when the study is comprised of four or five treatments, we find that the test of Standardized First with distance modification (mA^{**}_{max}) is better than that with no modification (A^{**}_{max}). Also, it is noticed that the Standardized Second for both non-modified and modified test statistics (A^{***}_{max} and mA^{***}_{max}, respectively) are similar in the performance. In general, the modified Standardized First, mA^{**}_{max}, has the highest power among all the last four test statistics.

In future studies, for both known and unknown umbrella peaks, one may consider tests for three-sample or more mixed design by using different proportions between the number of the blocks in the RCBD portion and the sample size for each treatment in the CRD portion. Also, one may consider other designs, such as a combination of CRD and incomplete block designs, or a combination of three different designs. For the unknown umbrella peak, one may consider the sample size for each treatment in the CRD portion and the number of blocks in the RCBD portion to be less than 5 when considering a three-sample or more mixed design. Based on that, it is necessary to provide estimated critical values for the unknown umbrella peak in this situation.

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APPENDIX A. 3 TREATMENTS WITH PEAK AT 2

Table A.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0508	0.0508
	Second	0.0574	0.0574
(0.0 , 1.0 , 0.0)	First	0.8738	0.8738
	Second	0.8286	0.8286
(0.0 , 1.0 , 0.5)	First	0.6812	0.6812
	Second	0.6408	0.6408
(0.5 , 1.0 , 0.0)	First	0.6870	0.6870
	Second	0.6442	0.6442
(0.0 , 0.5 , 0.5)	First	0.1814	0.1814
	Second	0.1576	0.1576
(0.5 , 0.5 , 0.0)	First	0.1692	0.1692
	Second	0.1604	0.1604

Table A.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0508	0.0508
	Second	0.0532	0.0532
(0.0 , 1.0 , 0.0)	First	0.9548	0.9548
	Second	0.8856	0.8856
(0.0 , 1.0 , 0.5)	First	0.8118	0.8118
	Second	0.7146	0.7146
(0.5 , 1.0 , 0.0)	First	0.8156	0.8156
	Second	0.7198	0.7198
(0.0 , 0.5 , 0.5)	First	0.2024	0.2024
	Second	0.1794	0.1794
(0.5 , 0.5 , 0.0)	First	0.1982	0.1982
	Second	0.1670	0.1670

Table A.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0512	0.0512
	Second	0.0494	0.0494
(0.0 , 1.0 , 0.0)	First	0.9904	0.9904
	Second	0.9308	0.9308
(0.0 , 1.0 , 0.5)	First	0.9218	0.9218
	Second	0.7826	0.7826
(0.5 , 1.0 , 0.0)	First	0.9226	0.9226
	Second	0.7658	0.7658
(0.0 , 0.5 , 0.5)	First	0.2604	0.2604
	Second	0.1760	0.1760
(0.5 , 0.5 , 0.0)	First	0.2660	0.2660
	Second	0.1946	0.1946

Table A.4. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0582	0.0582
	Second	0.0538	0.0538
(0.0 , 1.0 , 0.0)	First	0.9822	0.9822
	Second	0.9556	0.9556
(0.0 , 1.0 , 0.5)	First	0.8836	0.8836
	Second	0.8334	0.8334
(0.5 , 1.0 , 0.0)	First	0.8810	0.8810
	Second	0.8228	0.8228
(0.0 , 0.5 , 0.5)	First	0.2502	0.2502
	Second	0.2112	0.2112
(0.5 , 0.5 , 0.0)	First	0.2488	0.2488
	Second	0.2104	0.2104

Table A.5. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0488	0.0488
	Second	0.0434	0.0434
(0.0 , 1.0 , 0.0)	First	0.9958	0.9958
	Second	0.9734	0.9734
(0.0 , 1.0 , 0.5)	First	0.9556	0.9556
	Second	0.8668	0.8668
(0.5 , 1.0 , 0.0)	First	0.9602	0.9602
	Second	0.8630	0.8630
(0.0 , 0.5 , 0.5)	First	0.3026	0.3026
	Second	0.2312	0.2312
(0.5 , 0.5 , 0.0)	First	0.3168	0.3168
	Second	0.2342	0.2342

Table A.6. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0506	0.0506
	Second	0.0546	0.0546
(0.0 , 1.0 , 0.0)	First	0.9994	0.9994
	Second	0.9876	0.9876
(0.0 , 1.0 , 0.5)	First	0.9914	0.9914
	Second	0.9162	0.9162
(0.5 , 1.0 , 0.0)	First	0.9908	0.9908
	Second	0.9052	0.9052
(0.0 , 0.5 , 0.5)	First	0.3842	0.3842
	Second	0.2602	0.2602
(0.5 , 0.5 , 0.0)	First	0.3924	0.3924
	Second	0.2490	0.2490

Table A.7. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0484	0.0484
	Second	0.0504	0.0504
(0.0 , 1.0 , 0.0)	First	0.9994	0.9994
	Second	0.9970	0.9970
(0.0 , 1.0 , 0.5)	First	0.9786	0.9786
	Second	0.9510	0.9510
(0.5 , 1.0 , 0.0)	First	0.9798	0.9798
	Second	0.9578	0.9578
(0.0 , 0.5 , 0.5)	First	0.3468	0.3468
	Second	0.2942	0.2942
(0.5 , 0.5 , 0.0)	First	0.3298	0.3298
	Second	0.2776	0.2776

Table A.8. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0472	0.0472
	Second	0.0486	0.0486
(0.0 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9970	0.9970
(0.0 , 1.0 , 0.5)	First	0.9960	0.9960
	Second	0.9644	0.9644
(0.5 , 1.0 , 0.0)	First	0.9956	0.9956
	Second	0.9630	0.9630
(0.0 , 0.5 , 0.5)	First	0.4310	0.4310
	Second	0.3066	0.3066
(0.5 , 0.5 , 0.0)	First	0.4250	0.4250
	Second	0.3012	0.3012

Table A.9. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0518	0.0518
	Second	0.0590	0.0590
(0.0 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9994	0.9994
(0.0 , 1.0 , 0.5)	First	0.9996	0.9996
	Second	0.9768	0.9768
(0.5 , 1.0 , 0.0)	First	0.9998	0.9998
	Second	0.9756	0.9756
(0.0 , 0.5 , 0.5)	First	0.5470	0.5470
	Second	0.3450	0.3450
(0.5 , 0.5 , 0.0)	First	0.5422	0.5422
	Second	0.3372	0.3372

Table A.10. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0468	0.0468
	Second	0.0518	0.0518
(0.0 , 1.0 , 0.0)	First	0.9998	0.9998
	Second	0.9994	0.9994
(0.0 , 1.0 , 0.5)	First	0.9958	0.9958
	Second	0.9804	0.9804
(0.5 , 1.0 , 0.0)	First	0.9928	0.9928
	Second	0.9780	0.9780
(0.0 , 0.5 , 0.5)	First	0.4022	0.4022
	Second	0.3406	0.3406
(0.5 , 0.5 , 0.0)	First	0.4052	0.4052
	Second	0.3456	0.3456

Table A.11. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0498	0.0498
	Second	0.0474	0.0474
(0.0 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9998	0.9998
(0.0 , 1.0 , 0.5)	First	0.9992	0.9992
	Second	0.9840	0.9840
(0.5 , 1.0 , 0.0)	First	0.9992	0.9992
	Second	0.9878	0.9878
(0.0 , 0.5 , 0.5)	First	0.5014	0.5014
	Second	0.3514	0.3514
(0.5 , 0.5 , 0.0)	First	0.4902	0.4902
	Second	0.3486	0.3486

Table A.12. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0470	0.0470
	Second	0.0482	0.0482
(0.0 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9998	0.9998
(0.0 , 1.0 , 0.5)	First	1.0000	1.0000
	Second	0.9918	0.9918
(0.5 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9930	0.9930
(0.0 , 0.5 , 0.5)	First	0.6436	0.6436
	Second	0.3860	0.3860
(0.5 , 0.5 , 0.0)	First	0.6488	0.6488
	Second	0.3928	0.3928

Table A.13. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0446	0.0446
	Second	0.0528	0.0528
(0.0 , 1.0 , 0.0)	First	0.6822	0.6822
	Second	0.6408	0.6408
(0.0 , 1.0 , 0.5)	First	0.4824	0.4824
	Second	0.4476	0.4476
(0.5 , 1.0 , 0.0)	First	0.4850	0.4850
	Second	0.4358	0.4358
(0.0 , 0.5 , 0.5)	First	0.1288	0.1288
	Second	0.1252	0.1252
(0.5 , 0.5 , 0.0)	First	0.1312	0.1312
	Second	0.1196	0.1196

Table A.14. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0512	0.0512
	Second	0.0560	0.0560
(0.0 , 1.0 , 0.0)	First	0.7948	0.7948
	Second	0.6940	0.6940
(0.0 , 1.0 , 0.5)	First	0.5872	0.5872
	Second	0.5038	0.5038
(0.5 , 1.0 , 0.0)	First	0.5648	0.5648
	Second	0.4786	0.4786
(0.0 , 0.5 , 0.5)	First	0.1452	0.1452
	Second	0.1418	0.1418
(0.5 , 0.5 , 0.0)	First	0.1328	0.1328
	Second	0.1252	0.1252

Table A.15. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0474	0.0474
	Second	0.0426	0.0426
(0.0 , 1.0 , 0.0)	First	0.9060	0.9060
	Second	0.7760	0.7760
(0.0 , 1.0 , 0.5)	First	0.7200	0.7200
	Second	0.5520	0.5520
(0.5 , 1.0 , 0.0)	First	0.7266	0.7266
	Second	0.5488	0.5488
(0.0 , 0.5 , 0.5)	First	0.1812	0.1812
	Second	0.1438	0.1438
(0.5 , 0.5 , 0.0)	First	0.1832	0.1832
	Second	0.1376	0.1376

Table A.16. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0512	0.0512
	Second	0.0486	0.0486
(0.0 , 1.0 , 0.0)	First	0.8786	0.8786
	Second	0.8232	0.8232
(0.0 , 1.0 , 0.5)	First	0.6620	0.6620
	Second	0.5904	0.5904
(0.5 , 1.0 , 0.0)	First	0.6694	0.6694
	Second	0.6046	0.6046
(0.0 , 0.5 , 0.5)	First	0.1694	0.1694
	Second	0.1554	0.1554
(0.5 , 0.5 , 0.0)	First	0.1562	0.1562
	Second	0.1390	0.1390

Table A.17. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0522	0.0522
	Second	0.0556	0.0556
(0.0 , 1.0 , 0.0)	First	0.9436	0.9436
	Second	0.8534	0.8534
(0.0 , 1.0 , 0.5)	First	0.7768	0.7768
	Second	0.6390	0.6390
(0.5 , 1.0 , 0.0)	First	0.7792	0.7792
	Second	0.6430	0.6430
(0.0 , 0.5 , 0.5)	First	0.1988	0.1988
	Second	0.1636	0.1636
(0.5 , 0.5 , 0.0)	First	0.1896	0.1896
	Second	0.1486	0.1486

Table A.18. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0540	0.0540
	Second	0.0532	0.0532
(0.0 , 1.0 , 0.0)	First	0.9876	0.9876
	Second	0.9066	0.9066
(0.0 , 1.0 , 0.5)	First	0.8898	0.8898
	Second	0.7116	0.7116
(0.5 , 1.0 , 0.0)	First	0.8966	0.8966
	Second	0.7114	0.7114
(0.0 , 0.5 , 0.5)	First	0.2358	0.2358
	Second	0.1720	0.1720
(0.5 , 0.5 , 0.0)	First	0.2362	0.2362
	Second	0.1718	0.1718

Table A.19. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0502	0.0502
	Second	0.0524	0.0524
(0.0 , 1.0 , 0.0)	First	0.9734	0.9734
	Second	0.9462	0.9462
(0.0 , 1.0 , 0.5)	First	0.8434	0.8434
	Second	0.7748	0.7748
(0.5 , 1.0 , 0.0)	First	0.8390	0.8390
	Second	0.7660	0.7660
(0.0 , 0.5 , 0.5)	First	0.2302	0.2302
	Second	0.2078	0.2078
(0.5 , 0.5 , 0.0)	First	0.2200	0.2200
	Second	0.1946	0.1946

Table A.20. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 16, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0514	0.0514
	Second	0.0548	0.0548
(0.0 , 1.0 , 0.0)	First	0.9926	0.9926
	Second	0.9524	0.9524
(0.0 , 1.0 , 0.5)	First	0.9210	0.9210
	Second	0.7812	0.7812
(0.5 , 1.0 , 0.0)	First	0.9282	0.9282
	Second	0.7982	0.7982
(0.0 , 0.5 , 0.5)	First	0.2596	0.2596
	Second	0.1974	0.1974
(0.5 , 0.5 , 0.0)	First	0.2582	0.2582
	Second	0.1906	0.1906

Table A.21. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0522	0.0522
	Second	0.0526	0.0526
(0.0 , 1.0 , 0.0)	First	0.9992	0.9992
	Second	0.9730	0.9730
(0.0 , 1.0 , 0.5)	First	0.9770	0.9770
	Second	0.8376	0.8376
(0.5 , 1.0 , 0.0)	First	0.9800	0.9800
	Second	0.8288	0.8288
(0.0 , 0.5 , 0.5)	First	0.3338	0.3338
	Second	0.2034	0.2034
(0.5 , 0.5 , 0.0)	First	0.3366	0.3366
	Second	0.2152	0.2152

Table A.22. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0516	0.0516
	Second	0.0450	0.0450
(0.0 , 1.0 , 0.0)	First	0.9916	0.9916
	Second	0.9744	0.9744
(0.0 , 1.0 , 0.5)	First	0.9038	0.9038
	Second	0.8438	0.8438
(0.5 , 1.0 , 0.0)	First	0.9122	0.9122
	Second	0.8656	0.8656
(0.0 , 0.5 , 0.5)	First	0.2510	0.2510
	Second	0.2192	0.2192
(0.5 , 0.5 , 0.0)	First	0.2546	0.2546
	Second	0.2218	0.2218

Table A.23. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0482	0.0482
	Second	0.0484	0.0484
(0.0 , 1.0 , 0.0)	First	0.9988	0.9988
	Second	0.9784	0.9784
(0.0 , 1.0 , 0.5)	First	0.9650	0.9650
	Second	0.8664	0.8664
(0.5 , 1.0 , 0.0)	First	0.9646	0.9646
	Second	0.8544	0.8544
(0.0 , 0.5 , 0.5)	First	0.3152	0.3152
	Second	0.2304	0.2304
(0.5 , 0.5 , 0.0)	First	0.3108	0.3108
	Second	0.2298	0.2298

Table A.24. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0506	0.0506
	Second	0.0486	0.0486
(0.0 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9832	0.9832
(0.0 , 1.0 , 0.5)	First	0.9956	0.9956
	Second	0.8918	0.8918
(0.5 , 1.0 , 0.0)	First	0.9920	0.9920
	Second	0.8904	0.8904
(0.0 , 0.5 , 0.5)	First	0.4016	0.4016
	Second	0.2448	0.2448
(0.5 , 0.5 , 0.0)	First	0.4010	0.4010
	Second	0.2396	0.2396

Table A.25. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0566	0.0566
	Second	0.0580	0.0580
(0.0 , 1.0 , 0.0)	First	0.5258	0.5258
	Second	0.4838	0.4838
(0.0 , 1.0 , 0.5)	First	0.3556	0.3556
	Second	0.3214	0.3214
(0.5 , 1.0 , 0.0)	First	0.3576	0.3576
	Second	0.3242	0.3242
(0.0 , 0.5 , 0.5)	First	0.1150	0.1150
	Second	0.1098	0.1098
(0.5 , 0.5 , 0.0)	First	0.1080	0.1080
	Second	0.0990	0.0990

Table A.26. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0512	0.0512
	Second	0.0530	0.0530
(0.0 , 1.0 , 0.0)	First	0.6336	0.6336
	Second	0.5436	0.5436
(0.0 , 1.0 , 0.5)	First	0.4338	0.4338
	Second	0.3766	0.3766
(0.5 , 1.0 , 0.0)	First	0.4438	0.4438
	Second	0.3814	0.3814
(0.0 , 0.5 , 0.5)	First	0.1208	0.1208
	Second	0.1204	0.1204
(0.5 , 0.5 , 0.0)	First	0.1240	0.1240
	Second	0.1210	0.1210

Table A.27. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0436	0.0436
	Second	0.0446	0.0446
(0.0 , 1.0 , 0.0)	First	0.7588	0.7588
	Second	0.5954	0.5954
(0.0 , 1.0 , 0.5)	First	0.5512	0.5512
	Second	0.4078	0.4078
(0.5 , 1.0 , 0.0)	First	0.5616	0.5616
	Second	0.4128	0.4128
(0.0 , 0.5 , 0.5)	First	0.1414	0.1414
	Second	0.1150	0.1150
(0.5 , 0.5 , 0.0)	First	0.1400	0.1400
	Second	0.1188	0.1188

Table A.28. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0538	0.0538
	Second	0.0528	0.0528
(0.0 , 1.0 , 0.0)	First	0.7092	0.7092
	Second	0.6422	0.6422
(0.0 , 1.0 , 0.5)	First	0.5178	0.5178
	Second	0.4560	0.4560
(0.5 , 1.0 , 0.0)	First	0.5160	0.5160
	Second	0.4580	0.4580
(0.0 , 0.5 , 0.5)	First	0.1430	0.1430
	Second	0.1272	0.1272
(0.5 , 0.5 , 0.0)	First	0.1370	0.1370
	Second	0.1262	0.1262

Table A.29. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0500	0.0500
	Second	0.0492	0.0492
(0.0 , 1.0 , 0.0)	First	0.8320	0.8320
	Second	0.6844	0.6844
(0.0 , 1.0 , 0.5)	First	0.6190	0.6190
	Second	0.4794	0.4794
(0.5 , 1.0 , 0.0)	First	0.6282	0.6282
	Second	0.4964	0.4964
(0.0 , 0.5 , 0.5)	First	0.1608	0.1608
	Second	0.1330	0.1330
(0.5 , 0.5 , 0.0)	First	0.1568	0.1568
	Second	0.1256	0.1256

Table A.30. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0532	0.0532
	Second	0.0558	0.0558
(0.0 , 1.0 , 0.0)	First	0.9236	0.9236
	Second	0.7490	0.7490
(0.0 , 1.0 , 0.5)	First	0.7356	0.7356
	Second	0.5392	0.5392
(0.5 , 1.0 , 0.0)	First	0.7560	0.7560
	Second	0.5462	0.5462
(0.0 , 0.5 , 0.5)	First	0.1946	0.1946
	Second	0.1526	0.1526
(0.5 , 0.5 , 0.0)	First	0.1996	0.1996
	Second	0.1424	0.1424

Table A.31. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0508	0.0508
	Second	0.0504	0.0504
(0.0 , 1.0 , 0.0)	First	0.8850	0.8850
	Second	0.8222	0.8222
(0.0 , 1.0 , 0.5)	First	0.6968	0.6968
	Second	0.6186	0.6186
(0.5 , 1.0 , 0.0)	First	0.6900	0.6900
	Second	0.6096	0.6096
(0.0 , 0.5 , 0.5)	First	0.1712	0.1712
	Second	0.1550	0.1550
(0.5 , 0.5 , 0.0)	First	0.1832	0.1832
	Second	0.1534	0.1534

Table A.32. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 16, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0494	0.0494
	Second	0.0502	0.0502
(0.0 , 1.0 , 0.0)	First	0.9532	0.9532
	Second	0.8378	0.8378
(0.0 , 1.0 , 0.5)	First	0.7978	0.7978
	Second	0.6346	0.6346
(0.5 , 1.0 , 0.0)	First	0.7924	0.7924
	Second	0.6308	0.6308
(0.0 , 0.5 , 0.5)	First	0.2140	0.2140
	Second	0.1674	0.1674
(0.5 , 0.5 , 0.0)	First	0.2020	0.2020
	Second	0.1640	0.1640

Table A.33. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0470	0.0470
	Second	0.0504	0.0504
(0.0 , 1.0 , 0.0)	First	0.9892	0.9892
	Second	0.8736	0.8736
(0.0 , 1.0 , 0.5)	First	0.9074	0.9074
	Second	0.6756	0.6756
(0.5 , 1.0 , 0.0)	First	0.9082	0.9082
	Second	0.6676	0.6676
(0.0 , 0.5 , 0.5)	First	0.2678	0.2678
	Second	0.1702	0.1702
(0.5 , 0.5 , 0.0)	First	0.2636	0.2636
	Second	0.1698	0.1698

Table A.34. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0506	0.0506
	Second	0.0454	0.0454
(0.0 , 1.0 , 0.0)	First	0.9364	0.9364
	Second	0.8900	0.8900
(0.0 , 1.0 , 0.5)	First	0.7714	0.7714
	Second	0.6914	0.6914
(0.5 , 1.0 , 0.0)	First	0.7772	0.7772
	Second	0.7008	0.7008
(0.0 , 0.5 , 0.5)	First	0.2058	0.2058
	Second	0.1878	0.1878
(0.5 , 0.5 , 0.0)	First	0.2110	0.2110
	Second	0.1806	0.1806

Table A.35. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0448	0.0448
	Second	0.0474	0.0474
(0.0 , 1.0 , 0.0)	First	0.9798	0.9798
	Second	0.9008	0.9008
(0.0 , 1.0 , 0.5)	First	0.8724	0.8724
	Second	0.7030	0.7030
(0.5 , 1.0 , 0.0)	First	0.8706	0.8706
	Second	0.6984	0.6984
(0.0 , 0.5 , 0.5)	First	0.2328	0.2328
	Second	0.1678	0.1678
(0.5 , 0.5 , 0.0)	First	0.2356	0.2356
	Second	0.1738	0.1738

Table A.36. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0510	0.0510
	Second	0.0520	0.0520
(0.0 , 1.0 , 0.0)	First	0.9980	0.9980
	Second	0.9146	0.9146
(0.0 , 1.0 , 0.5)	First	0.9566	0.9566
	Second	0.7444	0.7444
(0.5 , 1.0 , 0.0)	First	0.9502	0.9502
	Second	0.7364	0.7364
(0.0 , 0.5 , 0.5)	First	0.2964	0.2964
	Second	0.1914	0.1914
(0.5 , 0.5 , 0.0)	First	0.2892	0.2892
	Second	0.1852	0.1852

APPENDIX B. 4 TREATMENTS WITH PEAK AT 2

Table B.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0486	0.0508
	Second	0.0538	0.0492
(0.0 , 5.0 , 0.0 , 0.0)	First	0.4514	0.4348
	Second	0.4168	0.3842
(0.5 , 1.0 , 0.2 , 0.2)	First	0.6462	0.6526
	Second	0.5970	0.5930
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2382	0.2790
	Second	0.2228	0.2414
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2640	0.3106
	Second	0.2518	0.2688
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4550	0.4574
	Second	0.4320	0.4116
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1138	0.0910
	Second	0.0978	0.0876
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2578	0.2954
	Second	0.2490	0.2710
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3816	0.3972
	Second	0.3536	0.3662
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4466	0.4454
	Second	0.4172	0.3806
(0.0 , 1.0 , 0.75 , 0.2)	First	0.8122	0.7674
	Second	0.7752	0.7052
(0.0 , 0.75 , 0.5 , 0.25)	First	0.5644	0.5166
	Second	0.5170	0.4590

Table B.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0488
	Second	0.0468	0.0518
(0.0 , 5.0 , 0.0 , 0.0)	First	0.5664	0.5432
	Second	0.4288	0.4400
(0.5 , 1.0 , 0.2 , 0.2)	First	0.7736	0.7872
	Second	0.6270	0.6598
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3042	0.3568
	Second	0.2288	0.2930
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3420	0.3918
	Second	0.2714	0.3178
(0.0 , 0.5 , 0.5 , 0.0)	First	0.5492	0.5482
	Second	0.4442	0.4546
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1388	0.1054
	Second	0.1092	0.0942
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3288	0.3654
	Second	0.2518	0.3026
(0.25 , 0.5 , 0.25 , 0.0)	First	0.4770	0.4936
	Second	0.3774	0.4036
(0.5 , 1.0 , 0.5 , 0.5)	First	0.5538	0.5474
	Second	0.4330	0.4404
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9064	0.8834
	Second	0.7974	0.7746
(0.0 , 0.75 , 0.5 , 0.25)	First	0.6862	0.6376
	Second	0.5460	0.5200

Table B.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0562	0.0508
	Second	0.0562	0.0516
(0.0 , 5.0 , 0.0 , 0.0)	First	0.7204	0.7022
	Second	0.5384	0.5248
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9052	0.9072
	Second	0.7516	0.7650
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3908	0.4704
	Second	0.2866	0.3388
(0.5 , 0.5 , 0.2 , 0.0)	First	0.4444	0.4886
	Second	0.3268	0.3568
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7008	0.6834
	Second	0.5354	0.5228
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1574	0.1270
	Second	0.1254	0.1068
(0.5 , 0.5 , 0.5 , 0.0)	First	0.4004	0.4752
	Second	0.3098	0.3534
(0.25 , 0.5 , 0.25 , 0.0)	First	0.6196	0.6206
	Second	0.4554	0.4734
(0.5 , 1.0 , 0.5 , 0.5)	First	0.7212	0.7048
	Second	0.5430	0.5216
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9722	0.9616
	Second	0.8836	0.8552
(0.0 , 0.75 , 0.5 , 0.25)	First	0.8210	0.7862
	Second	0.6536	0.6150

Table B.4. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0486	0.0464
	Second	0.0436	0.0434
(0.0 , 5.0 , 0.0 , 0.0)	First	0.6690	0.6372
	Second	0.5774	0.5526
(0.5 , 1.0 , 0.2 , 0.2)	First	0.8652	0.8680
	Second	0.7918	0.7972
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3416	0.4128
	Second	0.2928	0.3582
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3934	0.4520
	Second	0.3436	0.3976
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6504	0.6338
	Second	0.5698	0.5592
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1516	0.1064
	Second	0.1246	0.1038
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3702	0.4338
	Second	0.3226	0.3800
(0.25 , 0.5 , 0.25 , 0.0)	First	0.5518	0.5778
	Second	0.4798	0.5072
(0.5 , 1.0 , 0.5 , 0.5)	First	0.6612	0.6290
	Second	0.5754	0.5484
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9548	0.9372
	Second	0.9134	0.8900
(0.0 , 0.75 , 0.5 , 0.25)	First	0.7742	0.7270
	Second	0.6950	0.6534

Table B.5. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0502
	Second	0.0526	0.0506
(0.0 , 5.0 , 0.0 , 0.0)	First	0.7850	0.7636
	Second	0.6134	0.6018
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9416	0.9464
	Second	0.8224	0.8270
(0.5 , 0.5 , 0.0 , 0.0)	First	0.4528	0.5274
	Second	0.3246	0.3928
(0.5 , 0.5 , 0.2 , 0.0)	First	0.4912	0.5470
	Second	0.3616	0.4160
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7594	0.7446
	Second	0.6090	0.5794
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1718	0.1360
	Second	0.1326	0.1044
(0.5 , 0.5 , 0.5 , 0.0)	First	0.4572	0.5204
	Second	0.3408	0.3918
(0.25 , 0.5 , 0.25 , 0.0)	First	0.6764	0.6848
	Second	0.5204	0.5274
(0.5 , 1.0 , 0.5 , 0.5)	First	0.7764	0.7572
	Second	0.6110	0.5948
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9842	0.9810
	Second	0.9254	0.9130
(0.0 , 0.75 , 0.5 , 0.25)	First	0.8772	0.8402
	Second	0.7218	0.6752

Table B.6. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0488	0.0472
	Second	0.0472	0.0460
(0.0 , 5.0 , 0.0 , 0.0)	First	0.9008	0.8870
	Second	0.6896	0.6682
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9878	0.9878
	Second	0.8848	0.8768
(0.5 , 0.5 , 0.0 , 0.0)	First	0.5836	0.6598
	Second	0.3622	0.4280
(0.5 , 0.5 , 0.2 , 0.0)	First	0.6162	0.6846
	Second	0.4170	0.4672
(0.0 , 0.5 , 0.5 , 0.0)	First	0.8754	0.8706
	Second	0.6628	0.6526
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2234	0.1584
	Second	0.1496	0.1116
(0.5 , 0.5 , 0.5 , 0.0)	First	0.5864	0.6608
	Second	0.3868	0.4510
(0.25 , 0.5 , 0.25 , 0.0)	First	0.8230	0.8256
	Second	0.5868	0.5862
(0.5 , 1.0 , 0.5 , 0.5)	First	0.8920	0.8922
	Second	0.6794	0.6770
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9988	0.9966
	Second	0.9608	0.9456
(0.0 , 0.75 , 0.5 , 0.25)	First	0.9590	0.9368
	Second	0.7908	0.7412

Table B.7. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0488	0.0520
	Second	0.0520	0.0504
(0.0 , 5.0 , 0.0 , 0.0)	First	0.8424	0.8266
	Second	0.7700	0.7348
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9728	0.9710
	Second	0.9382	0.9336
(0.5 , 0.5 , 0.0 , 0.0)	First	0.5144	0.5870
	Second	0.4510	0.5016
(0.5 , 0.5 , 0.2 , 0.0)	First	0.5480	0.6242
	Second	0.4776	0.5416
(0.0 , 0.5 , 0.5 , 0.0)	First	0.8276	0.8074
	Second	0.7560	0.7294
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1920	0.1364
	Second	0.1706	0.1240
(0.5 , 0.5 , 0.5 , 0.0)	First	0.5140	0.5828
	Second	0.4456	0.5170
(0.25 , 0.5 , 0.25 , 0.0)	First	0.7484	0.7644
	Second	0.6712	0.6748
(0.5 , 1.0 , 0.5 , 0.5)	First	0.8490	0.8246
	Second	0.7656	0.7392
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9964	0.9904
	Second	0.9834	0.9766
(0.0 , 0.75 , 0.5 , 0.25)	First	0.9198	0.8918
	Second	0.8516	0.8244

Table B.8. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0552	0.0512
	Second	0.0504	0.0494
(0.0 , 5.0 , 0.0 , 0.0)	First	0.9314	0.9206
	Second	0.7926	0.7624
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9960	0.9934
	Second	0.9490	0.9406
(0.5 , 0.5 , 0.0 , 0.0)	First	0.6274	0.7232
	Second	0.4522	0.5326
(0.5 , 0.5 , 0.2 , 0.0)	First	0.6758	0.7262
	Second	0.5108	0.5594
(0.0 , 0.5 , 0.5 , 0.0)	First	0.9128	0.9096
	Second	0.7664	0.7524
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2312	0.1614
	Second	0.1778	0.1278
(0.5 , 0.5 , 0.5 , 0.0)	First	0.6354	0.7032
	Second	0.4792	0.5218
(0.25 , 0.5 , 0.25 , 0.0)	First	0.8526	0.8534
	Second	0.6734	0.6860
(0.5 , 1.0 , 0.5 , 0.5)	First	0.9306	0.9184
	Second	0.7902	0.7644
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9996	0.9988
	Second	0.9884	0.9806
(0.0 , 0.75 , 0.5 , 0.25)	First	0.9718	0.9574
	Second	0.8854	0.8402

Table B.9. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0488	0.0532
	Second	0.0520	0.0484
(0.0 , 5.0 , 0.0 , 0.0)	First	0.9824	0.9774
	Second	0.8278	0.8118
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9996	0.9996
	Second	0.9680	0.9638
(0.5 , 0.5 , 0.0 , 0.0)	First	0.7746	0.8510
	Second	0.4772	0.5750
(0.5 , 0.5 , 0.2 , 0.0)	First	0.8096	0.8632
	Second	0.5324	0.6096
(0.0 , 0.5 , 0.5 , 0.0)	First	0.9748	0.9694
	Second	0.8058	0.7842
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3050	0.2004
	Second	0.1838	0.1336
(0.5 , 0.5 , 0.5 , 0.0)	First	0.7530	0.8228
	Second	0.4926	0.5668
(0.25 , 0.5 , 0.25 , 0.0)	First	0.9410	0.9532
	Second	0.7298	0.7342
(0.5 , 1.0 , 0.5 , 0.5)	First	0.9850	0.9782
	Second	0.8240	0.8056
(0.0 , 1.0 , 0.75 , 0.2)	First	1.0000	1.0000
	Second	0.9954	0.9870
(0.0 , 0.75 , 0.5 , 0.25)	First	0.9962	0.9924
	Second	0.9106	0.8794

Table B.10. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0576	0.0544
	Second	0.0554	0.0490
(0.0 , 5.0 , 0.0 , 0.0)	First	0.9106	0.9032
	Second	0.8488	0.8252
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9906	0.9912
	Second	0.9766	0.9722
(0.5 , 0.5 , 0.0 , 0.0)	First	0.5964	0.6822
	Second	0.5080	0.5932
(0.5 , 0.5 , 0.2 , 0.0)	First	0.6516	0.6998
	Second	0.5632	0.5980
(0.0 , 0.5 , 0.5 , 0.0)	First	0.8986	0.8726
	Second	0.8230	0.7974
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2252	0.1668
	Second	0.1898	0.1450
(0.5 , 0.5 , 0.5 , 0.0)	First	0.5874	0.6638
	Second	0.5094	0.5728
(0.25 , 0.5 , 0.25 , 0.0)	First	0.8292	0.8420
	Second	0.7422	0.7614
(0.5 , 1.0 , 0.5 , 0.5)	First	0.9146	0.8994
	Second	0.8492	0.8248
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9992	0.9984
	Second	0.9954	0.9920
(0.0 , 0.75 , 0.5 , 0.25)	First	0.9660	0.9398
	Second	0.9238	0.8862

Table B.11. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0472
	Second	0.0456	0.0498
(0.0 , 5.0 , 0.0 , 0.0)	First	0.9668	0.9668
	Second	0.8590	0.8402
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9988	0.9996
	Second	0.9742	0.9800
(0.5 , 0.5 , 0.0 , 0.0)	First	0.7236	0.8126
	Second	0.5248	0.6126
(0.5 , 0.5 , 0.2 , 0.0)	First	0.7526	0.8270
	Second	0.5666	0.6370
(0.0 , 0.5 , 0.5 , 0.0)	First	0.9608	0.9516
	Second	0.8426	0.8142
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2774	0.1854
	Second	0.2012	0.1376
(0.5 , 0.5 , 0.5 , 0.0)	First	0.6910	0.7806
	Second	0.5150	0.5994
(0.25 , 0.5 , 0.25 , 0.0)	First	0.9130	0.9190
	Second	0.7624	0.7600
(0.5 , 1.0 , 0.5 , 0.5)	First	0.9702	0.9650
	Second	0.8706	0.8434
(0.0 , 1.0 , 0.75 , 0.2)	First	1.0000	0.9996
	Second	0.9960	0.9940
(0.0 , 0.75 , 0.5 , 0.25)	First	0.9932	0.9834
	Second	0.9332	0.9078

Table B.12. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0480	0.0498
	Second	0.0492	0.0524
(0.0 , 5.0 , 0.0 , 0.0)	First	0.9972	0.9928
	Second	0.8926	0.8706
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9998	0.9998
	Second	0.9840	0.9842
(0.5 , 0.5 , 0.0 , 0.0)	First	0.8510	0.9130
	Second	0.5624	0.6396
(0.5 , 0.5 , 0.2 , 0.0)	First	0.8752	0.9260
	Second	0.5952	0.6656
(0.0 , 0.5 , 0.5 , 0.0)	First	0.9922	0.9894
	Second	0.8670	0.8470
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3518	0.2400
	Second	0.2096	0.1438
(0.5 , 0.5 , 0.5 , 0.0)	First	0.8300	0.8882
	Second	0.5730	0.6366
(0.25 , 0.5 , 0.25 , 0.0)	First	0.9788	0.9780
	Second	0.7940	0.7996
(0.5 , 1.0 , 0.5 , 0.5)	First	0.9960	0.9950
	Second	0.8864	0.8750
(0.0 , 1.0 , 0.75 , 0.2)	First	1.0000	1.0000
	Second	0.9978	0.9960
(0.0 , 0.75 , 0.5 , 0.25)	First	1.0000	0.9976
	Second	0.9500	0.9254

Table B.13. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0488	0.0526
	Second	0.0472	0.0468
(0.0 , 5.0 , 0.0 , 0.0)	First	0.2872	0.2716
	Second	0.2610	0.2372
(0.5 , 1.0, 0.2 , 0.2)	First	0.4418	0.4474
	Second	0.4064	0.3970
(0.5 , 0.5 , 0.0 , 0.0)	First	0.1664	0.1892
	Second	0.1664	0.1616
(0.5 , 0.5 , 0.2 , 0.0)	First	0.1722	0.1970
	Second	0.1678	0.1694
(0.0 , 0.5 , 0.5 , 0.0)	First	0.2812	0.2708
	Second	0.2680	0.2410
(0.0 , 0.5 , 0.5 , 0.5)	First	0.0946	0.0826
	Second	0.0920	0.0792
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1656	0.1894
	Second	0.1538	0.1806
(0.25 , 0.5 , 0.25 , 0.0)	First	0.2274	0.2388
	Second	0.2096	0.2038
(0.5 , 1.0 , 0.5 , 0.5)	First	0.2984	0.2830
	Second	0.2770	0.2418
(0.0 , 1.0 , 0.75 , 0.2)	First	0.5800	0.5446
	Second	0.5346	0.4984
(0.0 , 0.75 , 0.5 , 0.25)	First	0.3468	0.3218
	Second	0.3208	0.2878

Table B.14. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0550	0.0476
	Second	0.0476	0.0496
(0.0 , 5.0 , 0.0 , 0.0)	First	0.3462	0.3422
	Second	0.2684	0.2928
(0.5 , 1.0, 0.2 , 0.2)	First	0.5224	0.5474
	Second	0.4136	0.4478
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2094	0.2200
	Second	0.1712	0.1944
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2158	0.2290
	Second	0.1678	0.2026
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3310	0.3412
	Second	0.2666	0.2890
(0.0 , 0.5 , 0.5 , 0.5)	First	0.0930	0.0890
	Second	0.0832	0.0786
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2090	0.2320
	Second	0.1672	0.1932
(0.25 , 0.5 , 0.25 , 0.0)	First	0.2754	0.2814
	Second	0.2232	0.2392
(0.5 , 1.0 , 0.5 , 0.5)	First	0.3408	0.3416
	Second	0.2772	0.2854
(0.0 , 1.0 , 0.75 , 0.2)	First	0.6940	0.6646
	Second	0.5630	0.5518
(0.0 , 0.75 , 0.5 , 0.25)	First	0.4248	0.3954
	Second	0.3344	0.3242

Table B.15. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0500	0.0526
	Second	0.0520	0.0534
(0.0 , 5.0 , 0.0 , 0.0)	First	0.4406	0.4398
	Second	0.3324	0.3208
(0.5 , 1.0, 0.2 , 0.2)	First	0.6690	0.6724
	Second	0.5058	0.5204
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2502	0.2844
	Second	0.1932	0.2150
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2528	0.2846
	Second	0.1986	0.2162
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4362	0.4292
	Second	0.3250	0.3270
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1244	0.0960
	Second	0.1066	0.0838
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2494	0.2906
	Second	0.1862	0.2228
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3418	0.3568
	Second	0.2646	0.2748
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4284	0.4242
	Second	0.3346	0.3182
(0.0 , 1.0 , 0.75 , 0.2)	First	0.8304	0.7912
	Second	0.6738	0.6358
(0.0 , 0.75 , 0.5 , 0.25)	First	0.5288	0.4914
	Second	0.4018	0.3684

Table B.16. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0486	0.0480
	Second	0.0514	0.0506
(0.0 , 5.0 , 0.0 , 0.0)	First	0.4104	0.3836
	Second	0.3544	0.3342
(0.5 , 1.0, 0.2 , 0.2)	First	0.6112	0.6348
	Second	0.5430	0.5598
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2338	0.2614
	Second	0.1968	0.2268
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2320	0.2666
	Second	0.1980	0.2302
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3952	0.3824
	Second	0.3450	0.3362
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1210	0.0888
	Second	0.1052	0.0814
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2332	0.2626
	Second	0.2022	0.2238
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3336	0.3246
	Second	0.2778	0.2916
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4012	0.3944
	Second	0.3512	0.3420
(0.0 , 1.0 , 0.75 , 0.2)	First	0.7760	0.7520
	Second	0.6994	0.6776
(0.0 , 0.75 , 0.5 , 0.25)	First	0.4996	0.4472
	Second	0.4316	0.4000

Table B.17. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0524	0.0482
	Second	0.0484	0.0494
(0.0 , 5.0 , 0.0 , 0.0)	First	0.4782	0.4912
	Second	0.3566	0.3678
(0.5 , 1.0, 0.2 , 0.2)	First	0.7206	0.7400
	Second	0.5550	0.5868
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2764	0.3324
	Second	0.2156	0.2506
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2968	0.3366
	Second	0.2222	0.2450
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4754	0.4814
	Second	0.3628	0.3712
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1292	0.0974
	Second	0.1114	0.0838
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2804	0.3334
	Second	0.2164	0.2438
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3780	0.4018
	Second	0.2788	0.3002
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4900	0.4814
	Second	0.3662	0.3728
(0.0 , 1.0 , 0.75 , 0.2)	First	0.8694	0.8566
	Second	0.7278	0.7042
(0.0 , 0.75 , 0.5 , 0.25)	First	0.5958	0.5462
	Second	0.4528	0.4126

Table B.18. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0484	0.0500
	Second	0.0516	0.0454
(0.0 , 5.0 , 0.0 , 0.0)	First	0.6196	0.5910
	Second	0.4222	0.3938
(0.5 , 1.0, 0.2 , 0.2)	First	0.8548	0.8722
	Second	0.6372	0.6626
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3488	0.4114
	Second	0.2362	0.2728
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3524	0.4170
	Second	0.2430	0.2866
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6244	0.6040
	Second	0.4288	0.4058
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1564	0.1178
	Second	0.1174	0.0974
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3606	0.4054
	Second	0.2530	0.2802
(0.25 , 0.5 , 0.25 , 0.0)	First	0.4862	0.5048
	Second	0.3294	0.3390
(0.5 , 1.0 , 0.5 , 0.5)	First	0.6032	0.6062
	Second	0.4078	0.4190
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9584	0.9432
	Second	0.7980	0.7738
(0.0 , 0.75 , 0.5 , 0.25)	First	0.7366	0.6940
	Second	0.5126	0.4800

Table B.19. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0526	0.0498
	Second	0.0524	0.0546
(0.0 , 5.0 , 0.0 , 0.0)	First	0.5466	0.5332
	Second	0.4860	0.4780
(0.5 , 1.0, 0.2 , 0.2)	First	0.7950	0.8052
	Second	0.7170	0.7202
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3148	0.3550
	Second	0.2824	0.3060
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3298	0.3658
	Second	0.2932	0.3136
(0.0 , 0.5 , 0.5 , 0.0)	First	0.5480	0.5296
	Second	0.4808	0.4592
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1402	0.1188
	Second	0.1282	0.1038
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3108	0.3660
	Second	0.2830	0.3130
(0.25 , 0.5 , 0.25 , 0.0)	First	0.4266	0.4540
	Second	0.3754	0.3892
(0.5 , 1.0 , 0.5 , 0.5)	First	0.5500	0.5536
	Second	0.4834	0.4784
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9222	0.9014
	Second	0.8654	0.8378
(0.0 , 0.75 , 0.5 , 0.25)	First	0.6626	0.6272
	Second	0.5798	0.5406

Table B.20. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0532	0.0492
	Second	0.0512	0.0502
(0.0 , 5.0 , 0.0 , 0.0)	First	0.6632	0.6512
	Second	0.5038	0.4872
(0.5 , 1.0, 0.2 , 0.2)	First	0.8956	0.8938
	Second	0.7432	0.7464
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3956	0.4458
	Second	0.2904	0.3308
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3926	0.4480
	Second	0.2854	0.3286
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6538	0.6540
	Second	0.5016	0.4910
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1610	0.1234
	Second	0.1290	0.1014
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3808	0.4574
	Second	0.2874	0.3266
(0.25 , 0.5 , 0.25 , 0.0)	First	0.5268	0.5514
	Second	0.3902	0.4108
(0.5 , 1.0 , 0.5 , 0.5)	First	0.6644	0.6344
	Second	0.5090	0.4818
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9708	0.9592
	Second	0.8818	0.8540
(0.0 , 0.75 , 0.5 , 0.25)	First	0.7782	0.7254
	Second	0.6172	0.5586

Table B.21. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0510	0.0480
	Second	0.0508	0.0508
(0.0 , 5.0 , 0.0 , 0.0)	First	0.7836	0.7752
	Second	0.5354	0.5150
(0.5 , 1.0, 0.2 , 0.2)	First	0.9688	0.9644
	Second	0.7766	0.7858
(0.5 , 0.5 , 0.0 , 0.0)	First	0.5002	0.5650
	Second	0.3070	0.3426
(0.5 , 0.5 , 0.2 , 0.0)	First	0.4978	0.5526
	Second	0.3100	0.3432
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7900	0.7736
	Second	0.5350	0.5132
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2100	0.1454
	Second	0.1406	0.1120
(0.5 , 0.5 , 0.5 , 0.0)	First	0.4882	0.5578
	Second	0.2972	0.3428
(0.25 , 0.5 , 0.25 , 0.0)	First	0.6598	0.6806
	Second	0.4196	0.4334
(0.5 , 1.0 , 0.5 , 0.5)	First	0.7960	0.7748
	Second	0.5320	0.5192
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9964	0.9916
	Second	0.9160	0.8876
(0.0 , 0.75 , 0.5 , 0.25)	First	0.8890	0.8610
	Second	0.6430	0.6048

Table B.22. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0512	0.0502
	Second	0.0474	0.0518
(0.0 , 5.0 , 0.0 , 0.0)	First	0.6326	0.6178
	Second	0.5410	0.5338
(0.5 , 1.0, 0.2 , 0.2)	First	0.8658	0.8750
	Second	0.7850	0.7972
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3772	0.4084
	Second	0.3072	0.3508
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3662	0.4234
	Second	0.3184	0.3566
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6354	0.6176
	Second	0.5406	0.5316
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1568	0.1294
	Second	0.1430	0.1156
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3636	0.4160
	Second	0.3190	0.3692
(0.25 , 0.5 , 0.25 , 0.0)	First	0.5090	0.5294
	Second	0.4400	0.4380
(0.5 , 1.0 , 0.5 , 0.5)	First	0.6202	0.6146
	Second	0.5264	0.5388
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9636	0.9524
	Second	0.9268	0.9052
(0.0 , 0.75 , 0.5 , 0.25)	First	0.7514	0.7052
	Second	0.6576	0.6096

Table B.23. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0528	0.0482
	Second	0.0464	0.0478
(0.0 , 5.0 , 0.0 , 0.0)	First	0.7362	0.7304
	Second	0.5668	0.5466
(0.5 , 1.0, 0.2 , 0.2)	First	0.9432	0.9474
	Second	0.8066	0.8232
(0.5 , 0.5 , 0.0 , 0.0)	First	0.4542	0.5242
	Second	0.3138	0.3832
(0.5 , 0.5 , 0.2 , 0.0)	First	0.4638	0.5058
	Second	0.3384	0.3654
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7490	0.7330
	Second	0.5638	0.5520
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1926	0.1364
	Second	0.1450	0.1098
(0.5 , 0.5 , 0.5 , 0.0)	First	0.4460	0.5124
	Second	0.3252	0.3634
(0.25 , 0.5 , 0.25 , 0.0)	First	0.6044	0.6238
	Second	0.4464	0.4534
(0.5 , 1.0 , 0.5 , 0.5)	First	0.7472	0.7294
	Second	0.5724	0.5568
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9916	0.9882
	Second	0.9314	0.9094
(0.0 , 0.75 , 0.5 , 0.25)	First	0.8472	0.8104
	Second	0.6666	0.6208

Table B.24. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0530	0.0550
	Second	0.0538	0.0512
(0.0 , 5.0 , 0.0 , 0.0)	First	0.8638	0.8570
	Second	0.5988	0.5992
(0.5 , 1.0, 0.2 , 0.2)	First	0.9874	0.9878
	Second	0.8442	0.8368
(0.5 , 0.5 , 0.0 , 0.0)	First	0.5776	0.6504
	Second	0.3456	0.3944
(0.5 , 0.5 , 0.2 , 0.0)	First	0.5662	0.6382
	Second	0.3346	0.3904
(0.0 , 0.5 , 0.5 , 0.0)	First	0.8646	0.8600
	Second	0.5990	0.5786
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2328	0.1622
	Second	0.1576	0.1168
(0.5 , 0.5 , 0.5 , 0.0)	First	0.5656	0.6516
	Second	0.3412	0.4016
(0.25 , 0.5 , 0.25 , 0.0)	First	0.7546	0.7726
	Second	0.4826	0.5028
(0.5 , 1.0 , 0.5 , 0.5)	First	0.8626	0.8576
	Second	0.5930	0.5824
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9990	0.9982
	Second	0.9522	0.9342
(0.0 , 0.75 , 0.5 , 0.25)	First	0.9384	0.9162
	Second	0.7148	0.6648

Table B.25. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0428	0.0538
	Second	0.0482	0.0504
(0.0 , 5.0 , 0.0 , 0.0)	First	0.2184	0.2098
	Second	0.1990	0.1956
(0.5 , 1.0 , 0.2 , 0.2)	First	0.3244	0.3294
	Second	0.3136	0.2888
(0.5 , 0.5 , 0.0 , 0.0)	First	0.1364	0.1556
	Second	0.1388	0.1396
(0.5 , 0.5 , 0.2 , 0.0)	First	0.1454	0.1552
	Second	0.1392	0.1474
(0.0 , 0.5 , 0.5 , 0.0)	First	0.2122	0.2112
	Second	0.1964	0.1878
(0.0 , 0.5 , 0.5 , 0.5)	First	0.0812	0.0782
	Second	0.0844	0.0744
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1428	0.1548
	Second	0.1370	0.1422
(0.25 , 0.5 , 0.25 , 0.0)	First	0.1740	0.1878
	Second	0.1774	0.1644
(0.5 , 1.0 , 0.5 , 0.5)	First	0.2168	0.2088
	Second	0.1986	0.1926
(0.0 , 1.0 , 0.75 , 0.2)	First	0.4390	0.4118
	Second	0.3962	0.3730
(0.0 , 0.75 , 0.5 , 0.25)	First	0.2414	0.2422
	Second	0.2380	0.2214

Table B.26. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0490	0.0522
	Second	0.0420	0.0542
(0.0 , 5.0 , 0.0 , 0.0)	First	0.2618	0.2614
	Second	0.2168	0.2212
(0.5 , 1.0 , 0.2 , 0.2)	First	0.3972	0.4154
	Second	0.3188	0.3468
(0.5 , 0.5 , 0.0 , 0.0)	First	0.1660	0.1840
	Second	0.1302	0.1648
(0.5 , 0.5 , 0.2 , 0.0)	First	0.1752	0.1856
	Second	0.1346	0.1626
(0.0 , 0.5 , 0.5 , 0.0)	First	0.2606	0.2522
	Second	0.2074	0.2188
(0.0 , 0.5 , 0.5 , 0.5)	First	0.0986	0.0802
	Second	0.0888	0.0776
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1596	0.1754
	Second	0.1296	0.1570
(0.25 , 0.5 , 0.25 , 0.0)	First	0.2092	0.2180
	Second	0.1678	0.1858
(0.5 , 1.0 , 0.5 , 0.5)	First	0.2708	0.2466
	Second	0.2120	0.2168
(0.0 , 1.0 , 0.75 , 0.2)	First	0.5258	0.5068
	Second	0.4194	0.4192
(0.0 , 0.75 , 0.5 , 0.25)	First	0.3200	0.2924
	Second	0.2544	0.2428

Table B.27. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0460
	Second	0.0494	0.0486
(0.0 , 5.0 , 0.0 , 0.0)	First	0.3288	0.3286
	Second	0.2440	0.2462
(0.5 , 1.0 , 0.2 , 0.2)	First	0.5086	0.5184
	Second	0.3760	0.3992
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2020	0.2298
	Second	0.1518	0.1806
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2008	0.2348
	Second	0.1642	0.1760
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3390	0.3266
	Second	0.2622	0.2472
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1100	0.0844
	Second	0.0896	0.0760
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1970	0.2220
	Second	0.1564	0.1838
(0.25 , 0.5 , 0.25 , 0.0)	First	0.2568	0.2790
	Second	0.1974	0.2084
(0.5 , 1.0 , 0.5 , 0.5)	First	0.3396	0.3258
	Second	0.2620	0.2476
(0.0 , 1.0 , 0.75 , 0.2)	First	0.6704	0.6392
	Second	0.5110	0.4930
(0.0 , 0.75 , 0.5 , 0.25)	First	0.4078	0.3696
	Second	0.3098	0.2796

Table B.28. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0480
	Second	0.0428	0.0506
(0.0 , 5.0 , 0.0 , 0.0)	First	0.2956	0.2972
	Second	0.2586	0.2636
(0.5 , 1.0 , 0.2 , 0.2)	First	0.4670	0.4662
	Second	0.4072	0.4134
(0.5 , 0.5 , 0.0 , 0.0)	First	0.1848	0.2046
	Second	0.1566	0.1794
(0.5 , 0.5 , 0.2 , 0.0)	First	0.1822	0.2138
	Second	0.1714	0.1866
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3058	0.3038
	Second	0.2704	0.2594
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1056	0.0950
	Second	0.0938	0.0934
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1804	0.2042
	Second	0.1630	0.1852
(0.25 , 0.5 , 0.25 , 0.0)	First	0.2406	0.2486
	Second	0.2144	0.2278
(0.5 , 1.0 , 0.5 , 0.5)	First	0.3038	0.2848
	Second	0.2648	0.2530
(0.0 , 1.0 , 0.75 , 0.2)	First	0.6126	0.5842
	Second	0.5452	0.5082
(0.0 , 0.75 , 0.5 , 0.25)	First	0.3730	0.3414
	Second	0.3220	0.2928

Table B.29. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0488
	Second	0.0516	0.0498
(0.0 , 5.0 , 0.0 , 0.0)	First	0.3666	0.3720
	Second	0.2798	0.2778
(0.5 , 1.0 , 0.2 , 0.2)	First	0.5608	0.5924
	Second	0.4158	0.4506
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2130	0.2372
	Second	0.1752	0.1838
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2252	0.2448
	Second	0.1790	0.1896
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3690	0.3636
	Second	0.2740	0.2796
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1102	0.0864
	Second	0.0998	0.0762
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2170	0.2510
	Second	0.1726	0.1912
(0.25 , 0.5 , 0.25 , 0.0)	First	0.2980	0.2946
	Second	0.2268	0.2264
(0.5 , 1.0 , 0.5 , 0.5)	First	0.3616	0.3682
	Second	0.2770	0.2720
(0.0 , 1.0 , 0.75 , 0.2)	First	0.7276	0.6924
	Second	0.5712	0.5310
(0.0 , 0.75 , 0.5 , 0.25)	First	0.4448	0.4238
	Second	0.3314	0.3140

Table B.30. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0512
	Second	0.0500	0.0450
(0.0 , 5.0 , 0.0 , 0.0)	First	0.4686	0.4680
	Second	0.3136	0.3186
(0.5 , 1.0 , 0.2 , 0.2)	First	0.6976	0.7222
	Second	0.4812	0.5046
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2660	0.3088
	Second	0.1796	0.2118
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2720	0.3224
	Second	0.1908	0.2254
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4780	0.4632
	Second	0.3222	0.3132
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1200	0.1086
	Second	0.1014	0.0780
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2758	0.3232
	Second	0.1966	0.2144
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3786	0.3844
	Second	0.2560	0.2628
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4708	0.4576
	Second	0.3212	0.3094
(0.0 , 1.0 , 0.75 , 0.2)	First	0.8502	0.8292
	Second	0.6394	0.5992
(0.0 , 0.75 , 0.5 , 0.25)	First	0.5720	0.5198
	Second	0.3866	0.3498

Table B.31. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0546
	Second	0.0516	0.0488
(0.0 , 5.0 , 0.0 , 0.0)	First	0.4238	0.4046
	Second	0.3734	0.3456
(0.5 , 1.0 , 0.2 , 0.2)	First	0.6306	0.6468
	Second	0.5514	0.5626
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2504	0.2710
	Second	0.2206	0.2356
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2486	0.2650
	Second	0.2242	0.2384
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4186	0.3944
	Second	0.3690	0.3478
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1188	0.0938
	Second	0.1132	0.0914
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2382	0.2788
	Second	0.2054	0.2304
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3294	0.3524
	Second	0.2814	0.2962
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4162	0.4146
	Second	0.3730	0.3530
(0.0 , 1.0 , 0.75 , 0.2)	First	0.7946	0.7574
	Second	0.7128	0.6844
(0.0 , 0.75 , 0.5 , 0.25)	First	0.5088	0.4842
	Second	0.4352	0.4028

Table B.32. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0468	0.0520
	Second	0.0540	0.0484
(0.0 , 5.0 , 0.0 , 0.0)	First	0.5074	0.4994
	Second	0.3718	0.3592
(0.5 , 1.0 , 0.2 , 0.2)	First	0.7516	0.7594
	Second	0.5828	0.5948
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2904	0.3304
	Second	0.2246	0.2460
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2962	0.3436
	Second	0.2202	0.2456
(0.0 , 0.5 , 0.5 , 0.0)	First	0.5042	0.4930
	Second	0.3698	0.3582
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1378	0.1084
	Second	0.1176	0.0904
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3008	0.3404
	Second	0.2162	0.2562
(0.25 , 0.5 , 0.25 , 0.0)	First	0.4138	0.4192
	Second	0.2992	0.3060
(0.5 , 1.0 , 0.5 , 0.5)	First	0.5072	0.4980
	Second	0.3790	0.3624
(0.0 , 1.0 , 0.75 , 0.2)	First	0.8848	0.8624
	Second	0.7434	0.6968
(0.0 , 0.75 , 0.5 , 0.25)	First	0.6300	0.5752
	Second	0.4584	0.4092

Table B.33. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0538	0.0488
	Second	0.0552	0.0516
(0.0 , 5.0 , 0.0 , 0.0)	First	0.6362	0.6196
	Second	0.4034	0.3830
(0.5 , 1.0 , 0.2 , 0.2)	First	0.8658	0.8800
	Second	0.6152	0.6242
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3816	0.4228
	Second	0.2358	0.2622
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3744	0.4330
	Second	0.2404	0.2656
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6326	0.6208
	Second	0.3954	0.3818
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1630	0.1270
	Second	0.1264	0.0930
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3814	0.4300
	Second	0.2316	0.2566
(0.25 , 0.5 , 0.25 , 0.0)	First	0.5008	0.5234
	Second	0.3236	0.3272
(0.5 , 1.0 , 0.5 , 0.5)	First	0.6354	0.6284
	Second	0.4010	0.3982
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9652	0.9486
	Second	0.7662	0.7330
(0.0 , 0.75 , 0.5 , 0.25)	First	0.7552	0.7140
	Second	0.4866	0.4508

Table B.34. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0482	0.0444
	Second	0.0502	0.0490
(0.0 , 5.0 , 0.0 , 0.0)	First	0.4892	0.4712
	Second	0.4178	0.4024
(0.5 , 1.0 , 0.2 , 0.2)	First	0.7224	0.7204
	Second	0.6224	0.6358
(0.5 , 0.5 , 0.0 , 0.0)	First	0.2796	0.3206
	Second	0.2392	0.2686
(0.5 , 0.5 , 0.2 , 0.0)	First	0.2756	0.3270
	Second	0.2372	0.2728
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4992	0.4678
	Second	0.4230	0.3904
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1302	0.1092
	Second	0.1222	0.0996
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2916	0.3182
	Second	0.2592	0.2646
(0.25 , 0.5 , 0.25 , 0.0)	First	0.3992	0.3932
	Second	0.3302	0.3322
(0.5 , 1.0 , 0.5 , 0.5)	First	0.4864	0.4740
	Second	0.4192	0.4012
(0.0 , 1.0 , 0.75 , 0.2)	First	0.8554	0.8522
	Second	0.7788	0.7700
(0.0 , 0.75 , 0.5 , 0.25)	First	0.5994	0.5526
	Second	0.5066	0.4710

Table B.35. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0532	0.0534
	Second	0.0538	0.0506
(0.0 , 5.0 , 0.0 , 0.0)	First	0.5768	0.5852
	Second	0.4258	0.4182
(0.5 , 1.0 , 0.2 , 0.2)	First	0.8240	0.8408
	Second	0.6530	0.6578
(0.5 , 0.5 , 0.0 , 0.0)	First	0.3434	0.4028
	Second	0.2508	0.2798
(0.5 , 0.5 , 0.2 , 0.0)	First	0.3388	0.3984
	Second	0.2456	0.2768
(0.0 , 0.5 , 0.5 , 0.0)	First	0.5918	0.5750
	Second	0.4362	0.4184
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1540	0.1226
	Second	0.1174	0.0988
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3550	0.4088
	Second	0.2552	0.2906
(0.25 , 0.5 , 0.25 , 0.0)	First	0.4700	0.4906
	Second	0.3410	0.3486
(0.5 , 1.0 , 0.5 , 0.5)	First	0.5846	0.5872
	Second	0.4366	0.4238
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9464	0.9224
	Second	0.8156	0.7774
(0.0 , 0.75 , 0.5 , 0.25)	First	0.7022	0.6612
	Second	0.5236	0.4886

Table B.36. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0482	0.0512
	Second	0.0514	0.0528
(0.0 , 5.0 , 0.0 , 0.0)	First	0.7272	0.7184
	Second	0.4668	0.4600
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9282	0.9334
	Second	0.6876	0.6942
(0.5 , 0.5 , 0.0 , 0.0)	First	0.4406	0.5016
	Second	0.2656	0.2898
(0.5 , 0.5 , 0.2 , 0.0)	First	0.4366	0.5004
	Second	0.2768	0.3074
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7236	0.7158
	Second	0.4524	0.4442
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1792	0.1314
	Second	0.1182	0.0982
(0.5 , 0.5 , 0.5 , 0.0)	First	0.4356	0.4970
	Second	0.2512	0.2958
(0.25 , 0.5 , 0.25 , 0.0)	First	0.5922	0.6092
	Second	0.3652	0.3800
(0.5 , 1.0 , 0.5 , 0.5)	First	0.7232	0.7152
	Second	0.4568	0.4402
(0.0 , 1.0 , 0.75 , 0.2)	First	0.9870	0.9820
	Second	0.8394	0.8198
(0.0 , 0.75 , 0.5 , 0.25)	First	0.8366	0.8058
	Second	0.5618	0.5194

APPENDIX C. 4 TREATMENTS WITH PEAK AT 3

Table C.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0452
	Second	0.0526	0.0448
(0.0 , 0.0 , 0.5 , 0.0)	First	0.4466	0.4428
	Second	0.4088	0.3854
(0.2 , 0.2 , 1.0 , 0.5)	First	0.6440	0.6724
	Second	0.5932	0.5970
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2418	0.2980
	Second	0.2210	0.2526
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2750	0.3154
	Second	0.2590	0.2750
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4626	0.4500
	Second	0.4300	0.4102
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1102	0.0954
	Second	0.1076	0.0826
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2524	0.3006
	Second	0.2546	0.2662
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3860	0.3990
	Second	0.3528	0.3500
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4462	0.4430
	Second	0.4070	0.3868
(0.2 , 0.75 , 1.0 , 0.0)	First	0.7998	0.7772
	Second	0.7642	0.7106
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5734	0.5224
	Second	0.5306	0.4648

Table C.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 6, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0532	0.0546
	Second	0.0470	0.0586
(0.0 , 0.0 , 0.5 , 0.0)	First	0.5756	0.5492
	Second	0.4444	0.4424
(0.2 , 0.2 , 1.0 , 0.5)	First	0.7726	0.7886
	Second	0.6358	0.6562
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3110	0.3526
	Second	0.2344	0.2908
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3344	0.3854
	Second	0.2688	0.3168
(0.0 , 0.5 , 0.5 , 0.0)	First	0.5648	0.5354
	Second	0.4492	0.4480
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1332	0.1006
	Second	0.1108	0.0972
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3166	0.3564
	Second	0.2614	0.2912
(0.0 , 0.25 , 0.5 , 0.25)	First	0.4828	0.4878
	Second	0.3780	0.3900
(0.5 , 0.5 , 1.0 , 0.5)	First	0.5582	0.5480
	Second	0.4336	0.4446
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9052	0.8740
	Second	0.8038	0.7770
(0.25 , 0.5 , 0.75 , 0.0)	First	0.6704	0.6354
	Second	0.5420	0.5282

Table C.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0492	0.0508
	Second	0.0528	0.0522
(0.0 , 0.0 , 0.5 , 0.0)	First	0.7062	0.6888
	Second	0.5300	0.5164
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9132	0.9028
	Second	0.7542	0.7414
(0.0 , 0.0 , 0.5 , 0.5)	First	0.4072	0.4604
	Second	0.2964	0.3378
(0.0 , 0.2 , 0.5 , 0.5)	First	0.4396	0.5006
	Second	0.3134	0.3638
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6898	0.6790
	Second	0.5340	0.5320
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1600	0.1258
	Second	0.1212	0.1016
(0.0 , 0.5 , 0.5 , 0.5)	First	0.4006	0.4696
	Second	0.2990	0.3520
(0.0 , 0.25 , 0.5 , 0.25)	First	0.6118	0.6166
	Second	0.4558	0.4564
(0.5 , 0.5 , 1.0 , 0.5)	First	0.7304	0.7012
	Second	0.5458	0.5282
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9736	0.9556
	Second	0.8884	0.8464
(0.25 , 0.5 , 0.75 , 0.0)	First	0.8236	0.7776
	Second	0.6584	0.6098

Table C.4. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0484
	Second	0.0520	0.0490
(0.0 , 0.0 , 0.5 , 0.0)	First	0.8056	0.8046
	Second	0.6232	0.6224
(0.2 , 0.2 , 1.0 , 0.5)	First	0.8692	0.8682
	Second	0.7988	0.7920
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3554	0.4142
	Second	0.3072	0.3694
(0.0 , 0.2 , 0.5 , 0.5)	First	0.4006	0.4428
	Second	0.3400	0.3890
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6476	0.6314
	Second	0.5820	0.5576
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1586	0.1098
	Second	0.1354	0.1048
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3720	0.4212
	Second	0.3270	0.3698
(0.0 , 0.25 , 0.5 , 0.25)	First	0.5570	0.5754
	Second	0.4798	0.4976
(0.5 , 0.5 , 1.0 , 0.5)	First	0.6554	0.6440
	Second	0.5734	0.5594
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9540	0.9334
	Second	0.9056	0.8850
(0.25 , 0.5 , 0.75 , 0.0)	First	0.7770	0.7368
	Second	0.6960	0.6414

Table C.5. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0522	0.0530
	Second	0.0488	0.0568
(0.0 , 0.0 , 0.5 , 0.0)	First	0.7828	0.7620
	Second	0.6088	0.5952
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9454	0.9396
	Second	0.8264	0.8220
(0.0 , 0.0 , 0.5 , 0.5)	First	0.4588	0.5228
	Second	0.3252	0.3790
(0.0 , 0.2 , 0.5 , 0.5)	First	0.4904	0.5662
	Second	0.3686	0.4188
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7544	0.7522
	Second	0.5922	0.5990
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1828	0.1350
	Second	0.1350	0.1052
(0.0 , 0.5 , 0.5 , 0.5)	First	0.4508	0.5232
	Second	0.3394	0.3994
(0.0 , 0.25 , 0.5 , 0.25)	First	0.6810	0.6892
	Second	0.5168	0.5278
(0.5 , 0.5 , 1.0 , 0.5)	First	0.7762	0.7682
	Second	0.6022	0.5908
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9860	0.9816
	Second	0.9324	0.9142
(0.25 , 0.5 , 0.75 , 0.0)	First	0.8792	0.8370
	Second	0.7290	0.6800

Table C.6. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0414
	Second	0.0500	0.0454
(0.0 , 0.0 , 0.5 , 0.0)	First	0.8990	0.8838
	Second	0.6828	0.6698
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9898	0.9870
	Second	0.8760	0.8944
(0.0 , 0.0 , 0.5 , 0.5)	First	0.5914	0.6672
	Second	0.3774	0.4348
(0.0 , 0.2 , 0.5 , 0.5)	First	0.6306	0.7008
	Second	0.4112	0.4784
(0.0 , 0.5 , 0.5 , 0.0)	First	0.8830	0.8646
	Second	0.6692	0.6520
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2224	0.1496
	Second	0.1506	0.1102
(0.0 , 0.5 , 0.5 , 0.5)	First	0.5846	0.6604
	Second	0.3974	0.4502
(0.0 , 0.25 , 0.5 , 0.25)	First	0.8140	0.8250
	Second	0.5778	0.5940
(0.5 , 0.5 , 1.0 , 0.5)	First	0.8986	0.8896
	Second	0.6862	0.6712
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9990	0.9970
	Second	0.9614	0.9474
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9622	0.9318
	Second	0.7974	0.7394

Table C.7. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0440	0.0502
	Second	0.0502	0.0488
(0.0 , 0.0 , 0.5 , 0.0)	First	0.8408	0.8280
	Second	0.7664	0.7378
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9726	0.9732
	Second	0.9350	0.9348
(0.0 , 0.0 , 0.5 , 0.5)	First	0.5148	0.5756
	Second	0.4434	0.4904
(0.0 , 0.2 , 0.5 , 0.5)	First	0.5546	0.6070
	Second	0.4812	0.5322
(0.0 , 0.5 , 0.5 , 0.0)	First	0.8196	0.8136
	Second	0.7464	0.7338
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1930	0.1410
	Second	0.1676	0.1304
(0.0 , 0.5 , 0.5 , 0.5)	First	0.5092	0.5936
	Second	0.4454	0.4916
(0.0 , 0.25 , 0.5 , 0.25)	First	0.7428	0.7512
	Second	0.6586	0.6684
(0.5 , 0.5 , 1.0 , 0.5)	First	0.8562	0.8344
	Second	0.7642	0.7478
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9944	0.9912
	Second	0.9812	0.9736
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9202	0.9006
	Second	0.8638	0.8290

Table C.8. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 16, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0524	0.0492
	Second	0.0500	0.0498
(0.0 , 0.0 , 0.5 , 0.0)	First	0.9388	0.9190
	Second	0.7942	0.7640
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9932	0.9922
	Second	0.9498	0.9422
(0.0 , 0.0 , 0.5 , 0.5)	First	0.6332	0.7238
	Second	0.4506	0.5272
(0.0 , 0.2 , 0.5 , 0.5)	First	0.6712	0.7306
	Second	0.4974	0.5598
(0.0 , 0.5 , 0.5 , 0.0)	First	0.9072	0.9078
	Second	0.7580	0.7534
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2446	0.1690
	Second	0.1770	0.1300
(0.0 , 0.5 , 0.5 , 0.5)	First	0.6200	0.7030
	Second	0.4594	0.5306
(0.0 , 0.25 , 0.5 , 0.25)	First	0.8582	0.8652
	Second	0.6888	0.6988
(0.5 , 0.5 , 1.0 , 0.5)	First	0.9268	0.9234
	Second	0.7950	0.7706
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9996	0.9992
	Second	0.9884	0.9788
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9720	0.9628
	Second	0.8836	0.8484

Table C.9. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0470	0.0532
	Second	0.0480	0.0516
(0.0 , 0.0 , 0.5 , 0.0)	First	0.9856	0.9778
	Second	0.8350	0.8102
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9994	0.9994
	Second	0.9592	0.9668
(0.0 , 0.0 , 0.5 , 0.5)	First	0.7724	0.8526
	Second	0.5066	0.5748
(0.0 , 0.2 , 0.5 , 0.5)	First	0.8056	0.8564
	Second	0.5352	0.5972
(0.0 , 0.5 , 0.5 , 0.0)	First	0.9770	0.9676
	Second	0.8098	0.7928
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3054	0.2080
	Second	0.1804	0.1302
(0.0 , 0.5 , 0.5 , 0.5)	First	0.7546	0.8272
	Second	0.4772	0.5594
(0.0 , 0.25 , 0.5 , 0.25)	First	0.9396	0.9512
	Second	0.7194	0.7382
(0.5 , 0.5 , 1.0 , 0.5)	First	0.9864	0.9788
	Second	0.8320	0.8114
(0.2 , 0.75 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9950	0.9872
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9956	0.9928
	Second	0.9114	0.8712

Table C.10. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 10, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0470	0.0538
	Second	0.0504	0.0516
(0.0 , 0.0 , 0.5 , 0.0)	First	0.9198	0.8972
	Second	0.8442	0.8264
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9908	0.9898
	Second	0.9744	0.9736
(0.0 , 0.0 , 0.5 , 0.5)	First	0.5916	0.6770
	Second	0.5016	0.5896
(0.0 , 0.2 , 0.5 , 0.5)	First	0.6434	0.7136
	Second	0.5588	0.6206
(0.0 , 0.5 , 0.5 , 0.0)	First	0.8968	0.8836
	Second	0.8228	0.8084
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2292	0.1580
	Second	0.2006	0.1446
(0.0 , 0.5 , 0.5 , 0.5)	First	0.6034	0.6724
	Second	0.5208	0.5846
(0.0 , 0.25 , 0.5 , 0.25)	First	0.8260	0.8354
	Second	0.7326	0.7492
(0.5 , 0.5 , 1.0 , 0.5)	First	0.9142	0.9012
	Second	0.8428	0.8222
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9992	0.9986
	Second	0.9964	0.9882
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9702	0.9390
	Second	0.9236	0.8838

Table C.11. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0522	0.0488
	Second	0.0512	0.0550
(0.0 , 0.0 , 0.5 , 0.0)	First	0.9722	0.9628
	Second	0.8690	0.8444
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9986	0.9984
	Second	0.9796	0.9746
(0.0 , 0.0 , 0.5 , 0.5)	First	0.7216	0.8014
	Second	0.5198	0.6046
(0.0 , 0.2 , 0.5 , 0.5)	First	0.7552	0.8186
	Second	0.5684	0.6266
(0.0 , 0.5 , 0.5 , 0.0)	First	0.9608	0.9526
	Second	0.8360	0.8234
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2796	0.1842
	Second	0.1976	0.1368
(0.0 , 0.5 , 0.5 , 0.5)	First	0.6976	0.7842
	Second	0.5196	0.6022
(0.0 , 0.25 , 0.5 , 0.25)	First	0.9096	0.9180
	Second	0.7520	0.7652
(0.5 , 0.5 , 1.0 , 0.5)	First	0.9748	0.9592
	Second	0.8610	0.8462
(0.2 , 0.75 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9980	0.9956
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9904	0.9824
	Second	0.9280	0.8924

Table C.12. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak 3: Blocks= 40, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0562	0.0530
	Second	0.0484	0.0492
(0.0 , 0.0 , 0.5 , 0.0)	First	0.9954	0.9928
	Second	0.8892	0.8758
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9998	1.0000
	Second	0.9858	0.9872
(0.0 , 0.0 , 0.5 , 0.5)	First	0.8502	0.9158
	Second	0.5590	0.6566
(0.0 , 0.2 , 0.5 , 0.5)	First	0.8830	0.9202
	Second	0.6148	0.6608
(0.0 , 0.5 , 0.5 , 0.0)	First	0.9894	0.9918
	Second	0.8722	0.8562
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3610	0.2332
	Second	0.2102	0.1486
(0.0 , 0.5 , 0.5 , 0.5)	First	0.8258	0.8940
	Second	0.5628	0.6408
(0.0 , 0.25 , 0.5 , 0.25)	First	0.9800	0.9766
	Second	0.8028	0.8024
(0.5 , 0.5 , 1.0 , 0.5)	First	0.9960	0.9930
	Second	0.8902	0.8690
(0.2 , 0.75 , 1.0 , 0.0)	First	1.0000	1.0000
	Second	0.9992	0.9936
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9988	0.9984
	Second	0.9484	0.9216

Table C.13. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 3, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0506	0.0514
	Second	0.0484	0.0496
(0.0 , 0.0 , 0.5 , 0.0)	First	0.2850	0.2824
	Second	0.2716	0.2472
(0.2 , 0.2 , 1.0 , 0.5)	First	0.4214	0.4500
	Second	0.3944	0.4012
(0.0 , 0.0 , 0.5 , 0.5)	First	0.1720	0.1906
	Second	0.1654	0.1728
(0.0 , 0.2 , 0.5 , 0.5)	First	0.1728	0.1924
	Second	0.1638	0.1790
(0.0 , 0.5 , 0.5 , 0.0)	First	0.2814	0.2784
	Second	0.2634	0.2472
(0.5 , 0.5 , 0.5 , 0.0)	First	0.0986	0.0800
	Second	0.0930	0.0706
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1682	0.1992
	Second	0.1666	0.1766
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2294	0.2398
	Second	0.2186	0.2162
(0.5 , 0.5 , 1.0 , 0.5)	First	0.2804	0.2788
	Second	0.2694	0.2498
(0.2 , 0.75 , 1.0 , 0.0)	First	0.5886	0.5560
	Second	0.5378	0.4946
(0.25 , 0.5 , 0.75 , 0.0)	First	0.0.3524	0.3244
	Second	0.3152	0.2834

Table C.14. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 6, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0492	0.0502
	Second	0.0452	0.0484
(0.0 , 0.0 , 0.5 , 0.0)	First	0.3454	0.3424
	Second	0.2788	0.2844
(0.2 , 0.2 , 1.0 , 0.5)	First	0.5254	0.5534
	Second	0.4214	0.4470
(0.0 , 0.0 , 0.5 , 0.5)	First	0.1992	0.2300
	Second	0.1660	0.1956
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2042	0.2340
	Second	0.1636	0.1986
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3474	0.3422
	Second	0.2670	0.2868
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1072	0.0854
	Second	0.0864	0.0868
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2132	0.2236
	Second	0.1692	0.1914
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2784	0.2870
	Second	0.2220	0.2440
(0.5 , 0.5 , 1.0 , 0.5)	First	0.3436	0.3410
	Second	0.2704	0.2828
(0.2 , 0.75 , 1.0 , 0.0)	First	0.6876	0.6662
	Second	0.5618	0.5548
(0.25 , 0.5 , 0.75 , 0.0)	First	0.4214	0.3994
	Second	0.3358	0.3334

Table C.15. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0518	0.0510
	Second	0.0520	0.0494
(0.0 , 0.0 , 0.5 , 0.0)	First	0.4362	0.4304
	Second	0.3246	0.3286
(0.2 , 0.2 , 1.0 , 0.5)	First	0.6622	0.6818
	Second	0.5046	0.5074
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2598	0.2836
	Second	0.1980	0.2120
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2614	0.2946
	Second	0.2082	0.2250
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4478	0.4310
	Second	0.3338	0.3162
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1240	0.0966
	Second	0.1098	0.0858
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2506	0.2948
	Second	0.1870	0.2146
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3476	0.3470
	Second	0.2568	0.2706
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4412	0.4378
	Second	0.3278	0.3262
(0.2 , 0.75 , 1.0 , 0.0)	First	0.8152	0.8012
	Second	0.6504	0.6368
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5396	0.5088
	Second	0.4028	0.3766

Table C.16. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0560	0.0522
	Second	0.0524	0.0486
(0.0 , 0.0 , 0.5 , 0.0)	First	0.5294	0.4958
	Second	0.3762	0.3562
(0.2 , 0.2 , 1.0 , 0.5)	First	0.6208	0.6216
	Second	0.5432	0.5570
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2342	0.2542
	Second	0.1942	0.2270
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2338	0.2682
	Second	0.1972	0.2366
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3948	0.3918
	Second	0.3480	0.3392
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1122	0.0972
	Second	0.0984	0.0888
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2324	0.2596
	Second	0.1986	0.2288
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3216	0.3288
	Second	0.2716	0.2916
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4038	0.3960
	Second	0.3520	0.3474
(0.2 , 0.75 , 1.0 , 0.0)	First	0.7780	0.7438
	Second	0.7078	0.6690
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5074	0.4552
	Second	0.4364	0.4064

Table C.17. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0554	0.0498
	Second	0.0526	0.0480
(0.0 , 0.0 , 0.5 , 0.0)	First	0.4790	0.4844
	Second	0.3552	0.3644
(0.2 , 0.2 , 1.0 , 0.5)	First	0.7342	0.7438
	Second	0.5774	0.5826
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2876	0.3236
	Second	0.2246	0.2318
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2930	0.3228
	Second	0.2288	0.2488
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4818	0.4684
	Second	0.3690	0.3572
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1270	0.0998
	Second	0.1006	0.0852
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2838	0.3280
	Second	0.2130	0.2360
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3874	0.4012
	Second	0.2946	0.2896
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4950	0.4824
	Second	0.3800	0.3664
(0.2 , 0.75 , 1.0 , 0.0)	First	0.8782	0.8526
	Second	0.7344	0.7040
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5984	0.5554
	Second	0.4544	0.4252

Table C.18. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0508
	Second	0.0500	0.0522
(0.0 , 0.0 , 0.5 , 0.0)	First	0.6020	0.5990
	Second	0.4102	0.4016
(0.2 , 0.2 , 1.0 , 0.5)	First	0.8596	0.8738
	Second	0.6348	0.6558
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3548	0.4074
	Second	0.2344	0.2706
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3668	0.4032
	Second	0.2430	0.2792
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6234	0.5980
	Second	0.4352	0.4046
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1584	0.1212
	Second	0.1176	0.0930
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3670	0.4174
	Second	0.2504	0.2726
(0.0 , 0.25 , 0.5 , 0.25)	First	0.4864	0.5192
	Second	0.3308	0.3400
(0.5 , 0.5 , 1.0 , 0.5)	First	0.5980	0.6066
	Second	0.4036	0.4044
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9550	0.9440
	Second	0.8018	0.7520
(0.25 , 0.5 , 0.75 , 0.0)	First	0.7252	0.6988
	Second	0.5130	0.4742

Table C.19. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0532	0.0500
	Second	0.0536	0.0464
(0.0 , 0.0 , 0.5 , 0.0)	First	0.5424	0.5300
	Second	0.4758	0.4540
(0.2 , 0.2 , 1.0 , 0.5)	First	0.7862	0.8082
	Second	0.7176	0.7192
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3164	0.3532
	Second	0.2788	0.3020
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3222	0.3746
	Second	0.2724	0.3214
(0.0 , 0.5 , 0.5 , 0.0)	First	0.5592	0.5388
	Second	0.4784	0.4620
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1444	0.1064
	Second	0.1324	0.0976
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3146	0.3492
	Second	0.2618	0.2956
(0.0 , 0.25 , 0.5 , 0.25)	First	0.4456	0.4692
	Second	0.3862	0.3964
(0.5 , 0.5 , 1.0 , 0.5)	First	0.5448	0.5350
	Second	0.4720	0.4572
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9234	0.9004
	Second	0.8614	0.8394
(0.25 , 0.5 , 0.75 , 0.0)	First	0.6588	0.6274
	Second	0.5724	0.5324

Table C.20. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0510	0.0494
	Second	0.0564	0.0512
(0.0 , 0.0 , 0.5 , 0.0)	First	0.6548	0.6396
	Second	0.5046	0.4714
(0.2 , 0.2 , 1.0 , 0.5)	First	0.8856	0.8972
	Second	0.7280	0.7390
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3886	0.4396
	Second	0.2876	0.3146
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3960	0.4470
	Second	0.2924	0.3224
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6600	0.6490
	Second	0.4976	0.4844
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1520	0.1268
	Second	0.1346	0.1074
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3844	0.4370
	Second	0.2856	0.3094
(0.0 , 0.25 , 0.5 , 0.25)	First	0.5356	0.5540
	Second	0.3928	0.4020
(0.5 , 0.5 , 1.0 , 0.5)	First	0.6606	0.6526
	Second	0.4914	0.4900
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9762	0.9590
	Second	0.8806	0.8520
(0.25 , 0.5 , 0.75 , 0.0)	First	0.7744	0.7416
	Second	0.6048	0.5694

Table C.21. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0538	0.0488
	Second	0.0548	0.0516
(0.0 , 0.0 , 0.5 , 0.0)	First	0.8040	0.7706
	Second	0.5346	0.5022
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9586	0.9760
	Second	0.7640	0.7830
(0.0 , 0.0 , 0.5 , 0.5)	First	0.4870	0.5572
	Second	0.3068	0.3388
(0.0 , 0.2 , 0.5 , 0.5)	First	0.4936	0.5624
	Second	0.3100	0.3512
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7842	0.7870
	Second	0.5242	0.5158
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1956	0.1442
	Second	0.1340	0.1052
(0.0 , 0.5 , 0.5 , 0.5)	First	0.4980	0.5698
	Second	0.3084	0.3484
(0.0 , 0.25 , 0.5 , 0.25)	First	0.6522	0.6802
	Second	0.4134	0.4316
(0.5 , 0.5 , 1.0 , 0.5)	First	0.7886	0.7866
	Second	0.5410	0.5178
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9960	0.9920
	Second	0.9130	0.8874
(0.25 , 0.5 , 0.75 , 0.0)	First	0.8850	0.8618
	Second	0.6288	0.5996

Table C.22. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0508	0.0442
	Second	0.0558	0.0502
(0.0 , 0.0 , 0.5 , 0.0)	First	0.6288	0.6184
	Second	0.5422	0.5328
(0.2 , 0.2 , 1.0 , 0.5)	First	0.8732	0.8792
	Second	0.7980	0.8114
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3642	0.4190
	Second	0.3092	0.3596
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3716	0.4102
	Second	0.3228	0.3492
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6314	0.6152
	Second	0.5408	0.5316
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1584	0.1196
	Second	0.1418	0.1068
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3638	0.4296
	Second	0.3080	0.3682
(0.0 , 0.25 , 0.5 , 0.25)	First	0.5014	0.5354
	Second	0.4324	0.4510
(0.5 , 0.5 , 1.0 , 0.5)	First	0.6272	0.6160
	Second	0.5490	0.5286
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9672	0.9514
	Second	0.9304	0.9024
(0.25 , 0.5 , 0.75 , 0.0)	First	0.7360	0.7120
	Second	0.6554	0.6208

Table C.23. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0502
	Second	0.0538	0.0468
(0.0 , 0.0 , 0.5 , 0.0)	First	0.7460	0.7412
	Second	0.5554	0.5496
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9412	0.9462
	Second	0.8072	0.8166
(0.0 , 0.0 , 0.5 , 0.5)	First	0.4418	0.5224
	Second	0.3134	0.3696
(0.0 , 0.2 , 0.5 , 0.5)	First	0.4524	0.5320
	Second	0.3288	0.3824
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7396	0.7350
	Second	0.5580	0.5556
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1834	0.1438
	Second	0.1464	0.1148
(0.0 , 0.5 , 0.5 , 0.5)	First	0.4590	0.5328
	Second	0.3302	0.3864
(0.0 , 0.25 , 0.5 , 0.25)	First	0.6120	0.6290
	Second	0.4618	0.4690
(0.5 , 0.5 , 1.0 , 0.5)	First	0.7474	0.7360
	Second	0.5664	0.5510
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9902	0.9880
	Second	0.9270	0.9182
(0.25 , 0.5 , 0.75 , 0.0)	First	0.8516	0.8138
	Second	0.6894	0.6298

Table C.24. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak 3: Blocks= 40, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0520
	Second	0.0496	0.0482
(0.0 , 0.0 , 0.5 , 0.0)	First	0.8648	0.8524
	Second	0.5876	0.5934
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9876	0.9886
	Second	0.8384	0.8514
(0.0 , 0.0 , 0.5 , 0.5)	First	0.5778	0.6468
	Second	0.3548	0.3990
(0.0 , 0.2 , 0.5 , 0.5)	First	0.5876	0.6440
	Second	0.3628	0.3906
(0.0 , 0.5 , 0.5 , 0.0)	First	0.8562	0.8584
	Second	0.5962	0.5966
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2332	0.1630
	Second	0.1606	0.1128
(0.0 , 0.5 , 0.5 , 0.5)	First	0.5704	0.6420
	Second	0.3470	0.3976
(0.0 , 0.25 , 0.5 , 0.25)	First	0.7528	0.7652
	Second	0.4810	0.4954
(0.5 , 0.5 , 1.0 , 0.5)	First	0.8674	0.8592
	Second	0.5988	0.5798
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9984	0.9986
	Second	0.9526	0.9340
(0.25 , 0.5 , 0.75 , 0.0)	First	0.9462	0.9212
	Second	0.7008	0.6704

Table C.25. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0518	0.0458
	Second	0.0532	0.0504
(0.0 , 0.0 , 0.5 , 0.0)	First	0.2248	0.2168
	Second	0.2054	0.1928
(0.2 , 0.2 , 1.0 , 0.5)	First	0.3250	0.3402
	Second	0.3026	0.2986
(0.0 , 0.0 , 0.5 , 0.5)	First	0.1336	0.1524
	Second	0.1414	0.1400
(0.0 , 0.2 , 0.5 , 0.5)	First	0.1382	0.1536
	Second	0.1338	0.1382
(0.0 , 0.5 , 0.5 , 0.0)	First	0.2178	0.2200
	Second	0.2172	0.1976
(0.5 , 0.5 , 0.5 , 0.0)	First	0.0866	0.0744
	Second	0.0834	0.0728
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1468	0.1554
	Second	0.1488	0.1446
(0.0 , 0.25 , 0.5 , 0.25)	First	0.1834	0.1888
	Second	0.1754	0.1754
(0.5 , 0.5 , 1.0 , 0.5)	First	0.2168	0.2178
	Second	0.2082	0.1892
(0.2 , 0.75 , 1.0 , 0.0)	First	0.4324	0.4142
	Second	0.4050	0.3720
(0.25 , 0.5 , 0.75 , 0.0)	First	0.2602	0.2408
	Second	0.2480	0.2214

Table C.26. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0574	0.0472
	Second	0.0544	0.0528
(0.0 , 0.0 , 0.5 , 0.0)	First	0.2716	0.2516
	Second	0.2162	0.2164
(0.2 , 0.2 , 1.0 , 0.5)	First	0.4034	0.4222
	Second	0.3146	0.3464
(0.0 , 0.0 , 0.5 , 0.5)	First	0.1598	0.1810
	Second	0.1386	0.1524
(0.0 , 0.2 , 0.5 , 0.5)	First	0.1634	0.1808
	Second	0.1324	0.1580
(0.0 , 0.5 , 0.5 , 0.0)	First	0.2662	0.2550
	Second	0.2124	0.2220
(0.5 , 0.5 , 0.5 , 0.0)	First	0.0922	0.0760
	Second	0.0806	0.0838
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1646	0.1756
	Second	0.1404	0.1552
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2230	0.2164
	Second	0.1838	0.1944
(0.5 , 0.5 , 1.0 , 0.5)	First	0.2652	0.2562
	Second	0.2060	0.2166
(0.2 , 0.75 , 1.0 , 0.0)	First	0.5360	0.5040
	Second	0.4304	0.4160
(0.25 , 0.5 , 0.75 , 0.0)	First	0.3334	0.2982
	Second	0.2624	0.2592

Table C.27. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0522
	Second	0.0548	0.0506
(0.0 , 0.0 , 0.5 , 0.0)	First	0.3356	0.3278
	Second	0.2600	0.2440
(0.2 , 0.2 , 1.0 , 0.5)	First	0.5102	0.5220
	Second	0.3736	0.3926
(0.0 , 0.0 , 0.5 , 0.5)	First	0.1954	0.2250
	Second	0.1598	0.1684
(0.0 , 0.2 , 0.5 , 0.5)	First	0.1984	0.2250
	Second	0.1664	0.1740
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3284	0.3414
	Second	0.2474	0.2616
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1128	0.0786
	Second	0.1060	0.0710
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1944	0.2212
	Second	0.1590	0.1784
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2684	0.2726
	Second	0.2094	0.2058
(0.5 , 0.5 , 1.0 , 0.5)	First	0.3452	0.3268
	Second	0.2600	0.2356
(0.2 , 0.75 , 1.0 , 0.0)	First	0.6622	0.6266
	Second	0.4986	0.4814
(0.25 , 0.5 , 0.75 , 0.0)	First	0.4016	0.3894
	Second	0.3002	0.2998

Table C.28. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0430
	Second	0.0486	0.0454
(0.0 , 0.0 , 0.5 , 0.0)	First	0.3926	0.3814
	Second	0.2928	0.2770
(0.2 , 0.2 , 1.0 , 0.5)	First	0.4794	0.4650
	Second	0.4152	0.3968
(0.0 , 0.0 , 0.5 , 0.5)	First	0.1848	0.2150
	Second	0.1642	0.1930
(0.0 , 0.2 , 0.5 , 0.5)	First	0.1910	0.2138
	Second	0.1574	0.1906
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3094	0.2916
	Second	0.2740	0.2590
(0.5 , 0.5 , 0.5 , 0.0)	First	0.0978	0.0864
	Second	0.0942	0.0812
(0.0 , 0.5 , 0.5 , 0.5)	First	0.1826	0.2046
	Second	0.1636	0.1840
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2448	0.2484
	Second	0.2114	0.2090
(0.5 , 0.5 , 1.0 , 0.5)	First	0.3068	0.2956
	Second	0.2662	0.2548
(0.2 , 0.75 , 1.0 , 0.0)	First	0.6216	0.5886
	Second	0.5468	0.5068
(0.25 , 0.5 , 0.75 , 0.0)	First	0.3554	0.3448
	Second	0.3182	0.3050

Table C.29. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0490	0.0526
	Second	0.0506	0.0510
(0.0 , 0.0 , 0.5 , 0.0)	First	0.3750	0.3744
	Second	0.2802	0.2744
(0.2 , 0.2 , 1.0 , 0.5)	First	0.5716	0.5786
	Second	0.4298	0.4338
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2224	0.2398
	Second	0.1772	0.1840
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2198	0.2492
	Second	0.1734	0.1936
(0.0 , 0.5 , 0.5 , 0.0)	First	0.3698	0.3582
	Second	0.2858	0.2786
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1698	0.0880
	Second	0.0964	0.0778
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2384	0.2472
	Second	0.1778	0.1938
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2930	0.3060
	Second	0.2308	0.2370
(0.5 , 0.5 , 1.0 , 0.5)	First	0.3820	0.3696
	Second	0.2952	0.2726
(0.2 , 0.75 , 1.0 , 0.0)	First	0.7236	0.6994
	Second	0.5690	0.5532
(0.25 , 0.5 , 0.75 , 0.0)	First	0.4526	0.4268
	Second	0.3416	0.3150

Table C.30. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0456	0.0510
	Second	0.0502	0.0508
(0.0 , 0.0 , 0.5 , 0.0)	First	0.4892	0.4634
	Second	0.3272	0.3132
(0.2 , 0.2 , 1.0 , 0.5)	First	0.7040	0.7166
	Second	0.4828	0.4936
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2776	0.3130
	Second	0.1904	0.2114
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2798	0.3154
	Second	0.1984	0.2188
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4836	0.4658
	Second	0.3170	0.3138
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1324	0.1034
	Second	0.1050	0.0830
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2730	0.3126
	Second	0.1826	0.2124
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3740	0.3844
	Second	0.2508	0.2570
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4560	0.4518
	Second	0.3112	0.3014
(0.2 , 0.75 , 1.0 , 0.0)	First	0.8546	0.8306
	Second	0.6486	0.6104
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5730	0.5352
	Second	0.3892	0.3610

Table C.31. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 8, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0506	0.0506
	Second	0.0522	0.0556
(0.0 , 0.0 , 0.5 , 0.0)	First	0.4266	0.4088
	Second	0.3714	0.3596
(0.2 , 0.2 , 1.0 , 0.5)	First	0.6358	0.6438
	Second	0.5566	0.5548
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2386	0.2936
	Second	0.2066	0.2438
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2432	0.2820
	Second	0.2154	0.2438
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4144	0.4068
	Second	0.3664	0.3506
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1146	0.0908
	Second	0.1086	0.0888
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2378	0.2738
	Second	0.2122	0.2348
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3274	0.3418
	Second	0.2884	0.3042
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4312	0.4122
	Second	0.3674	0.3406
(0.2 , 0.75 , 1.0 , 0.0)	First	0.7964	0.7598
	Second	0.7250	0.6772
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5052	0.4692
	Second	0.4424	0.4154

Table C.32. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0540	0.0526
	Second	0.0566	0.0510
(0.0 , 0.0 , 0.5 , 0.0)	First	0.5036	0.4920
	Second	0.3708	0.3700
(0.2 , 0.2 , 1.0 , 0.5)	First	0.7570	0.7582
	Second	0.5842	0.5844
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2944	0.3316
	Second	0.2224	0.2454
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3030	0.3364
	Second	0.2276	0.2542
(0.0 , 0.5 , 0.5 , 0.0)	First	0.5078	0.4942
	Second	0.3768	0.3576
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1332	0.1080
	Second	0.1146	0.0866
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2808	0.3390
	Second	0.2188	0.2444
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3966	0.4338
	Second	0.2992	0.2978
(0.5 , 0.5 , 1.0 , 0.5)	First	0.5042	0.4920
	Second	0.3768	0.3574
(0.2 , 0.75 , 1.0 , 0.0)	First	0.8866	0.8634
	Second	0.7304	0.7020
(0.25 , 0.5 , 0.75 , 0.0)	First	0.6080	0.5750
	Second	0.4598	0.4260

Table C.33. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0488	0.0512
	Second	0.0504	0.0526
(0.0 , 0.0 , 0.5 , 0.0)	First	0.6438	0.6342
	Second	0.4106	0.3922
(0.2 , 0.2 , 1.0 , 0.5)	First	0.8630	0.8740
	Second	0.6194	0.6204
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3766	0.4472
	Second	0.2296	0.2686
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3792	0.4354
	Second	0.2412	0.2688
(0.0 , 0.5 , 0.5 , 0.0)	First	0.6282	0.6322
	Second	0.4050	0.3918
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1554	0.1312
	Second	0.1140	0.1022
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3812	0.4248
	Second	0.2426	0.2598
(0.0 , 0.25 , 0.5 , 0.25)	First	0.5006	0.5308
	Second	0.3146	0.3356
(0.5 , 0.5 , 1.0 , 0.5)	First	0.6454	0.6296
	Second	0.4138	0.3940
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9618	0.9502
	Second	0.7760	0.7386
(0.25 , 0.5 , 0.75 , 0.0)	First	0.7414	0.7146
	Second	0.4830	0.4592

Table C.34. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 10, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0522	0.0566
	Second	0.0516	0.0544
(0.0 , 0.0 , 0.5 , 0.0)	First	0.4786	0.4768
	Second	0.4078	0.4008
(0.2 , 0.2 , 1.0 , 0.5)	First	0.7150	0.7218
	Second	0.6248	0.6382
(0.0 , 0.0 , 0.5 , 0.5)	First	0.2978	0.3280
	Second	0.2548	0.2746
(0.0 , 0.2 , 0.5 , 0.5)	First	0.2854	0.3166
	Second	0.2406	0.2612
(0.0 , 0.5 , 0.5 , 0.0)	First	0.4884	0.4798
	Second	0.4042	0.4062
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1336	0.1032
	Second	0.1150	0.0920
(0.0 , 0.5 , 0.5 , 0.5)	First	0.2780	0.3138
	Second	0.2414	0.2704
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3904	0.3878
	Second	0.3296	0.3380
(0.5 , 0.5 , 1.0 , 0.5)	First	0.4882	0.4760
	Second	0.4238	0.4128
(0.2 , 0.75 , 1.0 , 0.0)	First	0.8728	0.8430
	Second	0.7850	0.7558
(0.25 , 0.5 , 0.75 , 0.0)	First	0.5830	0.5480
	Second	0.5044	0.4686

Table C.35. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0438	0.0408
	Second	0.0456	0.0440
(0.0 , 0.0 , 0.5 , 0.0)	First	0.5980	0.5870
	Second	0.4334	0.4198
(0.2 , 0.2 , 1.0 , 0.5)	First	0.8274	0.8260
	Second	0.6486	0.6550
(0.0 , 0.0 , 0.5 , 0.5)	First	0.3406	0.3794
	Second	0.2424	0.2692
(0.0 , 0.2 , 0.5 , 0.5)	First	0.3486	0.3960
	Second	0.2468	0.2788
(0.0 , 0.5 , 0.5 , 0.0)	First	0.5864	0.5672
	Second	0.4288	0.4128
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1476	0.1064
	Second	0.1146	0.0932
(0.0 , 0.5 , 0.5 , 0.5)	First	0.3358	0.3804
	Second	0.2494	0.2706
(0.0 , 0.25 , 0.5 , 0.25)	First	0.4702	0.4840
	Second	0.3368	0.3492
(0.5 , 0.5 , 1.0 , 0.5)	First	0.5814	0.5744
	Second	0.4280	0.4190
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9386	0.9236
	Second	0.8020	0.7790
(0.25 , 0.5 , 0.75 , 0.0)	First	0.7054	0.6668
	Second	0.5180	0.4792

Table C.36. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak 3: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0474
	Second	0.0500	0.0524
(0.0 , 0.0 , 0.5 , 0.0)	First	0.7200	0.7098
	Second	0.4550	0.4384
(0.2 , 0.2 , 1.0 , 0.5)	First	0.9188	0.9350
	Second	0.6710	0.6882
(0.0 , 0.0 , 0.5 , 0.5)	First	0.4260	0.5036
	Second	0.2610	0.3104
(0.0 , 0.2 , 0.5 , 0.5)	First	0.4326	0.5090
	Second	0.2614	0.3020
(0.0 , 0.5 , 0.5 , 0.0)	First	0.7104	0.7122
	Second	0.4464	0.4526
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1710	0.1368
	Second	0.1172	0.1054
(0.0 , 0.5 , 0.5 , 0.5)	First	0.4396	0.4880
	Second	0.2618	0.2940
(0.0 , 0.25 , 0.5 , 0.25)	First	0.5838	0.6034
	Second	0.3476	0.3654
(0.5 , 0.5 , 1.0 , 0.5)	First	0.7262	0.7204
	Second	0.4516	0.4418
(0.2 , 0.75 , 1.0 , 0.0)	First	0.9844	0.9754
	Second	0.8290	0.8074
(0.25 , 0.5 , 0.75 , 0.0)	First	0.8334	0.8052
	Second	0.5554	0.5360

APPENDIX D. 5 TREATMENTS WITH PEAK AT 2

Table D.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0492	0.0542
	Second	0.0550	0.0518
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4076	0.3938
	Second	0.3580	0.3440
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3636	0.3672
	Second	0.3126	0.3190
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.3670	0.3106
	Second	0.3208	0.2788
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4622	0.4348
	Second	0.4022	0.3854
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3520	0.3692
	Second	0.3186	0.3348
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.3926	0.3620
	Second	0.3394	0.3218
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.5072	0.4968
	Second	0.4508	0.4614
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5158	0.4804
	Second	0.4658	0.4378
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.5582	0.5088
	Second	0.4942	0.4496
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.7252	0.7114
	Second	0.6620	0.6428
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8224	0.7906
	Second	0.7658	0.7356
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6726	0.6206
	Second	0.6140	0.5610
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.7742	0.7406
	Second	0.7150	0.6836
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8096	0.7784
	Second	0.7468	0.7260
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.7326	0.7278
	Second	0.6746	0.6770
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6636	0.6240
	Second	0.6182	0.5604
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2618	0.3044
	Second	0.2318	0.2806
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3052	0.3458
	Second	0.2786	0.3260
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3630	0.4022
	Second	0.3174	0.3626
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6200	0.6828
	Second	0.5738	0.6206
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4308	0.4758
	Second	0.3844	0.4404
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4024	0.4504
	Second	0.3482	0.4104
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3002	0.3268
	Second	0.2776	0.2992
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3668	0.3826
	Second	0.3364	0.3422
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2502	0.2362
	Second	0.2280	0.2222
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2814	0.2520
	Second	0.2642	0.2308
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0818	0.0712
	Second	0.0798	0.0678
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3308	0.3138
	Second	0.2872	0.2814
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5286	0.5358
	Second	0.4678	0.4928
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3746	0.3422
	Second	0.3250	0.3074
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5456	0.5202
	Second	0.4866	0.4690
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4882	0.4964
	Second	0.4358	0.4528
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.6956	0.7048
	Second	0.6332	0.6384

Table D.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0490
	Second	0.0510	0.0538
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5162	0.4906
	Second	0.3940	0.3674
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4422	0.4616
	Second	0.3404	0.3432
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.4570	0.4118
	Second	0.3478	0.3252
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5604	0.5270
	Second	0.4450	0.4186
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4564	0.4514
	Second	0.3454	0.3498
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.5032	0.4516
	Second	0.3926	0.3534
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.6182	0.6094
	Second	0.4904	0.4876
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6326	0.6032
	Second	0.5088	0.4716
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.6934	0.6238
	Second	0.5550	0.4936
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.8456	0.8112
	Second	0.7160	0.6810
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9110	0.8850
	Second	0.8176	0.7740
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.7818	0.7378
	Second	0.6496	0.6022
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.8650	0.8402
	Second	0.7454	0.7226
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8988	0.8890
	Second	0.7924	0.7754
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.8396	0.8430
	Second	0.7124	0.7178
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.7776	0.7430
	Second	0.6400	0.6092
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3376	0.3932
	Second	0.2594	0.3140
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3884	0.4308
	Second	0.3044	0.3366
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4416	0.4864
	Second	0.3394	0.3740
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7448	0.7900
	Second	0.6090	0.6610
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5284	0.6006
	Second	0.4122	0.4856
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4952	0.5364
	Second	0.3888	0.4290
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3470	0.4028
	Second	0.2776	0.3252
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4532	0.4534
	Second	0.3548	0.3674
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2834	0.2840
	Second	0.2320	0.2206
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3470	0.3082
	Second	0.2736	0.2538
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0998	0.0776
	Second	0.0788	0.0718
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3904	0.3952
	Second	0.2992	0.3104
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6276	0.6462
	Second	0.5052	0.5234
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4558	0.4258
	Second	0.3564	0.3280
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6434	0.6464
	Second	0.5246	0.5136
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6130	0.6014
	Second	0.4874	0.4852
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8226	0.8184
	Second	0.7002	0.6904

Table D.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0470	0.0490
	Second	0.0478	0.0538
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6600	0.6234
	Second	0.4926	0.4460
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5820	0.5932
	Second	0.4326	0.4124
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.5670	0.5246
	Second	0.4154	0.3778
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6968	0.6612
	Second	0.5412	0.4900
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5882	0.5958
	Second	0.4272	0.4310
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.6262	0.5572
	Second	0.4742	0.4070
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.7722	0.7606
	Second	0.5954	0.5854
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7748	0.7452
	Second	0.6018	0.5556
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.8250	0.7682
	Second	0.6548	0.5756
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9324	0.9278
	Second	0.8054	0.7906
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9740	0.9676
	Second	0.8932	0.8608
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8982	0.8524
	Second	0.7522	0.6802
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9530	0.9468
	Second	0.8422	0.8178
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9772	0.9632
	Second	0.8858	0.8524
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9368	0.9306
	Second	0.8130	0.7874
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8912	0.8738
	Second	0.7570	0.7020
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4452	0.5140
	Second	0.3136	0.3544
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4952	0.5600
	Second	0.3710	0.4022
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5798	0.6334
	Second	0.4262	0.4666
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8706	0.9078
	Second	0.7144	0.7630
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6584	0.7300
	Second	0.5076	0.5582
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6066	0.6614
	Second	0.4588	0.4932
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4388	0.4988
	Second	0.3384	0.3644
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5854	0.6018
	Second	0.4394	0.4480
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3748	0.3674
	Second	0.2820	0.2722
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4428	0.3782
	Second	0.3308	0.2796
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1100	0.0780
	Second	0.0920	0.0720
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5156	0.4996
	Second	0.3902	0.3664
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7792	0.8036
	Second	0.6088	0.6370
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5824	0.5362
	Second	0.4386	0.3848
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7844	0.7776
	Second	0.6300	0.6088
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7294	0.7334
	Second	0.5738	0.5626
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9238	0.9186
	Second	0.7882	0.7758

Table D.4. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0560
	Second	0.0522	0.0546
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6176	0.5636
	Second	0.5342	0.4810
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5296	0.5248
	Second	0.4456	0.4576
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.5428	0.4724
	Second	0.4564	0.4006
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6462	0.6188
	Second	0.5612	0.5358
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5450	0.5588
	Second	0.4546	0.4670
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.5632	0.5178
	Second	0.4846	0.4492
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.7134	0.6950
	Second	0.6388	0.6040
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7244	0.6820
	Second	0.6342	0.6010
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.7714	0.7148
	Second	0.6898	0.6268
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9074	0.8862
	Second	0.8480	0.8298
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9564	0.9392
	Second	0.9190	0.8862
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8600	0.8162
	Second	0.7878	0.7366
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9284	0.9124
	Second	0.8606	0.8518
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9466	0.9424
	Second	0.9036	0.8896
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9020	0.9032
	Second	0.8474	0.8392
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8598	0.8140
	Second	0.7914	0.7270
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3972	0.4638
	Second	0.3362	0.4002
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4464	0.4932
	Second	0.3854	0.4084
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5154	0.5778
	Second	0.4310	0.4894
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8276	0.8744
	Second	0.7568	0.7992
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5980	0.6742
	Second	0.5198	0.5942
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5478	0.6192
	Second	0.4824	0.5536
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4032	0.4726
	Second	0.3530	0.4102
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5512	0.5118
	Second	0.4668	0.4508
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3358	0.3250
	Second	0.2970	0.3006
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4130	0.3494
	Second	0.3614	0.3088
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1090	0.0748
	Second	0.0970	0.0684
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4678	0.4510
	Second	0.4076	0.3856
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7196	0.7286
	Second	0.6446	0.6598
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5184	0.5076
	Second	0.4426	0.4386
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7470	0.7136
	Second	0.6674	0.6232
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6678	0.6866
	Second	0.5912	0.6060
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8884	0.8846
	Second	0.8314	0.8120

Table D.5. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0548	0.0518
	Second	0.0528	0.0528
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.7296	0.6894
	Second	0.5590	0.5190
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6514	0.6622
	Second	0.4902	0.4950
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.6536	0.5834
	Second	0.4888	0.4272
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.7570	0.7288
	Second	0.6140	0.5630
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6536	0.6564
	Second	0.4906	0.4842
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.6770	0.6140
	Second	0.5118	0.4612
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.8130	0.8088
	Second	0.6628	0.6440
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8328	0.8074
	Second	0.6700	0.6340
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.8630	0.8202
	Second	0.7332	0.6528
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9662	0.9604
	Second	0.8670	0.8466
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9900	0.9772
	Second	0.9386	0.9078
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9408	0.9104
	Second	0.8258	0.7734
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9726	0.9660
	Second	0.9014	0.8756
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9844	0.9788
	Second	0.9276	0.9098
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9682	0.9592
	Second	0.8858	0.8564
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9436	0.9138
	Second	0.8280	0.7774
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4952	0.5844
	Second	0.3626	0.4364
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5544	0.6144
	Second	0.4192	0.4624
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6314	0.6952
	Second	0.4918	0.5380
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9204	0.9434
	Second	0.7848	0.8252
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7180	0.7958
	Second	0.5654	0.6382
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6492	0.7226
	Second	0.4960	0.5720
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4856	0.5664
	Second	0.3790	0.4192
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6394	0.6406
	Second	0.5008	0.4902
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4218	0.3996
	Second	0.3224	0.3002
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5072	0.4460
	Second	0.3824	0.3332
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1264	0.0802
	Second	0.1054	0.0694
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5730	0.5700
	Second	0.4404	0.4212
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8324	0.8538
	Second	0.6848	0.6996
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.6428	0.6014
	Second	0.5002	0.4538
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8490	0.8262
	Second	0.6984	0.6774
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7910	0.7966
	Second	0.6330	0.6390
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9546	0.9478
	Second	0.8556	0.8428

Table D.6. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0524	0.0480
	Second	0.0546	0.0486
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.8652	0.8456
	Second	0.6270	0.6028
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.7994	0.8024
	Second	0.5546	0.5568
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.7990	0.7374
	Second	0.5496	0.4970
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.8846	0.8570
	Second	0.6662	0.6376
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7992	0.8030
	Second	0.5542	0.5650
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.8216	0.7572
	Second	0.5856	0.5188
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.9276	0.9156
	Second	0.7346	0.7092
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9390	0.9192
	Second	0.7342	0.7016
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.9590	0.9274
	Second	0.7948	0.7206
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9930	0.9912
	Second	0.9186	0.9014
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9994	0.9984
	Second	0.9664	0.9438
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9892	0.9732
	Second	0.8760	0.8250
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9964	0.9938
	Second	0.9364	0.9134
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9978	0.9990
	Second	0.9596	0.9476
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9948	0.9930
	Second	0.9182	0.9166
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9862	0.9746
	Second	0.8812	0.8380
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6370	0.7128
	Second	0.4036	0.4690
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6828	0.7472
	Second	0.4574	0.5186
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7746	0.8230
	Second	0.5320	0.5814
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9764	0.9888
	Second	0.8438	0.8780
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8490	0.9018
	Second	0.6234	0.6862
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7974	0.8620
	Second	0.5728	0.6430
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6194	0.7006
	Second	0.4096	0.4852
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7708	0.7762
	Second	0.5556	0.5384
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5396	0.5074
	Second	0.3524	0.3384
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6158	0.5556
	Second	0.4138	0.3662
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1512	0.0882
	Second	0.1044	0.0770
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.6984	0.6896
	Second	0.4734	0.4654
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9302	0.9436
	Second	0.7404	0.7598
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.7856	0.7328
	Second	0.5422	0.5074
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9408	0.9268
	Second	0.7492	0.7332
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9036	0.9028
	Second	0.7002	0.7010
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9914	0.9876
	Second	0.8984	0.8878

Table D.7. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0462	0.0550
	Second	0.0460	0.0534
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.8020	0.7588
	Second	0.7104	0.6630
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.7282	0.7216
	Second	0.6334	0.6218
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.7342	0.6578
	Second	0.6406	0.5626
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.8352	0.7980
	Second	0.7446	0.6990
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7372	0.7202
	Second	0.6416	0.6276
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.7558	0.6828
	Second	0.6650	0.5944
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.8704	0.8604
	Second	0.7938	0.7924
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8860	0.8554
	Second	0.8180	0.7874
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.9174	0.8840
	Second	0.8564	0.8052
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9854	0.9780
	Second	0.9570	0.9414
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9966	0.9922
	Second	0.9872	0.9746
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9680	0.9500
	Second	0.9296	0.8970
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9918	0.9840
	Second	0.9700	0.9558
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9926	0.9928
	Second	0.9822	0.9756
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9836	0.9790
	Second	0.9582	0.9524
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9678	0.9430
	Second	0.9334	0.8856
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5630	0.6312
	Second	0.4804	0.5432
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6130	0.6766
	Second	0.5350	0.5760
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7154	0.7542
	Second	0.6154	0.6764
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9464	0.9730
	Second	0.8972	0.9260
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7906	0.8586
	Second	0.6960	0.7584
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7368	0.7932
	Second	0.6420	0.6978
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5572	0.6226
	Second	0.4746	0.5364
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7100	0.7128
	Second	0.6256	0.6192
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4758	0.4404
	Second	0.4012	0.3696
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5624	0.4892
	Second	0.4794	0.4206
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1330	0.0848
	Second	0.1110	0.0816
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.6250	0.6130
	Second	0.5448	0.5322
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8854	0.8960
	Second	0.8116	0.8198
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.7032	0.6658
	Second	0.6072	0.5652
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9032	0.8776
	Second	0.8306	0.8042
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8448	0.8436
	Second	0.7626	0.7540
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9758	0.9746
	Second	0.9410	0.9392

Table D.8. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0530	0.0514
	Second	0.0466	0.0504
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.9056	0.8772
	Second	0.7456	0.6888
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.8480	0.8350
	Second	0.6538	0.6610
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.8452	0.7832
	Second	0.6516	0.5946
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.9178	0.8944
	Second	0.7672	0.7250
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8442	0.8412
	Second	0.6630	0.6550
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.8542	0.7950
	Second	0.6784	0.6068
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.9516	0.9374
	Second	0.8180	0.7886
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9568	0.9378
	Second	0.8428	0.7930
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.9736	0.9548
	Second	0.8818	0.8292
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9972	0.9966
	Second	0.9662	0.9574
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9998	0.9986
	Second	0.9908	0.9782
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9910	0.9850
	Second	0.9392	0.9090
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9964	0.9984
	Second	0.9754	0.9694
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9994	0.9988
	Second	0.9846	0.9774
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9976	0.9968
	Second	0.9672	0.9608
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9934	0.9840
	Second	0.9394	0.9110
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6894	0.7558
	Second	0.5018	0.5586
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.7220	0.7904
	Second	0.5378	0.6036
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8098	0.8642
	Second	0.6346	0.6810
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9880	0.9920
	Second	0.9112	0.9456
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8836	0.9332
	Second	0.7260	0.7828
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8346	0.8886
	Second	0.6556	0.7310
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6574	0.7372
	Second	0.4972	0.5648
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8194	0.8176
	Second	0.6442	0.6344
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5674	0.5376
	Second	0.4252	0.3836
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6644	0.5896
	Second	0.4986	0.4370
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1546	0.0926
	Second	0.1166	0.0756
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.7538	0.7340
	Second	0.5646	0.5500
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9532	0.9566
	Second	0.8404	0.8326
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.8248	0.7808
	Second	0.6486	0.5926
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9594	0.9450
	Second	0.8450	0.8174
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9334	0.9260
	Second	0.7980	0.7882
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9936	0.9942
	Second	0.9510	0.9416

Table D.9. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0482
	Second	0.0550	0.0526
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.9756	0.9562
	Second	0.7762	0.7386
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.9452	0.9406
	Second	0.7064	0.6890
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.9438	0.8958
	Second	0.7078	0.6252
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.9820	0.9680
	Second	0.8084	0.7764
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9414	0.9346
	Second	0.7030	0.6930
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.9506	0.9096
	Second	0.7226	0.6510
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.9886	0.9854
	Second	0.8536	0.8414
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9930	0.9850
	Second	0.8814	0.8370
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.9974	0.9870
	Second	0.9118	0.8556
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	1.0000	1.0000
	Second	0.9772	0.9696
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	1.0000	1.0000
	Second	0.9936	0.9892
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9990	0.9970
	Second	0.9600	0.9324
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9996	0.9998
	Second	0.9870	0.9750
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	1.0000	1.0000
	Second	0.9918	0.9886
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	1.0000	0.9998
	Second	0.9790	0.9702
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9996	0.9978
	Second	0.9594	0.9290
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.8252	0.8878
	Second	0.5422	0.6186
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.8704	0.9010
	Second	0.6052	0.6400
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9212	0.9524
	Second	0.6686	0.7410
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9986	0.9996
	Second	0.9402	0.9612
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9616	0.9776
	Second	0.7548	0.8184
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9330	0.9650
	Second	0.7012	0.7580
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7928	0.8662
	Second	0.5342	0.6060
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.9204	0.9248
	Second	0.6754	0.6884
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7020	0.6798
	Second	0.4560	0.4210
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.8098	0.7272
	Second	0.5452	0.4726
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1898	0.1072
	Second	0.1310	0.0808
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.8674	0.8586
	Second	0.5916	0.5974
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9900	0.9938
	Second	0.8742	0.8746
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.9214	0.9022
	Second	0.6860	0.6404
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9934	0.9864
	Second	0.8770	0.8444
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9808	0.9842
	Second	0.8296	0.8254
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9994	0.9998
	Second	0.9690	0.9616

Table D.10. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0458	0.0468
	Second	0.0484	0.0482
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.8736	0.8468
	Second	0.7922	0.7600
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.8194	0.8134
	Second	0.7278	0.7220
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.8250	0.7488
	Second	0.7258	0.6504
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.8988	0.8594
	Second	0.8300	0.7802
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8226	0.8134
	Second	0.7360	0.7282
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.8328	0.7734
	Second	0.7514	0.6944
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.9286	0.9198
	Second	0.8636	0.8534
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9432	0.9192
	Second	0.8846	0.8454
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.9658	0.9432
	Second	0.9234	0.8882
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9964	0.9948
	Second	0.9818	0.9788
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9994	0.9988
	Second	0.9962	0.9940
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9884	0.9786
	Second	0.9666	0.9418
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9966	0.9966
	Second	0.9872	0.9826
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9994	0.9986
	Second	0.9962	0.9910
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9950	0.9952
	Second	0.9838	0.9792
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9894	0.9816
	Second	0.9704	0.9414
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6618	0.7260
	Second	0.5628	0.6240
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.7192	0.7758
	Second	0.6176	0.6744
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7970	0.8494
	Second	0.6946	0.7564
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9792	0.9912
	Second	0.9502	0.9636
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8570	0.9116
	Second	0.7742	0.8406
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8110	0.8630
	Second	0.7264	0.7758
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6512	0.7138
	Second	0.5634	0.6182
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7868	0.7926
	Second	0.6942	0.7004
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5442	0.5074
	Second	0.4694	0.4406
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6332	0.5724
	Second	0.5492	0.4674
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1598	0.1006
	Second	0.1382	0.0930
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.7280	0.7000
	Second	0.6208	0.6154
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9412	0.9484
	Second	0.8748	0.8872
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.7948	0.7456
	Second	0.6974	0.6524
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9480	0.9352
	Second	0.8958	0.8778
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9132	0.9206
	Second	0.8516	0.8528
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9944	0.9930
	Second	0.9750	0.9682

Table D.11. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0484	0.0532
	Second	0.0554	0.0564
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.9560	0.9322
	Second	0.8248	0.7888
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.9148	0.9118
	Second	0.7418	0.7342
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.9158	0.8594
	Second	0.7446	0.6634
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.9594	0.9408
	Second	0.8456	0.7994
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9170	0.9086
	Second	0.7348	0.7394
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.9268	0.8688
	Second	0.7624	0.6908
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.9792	0.9688
	Second	0.8830	0.8650
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9836	0.9750
	Second	0.9052	0.8710
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.9914	0.9796
	Second	0.9334	0.8954
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9994	0.9992
	Second	0.9868	0.9814
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	1.0000	0.9998
	Second	0.9954	0.9934
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9980	0.9958
	Second	0.9722	0.9468
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9996	0.9998
	Second	0.9912	0.9850
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	1.0000	1.0000
	Second	0.9942	0.9906
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9994	0.9998
	Second	0.9870	0.9830
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9986	0.9944
	Second	0.9744	0.9504
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.7838	0.8394
	Second	0.5808	0.6464
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.8156	0.8672
	Second	0.6356	0.6890
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8960	0.9180
	Second	0.7112	0.7678
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9960	0.9982
	Second	0.9574	0.9720
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9400	0.9678
	Second	0.7994	0.8542
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9056	0.9446
	Second	0.7376	0.8004
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7490	0.8098
	Second	0.5656	0.6326
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8834	0.8842
	Second	0.7044	0.7122
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6608	0.6182
	Second	0.4876	0.4584
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7472	0.6806
	Second	0.5644	0.4988
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1942	0.1012
	Second	0.1414	0.0864
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.8368	0.8154
	Second	0.6506	0.6286
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9840	0.9850
	Second	0.9018	0.9070
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.8968	0.8548
	Second	0.7324	0.6760
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9840	0.9814
	Second	0.9070	0.8934
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9676	0.9690
	Second	0.8698	0.8538
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9984	0.9984
	Second	0.9732	0.9766

Table D.12. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0572	0.0498
	Second	0.0516	0.0494
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.9926	0.9868
	Second	0.8460	0.8222
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.9814	0.9724
	Second	0.7988	0.7684
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.9800	0.9476
	Second	0.7830	0.6886
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.9920	0.9854
	Second	0.8612	0.8276
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9756	0.9726
	Second	0.7726	0.7660
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.9814	0.9542
	Second	0.7992	0.7310
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.9958	0.9960
	Second	0.9058	0.8972
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9972	0.9970
	Second	0.9294	0.8894
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.9992	0.9990
	Second	0.9510	0.9158
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	1.0000	1.0000
	Second	0.9910	0.9862
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	1.0000	1.0000
	Second	0.9976	0.9956
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	1.0000	1.0000
	Second	0.9818	0.9636
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	1.0000	1.0000
	Second	0.9938	0.9900
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	1.0000	1.0000
	Second	0.9980	0.9956
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	1.0000	1.0000
	Second	0.9910	0.9872
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	1.0000	0.9998
	Second	0.9802	0.9684
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.8994	0.9426
	Second	0.6014	0.6812
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.9206	0.9536
	Second	0.6770	0.7244
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9686	0.9794
	Second	0.7518	0.8064
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9992	0.9998
	Second	0.9654	0.9830
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9850	0.9946
	Second	0.8404	0.8934
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9714	0.9848
	Second	0.7652	0.8342
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8682	0.9222
	Second	0.5928	0.6698
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.9598	0.9646
	Second	0.7516	0.7574
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7946	0.7562
	Second	0.5058	0.4778
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.8704	0.8056
	Second	0.5914	0.5250
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2294	0.1206
	Second	0.1526	0.0852
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.9246	0.9174
	Second	0.6584	0.6602
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9980	0.9984
	Second	0.9262	0.9230
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.9628	0.9472
	Second	0.7608	0.7168
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9984	0.9972
	Second	0.9258	0.9006
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9940	0.9946
	Second	0.8814	0.8826
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	1.0000	1.0000
	Second	0.9866	0.9816

Table D.13. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0492	0.0482
	Second	0.0488	0.0522
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2702	0.2568
	Second	0.2382	0.2426
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2334	0.2290
	Second	0.2086	0.2032
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.2302	0.1980
	Second	0.2044	0.1854
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2566	0.2576
	Second	0.2338	0.2346
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2294	0.2204
	Second	0.2070	0.2186
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.2354	0.2038
	Second	0.2040	0.2000
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.2998	0.3000
	Second	0.2770	0.2706
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3044	0.2894
	Second	0.2794	0.2696
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.3298	0.3032
	Second	0.2938	0.2852
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.4488	0.4538
	Second	0.4090	0.4096
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5645	0.5412
	Second	0.5048	0.4934
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.4152	0.3744
	Second	0.3626	0.3324
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.5030	0.4990
	Second	0.4376	0.4382
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.5314	0.5406
	Second	0.4782	0.4934
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.4640	0.4648
	Second	0.4190	0.4178
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.4106	0.3768
	Second	0.3662	0.3364
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.1834	0.2014
	Second	0.1676	0.1894
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.1766	0.2218
	Second	0.1626	0.2064
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2072	0.2370
	Second	0.1936	0.2264
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.3858	0.4474
	Second	0.3520	0.4002
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2636	0.2990
	Second	0.2384	0.2688
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2338	0.2550
	Second	0.2216	0.2394
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1840	0.2106
	Second	0.1634	0.1942
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2320	0.2206
	Second	0.2058	0.2088
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1570	0.1492
	Second	0.1362	0.1398
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1640	0.1636
	Second	0.1606	0.1478
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0764	0.0722
	Second	0.0750	0.0670
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.1944	0.1918
	Second	0.1642	0.1712
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3170	0.3156
	Second	0.2846	0.2890
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2180	0.2018
	Second	0.1940	0.1918
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3254	0.3044
	Second	0.2900	0.2834
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2762	0.2972
	Second	0.2544	0.2656
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.4740	0.4456
	Second	0.4164	0.4070

Table D.14. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0484	0.0474
	Second	0.0482	0.0452
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3190	0.3068
	Second	0.2508	0.2408
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2774	0.2746
	Second	0.2232	0.2186
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.2714	0.2574
	Second	0.2242	0.2054
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3242	0.3110
	Second	0.2500	0.2494
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2766	0.2790
	Second	0.2288	0.2206
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.2756	0.2464
	Second	0.2206	0.2044
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.3698	0.3660
	Second	0.3000	0.2904
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3596	0.3548
	Second	0.2902	0.2710
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.4068	0.3854
	Second	0.3146	0.3076
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.5534	0.5532
	Second	0.4420	0.4464
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6700	0.6534
	Second	0.5444	0.5184
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.5132	0.4740
	Second	0.4084	0.3752
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.6048	0.6022
	Second	0.4892	0.4666
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.6560	0.6476
	Second	0.5328	0.5168
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.5626	0.5822
	Second	0.4494	0.4658
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.5036	0.4668
	Second	0.4026	0.3738
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2282	0.2534
	Second	0.1794	0.2010
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2202	0.2490
	Second	0.1832	0.2034
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2614	0.2946
	Second	0.2074	0.2294
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.4680	0.5532
	Second	0.3730	0.4316
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3264	0.3668
	Second	0.2558	0.2910
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2868	0.3018
	Second	0.2304	0.2464
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2244	0.2426
	Second	0.1756	0.2046
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2702	0.2810
	Second	0.2182	0.2212
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1718	0.1658
	Second	0.1418	0.1504
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2026	0.1772
	Second	0.1680	0.1420
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0872	0.0666
	Second	0.0768	0.0632
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2254	0.2236
	Second	0.1870	0.1872
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3886	0.4096
	Second	0.3142	0.3300
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2594	0.2482
	Second	0.2130	0.2040
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3950	0.3780
	Second	0.3164	0.2912
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3422	0.3580
	Second	0.2658	0.2854
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.5614	0.5474
	Second	0.4448	0.4486

Table D.15. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0528	0.0504
	Second	0.0518	0.0510
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4024	0.3762
	Second	0.3072	0.2764
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3552	0.3524
	Second	0.2662	0.2558
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.3546	0.3184
	Second	0.2618	0.2358
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4156	0.3804
	Second	0.3042	0.2842
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3564	0.3518
	Second	0.2678	0.2610
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.3694	0.3090
	Second	0.2766	0.2338
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.4712	0.4720
	Second	0.3536	0.3474
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4572	0.4514
	Second	0.3438	0.3278
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.5164	0.4804
	Second	0.3898	0.3548
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.6846	0.6934
	Second	0.5302	0.5122
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7980	0.7784
	Second	0.6354	0.5992
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6384	0.5964
	Second	0.4832	0.4304
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.7352	0.7356
	Second	0.5740	0.5706
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.7848	0.7986
	Second	0.6120	0.6078
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.6920	0.7004
	Second	0.5290	0.5298
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6476	0.5984
	Second	0.4930	0.4428
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2748	0.3234
	Second	0.2066	0.2374
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2784	0.3202
	Second	0.2158	0.2326
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3298	0.3798
	Second	0.2530	0.2798
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6060	0.6734
	Second	0.4568	0.4908
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4256	0.4762
	Second	0.3216	0.3394
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3588	0.3992
	Second	0.2804	0.2898
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2744	0.3076
	Second	0.2152	0.2314
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3622	0.3562
	Second	0.2794	0.2620
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2160	0.2070
	Second	0.1708	0.1550
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2598	0.2310
	Second	0.2086	0.1742
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1030	0.0704
	Second	0.0926	0.0684
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2792	0.2722
	Second	0.2168	0.1988
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5002	0.5010
	Second	0.3746	0.3734
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3402	0.3114
	Second	0.2590	0.2360
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4948	0.4918
	Second	0.3842	0.3666
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4346	0.4614
	Second	0.3252	0.3310
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.6916	0.6938
	Second	0.5278	0.5264

Table D.16. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0482	0.0534
	Second	0.0444	0.0516
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3692	0.3480
	Second	0.3180	0.3038
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3226	0.3350
	Second	0.2714	0.2816
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.3190	0.2840
	Second	0.2772	0.2466
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3846	0.3598
	Second	0.3334	0.3092
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3140	0.3266
	Second	0.2816	0.2744
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.3334	0.2924
	Second	0.2832	0.2534
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.4178	0.4424
	Second	0.3636	0.3748
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4334	0.3982
	Second	0.3898	0.3492
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.4748	0.4314
	Second	0.4054	0.3720
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.6362	0.6388
	Second	0.5596	0.5608
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7474	0.7318
	Second	0.6652	0.6556
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.5798	0.5392
	Second	0.5060	0.4594
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.6922	0.6738
	Second	0.6118	0.5878
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.7276	0.7244
	Second	0.6498	0.6432
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.6334	0.6620
	Second	0.5546	0.5766
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.5826	0.5346
	Second	0.5040	0.4646
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2594	0.2888
	Second	0.2158	0.2490
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2440	0.2830
	Second	0.2178	0.2474
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3064	0.3510
	Second	0.2730	0.3048
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5564	0.6306
	Second	0.4934	0.5522
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3544	0.4258
	Second	0.3116	0.3500
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3276	0.3656
	Second	0.2832	0.3108
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2592	0.2922
	Second	0.2228	0.2536
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3262	0.3146
	Second	0.2890	0.2768
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1880	0.1918
	Second	0.1618	0.1722
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2356	0.2062
	Second	0.1966	0.1814
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0960	0.0736
	Second	0.0912	0.0712
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2586	0.2598
	Second	0.2280	0.2284
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4478	0.4692
	Second	0.3864	0.3988
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2928	0.2704
	Second	0.2636	0.2418
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4508	0.4380
	Second	0.3878	0.3744
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4074	0.4146
	Second	0.3422	0.3608
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.6348	0.6370
	Second	0.5610	0.5578

Table D.17. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0520
	Second	0.0498	0.0508
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4514	0.4416
	Second	0.3474	0.3238
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3856	0.3974
	Second	0.2906	0.3042
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.3872	0.3496
	Second	0.2894	0.2660
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4590	0.4242
	Second	0.3446	0.3224
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4022	0.4004
	Second	0.2940	0.2930
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.4030	0.3496
	Second	0.3054	0.2614
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.5164	0.5144
	Second	0.3994	0.3828
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5050	0.4986
	Second	0.3928	0.3660
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.5664	0.5430
	Second	0.4458	0.4012
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.7430	0.7474
	Second	0.5910	0.5858
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8514	0.8336
	Second	0.7098	0.6708
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6852	0.6560
	Second	0.5452	0.4982
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.7936	0.7854
	Second	0.6458	0.6334
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8410	0.8378
	Second	0.6922	0.6858
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.7428	0.7634
	Second	0.5754	0.5960
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.7012	0.6578
	Second	0.5534	0.5006
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3074	0.3396
	Second	0.2330	0.2630
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3006	0.3510
	Second	0.2300	0.2724
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3708	0.4026
	Second	0.2740	0.3086
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6574	0.7372
	Second	0.5102	0.5740
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4542	0.5232
	Second	0.3450	0.3876
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3900	0.4528
	Second	0.2980	0.3448
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3044	0.3426
	Second	0.2438	0.2572
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3912	0.3968
	Second	0.2996	0.2998
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2304	0.2168
	Second	0.1878	0.1716
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2824	0.2532
	Second	0.2154	0.1976
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0966	0.0786
	Second	0.0902	0.0690
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3158	0.3072
	Second	0.2374	0.2386
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5708	0.5656
	Second	0.4276	0.4184
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3608	0.3370
	Second	0.2742	0.2594
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5540	0.5300
	Second	0.4280	0.4010
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4886	0.5092
	Second	0.3742	0.3860
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.7424	0.7558
	Second	0.5894	0.5920

Table D.18. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0464	0.0530
	Second	0.0494	0.0506
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5700	0.5384
	Second	0.3758	0.3500
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4958	0.4904
	Second	0.3322	0.3230
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.4896	0.4504
	Second	0.3198	0.2986
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5838	0.5534
	Second	0.3802	0.3692
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5074	0.5118
	Second	0.3362	0.3442
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.5098	0.4442
	Second	0.3320	0.3030
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.6630	0.6500
	Second	0.4384	0.4470
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6548	0.6372
	Second	0.4488	0.4248
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.6964	0.6692
	Second	0.4828	0.4506
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.8696	0.8824
	Second	0.6462	0.6544
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9444	0.9252
	Second	0.7730	0.7400
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8220	0.7812
	Second	0.6084	0.5520
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9014	0.9048
	Second	0.6924	0.6884
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9350	0.9362
	Second	0.7500	0.7388
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.8688	0.8902
	Second	0.6512	0.6784
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8308	0.7864
	Second	0.6080	0.5732
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3844	0.4592
	Second	0.2532	0.3014
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3916	0.4534
	Second	0.2546	0.2940
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4844	0.5280
	Second	0.3134	0.3490
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7966	0.8654
	Second	0.5632	0.6490
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5738	0.6456
	Second	0.3738	0.4520
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4976	0.5794
	Second	0.3274	0.3870
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3864	0.4594
	Second	0.2588	0.3018
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4930	0.5100
	Second	0.3166	0.3362
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3004	0.2708
	Second	0.2018	0.1924
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3554	0.3194
	Second	0.2346	0.2148
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1162	0.0810
	Second	0.0910	0.0706
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3992	0.3872
	Second	0.2680	0.2588
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6810	0.6986
	Second	0.4716	0.4820
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4630	0.4426
	Second	0.3136	0.2980
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6902	0.6850
	Second	0.4610	0.4842
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6214	0.6452
	Second	0.4160	0.4274
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8656	0.8662
	Second	0.6584	0.6442

Table D.19. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0456
	Second	0.0538	0.0496
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4886	0.4920
	Second	0.4194	0.4090
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4452	0.4610
	Second	0.3718	0.3958
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.4442	0.3916
	Second	0.3812	0.3282
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5224	0.4834
	Second	0.4394	0.4188
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4384	0.4532
	Second	0.3778	0.3864
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.4476	0.4174
	Second	0.3794	0.3376
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.5712	0.5648
	Second	0.4962	0.4720
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5824	0.5624
	Second	0.4974	0.4764
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.6482	0.5844
	Second	0.5720	0.5050
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.8164	0.8186
	Second	0.7336	0.7262
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9056	0.8850
	Second	0.8328	0.8160
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.7606	0.7112
	Second	0.6744	0.6296
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.8462	0.8434
	Second	0.7690	0.7656
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8874	0.8830
	Second	0.8136	0.8056
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.8118	0.8248
	Second	0.7294	0.7408
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.7644	0.7216
	Second	0.6788	0.6286
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3430	0.4042
	Second	0.2968	0.3400
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3596	0.4048
	Second	0.3046	0.3440
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4102	0.4636
	Second	0.3534	0.4026
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7340	0.8046
	Second	0.6440	0.7106
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5028	0.5766
	Second	0.4226	0.4864
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4438	0.4916
	Second	0.3742	0.4236
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3388	0.3950
	Second	0.2982	0.3164
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4546	0.4520
	Second	0.3754	0.3810
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2742	0.2484
	Second	0.2328	0.2002
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3218	0.2648
	Second	0.2638	0.2272
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1092	0.0786
	Second	0.0990	0.0710
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3432	0.3446
	Second	0.2966	0.2876
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6092	0.6498
	Second	0.5304	0.5546
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4114	0.3832
	Second	0.3504	0.3268
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6272	0.5866
	Second	0.5242	0.5126
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5518	0.5650
	Second	0.4672	0.4782
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8060	0.8132
	Second	0.7198	0.7276

Table D.20. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0494	0.0476
	Second	0.0516	0.0516
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6104	0.5942
	Second	0.4438	0.4352
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5436	0.5408
	Second	0.3928	0.3920
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.5476	0.4812
	Second	0.3930	0.3440
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6314	0.5970
	Second	0.4644	0.4338
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5396	0.5562
	Second	0.3884	0.4002
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.5452	0.4850
	Second	0.4000	0.3578
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.6976	0.6876
	Second	0.5134	0.5054
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6940	0.6798
	Second	0.5168	0.5066
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.7578	0.7008
	Second	0.5762	0.5212
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9050	0.9070
	Second	0.7408	0.7450
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9630	0.9562
	Second	0.8514	0.8364
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8702	0.8278
	Second	0.6974	0.6474
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9332	0.9228
	Second	0.7950	0.7832
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9498	0.9536
	Second	0.8412	0.8326
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.8988	0.9172
	Second	0.7532	0.7618
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8560	0.8278
	Second	0.6836	0.6436
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4228	0.4790
	Second	0.3180	0.3374
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4354	0.4844
	Second	0.3246	0.3486
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4942	0.5776
	Second	0.3582	0.7106
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8390	0.8908
	Second	0.6630	0.7352
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6304	0.7028
	Second	0.4626	0.5166
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5494	0.6096
	Second	0.4066	0.4474
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4406	0.4848
	Second	0.3176	0.3416
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5392	0.5616
	Second	0.3928	0.4124
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3240	0.3090
	Second	0.2354	0.2314
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3846	0.3456
	Second	0.2730	0.2504
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1182	0.0838
	Second	0.0974	0.0794
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4306	0.4240
	Second	0.3204	0.2980
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7314	0.7516
	Second	0.5498	0.5740
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4992	0.4648
	Second	0.3636	0.3276
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7256	0.7080
	Second	0.5512	0.5294
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6654	0.6688
	Second	0.5034	0.4984
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8864	0.9112
	Second	0.7356	0.7564

Table D.21. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0468	0.0540
	Second	0.0494	0.0536
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.7478	0.7218
	Second	0.4984	0.4524
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6730	0.6764
	Second	0.4312	0.4254
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.6744	0.6056
	Second	0.4244	0.3742
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.7510	0.7292
	Second	0.4970	0.4638
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6712	0.6810
	Second	0.4212	0.4218
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.6850	0.6134
	Second	0.4264	0.3776
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.8310	0.8276
	Second	0.5672	0.5552
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8334	0.8066
	Second	0.5746	0.5304
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.8706	0.8420
	Second	0.6182	0.5686
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9648	0.9700
	Second	0.7886	0.7850
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9944	0.9914
	Second	0.8844	0.8706
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9450	0.9244
	Second	0.7252	0.6928
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9810	0.9830
	Second	0.8310	0.8320
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9894	0.9896
	Second	0.8750	0.8670
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9706	0.9760
	Second	0.7806	0.8006
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9460	0.9218
	Second	0.7366	0.6792
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5448	0.6116
	Second	0.3388	0.3730
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5440	0.6094
	Second	0.3306	0.3804
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6334	0.7122
	Second	0.3982	0.4498
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9362	0.9686
	Second	0.7044	0.7824
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7518	0.8168
	Second	0.4948	0.5408
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6740	0.7472
	Second	0.4238	0.4836
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5332	0.6046
	Second	0.3204	0.3682
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6846	0.6850
	Second	0.4380	0.4280
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4008	0.3970
	Second	0.2484	0.2412
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4870	0.4484
	Second	0.3040	0.2766
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1326	0.0874
	Second	0.1046	0.0754
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5480	0.5364
	Second	0.3406	0.3260
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8480	0.8608
	Second	0.5756	0.5952
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.6380	0.5806
	Second	0.3948	0.3560
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8540	0.8328
	Second	0.5904	0.5652
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7926	0.7990
	Second	0.5306	0.5310
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9704	0.9728
	Second	0.7862	0.7900

Table D.22. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0532	0.0494
	Second	0.0482	0.0490
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5902	0.5568
	Second	0.5172	0.4694
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5202	0.5294
	Second	0.4360	0.4448
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.5306	0.4562
	Second	0.4406	0.3862
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5896	0.5676
	Second	0.5140	0.4802
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5112	0.5198
	Second	0.4276	0.4350
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.5100	0.4650
	Second	0.4356	0.3820
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.6640	0.6798
	Second	0.5702	0.5732
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6598	0.6510
	Second	0.5668	0.5514
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.7396	0.6762
	Second	0.6458	0.5790
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.8830	0.8844
	Second	0.8076	0.8100
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9534	0.9386
	Second	0.9106	0.8852
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8424	0.7898
	Second	0.7516	0.6982
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9192	0.9140
	Second	0.8446	0.8382
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9388	0.9518
	Second	0.8890	0.8870
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.8756	0.8932
	Second	0.7930	0.8170
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8438	0.7948
	Second	0.7528	0.7022
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4054	0.4596
	Second	0.3362	0.3916
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4032	0.4782
	Second	0.3432	0.4006
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4728	0.5432
	Second	0.4088	0.4528
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8216	0.8736
	Second	0.7298	0.7956
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5894	0.6490
	Second	0.5078	0.5574
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5226	0.5868
	Second	0.4454	0.5042
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3980	0.4484
	Second	0.3398	0.3788
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5268	0.5240
	Second	0.4336	0.4374
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2942	0.2884
	Second	0.2508	0.2422
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3648	0.3274
	Second	0.3112	0.2788
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1186	0.0806
	Second	0.1130	0.0728
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4026	0.3986
	Second	0.3536	0.3354
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6938	0.7230
	Second	0.5988	0.6304
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4758	0.4390
	Second	0.3950	0.3728
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7108	0.6788
	Second	0.6074	0.5880
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6288	0.6424
	Second	0.5456	0.5478
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8808	0.8926
	Second	0.8046	0.8158

Table D.23. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0506
	Second	0.0534	0.0514
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.7042	0.6746
	Second	0.5286	0.4956
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6198	0.6400
	Second	0.4530	0.4586
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.6216	0.5626
	Second	0.4560	0.3878
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.7104	0.6802
	Second	0.5240	0.4818
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6294	0.6206
	Second	0.4594	0.4510
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.6242	0.5724
	Second	0.4472	0.4056
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.7800	0.7832
	Second	0.5932	0.5954
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7792	0.7542
	Second	0.5824	0.5616
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.8300	0.7972
	Second	0.6564	0.5998
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9508	0.9506
	Second	0.8128	0.8198
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9868	0.9848
	Second	0.9100	0.8944
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9150	0.8860
	Second	0.7654	0.7166
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9670	0.9714
	Second	0.8586	0.8564
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9810	0.9814
	Second	0.8966	0.8936
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9424	0.9560
	Second	0.8150	0.8342
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9274	0.8966
	Second	0.7666	0.7328
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4902	0.5538
	Second	0.3502	0.3954
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5068	0.5710
	Second	0.3574	0.4170
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5860	0.6596
	Second	0.4184	0.4822
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9084	0.9436
	Second	0.7484	0.8096
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7068	0.7784
	Second	0.5140	0.6074
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6354	0.7028
	Second	0.4540	0.5142
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4864	0.5682
	Second	0.3474	0.4098
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6120	0.6366
	Second	0.4554	0.4576
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3636	0.3430
	Second	0.2662	0.2464
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4568	0.4004
	Second	0.3266	0.2836
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1378	0.0912
	Second	0.1178	0.0836
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4966	0.4890
	Second	0.3578	0.3572
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8122	0.8362
	Second	0.6340	0.6482
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5960	0.5380
	Second	0.4274	0.3910
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8222	0.7958
	Second	0.6322	0.5992
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7458	0.7476
	Second	0.5656	0.5684
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9514	0.9502
	Second	0.8164	0.8188

Table D.24. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0442	0.0434
	Second	0.0462	0.0470
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.8402	0.8122
	Second	0.5606	0.5230
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.7624	0.7684
	Second	0.4896	0.4738
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.7570	0.6968
	Second	0.4836	0.4286
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.8396	0.8050
	Second	0.5660	0.5350
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7612	0.7708
	Second	0.4886	0.4910
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.7500	0.6930
	Second	0.4730	0.4252
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.8970	0.8988
	Second	0.6206	0.6212
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.9006	0.8802
	Second	0.6360	0.5896
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.9352	0.8998
	Second	0.6902	0.6378
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9898	0.9878
	Second	0.8516	0.8610
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9988	0.9982
	Second	0.9352	0.9114
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9790	0.9702
	Second	0.8058	0.7590
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9964	0.9944
	Second	0.8986	0.8822
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9970	0.9986
	Second	0.9168	0.9178
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9914	0.9924
	Second	0.8598	0.8664
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9804	0.9618
	Second	0.7986	0.7558
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6192	0.7102
	Second	0.3624	0.4452
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6276	0.6954
	Second	0.3804	0.4192
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7148	0.7968
	Second	0.4426	0.5100
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9706	0.9886
	Second	0.7808	0.8430
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8294	0.8962
	Second	0.5544	0.6372
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7650	0.8262
	Second	0.4956	0.5442
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6184	0.7096
	Second	0.3798	0.4250
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7680	0.7650
	Second	0.4826	0.4788
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4846	0.4440
	Second	0.2944	0.2714
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5696	0.4986
	Second	0.3382	0.3072
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1522	0.0954
	Second	0.1062	0.0770
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.6328	0.6110
	Second	0.3926	0.3758
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9188	0.9310
	Second	0.6606	0.6806
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.7226	0.6776
	Second	0.4448	0.4076
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9128	0.9116
	Second	0.6626	0.6452
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8668	0.8734
	Second	0.5896	0.5960
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9910	0.9906
	Second	0.8490	0.8484

Table D.25. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0524	0.0516
	Second	0.0532	0.0554
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2092	0.1942
	Second	0.1944	0.1742
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.1790	0.1912
	Second	0.1690	0.1790
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.1788	0.1700
	Second	0.1644	0.1610
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2072	0.2008
	Second	0.1826	0.1924
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.1792	0.1754
	Second	0.1628	0.1670
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.1774	0.1672
	Second	0.1640	0.1590
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.2400	0.2366
	Second	0.2110	0.2266
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2286	0.2238
	Second	0.1994	0.2040
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.2576	0.2344
	Second	0.2256	0.2148
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.3470	0.3542
	Second	0.3108	0.3216
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.4156	0.4034
	Second	0.3720	0.3716
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.3128	0.2816
	Second	0.2856	0.2544
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.3746	0.3774
	Second	0.3344	0.3406
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.3940	0.3982
	Second	0.3536	0.3526
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.3454	0.3536
	Second	0.3206	0.3174
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.3056	0.2818
	Second	0.2852	0.2612
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.1430	0.1604
	Second	0.1352	0.1480
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.1458	0.1694
	Second	0.1360	0.1610
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.1746	0.1884
	Second	0.1628	0.1756
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.2898	0.3306
	Second	0.2726	0.2978
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1996	0.2268
	Second	0.1822	0.2102
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1784	0.2056
	Second	0.1574	0.1914
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1450	0.1802
	Second	0.1330	0.1652
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1812	0.1894
	Second	0.1772	0.1694
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1206	0.1164
	Second	0.1218	0.1192
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1464	0.1324
	Second	0.1382	0.1262
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0704	0.0640
	Second	0.0624	0.0640
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.1548	0.1458
	Second	0.1372	0.1500
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2438	0.2462
	Second	0.2226	0.2282
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.1768	0.1636
	Second	0.1602	0.1492
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2404	0.2294
	Second	0.2158	0.2232
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2252	0.2210
	Second	0.1984	0.1948
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.3450	0.3496
	Second	0.3196	0.3088

Table D.26. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0508
	Second	0.0506	0.0488
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2482	0.2182
	Second	0.1940	0.1832
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2144	0.2178
	Second	0.1766	0.1784
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.2194	0.1850
	Second	0.1848	0.1592
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2382	0.2382
	Second	0.1938	0.1896
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2218	0.2222
	Second	0.1802	0.1858
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.2216	0.2016
	Second	0.1742	0.1700
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.2798	0.2638
	Second	0.2242	0.2122
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2744	0.2818
	Second	0.2284	0.2232
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.3152	0.2904
	Second	0.2504	0.2316
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.4084	0.4176
	Second	0.3230	0.3412
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5160	0.4888
	Second	0.4088	0.3952
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.3860	0.3582
	Second	0.3056	0.2878
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.4442	0.4462
	Second	0.3516	0.3358
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.4944	0.4890
	Second	0.3942	0.3902
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.4210	0.4380
	Second	0.3280	0.3420
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.3728	0.3508
	Second	0.3012	0.2836
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.1710	0.1922
	Second	0.1480	0.1554
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.1772	0.1954
	Second	0.1464	0.1614
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.1966	0.2348
	Second	0.1648	0.1896
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.3668	0.3958
	Second	0.2904	0.3106
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2460	0.2662
	Second	0.1938	0.2150
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2222	0.2326
	Second	0.1840	0.1920
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1630	0.2048
	Second	0.1386	0.1664
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2124	0.2154
	Second	0.1764	0.1676
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1428	0.1360
	Second	0.1188	0.1172
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1614	0.1526
	Second	0.1374	0.1298
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0822	0.0668
	Second	0.0708	0.0656
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.1814	0.1766
	Second	0.1466	0.1456
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2928	0.3002
	Second	0.2296	0.2452
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2160	0.1894
	Second	0.1770	0.1604
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3070	0.2934
	Second	0.2374	0.2338
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2680	0.2746
	Second	0.2136	0.2234
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.4254	0.4300
	Second	0.3474	0.3440

Table D.27. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0486	0.0490
	Second	0.0548	0.0500
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3118	0.2940
	Second	0.2462	0.2238
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2658	0.2694
	Second	0.2098	0.1996
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.2632	0.2342
	Second	0.2038	0.1774
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3008	0.2914
	Second	0.2298	0.2110
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2630	0.2766
	Second	0.2016	0.2074
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.2760	0.2396
	Second	0.2178	0.1812
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.3510	0.3402
	Second	0.2666	0.2522
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3570	0.3394
	Second	0.2688	0.2446
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.3884	0.3584
	Second	0.2984	0.2660
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.5250	0.5318
	Second	0.3948	0.3924
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6278	0.6100
	Second	0.4862	0.4462
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.4834	0.4444
	Second	0.3704	0.3240
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.5784	0.5806
	Second	0.4340	0.4286
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.6166	0.6346
	Second	0.4716	0.4570
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.5288	0.5374
	Second	0.4012	0.4044
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.4836	0.4438
	Second	0.3664	0.3384
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2162	0.2378
	Second	0.1730	0.1762
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2232	0.2456
	Second	0.1774	0.1878
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2480	0.2700
	Second	0.1974	0.2132
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.4578	0.5288
	Second	0.3444	0.3882
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3072	0.3538
	Second	0.2342	0.2514
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2700	0.2982
	Second	0.2082	0.2242
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2138	0.2452
	Second	0.1656	0.1888
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2746	0.2698
	Second	0.2168	0.1954
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1678	0.1590
	Second	0.1406	0.1316
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1966	0.1786
	Second	0.1590	0.1438
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0826	0.0652
	Second	0.0798	0.0634
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2172	0.2198
	Second	0.1732	0.1728
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3666	0.3990
	Second	0.2838	0.2936
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2544	0.2460
	Second	0.2022	0.1864
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3734	0.3732
	Second	0.2790	0.2690
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3450	0.3662
	Second	0.2596	0.2586
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.5342	0.5298
	Second	0.4094	0.3882

Table D.28. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0468	0.0488
	Second	0.0468	0.0424
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2828	0.2636
	Second	0.2428	0.2258
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2522	0.2416
	Second	0.2172	0.2106
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.2458	0.2216
	Second	0.2160	0.1968
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2906	0.2730
	Second	0.2582	0.2334
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2442	0.2568
	Second	0.2168	0.2202
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.2502	0.2294
	Second	0.2066	0.1988
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.3182	0.3162
	Second	0.2912	0.2700
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3194	0.3206
	Second	0.2916	0.2762
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.3686	0.3280
	Second	0.3230	0.2682
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.4792	0.4922
	Second	0.4278	0.4230
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5896	0.5710
	Second	0.5124	0.5054
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.4438	0.4090
	Second	0.3784	0.3630
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.5228	0.5190
	Second	0.4556	0.4426
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.5714	0.5692
	Second	0.5094	0.4930
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.4772	0.5068
	Second	0.4168	0.4282
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.4430	0.4064
	Second	0.3792	0.3566
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2068	0.2262
	Second	0.1768	0.1978
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.1980	0.2198
	Second	0.1718	0.1872
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2340	0.2558
	Second	0.1934	0.2298
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.4194	0.4706
	Second	0.3630	0.4046
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2924	0.3270
	Second	0.2480	0.2926
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2372	0.2826
	Second	0.2178	0.2406
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1984	0.2108
	Second	0.1782	0.1918
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2490	0.2514
	Second	0.2142	0.2148
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1670	0.1538
	Second	0.1512	0.1378
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1906	0.1722
	Second	0.1736	0.1556
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0782	0.0650
	Second	0.0776	0.0676
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2110	0.2074
	Second	0.1934	0.1780
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3364	0.3608
	Second	0.2872	0.3066
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2334	0.2208
	Second	0.2038	0.1942
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3366	0.3248
	Second	0.2948	0.2862
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3000	0.3102
	Second	0.2594	0.2662
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.4894	0.4872
	Second	0.4228	0.4204

Table D.29. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0472
	Second	0.0506	0.0484
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3450	0.3292
	Second	0.2716	0.2478
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2966	0.3110
	Second	0.2298	0.2366
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.3006	0.2820
	Second	0.2364	0.2132
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3448	0.3316
	Second	0.2676	0.2404
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3046	0.3132
	Second	0.2302	0.2328
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.2968	0.2674
	Second	0.2294	0.2084
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.3978	0.3872
	Second	0.3036	0.2916
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3944	0.3890
	Second	0.3004	0.2978
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.4326	0.4130
	Second	0.3362	0.3100
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.5878	0.6006
	Second	0.4556	0.4412
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6940	0.6746
	Second	0.5454	0.5170
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.5492	0.5080
	Second	0.4138	0.3736
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.6380	0.6346
	Second	0.4834	0.4784
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.6764	0.6796
	Second	0.5284	0.5250
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.5808	0.6106
	Second	0.4594	0.4536
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.5460	0.5022
	Second	0.4244	0.3668
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2404	0.2790
	Second	0.1924	0.2056
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2450	0.2674
	Second	0.1924	0.2090
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2778	0.3054
	Second	0.2096	0.2324
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5198	0.5854
	Second	0.3864	0.4448
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3484	0.3982
	Second	0.2568	0.2972
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3120	0.3352
	Second	0.2280	0.2452
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2398	0.2682
	Second	0.1908	0.1974
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3082	0.3114
	Second	0.2304	0.2298
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1850	0.1806
	Second	0.1558	0.1476
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2210	0.1990
	Second	0.1820	0.1620
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0850	0.0676
	Second	0.0800	0.0622
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2410	0.2306
	Second	0.1986	0.1828
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4056	0.4410
	Second	0.3130	0.3284
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2714	0.2600
	Second	0.2136	0.1998
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4234	0.3948
	Second	0.3304	0.2972
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3644	0.3932
	Second	0.2744	0.2956
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.5808	0.5976
	Second	0.4564	0.4524

Table D.30. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0500
	Second	0.0530	0.0500
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4296	0.4168
	Second	0.2766	0.2854
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3832	0.3890
	Second	0.2510	0.2532
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.3926	0.3408
	Second	0.2592	0.2288
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4362	0.4218
	Second	0.2914	0.2784
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3784	0.3760
	Second	0.2464	0.2506
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.3840	0.3388
	Second	0.2518	0.2164
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.5132	0.5056
	Second	0.3366	0.3422
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5192	0.4798
	Second	0.3410	0.3204
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.5568	0.5216
	Second	0.3680	0.3456
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.7262	0.7234
	Second	0.5112	0.4860
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8370	0.8066
	Second	0.6116	0.5886
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6680	0.6326
	Second	0.4510	0.4310
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.7794	0.7758
	Second	0.5530	0.5492
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8284	0.8154
	Second	0.5922	0.5966
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.7198	0.7428
	Second	0.4974	0.5192
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6756	0.6326
	Second	0.4526	0.4280
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2988	0.3370
	Second	0.2062	0.2356
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2950	0.3404
	Second	0.2040	0.2240
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3462	0.4012
	Second	0.2316	0.2632
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6444	0.7080
	Second	0.4390	0.4908
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4334	0.4866
	Second	0.2888	0.3332
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3922	0.4336
	Second	0.2560	0.2888
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2908	0.3246
	Second	0.2012	0.2178
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3910	0.3972
	Second	0.2558	0.2684
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2360	0.2228
	Second	0.1624	0.1648
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2726	0.2410
	Second	0.1844	0.1746
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0960	0.0776
	Second	0.0780	0.0710
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3082	0.3026
	Second	0.2150	0.2144
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5168	0.5576
	Second	0.3430	0.3766
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3700	0.3324
	Second	0.2452	0.2228
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5354	0.5132
	Second	0.3506	0.3480
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4676	0.4906
	Second	0.3116	0.3192
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.7198	0.7220
	Second	0.4904	0.5120

Table D.31. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0530	0.0468
	Second	0.0420	0.0478
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3784	0.3698
	Second	0.3190	0.3128
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3344	0.3296
	Second	0.2878	0.2874
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.3434	0.2998
	Second	0.2846	0.2518
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3854	0.3786
	Second	0.3330	0.3322
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3322	0.3404
	Second	0.2868	0.2886
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.3390	0.2994
	Second	0.2852	0.2582
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.4418	0.4420
	Second	0.3720	0.3776
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4418	0.4208
	Second	0.3436	0.3664
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.4916	0.4624
	Second	0.4296	0.3896
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.6456	0.6574
	Second	0.5618	0.5598
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7766	0.7438
	Second	0.6778	0.6442
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6044	0.5572
	Second	0.5236	0.4822
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.6956	0.6970
	Second	0.5974	0.6094
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.7510	0.7572
	Second	0.6588	0.6620
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.6578	0.6718
	Second	0.5728	0.5820
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6174	0.5606
	Second	0.5202	0.4736
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.2672	0.3010
	Second	0.2292	0.2514
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2632	0.2920
	Second	0.2250	0.2536
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3144	0.3654
	Second	0.2678	0.3050
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5712	0.6548
	Second	0.4894	0.5502
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3912	0.4432
	Second	0.3364	0.3672
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3344	0.3824
	Second	0.2916	0.3296
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2590	0.2862
	Second	0.2284	0.2462
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3376	0.3388
	Second	0.2950	0.2988
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2122	0.1900
	Second	0.1862	0.1656
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2508	0.2212
	Second	0.2198	0.1942
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.0958	0.0816
	Second	0.0918	0.0670
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.2700	0.2676
	Second	0.2346	0.2282
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4506	0.4868
	Second	0.3884	0.4152
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3118	0.2822
	Second	0.2696	0.2460
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4758	0.4578
	Second	0.3980	0.3806
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4220	0.4392
	Second	0.3614	0.3656
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.6552	0.6712
	Second	0.5682	0.5740

Table D.32. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0508	0.0464
	Second	0.0490	0.0492
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4820	0.4484
	Second	0.3426	0.3246
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4236	0.4150
	Second	0.3040	0.2876
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.4142	0.3584
	Second	0.3058	0.2688
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4696	0.4508
	Second	0.3478	0.3360
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4196	0.4208
	Second	0.2960	0.3100
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.4094	0.3648
	Second	0.3022	0.2668
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.5372	0.5460
	Second	0.3986	0.4004
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5382	0.5182
	Second	0.3940	0.3828
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.6136	0.5492
	Second	0.4612	0.4028
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.7652	0.7612
	Second	0.5832	0.5828
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8708	0.8544
	Second	0.7030	0.6776
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.7224	0.6622
	Second	0.5400	0.4970
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.8190	0.8066
	Second	0.6374	0.6374
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8624	0.8494
	Second	0.6808	0.6724
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.7774	0.7772
	Second	0.5968	0.6096
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.7180	0.6806
	Second	0.5414	0.5032
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3240	0.3672
	Second	0.2394	0.2648
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3422	0.3720
	Second	0.2550	0.2682
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3822	0.4322
	Second	0.2716	0.3130
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6998	0.7592
	Second	0.5266	0.5890
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4630	0.5428
	Second	0.3372	0.3830
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4062	0.4812
	Second	0.2958	0.3406
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3216	0.3580
	Second	0.2442	0.2520
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4154	0.4196
	Second	0.2976	0.2968
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2400	0.2272
	Second	0.1922	0.1842
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2924	0.2580
	Second	0.2082	0.1936
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1008	0.0750
	Second	0.0856	0.0654
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3348	0.3176
	Second	0.2400	0.2284
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5614	0.5878
	Second	0.4186	0.4236
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3796	0.3502
	Second	0.2762	0.2646
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5752	0.5500
	Second	0.4082	0.3894
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5170	0.5102
	Second	0.3728	0.3708
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.7672	0.7760
	Second	0.5924	0.5872

Table D.33. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0538	0.0476
	Second	0.0544	0.0488
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6186	0.5600
	Second	0.3716	0.3462
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5260	0.5302
	Second	0.3300	0.3250
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.5264	0.4778
	Second	0.3178	0.2944
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5936	0.5700
	Second	0.3706	0.3466
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5290	0.5264
	Second	0.3278	0.3324
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.5230	0.4724
	Second	0.3124	0.2926
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.6726	0.6772
	Second	0.4284	0.4180
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6830	0.6572
	Second	0.4346	0.3984
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.7406	0.6758
	Second	0.4830	0.4192
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.8820	0.8898
	Second	0.6320	0.6310
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9544	0.9406
	Second	0.7480	0.7168
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8354	0.8020
	Second	0.5740	0.5358
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9230	0.9170
	Second	0.6806	0.6660
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9446	0.9484
	Second	0.7368	0.7274
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.8856	0.8952
	Second	0.6332	0.6504
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8450	0.8052
	Second	0.5732	0.5250
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4084	0.4430
	Second	0.2470	0.2660
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4204	0.4718
	Second	0.2662	0.2844
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4884	0.5570
	Second	0.3062	0.3338
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8122	0.8772
	Second	0.5554	0.6124
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6090	0.6656
	Second	0.3784	0.4062
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5310	0.6028
	Second	0.3314	0.3746
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4036	0.4604
	Second	0.2440	0.2832
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5300	0.5224
	Second	0.3348	0.3074
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3014	0.2952
	Second	0.1914	0.1918
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3728	0.3344
	Second	0.2336	0.2142
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1218	0.0876
	Second	0.0934	0.0756
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4224	0.4074
	Second	0.2594	0.2492
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6944	0.7182
	Second	0.4484	0.4672
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4840	0.4504
	Second	0.2934	0.2760
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7140	0.6976
	Second	0.4676	0.4360
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6280	0.6572
	Second	0.3942	0.4142
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8940	0.8920
	Second	0.6284	0.6400

Table D.34. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0476	0.0550
	Second	0.0514	0.0466
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4486	0.4314
	Second	0.3824	0.3616
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3958	0.3986
	Second	0.3414	0.3388
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.3966	0.3412
	Second	0.3388	0.3036
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4502	0.4328
	Second	0.3760	0.3642
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3926	0.3898
	Second	0.3306	0.3312
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.3922	0.3504
	Second	0.3316	0.2938
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.5144	0.5044
	Second	0.4362	0.4216
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5132	0.5022
	Second	0.4366	0.4256
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.5634	0.5206
	Second	0.4818	0.4524
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.7558	0.7364
	Second	0.6656	0.6476
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8412	0.8318
	Second	0.7640	0.7418
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6934	0.6416
	Second	0.5982	0.5500
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.7952	0.7834
	Second	0.6926	0.6856
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.8226	0.8338
	Second	0.7408	0.7420
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.7262	0.7532
	Second	0.6364	0.6602
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.6910	0.6370
	Second	0.5942	0.5550
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3062	0.3600
	Second	0.2674	0.2952
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3020	0.3516
	Second	0.2638	0.2934
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3710	0.4172
	Second	0.3104	0.3502
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6644	0.7384
	Second	0.5728	0.6474
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4546	0.5070
	Second	0.3834	0.4246
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3974	0.4398
	Second	0.3354	0.3736
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3038	0.3460
	Second	0.2562	0.2894
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3924	0.3882
	Second	0.3268	0.3298
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2346	0.2232
	Second	0.2054	0.1840
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2732	0.2500
	Second	0.2356	0.2140
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1028	0.0760
	Second	0.0952	0.0692
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3196	0.3136
	Second	0.2666	0.2700
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5408	0.5696
	Second	0.4562	0.4690
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3628	0.3374
	Second	0.3052	0.2728
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5444	0.5316
	Second	0.4566	0.4586
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4832	0.5012
	Second	0.4164	0.4234
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.7400	0.7512
	Second	0.6454	0.6516

Table D.35. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0500	0.0434
	Second	0.0476	0.0446
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.5432	0.5264
	Second	0.3852	0.3718
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4678	0.4826
	Second	0.3338	0.3414
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.4892	0.4362
	Second	0.3520	0.3042
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.5550	0.5338
	Second	0.3882	0.3740
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4832	0.4932
	Second	0.3494	0.3386
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.4796	0.4222
	Second	0.3386	0.3002
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.6300	0.6098
	Second	0.4606	0.4410
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6280	0.6058
	Second	0.4570	0.4398
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.6742	0.6438
	Second	0.4890	0.4676
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.8522	0.8440
	Second	0.6696	0.6632
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9270	0.9108
	Second	0.7770	0.7444
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.7956	0.7506
	Second	0.6192	0.5612
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.8842	0.8772
	Second	0.7192	0.7080
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9118	0.9130
	Second	0.7578	0.7562
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.8404	0.8630
	Second	0.6650	0.6778
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.8018	0.7596
	Second	0.6084	0.5750
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.3626	0.4258
	Second	0.2596	0.3030
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3742	0.4278
	Second	0.2752	0.3028
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4532	0.5108
	Second	0.3136	0.3568
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7674	0.8330
	Second	0.5868	0.6426
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5570	0.6318
	Second	0.3916	0.4512
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4762	0.5502
	Second	0.3318	0.3958
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3788	0.4130
	Second	0.2710	0.2982
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4796	0.4810
	Second	0.3404	0.3478
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2730	0.2606
	Second	0.2042	0.1968
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3310	0.2910
	Second	0.2330	0.2158
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1144	0.0828
	Second	0.0934	0.0756
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.3862	0.3792
	Second	0.2816	0.2736
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6544	0.6856
	Second	0.4792	0.4968
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4438	0.4042
	Second	0.3128	0.2982
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6696	0.6452
	Second	0.4990	0.4846
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5964	0.5978
	Second	0.4318	0.4320
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.8388	0.8470
	Second	0.6542	0.6630

Table D.36. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 2: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0530
	Second	0.0462	0.0476
(0.0 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6754	0.6554
	Second	0.4118	0.3932
(0.2 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.6060	0.6052
	Second	0.3686	0.3598
(0.0 , 0.6 , 0.2 , 0.2 , 0.2)	First	0.5924	0.5338
	Second	0.3572	0.3160
(0.0 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6872	0.6510
	Second	0.4184	0.3922
(0.2 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.6026	0.6126
	Second	0.3682	0.3726
(0.0 , 0.6 , 0.4 , 0.4 , 0.2)	First	0.6070	0.5452
	Second	0.3716	0.3280
(0.2 , 0.6 , 0.4 , 0.4 , 0.0)	First	0.7640	0.7516
	Second	0.4902	0.4936
(0.0 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7578	0.7432
	Second	0.4848	0.4680
(0.0 , 0.7 , 0.4 , 0.2 , 0.2)	First	0.8230	0.7696
	Second	0.5336	0.4852
(0.2 , 0.7 , 0.4 , 0.0 , 0.0)	First	0.9402	0.9398
	Second	0.7008	0.6934
(0.0 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9806	0.9710
	Second	0.8074	0.7824
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9098	0.8766
	Second	0.6522	0.6090
(0.2 , 0.8 , 0.6 , 0.4 , 0.0)	First	0.9586	0.9560
	Second	0.7444	0.7306
(0.2 , 0.8 , 0.6 , 0.2 , 0.0)	First	0.9760	0.9736
	Second	0.7908	0.7794
(0.4 , 0.8 , 0.4 , 0.2 , 0.0)	First	0.9382	0.9422
	Second	0.6864	0.7092
(0.0 , 0.8 , 0.6 , 0.4 , 0.2)	First	0.9076	0.8740
	Second	0.6576	0.5952
(0.5 , 0.5 , 0.0 , 0.0 , 0.0)	First	0.4764	0.5400
	Second	0.2946	0.3124
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4866	0.5432
	Second	0.2944	0.3230
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5576	0.6360
	Second	0.3384	0.3878
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8806	0.9364
	Second	0.6344	0.6800
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6938	0.7516
	Second	0.4368	0.4810
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6110	0.6760
	Second	0.3660	0.4100
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4882	0.5378
	Second	0.2872	0.3244
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5956	0.6026
	Second	0.3714	0.3546
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3682	0.3356
	Second	0.2250	0.2148
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4254	0.3710
	Second	0.2556	0.2254
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1414	0.0906
	Second	0.1004	0.0766
(0.2 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.4956	0.4728
	Second	0.2972	0.2812
(0.2 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7922	0.8164
	Second	0.5044	0.5192
(0.0 , 0.5 , 0.5 , 0.2 , 0.2)	First	0.5682	0.5302
	Second	0.3462	0.3120
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7872	0.7822
	Second	0.5152	0.4990
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7236	0.7388
	Second	0.4506	0.4684
(0.2 , 0.7 , 0.7 , 0.3 , 0.0)	First	0.9500	0.9400
	Second	0.7138	0.6970

APPENDIX E. 5 TREATMENTS WITH PEAK AT 3

Table E.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0486
	Second	0.0528	0.0506
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.4544	0.4600
	Second	0.4052	0.4076
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.3450	0.3554
	Second	0.2990	0.3178
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3460	0.3562
	Second	0.2890	0.3154
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.5158	0.4930
	Second	0.4524	0.4376
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.7356	0.7100
	Second	0.6686	0.6528
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.6172	0.6136
	Second	0.5510	0.5550
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.6316	0.6280
	Second	0.5612	0.5540
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.6662	0.6596
	Second	0.5932	0.6006
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4720	0.4776
	Second	0.4102	0.4274
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4852	0.4884
	Second	0.4260	0.4414
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3706	0.3870
	Second	0.3394	0.3502
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.6724	0.6832
	Second	0.6278	0.6160
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.6894	0.6952
	Second	0.6216	0.6356
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4722	0.4832
	Second	0.4166	0.4410
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3542	0.3652
	Second	0.3152	0.3264
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1872	0.1952
	Second	0.1754	0.1728
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1824	0.1818
	Second	0.1746	0.1658
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1738	0.1726
	Second	0.1504	0.1534
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1728	0.1836
	Second	0.1560	0.1552
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1966	0.1896
	Second	0.1682	0.1746
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1910	0.1884
	Second	0.1624	0.1674

Table E.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0484	0.0494
	Second	0.0494	0.0506
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.5848	0.5896
	Second	0.4556	0.4550
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.4246	0.4414
	Second	0.3294	0.3444
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4374	0.4388
	Second	0.3466	0.3394
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.6266	0.6212
	Second	0.4984	0.4834
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.8476	0.8468
	Second	0.7330	0.7144
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.7518	0.7322
	Second	0.6202	0.5932
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.7440	0.7328
	Second	0.6190	0.5994
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.7924	0.7870
	Second	0.6692	0.6480
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5900	0.5866
	Second	0.4696	0.4582
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6018	0.5984
	Second	0.4864	0.4592
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4626	0.4606
	Second	0.3624	0.3568
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8126	0.8124
	Second	0.6846	0.6716
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.8036	0.8066
	Second	0.6780	0.6762
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5740	0.5832
	Second	0.4636	0.4624
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4452	0.4496
	Second	0.3684	0.3578
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2324	0.2222
	Second	0.1826	0.1866
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2138	0.2200
	Second	0.1802	0.1866
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2178	0.2082
	Second	0.1718	0.1556
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2038	0.2054
	Second	0.1704	0.1634
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2268	0.2240
	Second	0.1836	0.1856
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2286	0.2218
	Second	0.1824	0.1806

Table E.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0472	0.0544
	Second	0.0462	0.0504
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.7420	0.7446
	Second	0.5330	0.5586
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.5726	0.5946
	Second	0.3968	0.4284
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.5676	0.5838
	Second	0.4070	0.4230
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.7714	0.7554
	Second	0.5862	0.5794
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9482	0.9388
	Second	0.8134	0.8078
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.8770	0.8700
	Second	0.7040	0.7056
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.8768	0.8700
	Second	0.7058	0.7148
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9118	0.9082
	Second	0.7566	0.7562
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7248	0.7332
	Second	0.5392	0.5566
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7488	0.7516
	Second	0.5636	0.5760
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6008	0.6018
	Second	0.4348	0.4302
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9114	0.9174
	Second	0.7594	0.7790
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9196	0.9140
	Second	0.7666	0.7750
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7234	0.7410
	Second	0.5452	0.5698
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5672	0.5730
	Second	0.4096	0.4250
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2842	0.2776
	Second	0.2072	0.2104
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2830	0.2904
	Second	0.2060	0.2142
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2686	0.2658
	Second	0.1798	0.1930
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2778	0.2656
	Second	0.1834	0.1970
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3054	0.2914
	Second	0.2162	0.2250
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2956	0.2980
	Second	0.2136	0.2166

Table E.4. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0544	0.0462
	Second	0.0536	0.0490
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.6760	0.6912
	Second	0.5934	0.5972
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.5246	0.5298
	Second	0.4582	0.4484
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.5190	0.5292
	Second	0.4458	0.4524
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.7146	0.7130
	Second	0.6284	0.6274
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9132	0.9078
	Second	0.8598	0.8454
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.8402	0.8216
	Second	0.7610	0.7486
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.8350	0.8308
	Second	0.7606	0.7588
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.8740	0.8666
	Second	0.8010	0.8010
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6710	0.6748
	Second	0.5928	0.5936
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6972	0.6886
	Second	0.6138	0.6094
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5444	0.5480
	Second	0.4716	0.4766
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8706	0.8918
	Second	0.7998	0.8164
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.8794	0.8808
	Second	0.8114	0.8096
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6660	0.6654
	Second	0.5804	0.5878
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5222	0.5232
	Second	0.4558	0.4594
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2568	0.2494
	Second	0.2302	0.2278
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2556	0.2548
	Second	0.2176	0.2322
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2518	0.2448
	Second	0.2182	0.2058
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2488	0.2542
	Second	0.2144	0.2142
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2782	0.2708
	Second	0.2414	0.2252
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2686	0.2670
	Second	0.2390	0.2240

Table E.5. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0526	0.0532
	Second	0.0504	0.0520
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.8104	0.8154
	Second	0.6454	0.6360
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.6384	0.6378
	Second	0.4794	0.4880
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.6502	0.6364
	Second	0.4910	0.4680
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.8372	0.8318
	Second	0.6822	0.6760
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9678	0.9604
	Second	0.8832	0.8768
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9192	0.9240
	Second	0.8012	0.7826
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9228	0.9176
	Second	0.7860	0.7904
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9474	0.9484
	Second	0.8404	0.8314
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7888	0.7912
	Second	0.6280	0.6332
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8100	0.8022
	Second	0.6398	0.6308
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6472	0.6620
	Second	0.5114	0.5164
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9468	0.9506
	Second	0.8388	0.8340
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9484	0.9572
	Second	0.8350	0.8494
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7722	0.7900
	Second	0.6236	0.6272
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6112	0.6382
	Second	0.4756	0.4802
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3220	0.3122
	Second	0.2568	0.2408
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3114	0.3100
	Second	0.2352	0.2392
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3024	0.3060
	Second	0.2322	0.2210
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2962	0.3102
	Second	0.2072	0.2192
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3392	0.3340
	Second	0.2456	0.2396
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3334	0.3202
	Second	0.2502	0.2482

Table E.6. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0578
	Second	0.0470	0.0538
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.9194	0.9288
	Second	0.7140	0.7250
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.7872	0.7982
	Second	0.5434	0.5616
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.7882	0.7908
	Second	0.5356	0.5402
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.9308	0.9426
	Second	0.7342	0.7406
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9944	0.9936
	Second	0.9218	0.9208
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9768	0.9766
	Second	0.8444	0.8322
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9818	0.9766
	Second	0.8520	0.8348
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9908	0.9864
	Second	0.8910	0.8770
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9058	0.9158
	Second	0.6826	0.7018
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9044	0.9142
	Second	0.7084	0.7142
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7914	0.7850
	Second	0.5592	0.5520
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9882	0.9898
	Second	0.8890	0.8956
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9850	0.9878
	Second	0.8922	0.8990
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8896	0.9056
	Second	0.6732	0.6954
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7514	0.7766
	Second	0.5384	0.5406
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3932	0.3982
	Second	0.2506	0.2624
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3958	0.4044
	Second	0.2654	0.2676
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3968	0.4116
	Second	0.2432	0.2582
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3864	0.3972
	Second	0.2368	0.2644
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4294	0.4358
	Second	0.2842	0.2766
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.4298	0.4292
	Second	0.2744	0.2794

Table E.7. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 8, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0492	0.0500
	Second	0.0512	0.0526
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.8690	0.8650
	Second	0.7916	0.7786
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.7162	0.7224
	Second	0.6204	0.6176
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.7200	0.7120
	Second	0.6094	0.6314
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.8848	0.8816
	Second	0.8088	0.7976
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9874	0.9840
	Second	0.9670	0.9576
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9620	0.9546
	Second	0.9168	0.9044
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9570	0.9580
	Second	0.9056	0.9008
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9738	0.9682
	Second	0.9380	0.9258
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8526	0.8582
	Second	0.7732	0.7662
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8610	0.8650
	Second	0.7842	0.7768
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7162	0.7236
	Second	0.6288	0.6314
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9724	0.9756
	Second	0.9436	0.9404
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9714	0.9714
	Second	0.9256	0.9312
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8324	0.8444
	Second	0.7482	0.7656
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6878	0.7104
	Second	0.6074	0.6108
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3490	0.3592
	Second	0.3014	0.2996
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3582	0.3636
	Second	0.3074	0.3000
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3510	0.3484
	Second	0.2834	0.2932
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3502	0.3474
	Second	0.2866	0.3012
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3754	0.3688
	Second	0.3200	0.3074
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3722	0.3706
	Second	0.3204	0.3112

Table E.8. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0450	0.0486
	Second	0.0414	0.0492
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.9474	0.9452
	Second	0.8116	0.8056
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.8394	0.8472
	Second	0.6384	0.6462
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.8318	0.8306
	Second	0.6470	0.6482
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.9600	0.9598
	Second	0.8342	0.8314
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9982	0.9968
	Second	0.9676	0.9670
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9896	0.9872
	Second	0.9252	0.9180
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9868	0.9896
	Second	0.9242	0.9176
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9924	0.9920
	Second	0.9524	0.9380
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9356	0.9334
	Second	0.7952	0.7912
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9376	0.9408
	Second	0.8168	0.8028
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8312	0.8364
	Second	0.6568	0.6558
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9946	0.9944
	Second	0.9494	0.9424
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9948	0.9922
	Second	0.9462	0.9528
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.9152	0.9292
	Second	0.7672	0.7856
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.8108	0.8072
	Second	0.6342	0.6432
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4496	0.4426
	Second	0.3152	0.3030
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4410	0.4486
	Second	0.3124	0.3254
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4220	0.4354
	Second	0.2902	0.2966
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4206	0.4404
	Second	0.2972	0.3092
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4708	0.4682
	Second	0.3400	0.3254
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.4816	0.4630
	Second	0.3478	0.3252

Table E.9. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0512	0.0498
	Second	0.0514	0.0530
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.9894	0.9918
	Second	0.8500	0.8494
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.9378	0.9316
	Second	0.6928	0.6866
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.9378	0.9404
	Second	0.6880	0.7052
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.9936	0.9906
	Second	0.8722	0.8616
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9998	1.0000
	Second	0.9822	0.9780
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9986	0.9994
	Second	0.9454	0.9400
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9984	0.9986
	Second	0.9430	0.9398
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9996	0.9992
	Second	0.9652	0.9538
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9810	0.9846
	Second	0.8300	0.8300
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9888	0.9862
	Second	0.8406	0.8516
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9402	0.9360
	Second	0.7008	0.6972
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9994	0.9994
	Second	0.9650	0.9674
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9998	0.9998
	Second	0.9676	0.9680
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.9796	0.9774
	Second	0.8116	0.8188
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.9110	0.9242
	Second	0.6642	0.6678
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.5576	0.5664
	Second	0.3460	0.3392
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5532	0.5684
	Second	0.3400	0.3460
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5578	0.5664
	Second	0.3274	0.3268
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5578	0.5550
	Second	0.3236	0.3204
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6076	0.5912
	Second	0.3782	0.3508
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5944	0.6048
	Second	0.3644	0.3614

Table E.10. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 10, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0464	0.0496
	Second	0.0452	0.0492
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.9336	0.9282
	Second	0.8604	0.8634
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.8004	0.8094
	Second	0.7134	0.7048
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.8000	0.8162
	Second	0.7050	0.7170
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.9418	0.9408
	Second	0.8826	0.8758
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9964	0.9966
	Second	0.9842	0.9800
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9854	0.9850
	Second	0.9528	0.9534
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9826	0.9794
	Second	0.9524	0.9456
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9946	0.9878
	Second	0.9710	0.9712
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9148	0.9188
	Second	0.8566	0.8450
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9258	0.9292
	Second	0.8534	0.8500
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8186	0.8220
	Second	0.7256	0.7252
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9926	0.9916
	Second	0.9714	0.9732
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9918	0.9904
	Second	0.9710	0.9740
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8938	0.9048
	Second	0.8268	0.8290
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7692	0.7860
	Second	0.6770	0.6884
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4156	0.4144
	Second	0.3570	0.3432
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4262	0.4162
	Second	0.3616	0.3496
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4044	0.4258
	Second	0.3444	0.3358
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4146	0.4142
	Second	0.3396	0.3396
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4616	0.4406
	Second	0.3784	0.3688
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.4356	0.4416
	Second	0.3758	0.3642

Table E.11. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0464
	Second	0.0480	0.0534
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.9760	0.9764
	Second	0.8794	0.8828
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.9074	0.9002
	Second	0.7366	0.7138
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.9004	0.8980
	Second	0.7266	0.7312
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.9810	0.9782
	Second	0.8938	0.8922
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9994	0.9996
	Second	0.9886	0.9882
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9972	0.9960
	Second	0.9596	0.9552
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9978	0.9966
	Second	0.9618	0.9620
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9986	0.9988
	Second	0.9774	0.9750
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9748	0.9680
	Second	0.8672	0.8624
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9698	0.9756
	Second	0.8712	0.8714
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9010	0.9064
	Second	0.7470	0.7396
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9994	0.9986
	Second	0.9768	0.9756
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9984	0.9996
	Second	0.9746	0.9772
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.9662	0.9700
	Second	0.8466	0.8482
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.8734	0.8838
	Second	0.7118	0.7176
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.5026	0.5144
	Second	0.3506	0.3638
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4992	0.5274
	Second	0.3608	0.3624
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5010	0.5044
	Second	0.3450	0.3498
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5124	0.5300
	Second	0.3464	0.3556
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5466	0.5386
	Second	0.3920	0.3792
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5340	0.5516
	Second	0.3916	0.3726

Table E.12. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 3: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0476	0.0538
	Second	0.0484	0.0528
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.9982	0.9974
	Second	0.9108	0.9014
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.9746	0.9704
	Second	0.7654	0.7594
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.9744	0.9722
	Second	0.7594	0.7670
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.9978	0.9976
	Second	0.9202	0.9244
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	1.0000	1.0000
	Second	0.9932	0.9936
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9994	1.0000
	Second	0.9680	0.9666
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9998	0.9996
	Second	0.9732	0.9712
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	1.0000	1.0000
	Second	0.9862	0.9844
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.9942	0.9962
	Second	0.8834	0.8940
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9940	0.9968
	Second	0.8964	0.9002
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.9738	0.9758
	Second	0.7756	0.7796
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	1.0000	1.0000
	Second	0.9828	0.9838
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9998	1.0000
	Second	0.9832	0.9856
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.9914	0.9946
	Second	0.8714	0.8800
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.9544	0.9610
	Second	0.7330	0.7438
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.6294	0.6418
	Second	0.3748	0.3928
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6378	0.6468
	Second	0.3798	0.3806
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6472	0.6514
	Second	0.3668	0.3852
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.6504	0.6580
	Second	0.3700	0.3882
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6780	0.6840
	Second	0.4026	0.4096
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.6796	0.6846
	Second	0.4140	0.4206

Table E.13. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 3, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0542	0.0448
	Second	0.0504	0.0432
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.2834	0.2934
	Second	0.2512	0.2630
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.2160	0.2234
	Second	0.1884	0.2126
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2178	0.2234
	Second	0.1984	0.2064
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.3052	0.3030
	Second	0.2652	0.2676
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.4592	0.4602
	Second	0.4030	0.4194
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.3816	0.3706
	Second	0.3364	0.3396
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.3790	0.3830
	Second	0.3250	0.3470
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.4112	0.4138
	Second	0.3652	0.3718
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2926	0.2968
	Second	0.2582	0.2662
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2946	0.3018
	Second	0.2566	0.2704
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2156	0.2198
	Second	0.1890	0.2078
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.4546	0.4644
	Second	0.4008	0.4094
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.4498	0.4554
	Second	0.3986	0.4174
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2876	0.2930
	Second	0.2544	0.2604
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2098	0.2242
	Second	0.1956	0.2096
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1338	0.1300
	Second	0.1216	0.1206
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1322	0.1310
	Second	0.1176	0.1296
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1268	0.1396
	Second	0.1150	0.1246
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1368	0.1362
	Second	0.1194	0.1278
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1346	0.1316
	Second	0.1196	0.1272
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1280	0.1224
	Second	0.1230	0.1226

Table E.14. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 6, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0528	0.0488
	Second	0.0588	0.0460
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.3718	0.3668
	Second	0.2958	0.2858
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.2648	0.2688
	Second	0.2146	0.2158
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2680	0.2664
	Second	0.2092	0.2136
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.3584	0.3620
	Second	0.2832	0.2952
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.5550	0.5598
	Second	0.4472	0.4554
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.4468	0.4562
	Second	0.3596	0.3582
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.4664	0.4702
	Second	0.3664	0.3650
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.5056	0.4978
	Second	0.4048	0.3976
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3568	0.3670
	Second	0.2898	0.2788
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3532	0.3534
	Second	0.2824	0.2830
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2728	0.2618
	Second	0.2186	0.2164
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.5498	0.5510
	Second	0.4372	0.4280
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.5494	0.5534
	Second	0.4436	0.4448
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3486	0.3560
	Second	0.2742	0.2798
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2624	0.2614
	Second	0.2138	0.2070
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1594	0.1540
	Second	0.1388	0.1262
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1566	0.1538
	Second	0.1314	0.1240
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1512	0.1494
	Second	0.1232	0.1286
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1522	0.1642
	Second	0.1276	0.1352
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1516	0.1576
	Second	0.1346	0.1316
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1642	0.1488
	Second	0.1376	0.1296

Table E.15. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0466	0.0514
	Second	0.0506	0.0534
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.4580	0.4522
	Second	0.3368	0.3380
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.3406	0.3454
	Second	0.2488	0.2556
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3446	0.3488
	Second	0.2474	0.2552
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.4622	0.4582
	Second	0.3392	0.3410
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.7020	0.6850
	Second	0.5320	0.5236
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.5774	0.5850
	Second	0.4180	0.4342
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.5610	0.5882
	Second	0.4096	0.4410
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.6404	0.6336
	Second	0.4706	0.4784
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4544	0.4626
	Second	0.3304	0.3558
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4684	0.4762
	Second	0.3354	0.3538
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3338	0.3462
	Second	0.2446	0.2564
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.6904	0.6942
	Second	0.5086	0.5344
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.6924	0.6824
	Second	0.5024	0.5290
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4542	0.4540
	Second	0.3332	0.3464
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3372	0.3480
	Second	0.2496	0.2548
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1792	0.1786
	Second	0.1352	0.1458
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1878	0.1900
	Second	0.1472	0.1606
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1826	0.1914
	Second	0.1396	0.1516
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1714	0.1872
	Second	0.1306	0.1440
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1908	0.1914
	Second	0.1432	0.1566
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1846	0.1842
	Second	0.1494	0.1504

Table E.16. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0498	0.0520
	Second	0.0544	0.0528
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.4050	0.4268
	Second	0.3564	0.3646
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.3090	0.3122
	Second	0.2678	0.2708
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3102	0.3100
	Second	0.2700	0.2774
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.4150	0.4212
	Second	0.3470	0.3630
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.6524	0.6468
	Second	0.5728	0.5768
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.5336	0.5350
	Second	0.4744	0.4678
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.5344	0.5340
	Second	0.4732	0.4692
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.5766	0.5822
	Second	0.5054	0.5122
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3984	0.4100
	Second	0.3428	0.3542
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4300	0.4272
	Second	0.3704	0.3638
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3090	0.2950
	Second	0.2678	0.2642
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.6328	0.6464
	Second	0.5664	0.5628
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.6360	0.6368
	Second	0.5630	0.5718
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4154	0.4108
	Second	0.3596	0.3624
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2998	0.3012
	Second	0.2712	0.2662
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1694	0.1732
	Second	0.1570	0.1536
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1750	0.1730
	Second	0.1564	0.1584
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1674	0.1726
	Second	0.1416	0.1548
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1678	0.1708
	Second	0.1528	0.1486
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1754	0.1664
	Second	0.1620	0.1556
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1688	0.1690
	Second	0.1600	0.1612

Table E.17. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0476
	Second	0.0496	0.0464
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.5106	0.5074
	Second	0.3944	0.3880
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.3820	0.3778
	Second	0.2906	0.2866
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3742	0.3906
	Second	0.2916	0.2852
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.5052	0.5230
	Second	0.3844	0.3932
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.7594	0.7604
	Second	0.6020	0.6122
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.6402	0.6468
	Second	0.4996	0.4954
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.6410	0.6378
	Second	0.4962	0.4866
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.6850	0.6846
	Second	0.5366	0.5362
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5126	0.5138
	Second	0.3902	0.3838
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5118	0.5228
	Second	0.3834	0.3824
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3724	0.3720
	Second	0.2782	0.2806
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.7442	0.7556
	Second	0.5946	0.5954
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.7468	0.7492
	Second	0.5942	0.5866
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5178	0.4962
	Second	0.3928	0.3768
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3612	0.3806
	Second	0.2928	0.2882
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1972	0.2116
	Second	0.1598	0.1724
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2080	0.2032
	Second	0.1734	0.1642
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2062	0.2000
	Second	0.1686	0.1652
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2086	0.2082
	Second	0.1606	0.1610
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2074	0.2010
	Second	0.1614	0.1568
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1938	0.2030
	Second	0.1518	0.1572

Table E.18. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0476	0.0474
	Second	0.0498	0.0450
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.6404	0.6458
	Second	0.4314	0.4448
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.4786	0.4882
	Second	0.3106	0.3294
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4730	0.4870
	Second	0.3160	0.3174
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.6402	0.6504
	Second	0.4370	0.4538
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.8776	0.8782
	Second	0.6594	0.6688
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.7802	0.7822
	Second	0.5460	0.5598
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.7802	0.7760
	Second	0.5572	0.5404
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.8296	0.8292
	Second	0.5834	0.6052
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6386	0.6376
	Second	0.4326	0.4292
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6340	0.6500
	Second	0.4274	0.4444
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4732	0.4852
	Second	0.3128	0.3224
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8748	0.8754
	Second	0.6552	0.6576
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.8726	0.8726
	Second	0.6488	0.6516
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6292	0.6332
	Second	0.4174	0.4232
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4744	0.4818
	Second	0.3140	0.3134
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2628	0.2446
	Second	0.1800	0.1780
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2454	0.2632
	Second	0.1746	0.1768
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2474	0.2512
	Second	0.1740	0.1750
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2566	0.2574
	Second	0.1816	0.1894
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2486	0.2530
	Second	0.1732	0.1814
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2544	0.2480
	Second	0.1836	0.1808

Table E.19. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 8, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0484
	Second	0.0498	0.0540
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.5650	0.5682
	Second	0.4822	0.4878
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.4130	0.4270
	Second	0.3636	0.3600
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4292	0.4294
	Second	0.3624	0.3624
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.5626	0.5764
	Second	0.4794	0.4952
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.8284	0.8136
	Second	0.7282	0.7198
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.7134	0.6914
	Second	0.6156	0.6010
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.7092	0.7176
	Second	0.6122	0.6190
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.7636	0.7602
	Second	0.6732	0.6622
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5594	0.5616
	Second	0.4788	0.4874
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5654	0.5760
	Second	0.4832	0.4880
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4134	0.4186
	Second	0.3580	0.3590
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8084	0.8150
	Second	0.7226	0.7362
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.8078	0.8168
	Second	0.7218	0.7256
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5702	0.5558
	Second	0.4840	0.4714
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4208	0.4334
	Second	0.3544	0.3598
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2342	0.2284
	Second	0.1994	0.2006
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2268	0.2314
	Second	0.1974	0.1954
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2248	0.2214
	Second	0.2034	0.1880
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2290	0.2284
	Second	0.1856	0.1914
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2340	0.2288
	Second	0.2064	0.2022
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2246	0.2220
	Second	0.1984	0.1898

Table E.20. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0480	0.0556
	Second	0.0494	0.0534
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.6754	0.6864
	Second	0.4992	0.5030
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.5036	0.5280
	Second	0.3728	0.3856
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.5252	0.5218
	Second	0.3724	0.3720
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.6854	0.6812
	Second	0.5080	0.5180
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9126	0.9114
	Second	0.7650	0.7542
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.8136	0.8174
	Second	0.6340	0.6472
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.8134	0.8248
	Second	0.6430	0.6572
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.8530	0.8702
	Second	0.6924	0.7056
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6738	0.6856
	Second	0.5112	0.5012
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6680	0.6860
	Second	0.4958	0.5062
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5224	0.5182
	Second	0.3876	0.3738
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9018	0.9100
	Second	0.7492	0.7470
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9022	0.9080
	Second	0.7454	0.7500
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6764	0.6876
	Second	0.5070	0.5034
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5158	0.5344
	Second	0.3666	0.3808
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2776	0.2790
	Second	0.2060	0.1958
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2736	0.2620
	Second	0.1986	0.2020
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2666	0.2768
	Second	0.2022	0.2010
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2678	0.2752
	Second	0.2010	0.2040
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2760	0.2758
	Second	0.2012	0.1992
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2728	0.2818
	Second	0.1982	0.1994

Table E.21. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0540
	Second	0.0498	0.0460
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.8078	0.8264
	Second	0.5306	0.5536
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.6498	0.6498
	Second	0.3972	0.4040
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.6586	0.6496
	Second	0.4158	0.4066
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.7988	0.8114
	Second	0.5502	0.5452
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9754	0.9706
	Second	0.8100	0.7898
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9250	0.9190
	Second	0.6916	0.6878
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9176	0.9330
	Second	0.6788	0.6910
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9512	0.9508
	Second	0.7436	0.7282
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8238	0.8208
	Second	0.5498	0.5492
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8100	0.8142
	Second	0.5456	0.5592
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6514	0.6532
	Second	0.4056	0.4002
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9658	0.9702
	Second	0.7856	0.7906
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9746	0.9706
	Second	0.7974	0.7946
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8164	0.8118
	Second	0.5510	0.5424
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6614	0.6484
	Second	0.4182	0.4134
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3400	0.3552
	Second	0.2166	0.2140
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3448	0.3416
	Second	0.2268	0.2184
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3528	0.3396
	Second	0.2252	0.2234
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3382	0.3568
	Second	0.2152	0.2268
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3454	0.3404
	Second	0.2174	0.2062
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3412	0.3492
	Second	0.2158	0.2162

Table E.22. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0494	0.0514
	Second	0.0492	0.0558
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.6658	0.6546
	Second	0.5642	0.5640
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.4842	0.4610
	Second	0.4156	0.4122
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4890	0.5080
	Second	0.4194	0.4170
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.6444	0.6588
	Second	0.5674	0.5710
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.8808	0.8914
	Second	0.8138	0.8156
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.7954	0.7916
	Second	0.7030	0.6974
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.7882	0.7928
	Second	0.6938	0.7030
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.8392	0.8518
	Second	0.7666	0.7626
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6484	0.6600
	Second	0.5526	0.5670
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6588	0.6556
	Second	0.5726	0.5728
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4916	0.5042
	Second	0.4174	0.4166
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8782	0.8864
	Second	0.7994	0.8030
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.8908	0.8878
	Second	0.8130	0.8022
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6518	0.6554
	Second	0.5644	0.5664
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5020	0.4934
	Second	0.4294	0.4182
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2602	0.2642
	Second	0.2266	0.2164
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2620	0.2584
	Second	0.2206	0.2172
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2568	0.2562
	Second	0.2164	0.2262
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2526	0.2594
	Second	0.2176	0.2098
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2678	0.2580
	Second	0.2172	0.2234
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2630	0.2626
	Second	0.2206	0.2234

Table E.23. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 20, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0494	0.0478
	Second	0.0498	0.0520
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.7738	0.7776
	Second	0.5894	0.5900
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.6018	0.6146
	Second	0.4382	0.4328
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.5944	0.5954
	Second	0.4390	0.4250
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.7686	0.7666
	Second	0.5924	0.5890
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9554	0.9588
	Second	0.8290	0.8330
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.8850	0.8910
	Second	0.7212	0.7194
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.8804	0.8922
	Second	0.7106	0.7204
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9270	0.9236
	Second	0.7830	0.7804
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7684	0.7672
	Second	0.5810	0.5844
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7636	0.7644
	Second	0.5780	0.5772
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5880	0.6022
	Second	0.4250	0.4266
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9502	0.9520
	Second	0.8224	0.8186
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9498	0.9572
	Second	0.8198	0.8190
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7644	0.7692
	Second	0.5710	0.5786
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5906	0.6002
	Second	0.4296	0.4248
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3246	0.3180
	Second	0.2350	0.2278
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3200	0.3178
	Second	0.2410	0.2282
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3046	0.3186
	Second	0.2270	0.2326
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3082	0.3198
	Second	0.2228	0.2276
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3176	0.3168
	Second	0.2414	0.2316
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3064	0.3304
	Second	0.2368	0.2308

Table E.24. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 3: Blocks= 40, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0518	0.0526
	Second	0.0476	0.0492
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.8780	0.8906
	Second	0.5970	0.6204
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.7256	0.7310
	Second	0.4566	0.4490
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.7412	0.7302
	Second	0.4468	0.4518
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.8894	0.8880
	Second	0.6120	0.6172
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9910	0.9926
	Second	0.8526	0.8578
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.9610	0.9614
	Second	0.7480	0.7538
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.9642	0.9666
	Second	0.7620	0.7530
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9776	0.9784
	Second	0.8002	0.8180
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8864	0.8906
	Second	0.6142	0.6044
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.8844	0.8884
	Second	0.6138	0.6226
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7362	0.7348
	Second	0.4646	0.4600
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9904	0.9908
	Second	0.8450	0.8472
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9900	0.9910
	Second	0.8446	0.8624
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8802	0.8912
	Second	0.6094	0.6180
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7226	0.7412
	Second	0.4494	0.4714
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3996	0.4098
	Second	0.2378	0.2470
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4070	0.4092
	Second	0.2488	0.2434
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3984	0.4120
	Second	0.2388	0.2402
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4022	0.4076
	Second	0.2454	0.2456
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4004	0.4006
	Second	0.2462	0.2416
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3960	0.4032
	Second	0.2474	0.2498

Table E.25. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 3, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0534
	Second	0.0472	0.0544
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.2302	0.2220
	Second	0.2034	0.2054
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.1710	0.1750
	Second	0.1448	0.1610
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.1720	0.1782
	Second	0.1554	0.1668
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.2256	0.2354
	Second	0.2056	0.2166
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.3328	0.3418
	Second	0.2926	0.3092
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.3008	0.2786
	Second	0.2596	0.2594
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.2792	0.2948
	Second	0.2444	0.2584
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.3138	0.3086
	Second	0.2808	0.2912
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2212	0.2240
	Second	0.1922	0.2024
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2240	0.2278
	Second	0.2052	0.2214
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1706	0.1820
	Second	0.1538	0.1734
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.3528	0.3528
	Second	0.3178	0.3176
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.3412	0.3474
	Second	0.2994	0.3186
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2264	0.2266
	Second	0.2000	0.2012
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1748	0.1808
	Second	0.1626	0.1686
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1128	0.1142
	Second	0.1042	0.1054
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1148	0.1122
	Second	0.1122	0.1094
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1072	0.1190
	Second	0.1010	0.1098
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1118	0.1160
	Second	0.1016	0.1100
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1102	0.1140
	Second	0.1002	0.1004
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1240	0.1160
	Second	0.1120	0.1060

Table E.26. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0534	0.0512
	Second	0.0540	0.0486
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.2778	0.2786
	Second	0.2244	0.2210
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.2034	0.2090
	Second	0.1744	0.1820
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2106	0.1938
	Second	0.1762	0.1588
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.2638	0.2752
	Second	0.2254	0.2182
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.4204	0.4148
	Second	0.3364	0.3270
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.3320	0.3450
	Second	0.2658	0.2748
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.3322	0.3516
	Second	0.2726	0.2792
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.3802	0.3870
	Second	0.3070	0.3072
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2836	0.2634
	Second	0.2346	0.2144
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2822	0.2674
	Second	0.2302	0.2098
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2048	0.2090
	Second	0.1718	0.1724
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.4118	0.4178
	Second	0.3360	0.3264
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.4094	0.4236
	Second	0.3284	0.3348
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2624	0.2658
	Second	0.2174	0.2172
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2090	0.2150
	Second	0.1786	0.1776
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1326	0.1286
	Second	0.1154	0.1122
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1298	0.1290
	Second	0.1066	0.1154
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1264	0.1420
	Second	0.1152	0.1196
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1312	0.1304
	Second	0.1104	0.1090
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1278	0.1206
	Second	0.1126	0.1136
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1302	0.1300
	Second	0.1168	0.1088

Table E.27. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 12, n= 6.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0490	0.0456
	Second	0.0478	0.0500
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.3516	0.3570
	Second	0.2560	0.2712
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.2576	0.2706
	Second	0.1986	0.2084
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2626	0.2550
	Second	0.2008	0.1956
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.3414	0.3428
	Second	0.2520	0.2544
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.5514	0.5426
	Second	0.4030	0.4110
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.4434	0.4400
	Second	0.3140	0.3194
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.4320	0.4372
	Second	0.3092	0.3194
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.4846	0.4934
	Second	0.3480	0.3666
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3506	0.3500
	Second	0.2510	0.2588
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3348	0.3582
	Second	0.2380	0.2670
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2458	0.2738
	Second	0.1858	0.2156
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.5342	0.5488
	Second	0.3890	0.4052
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.5294	0.5244
	Second	0.3804	0.3992
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3484	0.3454
	Second	0.2526	0.2566
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2562	0.2658
	Second	0.1822	0.1968
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1542	0.1510
	Second	0.1242	0.1286
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1656	0.1618
	Second	0.1276	0.1308
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1632	0.1442
	Second	0.1268	0.1238
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1518	0.1464
	Second	0.1262	0.1212
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1486	0.1534
	Second	0.1138	0.1304
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1474	0.1532
	Second	0.1156	0.1318

Table E.28. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0470	0.0484
	Second	0.0510	0.0492
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.3158	0.3122
	Second	0.2756	0.2624
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.2290	0.2400
	Second	0.2004	0.2210
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2362	0.2396
	Second	0.2094	0.2138
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.2958	0.3238
	Second	0.2708	0.2782
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.5010	0.4908
	Second	0.4314	0.4364
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.3934	0.4040
	Second	0.3444	0.3522
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.4044	0.4054
	Second	0.3472	0.3438
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.4428	0.4588
	Second	0.3870	0.3948
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3154	0.3076
	Second	0.2770	0.2674
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3136	0.3142
	Second	0.2706	0.2720
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2352	0.2440
	Second	0.2130	0.2176
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.4856	0.4904
	Second	0.4232	0.4290
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.4986	0.4980
	Second	0.4358	0.4228
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3150	0.3112
	Second	0.2784	0.2704
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2414	0.2312
	Second	0.2120	0.2180
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1442	0.1472
	Second	0.1250	0.1334
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1396	0.1470
	Second	0.1284	0.1324
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1418	0.1368
	Second	0.1388	0.1210
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1400	0.1426
	Second	0.1292	0.1254
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1414	0.1422
	Second	0.1314	0.1258
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1406	0.1412
	Second	0.1302	0.1370

Table E.29. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0450	0.0498
	Second	0.0494	0.0528
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.3868	0.3850
	Second	0.2926	0.2758
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.2804	0.2778
	Second	0.2216	0.2106
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2862	0.2936
	Second	0.2254	0.2206
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.3894	0.3932
	Second	0.2940	0.2844
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.6090	0.6006
	Second	0.4624	0.4576
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.4954	0.4904
	Second	0.3726	0.3696
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.4874	0.4978
	Second	0.3740	0.3710
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.5402	0.5402
	Second	0.4218	0.4148
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3834	0.3910
	Second	0.2962	0.2988
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3928	0.3856
	Second	0.3090	0.2934
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2820	0.2832
	Second	0.2190	0.2144
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.5928	0.5972
	Second	0.4482	0.4492
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.5908	0.5836
	Second	0.4516	0.4518
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3674	0.3988
	Second	0.2826	0.3014
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2924	0.2782
	Second	0.2264	0.2104
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1678	0.1486
	Second	0.1304	0.1292
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1598	0.1554
	Second	0.1386	0.1306
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1584	0.1644
	Second	0.1288	0.1370
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1664	0.1638
	Second	0.1348	0.1344
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1678	0.1770
	Second	0.1394	0.1366
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1616	0.1638
	Second	0.1308	0.1354

Table E.30. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0486
	Second	0.0458	0.0516
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.4838	0.4900
	Second	0.3172	0.3256
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.3632	0.3700
	Second	0.2390	0.2482
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3598	0.3706
	Second	0.2448	0.2508
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.4918	0.4892
	Second	0.3384	0.3240
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.7248	0.7382
	Second	0.5104	0.5080
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.6204	0.6118
	Second	0.4086	0.4150
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.6268	0.6268
	Second	0.4244	0.4280
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.6746	0.6828
	Second	0.4532	0.4566
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4900	0.5102
	Second	0.3242	0.3306
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4940	0.5018
	Second	0.3284	0.3368
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3646	0.3672
	Second	0.2440	0.2526
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.7250	0.7316
	Second	0.4928	0.5092
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.7248	0.7168
	Second	0.5040	0.5008
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4920	0.5036
	Second	0.3296	0.3342
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3622	0.3610
	Second	0.2460	0.2492
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2098	0.1916
	Second	0.1526	0.1480
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1936	0.1998
	Second	0.1394	0.1442
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1984	0.1942
	Second	0.1330	0.1378
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1874	0.2090
	Second	0.1392	0.1540
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2058	0.1998
	Second	0.1514	0.1400
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1980	0.2046
	Second	0.1472	0.1460

Table E.31. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0458	0.0458
	Second	0.0514	0.0494
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.4328	0.4424
	Second	0.3702	0.3718
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.3196	0.3184
	Second	0.2720	0.2740
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3238	0.3182
	Second	0.2746	0.2676
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.4456	0.4406
	Second	0.3796	0.3828
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.6530	0.6562
	Second	0.5654	0.5692
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.5408	0.5578
	Second	0.4666	0.4670
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.5360	0.5578
	Second	0.4632	0.4764
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.6082	0.6124
	Second	0.5304	0.5198
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4316	0.4476
	Second	0.3662	0.3720
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4140	0.4436
	Second	0.3582	0.3670
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3216	0.3270
	Second	0.2712	0.2852
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.6528	0.6526
	Second	0.5570	0.5656
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.6624	0.6528
	Second	0.5604	0.5576
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4268	0.4342
	Second	0.3542	0.3640
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3260	0.3318
	Second	0.2758	0.2742
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1774	0.1796
	Second	0.1650	0.1636
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1800	0.1822
	Second	0.1684	0.1536
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1730	0.1750
	Second	0.1524	0.1524
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1766	0.1858
	Second	0.1586	0.1632
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.1704	0.1828
	Second	0.1508	0.1586
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1910	0.1884
	Second	0.1718	0.1670

Table E.32. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0490
	Second	0.0454	0.0446
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.5240	0.5352
	Second	0.3832	0.3796
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.3926	0.3918
	Second	0.2900	0.2920
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3932	0.3956
	Second	0.2852	0.2864
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.5326	0.5384
	Second	0.3812	0.3930
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.7752	0.7858
	Second	0.6052	0.6022
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.6750	0.6616
	Second	0.4984	0.4878
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.6610	0.6684
	Second	0.4982	0.4904
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.7334	0.7116
	Second	0.5414	0.5372
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5190	0.5348
	Second	0.3704	0.3964
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5224	0.5432
	Second	0.3866	0.3824
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3976	0.3902
	Second	0.2956	0.2840
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.7502	0.7772
	Second	0.5806	0.5906
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.7540	0.7768
	Second	0.5860	0.5970
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5258	0.5432
	Second	0.3842	0.3994
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3978	0.3986
	Second	0.2844	0.2864
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2076	0.2170
	Second	0.1612	0.1628
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2148	0.2156
	Second	0.1644	0.1596
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2112	0.2102
	Second	0.1604	0.1534
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2154	0.2180
	Second	0.1610	0.1634
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2150	0.2080
	Second	0.1624	0.1580
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2164	0.2278
	Second	0.1642	0.1690

Table E.33. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 32, n= 16.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0426	0.0448
	Second	0.0438	0.0500
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.6396	0.6732
	Second	0.4044	0.4278
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.4982	0.5106
	Second	0.3076	0.3168
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4972	0.5046
	Second	0.3174	0.3160
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.6566	0.6598
	Second	0.4030	0.4032
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.8926	0.8948
	Second	0.6394	0.6292
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.7892	0.7942
	Second	0.5282	0.5280
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.7960	0.7922
	Second	0.5416	0.5266
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.8468	0.8456
	Second	0.5740	0.5876
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6476	0.6678
	Second	0.4084	0.4154
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6596	0.6712
	Second	0.4256	0.4170
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5108	0.5086
	Second	0.3116	0.3076
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8882	0.8964
	Second	0.6266	0.6386
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.8832	0.8926
	Second	0.6296	0.6340
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6656	0.6588
	Second	0.4134	0.4240
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4992	0.4982
	Second	0.3038	0.3002
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2706	0.2690
	Second	0.1692	0.1706
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2630	0.2772
	Second	0.1782	0.1830
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2682	0.2686
	Second	0.1718	0.1696
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2678	0.2672
	Second	0.1746	0.1790
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2718	0.2544
	Second	0.1888	0.1694
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2668	0.2720
	Second	0.1822	0.1780

Table E.34. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0546	0.0540
	Second	0.0498	0.0492
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.5032	0.4972
	Second	0.4202	0.4194
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.3618	0.3758
	Second	0.3050	0.3102
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3758	0.3690
	Second	0.3264	0.3086
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.5044	0.5036
	Second	0.4212	0.4280
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.7354	0.7504
	Second	0.6346	0.6484
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.6362	0.6310
	Second	0.5474	0.5358
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.6208	0.6384
	Second	0.5414	0.5350
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.6854	0.6896
	Second	0.5850	0.5920
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.5072	0.5114
	Second	0.4248	0.4264
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5110	0.5170
	Second	0.4258	0.4312
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3850	0.3786
	Second	0.3190	0.3044
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.7296	0.7460
	Second	0.6418	0.6534
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.7316	0.7314
	Second	0.6516	0.6432
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5038	0.5048
	Second	0.4278	0.4240
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3690	0.3778
	Second	0.3198	0.3108
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2024	0.2100
	Second	0.1794	0.1760
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2032	0.2026
	Second	0.1742	0.1684
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.1970	0.2026
	Second	0.1716	0.1714
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2138	0.2128
	Second	0.1856	0.1834
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2006	0.2108
	Second	0.1814	0.1830
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2046	0.2010
	Second	0.1786	0.1760

Table E.35. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 20, n= 20.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0512	0.0542
	Second	0.0496	0.0522
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.6102	0.6048
	Second	0.4432	0.4408
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.4508	0.4704
	Second	0.3264	0.3294
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4572	0.4608
	Second	0.3270	0.3286
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.6114	0.6158
	Second	0.4456	0.4444
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.8582	0.8462
	Second	0.6628	0.6652
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.7416	0.7540
	Second	0.5602	0.5594
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.7380	0.7484
	Second	0.5602	0.5606
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.8052	0.8030
	Second	0.6190	0.6220
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6082	0.6112
	Second	0.4338	0.4388
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.6104	0.6216
	Second	0.4484	0.4454
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.4446	0.4608
	Second	0.3270	0.3376
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.8370	0.8490
	Second	0.6580	0.6706
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.8398	0.8466
	Second	0.6628	0.6770
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6008	0.6120
	Second	0.4330	0.4354
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4640	0.4674
	Second	0.3330	0.3330
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2418	0.2390
	Second	0.1868	0.1736
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2368	0.2444
	Second	0.1816	0.1788
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2438	0.2630
	Second	0.1872	0.1890
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2392	0.2422
	Second	0.1794	0.1900
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.2588	0.2368
	Second	0.1938	0.1780
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2374	0.2404
	Second	0.1938	0.1882

Table E.36. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 3: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0488	0.0502
	Second	0.0492	0.0514
(0.0 , 0.0 , 0.5 , 0.0 , 0.0)	First	0.7402	0.7614
	Second	0.4598	0.4778
(0.0 , 0.0 , 0.5 , 0.2 , 0.2)	First	0.5760	0.5762
	Second	0.3402	0.3380
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.5800	0.5914
	Second	0.3506	0.3510
(0.0 , 0.2 , 0.5 , 0.2 , 0.0)	First	0.7518	0.7386
	Second	0.4652	0.4734
(0.0 , 0.4 , 0.7 , 0.2 , 0.0)	First	0.9368	0.9354
	Second	0.7078	0.7078
(0.0 , 0.4 , 0.7 , 0.4 , 0.2)	First	0.8574	0.8686
	Second	0.5810	0.5970
(0.2 , 0.4 , 0.7 , 0.4 , 0.0)	First	0.8650	0.8764
	Second	0.5954	0.5950
(0.0 , 0.2 , 0.8 , 0.5 , 0.3)	First	0.9080	0.9144
	Second	0.6530	0.6530
(0.0 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7324	0.7448
	Second	0.4566	0.4592
(0.0 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.7446	0.7452
	Second	0.4654	0.4724
(0.2 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.5864	0.5810
	Second	0.3542	0.3412
(0.0 , 0.8 , 0.8 , 0.5 , 0.2)	First	0.9344	0.9484
	Second	0.6946	0.7138
(0.2 , 0.5 , 0.8 , 0.8 , 0.0)	First	0.9334	0.9402
	Second	0.6968	0.7020
(0.0 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7460	0.7498
	Second	0.4650	0.4726
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5796	0.5708
	Second	0.3604	0.3424
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3130	0.3080
	Second	0.1884	0.1920
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2866	0.3194
	Second	0.1852	0.1942
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2990	0.3170
	Second	0.1894	0.1946
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3092	0.3088
	Second	0.1910	0.1948
(0.5 , 0.5 , 0.5 , 0.2 , 0.0)	First	0.3068	0.3048
	Second	0.1914	0.1884
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2986	0.3120
	Second	0.1790	0.1922

APPENDIX F. 5 TREATMENTS WITH PEAK AT 4

Table F.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0546
	Second	0.0472	0.0594
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.4160	0.4014
	Second	0.3720	0.3544
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.3570	0.3570
	Second	0.3114	0.3190
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.3534	0.3260
	Second	0.3142	0.2792
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.4570	0.4274
	Second	0.4070	0.3886
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.4524	0.4608
	Second	0.4112	0.4158
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.3822	0.3556
	Second	0.3442	0.3240
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.5084	0.4990
	Second	0.4564	0.4448
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.5248	0.4900
	Second	0.4790	0.4476
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.5530	0.5088
	Second	0.4904	0.4598
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.7098	0.7170
	Second	0.6486	0.6466
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.8050	0.7822
	Second	0.7574	0.7260
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6700	0.6218
	Second	0.6050	0.5674
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.7692	0.7260
	Second	0.7084	0.6800
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.8004	0.7906
	Second	0.7462	0.7352
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.7234	0.7236
	Second	0.6646	0.6596
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6666	0.6180
	Second	0.6052	0.5598
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2598	0.3156
	Second	0.2300	0.2856
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3142	0.3462
	Second	0.2882	0.3156
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3598	0.4020
	Second	0.3228	0.3644
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.6374	0.6774
	Second	0.5730	0.6216
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4164	0.4764
	Second	0.3620	0.4326
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3820	0.4506
	Second	0.3418	0.4020
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2824	0.3260
	Second	0.2578	0.3008
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2702	0.2534
	Second	0.2550	0.2318
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2524	0.2356
	Second	0.2308	0.2274
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3774	0.3788
	Second	0.3328	0.3404
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0858	0.0754
	Second	0.0844	0.0778
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3128	0.2982
	Second	0.2798	0.2880
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.5270	0.5440
	Second	0.4722	0.5052
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3688	0.3428
	Second	0.3292	0.3076
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5400	0.5290
	Second	0.4950	0.4812
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4844	0.4912
	Second	0.4398	0.4458
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.7076	0.7074
	Second	0.6374	0.6562

Table F.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0584	0.0478
	Second	0.0514	0.0474
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.5112	0.4958
	Second	0.3934	0.3730
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.4592	0.4512
	Second	0.3468	0.3446
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.4604	0.4060
	Second	0.3442	0.3126
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.5674	0.5342
	Second	0.4544	0.4128
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.5634	0.5682
	Second	0.4322	0.4492
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.4944	0.4306
	Second	0.3836	0.3400
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.6402	0.6024
	Second	0.5102	0.4818
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.6272	0.5920
	Second	0.4986	0.4746
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.6894	0.6304
	Second	0.5458	0.5060
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.8294	0.8258
	Second	0.6980	0.6926
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9146	0.8822
	Second	0.8140	0.7696
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.7976	0.7366
	Second	0.6790	0.6090
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.8696	0.8460
	Second	0.7588	0.7266
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9070	0.8902
	Second	0.8020	0.7682
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.8400	0.8394
	Second	0.7188	0.7038
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.7936	0.7340
	Second	0.6502	0.5966
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3214	0.3930
	Second	0.2442	0.3026
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3764	0.4228
	Second	0.2882	0.3324
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.4532	0.5068
	Second	0.3366	0.3994
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.7412	0.7916
	Second	0.6148	0.6696
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5344	0.6016
	Second	0.4254	0.4790
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.4850	0.5458
	Second	0.3838	0.4374
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3460	0.4014
	Second	0.2788	0.3218
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3550	0.3014
	Second	0.2834	0.2540
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2932	0.2880
	Second	0.2402	0.2348
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4594	0.4666
	Second	0.3726	0.3624
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1042	0.0766
	Second	0.0886	0.0678
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3946	0.3812
	Second	0.3098	0.3030
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.6442	0.6512
	Second	0.5190	0.5158
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4430	0.4178
	Second	0.3478	0.3408
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6480	0.6228
	Second	0.5168	0.4910
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.5900	0.6074
	Second	0.4728	0.4836
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8282	0.8134
	Second	0.6932	0.6928

Table F.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0480	0.0546
	Second	0.0542	0.0502
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.6636	0.6424
	Second	0.4816	0.4548
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.5762	0.5984
	Second	0.4168	0.4318
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.5904	0.5312
	Second	0.4326	0.3880
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.7062	0.6696
	Second	0.5442	0.4970
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.7136	0.7064
	Second	0.5428	0.5268
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.6244	0.5740
	Second	0.4726	0.4280
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.7468	0.7490
	Second	0.5884	0.5758
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.7842	0.7384
	Second	0.6084	0.5498
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.8190	0.7668
	Second	0.6524	0.5800
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9332	0.9274
	Second	0.8070	0.7936
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9730	0.9642
	Second	0.8864	0.8488
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9092	0.8714
	Second	0.7660	0.7144
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9580	0.9398
	Second	0.8438	0.8110
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9718	0.9564
	Second	0.8744	0.8422
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9406	0.9320
	Second	0.8204	0.7974
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9070	0.8714
	Second	0.7622	0.7052
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.4408	0.5206
	Second	0.3218	0.3678
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.5002	0.5538
	Second	0.3716	0.3994
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.5616	0.6336
	Second	0.4134	0.4626
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.8708	0.9190
	Second	0.7240	0.7732
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.6584	0.7326
	Second	0.5162	0.5692
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5984	0.6710
	Second	0.4586	0.5080
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4400	0.5144
	Second	0.3396	0.3854
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4448	0.3992
	Second	0.3384	0.2946
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3704	0.3634
	Second	0.2880	0.2676
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5876	0.5832
	Second	0.4456	0.4294
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1136	0.0786
	Second	0.1006	0.0670
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4962	0.4890
	Second	0.3742	0.3544
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.7836	0.7888
	Second	0.6196	0.6134
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5736	0.5492
	Second	0.4230	0.4036
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7898	0.7662
	Second	0.6236	0.5948
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7206	0.7414
	Second	0.5652	0.5664
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9226	0.9162
	Second	0.7990	0.7802

Table F.4. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0546
	Second	0.0480	0.0510
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.6048	0.5838
	Second	0.5122	0.4904
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.5278	0.5302
	Second	0.4544	0.4628
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.5356	0.4904
	Second	0.4444	0.4174
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.6428	0.6114
	Second	0.5674	0.5246
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.6572	0.6514
	Second	0.5836	0.5780
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.5668	0.5042
	Second	0.4880	0.4380
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.7090	0.7058
	Second	0.6094	0.6256
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.7100	0.6818
	Second	0.6272	0.5934
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.7722	0.7198
	Second	0.6918	0.6452
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.8908	0.8890
	Second	0.8326	0.8220
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9620	0.9384
	Second	0.9188	0.8880
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8676	0.8208
	Second	0.8040	0.7424
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9260	0.9064
	Second	0.8686	0.8484
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9544	0.9330
	Second	0.8996	0.8770
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9074	0.8972
	Second	0.8494	0.8388
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8592	0.8190
	Second	0.7966	0.7454
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3886	0.4568
	Second	0.3332	0.3816
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.4614	0.5086
	Second	0.3926	0.4302
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.5248	0.5846
	Second	0.4522	0.5068
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.8310	0.8686
	Second	0.7570	0.7980
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.6058	0.6896
	Second	0.5254	0.5962
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5452	0.6110
	Second	0.4778	0.5492
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4122	0.4618
	Second	0.3488	0.4108
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3984	0.3568
	Second	0.3608	0.3120
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3414	0.3244
	Second	0.3018	0.2860
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5290	0.5380
	Second	0.4598	0.4682
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1136	0.0786
	Second	0.1088	0.0716
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4518	0.4538
	Second	0.3878	0.3968
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.7250	0.7364
	Second	0.6448	0.6584
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5374	0.4976
	Second	0.4668	0.4302
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7418	0.7092
	Second	0.6556	0.6300
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6746	0.6868
	Second	0.5894	0.6160
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8860	0.8830
	Second	0.8262	0.8042

Table F.5. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0492	0.0492
	Second	0.0490	0.0546
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.7286	0.6940
	Second	0.5520	0.5276
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.6642	0.6418
	Second	0.4984	0.4798
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.6552	0.5958
	Second	0.4884	0.4298
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.7692	0.7268
	Second	0.6118	0.5546
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.7656	0.7722
	Second	0.6062	0.6036
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.6850	0.6100
	Second	0.5128	0.4562
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.8070	0.8078
	Second	0.6630	0.6488
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.8408	0.8050
	Second	0.6832	0.6412
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.8756	0.8372
	Second	0.7320	0.6676
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9630	0.9546
	Second	0.8772	0.8538
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9908	0.9812
	Second	0.9414	0.9104
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9408	0.9150
	Second	0.8278	0.7770
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9772	0.9688
	Second	0.8930	0.8700
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9846	0.9778
	Second	0.9226	0.9052
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9674	0.9622
	Second	0.8842	0.8694
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9428	0.9084
	Second	0.8294	0.7768
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.4982	0.5748
	Second	0.3634	0.4244
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.5534	0.6062
	Second	0.4146	0.4474
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.6240	0.6992
	Second	0.4824	0.5364
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9204	0.9406
	Second	0.7924	0.8362
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.7210	0.7806
	Second	0.5656	0.6318
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.6486	0.7218
	Second	0.5172	0.5658
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4900	0.5674
	Second	0.3716	0.4190
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4976	0.4362
	Second	0.3742	0.3250
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4122	0.3956
	Second	0.3094	0.3016
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6444	0.6362
	Second	0.5024	0.4828
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1216	0.0840
	Second	0.1032	0.0768
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.5796	0.5416
	Second	0.4394	0.3958
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.8370	0.8458
	Second	0.6816	0.6902
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6436	0.5910
	Second	0.4940	0.4408
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.8408	0.8226
	Second	0.6950	0.6722
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7724	0.7938
	Second	0.6328	0.6318
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9506	0.9492
	Second	0.8592	0.8402

Table F.6. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0522	0.0490
	Second	0.0522	0.0492
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.8718	0.8466
	Second	0.6314	0.6034
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.8056	0.7864
	Second	0.5538	0.5608
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.8070	0.7392
	Second	0.5594	0.4938
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.8916	0.8638
	Second	0.6652	0.6228
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.8948	0.8916
	Second	0.6712	0.6600
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.8154	0.7532
	Second	0.5884	0.5244
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.9188	0.9172
	Second	0.7288	0.7080
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.9362	0.9244
	Second	0.7340	0.7114
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.9516	0.9284
	Second	0.7876	0.7316
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9960	0.9918
	Second	0.9210	0.9024
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9996	0.9976
	Second	0.9682	0.9470
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9858	0.9742
	Second	0.8672	0.8376
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9982	0.9946
	Second	0.9384	0.9160
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9982	0.9962
	Second	0.9578	0.9398
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9948	0.9938
	Second	0.9234	0.9044
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9840	0.9732
	Second	0.8790	0.8290
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.6460	0.7184
	Second	0.4220	0.4768
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.6908	0.7492
	Second	0.4692	0.5206
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.7812	0.8296
	Second	0.5330	0.5868
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9768	0.9866
	Second	0.8326	0.8854
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.8488	0.9002
	Second	0.6102	0.6970
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.7974	0.8576
	Second	0.5680	0.6400
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.6178	0.7062
	Second	0.4304	0.4814
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6146	0.5618
	Second	0.4150	0.3672
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5290	0.5088
	Second	0.3464	0.3332
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7714	0.7706
	Second	0.5592	0.5482
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1526	0.0976
	Second	0.1136	0.0782
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7006	0.6872
	Second	0.4582	0.4716
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.9344	0.9428
	Second	0.7376	0.7636
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7764	0.7406
	Second	0.5484	0.5230
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9356	0.9268
	Second	0.7522	0.7350
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.9130	0.8992
	Second	0.6982	0.6910
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9900	0.9890
	Second	0.9016	0.8936

Table F.7. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0562	0.0464
	Second	0.0558	0.0468
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.8082	0.7662
	Second	0.7116	0.6688
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.7200	0.7270
	Second	0.6282	0.6220
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.7346	0.6746
	Second	0.6426	0.5708
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.8368	0.7924
	Second	0.7552	0.7024
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.8406	0.8364
	Second	0.7542	0.7366
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.7508	0.6760
	Second	0.6584	0.5818
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.8720	0.8634
	Second	0.7908	0.7846
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.8900	0.8718
	Second	0.8176	0.7862
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.9164	0.8888
	Second	0.8492	0.8110
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9856	0.9786
	Second	0.9558	0.9416
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9962	0.9934
	Second	0.9870	0.9770
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9726	0.9470
	Second	0.9320	0.8860
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9890	0.9856
	Second	0.9676	0.9594
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9932	0.9920
	Second	0.9784	0.9710
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9884	0.9854
	Second	0.9556	0.9548
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9676	0.9408
	Second	0.9304	0.8798
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.5662	0.6392
	Second	0.4726	0.5458
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.6250	0.6794
	Second	0.5412	0.5906
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.6946	0.7580
	Second	0.6012	0.6704
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9512	0.9714
	Second	0.9038	0.9274
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.7794	0.8514
	Second	0.6846	0.7658
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.7404	0.7890
	Second	0.6390	0.6910
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.5558	0.6242
	Second	0.4770	0.5398
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5564	0.4822
	Second	0.4772	0.4140
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4704	0.4468
	Second	0.3898	0.3684
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7004	0.7232
	Second	0.6098	0.6270
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1314	0.0854
	Second	0.1180	0.0856
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6382	0.6228
	Second	0.5446	0.5354
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.8872	0.8910
	Second	0.8150	0.8270
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7052	0.6612
	Second	0.6084	0.5700
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.8974	0.8740
	Second	0.8240	0.7956
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.8484	0.8532
	Second	0.7784	0.7732
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9774	0.9750
	Second	0.9474	0.9360

Table F.8. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0478
	Second	0.0558	0.0470
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.8958	0.8742
	Second	0.7392	0.6958
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.8424	0.8458
	Second	0.6550	0.6480
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.8384	0.7838
	Second	0.6536	0.5850
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.9138	0.8926
	Second	0.7676	0.7210
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.9264	0.9170
	Second	0.7854	0.7708
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.8536	0.8038
	Second	0.6824	0.6118
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.9410	0.9444
	Second	0.8116	0.8118
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.9570	0.9376
	Second	0.8450	0.8048
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.9752	0.9472
	Second	0.8758	0.8274
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9974	0.9958
	Second	0.9652	0.9568
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9998	0.9998
	Second	0.9896	0.9816
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9944	0.9838
	Second	0.9430	0.9056
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9980	0.9962
	Second	0.9718	0.9642
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9992	0.9988
	Second	0.9844	0.9814
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9956	0.9966
	Second	0.9658	0.9610
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9910	0.9860
	Second	0.9416	0.9118
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.6746	0.7652
	Second	0.4942	0.5578
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.7262	0.8010
	Second	0.5508	0.6114
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.8224	0.8712
	Second	0.6372	0.6958
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9888	0.9924
	Second	0.9126	0.9434
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.8782	0.9270
	Second	0.7184	0.7826
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.8430	0.8788
	Second	0.6718	0.7122
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.6560	0.7448
	Second	0.4972	0.5640
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6660	0.5972
	Second	0.4850	0.4346
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5818	0.5430
	Second	0.4226	0.3946
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.8066	0.8160
	Second	0.6346	0.6418
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1668	0.0952
	Second	0.1258	0.0810
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7528	0.7352
	Second	0.5518	0.5526
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.9550	0.9598
	Second	0.8396	0.8426
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.8376	0.7816
	Second	0.6494	0.6004
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9596	0.9474
	Second	0.8478	0.8214
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.9190	0.9310
	Second	0.7846	0.7924
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9922	0.9962
	Second	0.9516	0.9490

Table F.9. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0500	0.0518
	Second	0.0476	0.0492
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.9718	0.9600
	Second	0.7708	0.7432
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.9416	0.9402
	Second	0.7056	0.6938
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.9456	0.8984
	Second	0.7012	0.6320
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.9824	0.9656
	Second	0.8166	0.7676
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.9840	0.9778
	Second	0.8138	0.8050
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.9478	0.9116
	Second	0.7268	0.6494
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.9878	0.9850
	Second	0.8632	0.8420
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.9944	0.9876
	Second	0.8732	0.8394
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.9948	0.9900
	Second	0.9116	0.8650
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9998	0.9998
	Second	0.9774	0.9700
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	1.0000	1.0000
	Second	0.9930	0.9868
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9992	0.9992
	Second	0.9624	0.9376
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	1.0000	1.0000
	Second	0.9858	0.9754
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	1.0000	0.9998
	Second	0.9940	0.9874
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	1.0000	0.9998
	Second	0.9806	0.9736
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9998	0.9978
	Second	0.9648	0.9248
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.8260	0.8822
	Second	0.5360	0.6082
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.8564	0.9116
	Second	0.6038	0.6614
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.9230	0.9484
	Second	0.6810	0.7260
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9990	0.9994
	Second	0.9388	0.9604
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.9614	0.9844
	Second	0.7692	0.8292
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.9366	0.9630
	Second	0.7106	0.7690
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.7934	0.8642
	Second	0.5426	0.6008
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7950	0.7244
	Second	0.5260	0.4754
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6990	0.6594
	Second	0.4524	0.4098
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.9186	0.9254
	Second	0.6930	0.6852
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2050	0.1126
	Second	0.1348	0.0838
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.8698	0.8654
	Second	0.6026	0.6038
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.9906	0.9932
	Second	0.8688	0.8730
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9302	0.9004
	Second	0.7008	0.6332
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9920	0.9870
	Second	0.8806	0.8604
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.9800	0.9836
	Second	0.8270	0.8368
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9994	0.9998
	Second	0.9646	0.9628

Table F.10. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0532	0.0474
	Second	0.0532	0.0522
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.8764	0.8506
	Second	0.8102	0.7574
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.8174	0.8174
	Second	0.7218	0.7172
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.8310	0.7604
	Second	0.7304	0.6536
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.8972	0.8652
	Second	0.8292	0.7832
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.9014	0.9022
	Second	0.8398	0.8316
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.8240	0.7714
	Second	0.7380	0.6706
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.9304	0.9198
	Second	0.8666	0.8498
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.9444	0.9182
	Second	0.8918	0.8524
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.9648	0.9388
	Second	0.9152	0.8752
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9944	0.9916
	Second	0.9800	0.9756
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9988	0.9986
	Second	0.9954	0.9930
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9898	0.9784
	Second	0.9698	0.9482
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9966	0.9954
	Second	0.9882	0.9834
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9982	0.9982
	Second	0.9920	0.9898
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9964	0.9952
	Second	0.9832	0.9808
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9912	0.9766
	Second	0.9674	0.9440
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.6534	0.7304
	Second	0.5570	0.6356
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.7074	0.7732
	Second	0.6100	0.6786
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.7810	0.8464
	Second	0.6924	0.7620
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9802	0.9914
	Second	0.9512	0.9646
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.8488	0.9098
	Second	0.7678	0.8380
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.8102	0.8612
	Second	0.7230	0.7766
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.6298	0.7178
	Second	0.5376	0.6296
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.6380	0.5660
	Second	0.5442	0.4782
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5400	0.5080
	Second	0.4582	0.4398
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7904	0.7948
	Second	0.7016	0.6960
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1490	0.0944
	Second	0.1288	0.0898
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7166	0.7044
	Second	0.6284	0.6226
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.9454	0.9454
	Second	0.8870	0.8864
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7942	0.7454
	Second	0.7024	0.6524
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9372	0.9392
	Second	0.8894	0.8818
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.9124	0.9150
	Second	0.8432	0.8470
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9904	0.9926
	Second	0.9714	0.9716

Table F.11. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0530	0.0490
	Second	0.0526	0.0524
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.9560	0.9294
	Second	0.8246	0.7802
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.9154	0.9158
	Second	0.7454	0.7440
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.9154	0.8634
	Second	0.7434	0.6718
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.9622	0.9426
	Second	0.8442	0.7894
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.9646	0.9642
	Second	0.8432	0.8386
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.9214	0.8658
	Second	0.7684	0.6846
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.9780	0.9744
	Second	0.8868	0.8682
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.9816	0.9744
	Second	0.8956	0.8708
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.9914	0.9814
	Second	0.9272	0.8918
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9992	0.9992
	Second	0.9870	0.9824
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	1.0000	1.0000
	Second	0.9970	0.9932
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9986	0.9966
	Second	0.9712	0.9492
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	1.0000	0.9994
	Second	0.9912	0.9856
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	1.0000	1.0000
	Second	0.9968	0.9926
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9994	0.9988
	Second	0.9860	0.9836
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9988	0.9944
	Second	0.9712	0.9510
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.7798	0.8422
	Second	0.5762	0.6464
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.8180	0.8584
	Second	0.6262	0.6834
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.8950	0.9220
	Second	0.7076	0.7698
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9972	0.9996
	Second	0.9610	0.9738
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.9358	0.9688
	Second	0.7950	0.8560
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.8974	0.9412
	Second	0.7448	0.7984
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.7598	0.8222
	Second	0.5626	0.6452
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.7398	0.6674
	Second	0.5564	0.5016
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6578	0.6342
	Second	0.4800	0.4760
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.8820	0.8828
	Second	0.7062	0.7072
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1880	0.1040
	Second	0.1390	0.0876
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.8270	0.8214
	Second	0.6460	0.6354
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.9838	0.9842
	Second	0.8968	0.9048
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.8944	0.8596
	Second	0.7232	0.6792
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9852	0.9754
	Second	0.9048	0.8912
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.9662	0.9670
	Second	0.8672	0.8598
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9976	0.9990
	Second	0.9780	0.9758

Table F.12. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak 4: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0538	0.0540
	Second	0.0558	0.0540
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.9934	0.9842
	Second	0.8546	0.8094
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.9782	0.9722
	Second	0.7888	0.7662
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.9804	0.9474
	Second	0.7836	0.7086
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.9946	0.9852
	Second	0.8798	0.8260
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.9948	0.9930
	Second	0.8712	0.8692
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.9766	0.9540
	Second	0.8018	0.7336
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.9958	0.9950
	Second	0.9072	0.8898
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.9976	0.9952
	Second	0.9194	0.8934
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.9998	0.9982
	Second	0.9530	0.9166
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	1.0000	1.0000
	Second	0.9904	0.9854
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	1.0000	1.0000
	Second	0.9988	0.9962
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	1.0000	1.0000
	Second	0.9794	0.9634
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	1.0000	1.0000
	Second	0.9942	0.9922
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	1.0000	1.0000
	Second	0.9960	0.9946
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	1.0000	1.0000
	Second	0.9902	0.9888
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9998	0.9996
	Second	0.9836	0.9602
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.8946	0.9434
	Second	0.6060	0.6974
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.9224	0.9534
	Second	0.6598	0.7256
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.9656	0.9800
	Second	0.7518	0.8052
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	1.0000	1.0000
	Second	0.9706	0.9848
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.9846	0.9954
	Second	0.8234	0.8864
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.9686	0.9890
	Second	0.7668	0.8418
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.8744	0.9184
	Second	0.6008	0.6692
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.8622	0.8056
	Second	0.5950	0.5258
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7770	0.7704
	Second	0.5030	0.4798
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.9640	0.9570
	Second	0.7492	0.7472
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2288	0.1312
	Second	0.1458	0.0924
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.9248	0.9228
	Second	0.6724	0.6612
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.9978	0.9988
	Second	0.9258	0.9280
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9674	0.9436
	Second	0.7540	0.6990
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9970	0.9970
	Second	0.9254	0.9168
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.9956	0.9948
	Second	0.9004	0.8878
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	1.0000	1.0000
	Second	0.9890	0.9800

Table F.13. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0490	0.0446
	Second	0.0514	0.0484
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.2586	0.2568
	Second	0.2352	0.2282
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.2282	0.2414
	Second	0.2110	0.2192
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.2212	0.2004
	Second	0.2018	0.1860
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.2606	0.2602
	Second	0.2326	0.2360
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.2636	0.2686
	Second	0.2406	0.2424
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.2362	0.2064
	Second	0.2036	0.1934
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.2964	0.2954
	Second	0.2614	0.2690
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.2982	0.2900
	Second	0.2652	0.2590
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.3352	0.2962
	Second	0.3006	0.2670
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.4536	0.4608
	Second	0.4010	0.4238
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.5510	0.5370
	Second	0.4994	0.4846
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.4140	0.3684
	Second	0.3634	0.3270
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.4984	0.4940
	Second	0.4424	0.4412
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.5336	0.5374
	Second	0.4860	0.4834
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.4574	0.4732
	Second	0.4092	0.4254
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.4140	0.3758
	Second	0.3678	0.3430
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.1780	0.1906
	Second	0.1678	0.1854
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.1912	0.2058
	Second	0.1698	0.1946
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2334	0.2450
	Second	0.2168	0.2280
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.3944	0.4386
	Second	0.3538	0.4144
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2658	0.2956
	Second	0.2384	0.2710
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2296	0.2752
	Second	0.2160	0.2540
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1834	0.2010
	Second	0.1608	0.1872
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1770	0.1586
	Second	0.1596	0.1492
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1502	0.1476
	Second	0.1288	0.1368
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2302	0.2272
	Second	0.2012	0.2158
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0820	0.0590
	Second	0.0776	0.0636
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.1834	0.1796
	Second	0.1700	0.1676
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.3230	0.3220
	Second	0.2884	0.2926
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2190	0.2104
	Second	0.1974	0.1890
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3160	0.3128
	Second	0.2812	0.2810
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2862	0.2962
	Second	0.2542	0.2642
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.4656	0.4542
	Second	0.4066	0.4090

Table F.14. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0458	0.0510
	Second	0.0516	0.0534
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.3190	0.3008
	Second	0.2494	0.2470
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.2610	0.2852
	Second	0.2122	0.2274
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.2660	0.2440
	Second	0.2156	0.2058
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.3242	0.2944
	Second	0.2620	0.2464
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.3224	0.3274
	Second	0.2554	0.2654
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.2732	0.2504
	Second	0.2234	0.1986
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.3778	0.3624
	Second	0.2934	0.2966
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.3718	0.3566
	Second	0.2986	0.2868
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.4118	0.3702
	Second	0.3272	0.2976
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.5664	0.5608
	Second	0.4498	0.4474
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.6688	0.6446
	Second	0.5520	0.5090
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.4986	0.4636
	Second	0.3850	0.3808
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.6064	0.5990
	Second	0.4864	0.4778
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.6514	0.6524
	Second	0.5286	0.5188
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.5516	0.5706
	Second	0.4452	0.4496
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.5098	0.4642
	Second	0.3936	0.3552
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2180	0.2480
	Second	0.1752	0.1996
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.2308	0.2594
	Second	0.1882	0.2060
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2628	0.2960
	Second	0.2074	0.2372
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.4760	0.5524
	Second	0.3760	0.4466
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3298	0.3600
	Second	0.2606	0.2914
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2818	0.3078
	Second	0.2244	0.2458
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2226	0.2420
	Second	0.1800	0.1994
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2018	0.1780
	Second	0.1628	0.1564
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1690	0.1658
	Second	0.1422	0.1378
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2788	0.2724
	Second	0.2240	0.2100
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0870	0.0712
	Second	0.0800	0.0664
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2332	0.2074
	Second	0.1892	0.1770
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.3808	0.4022
	Second	0.2984	0.3084
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2524	0.2428
	Second	0.2094	0.2032
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3884	0.3754
	Second	0.3070	0.2964
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3416	0.3528
	Second	0.2810	0.2704
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.5318	0.5606
	Second	0.4256	0.4384

Table F.15. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0454	0.0486
	Second	0.0468	0.0480
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.4018	0.3820
	Second	0.3082	0.2764
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.3642	0.3672
	Second	0.2736	0.2712
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.3520	0.3176
	Second	0.2530	0.2330
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.4134	0.3976
	Second	0.3160	0.2862
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.4202	0.4312
	Second	0.3224	0.3176
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.3620	0.3092
	Second	0.2732	0.2284
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.4632	0.4634
	Second	0.3516	0.3338
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.4604	0.4546
	Second	0.3476	0.3326
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.5288	0.4860
	Second	0.3974	0.3618
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.6968	0.6974
	Second	0.5382	0.5096
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.8062	0.7796
	Second	0.6272	0.6110
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6376	0.5906
	Second	0.4888	0.4300
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.7346	0.4360
	Second	0.5706	0.5650
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.7734	0.7730
	Second	0.6170	0.5954
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.6986	0.7108
	Second	0.5356	0.5226
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6246	0.5876
	Second	0.4810	0.4350
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2830	0.3176
	Second	0.2194	0.2192
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.2910	0.3186
	Second	0.2230	0.2420
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3294	0.3730
	Second	0.2504	0.2768
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.5950	0.6828
	Second	0.4444	0.4998
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3994	0.4666
	Second	0.3108	0.3378
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3680	0.4220
	Second	0.2758	0.3106
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2668	0.3130
	Second	0.2016	0.2314
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2538	0.2340
	Second	0.1962	0.1842
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2136	0.2106
	Second	0.1780	0.1608
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3444	0.3586
	Second	0.2634	0.2608
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0944	0.0742
	Second	0.0826	0.0680
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2888	0.2714
	Second	0.2238	0.2102
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.5012	0.5076
	Second	0.3786	0.3726
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3348	0.3092
	Second	0.2518	0.2328
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4970	0.4896
	Second	0.3812	0.3534
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4312	0.4502
	Second	0.3294	0.3406
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.6962	0.6926
	Second	0.5458	0.5206

Table F.16. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0516	0.0460
	Second	0.0456	0.0456
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.3708	0.3522
	Second	0.3220	0.3120
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.3188	0.3278
	Second	0.2732	0.2840
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.3394	0.2934
	Second	0.2888	0.2594
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.3668	0.3624
	Second	0.3202	0.2946
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.3676	0.3764
	Second	0.3246	0.3156
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.3186	0.2822
	Second	0.2782	0.2456
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.4250	0.4182
	Second	0.3572	0.3662
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.4332	0.4200
	Second	0.3676	0.3612
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.4816	0.4304
	Second	0.4210	0.3768
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.6256	0.6434
	Second	0.5514	0.5622
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.7574	0.7196
	Second	0.6696	0.6432
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.5764	0.5408
	Second	0.5128	0.4672
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.6778	0.6834
	Second	0.5928	0.6080
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.7174	0.7334
	Second	0.6498	0.6526
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.6340	0.6554
	Second	0.5598	0.5720
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.5690	0.5452
	Second	0.5004	0.4710
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2560	0.2762
	Second	0.2208	0.2482
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.2618	0.2918
	Second	0.2226	0.2476
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2992	0.3432
	Second	0.2616	0.3020
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.5442	0.6184
	Second	0.4764	0.5346
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3658	0.4170
	Second	0.3026	0.3644
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3254	0.3614
	Second	0.2790	0.3218
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2472	0.2818
	Second	0.2356	0.2510
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2320	0.2026
	Second	0.2036	0.1852
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2010	0.1904
	Second	0.1740	0.1700
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3140	0.3232
	Second	0.2766	0.2750
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0892	0.0710
	Second	0.0870	0.0660
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2556	0.2654
	Second	0.2268	0.2282
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.4542	0.4746
	Second	0.3860	0.4118
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2886	0.2824
	Second	0.2548	0.2482
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4482	0.4336
	Second	0.3884	0.3778
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4110	0.4136
	Second	0.3516	0.3534
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.6348	0.6354
	Second	0.5680	0.5534

Table F.17. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0514	0.0456
	Second	0.0540	0.0502
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.4504	0.4250
	Second	0.3510	0.3162
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.4036	0.3974
	Second	0.3014	0.2906
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.3864	0.3408
	Second	0.2966	0.2550
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.4578	0.4318
	Second	0.3530	0.3172
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.4786	0.4596
	Second	0.3642	0.3496
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.4084	0.3584
	Second	0.3028	0.2696
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.5264	0.5082
	Second	0.3966	0.3898
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.5212	0.5038
	Second	0.3946	0.3806
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.5738	0.5340
	Second	0.4436	0.4020
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.7468	0.7566
	Second	0.6006	0.5924
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.8652	0.8394
	Second	0.7274	0.6982
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6940	0.6532
	Second	0.5522	0.5068
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.7990	0.7870
	Second	0.6486	0.6296
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.8308	0.8492
	Second	0.6788	0.6898
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.7580	0.7576
	Second	0.5988	0.5992
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6888	0.6456
	Second	0.5364	0.4952
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3138	0.3374
	Second	0.2480	0.2578
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3092	0.3586
	Second	0.2376	0.2684
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3660	0.4150
	Second	0.2874	0.3122
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.6468	0.7398
	Second	0.4958	0.5722
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4530	0.5238
	Second	0.3482	0.3908
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3902	0.4466
	Second	0.2990	0.3342
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2946	0.3520
	Second	0.2380	0.2598
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2776	0.2462
	Second	0.2202	0.1886
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2348	0.2190
	Second	0.1916	0.1808
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3912	0.4008
	Second	0.2948	0.3038
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1006	0.0722
	Second	0.0860	0.0634
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3176	0.3104
	Second	0.2500	0.2372
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.5504	0.5788
	Second	0.4110	0.4324
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3664	0.3340
	Second	0.2920	0.2480
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5428	0.5418
	Second	0.4116	0.4020
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4908	0.5040
	Second	0.3854	0.3848
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.7370	0.7640
	Second	0.5842	0.5986

Table F.18. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0462	0.0482
	Second	0.0476	0.0508
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.5800	0.5550
	Second	0.3822	0.3616
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.5158	0.4988
	Second	0.3346	0.3238
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.4906	0.4438
	Second	0.3162	0.3080
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.5812	0.5530
	Second	0.3892	0.3728
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.5774	0.5960
	Second	0.3878	0.4032
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.5124	0.4512
	Second	0.3392	0.3002
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.6488	0.6586
	Second	0.4332	0.4322
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.6498	0.6354
	Second	0.4370	0.4188
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.7168	0.6642
	Second	0.4940	0.4402
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.8548	0.8734
	Second	0.6366	0.6534
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9446	0.9348
	Second	0.7612	0.7438
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8178	0.7770
	Second	0.5938	0.5498
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9090	0.9104
	Second	0.7088	0.6930
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9340	0.9312
	Second	0.7448	0.7396
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.8632	0.8794
	Second	0.6368	0.6588
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8234	0.7864
	Second	0.5912	0.5594
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3812	0.4436
	Second	0.2498	0.2852
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3966	0.4440
	Second	0.2576	0.3030
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.4686	0.5352
	Second	0.3080	0.3512
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.7962	0.8560
	Second	0.5698	0.6386
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5746	0.6532
	Second	0.3816	0.4360
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5020	0.5844
	Second	0.3290	0.3954
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3890	0.4408
	Second	0.2574	0.2956
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3628	0.3096
	Second	0.2382	0.2140
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2896	0.2798
	Second	0.1970	0.1860
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5076	0.5066
	Second	0.3294	0.3362
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1154	0.0866
	Second	0.0960	0.0762
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4136	0.3910
	Second	0.2698	0.2646
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.6668	0.6982
	Second	0.4604	0.4834
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4754	0.4466
	Second	0.3110	0.2964
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6816	0.6852
	Second	0.4680	0.4576
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6146	0.6366
	Second	0.4196	0.4228
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8702	0.8724
	Second	0.6570	0.6556

Table F.19. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0524	0.0544
	Second	0.0516	0.0500
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.5152	0.4784
	Second	0.4362	0.4140
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.4466	0.4384
	Second	0.3608	0.3734
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.4564	0.3914
	Second	0.3774	0.3386
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.5164	0.4886
	Second	0.4414	0.4178
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.5088	0.5336
	Second	0.4248	0.4598
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.4412	0.3898
	Second	0.3844	0.3248
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.5948	0.5774
	Second	0.5144	0.4964
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.5902	0.5550
	Second	0.5056	0.4822
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.6450	0.5956
	Second	0.5520	0.5190
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.8192	0.8222
	Second	0.7270	0.7200
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9024	0.8938
	Second	0.8292	0.8214
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.7570	0.7204
	Second	0.6686	0.6122
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.8554	0.8500
	Second	0.7772	0.7744
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.8912	0.8910
	Second	0.8166	0.8024
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.8092	0.8288
	Second	0.7282	0.7340
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.7604	0.7206
	Second	0.6616	0.6344
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3408	0.3938
	Second	0.2918	0.3220
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3620	0.3962
	Second	0.3044	0.3384
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.4124	0.4714
	Second	0.3490	0.3916
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.7286	0.7976
	Second	0.6494	0.7022
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5086	0.5742
	Second	0.4404	0.4798
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.4446	0.5016
	Second	0.3846	0.4242
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3348	0.3940
	Second	0.2932	0.3438
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3214	0.2846
	Second	0.2738	0.2446
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2622	0.2526
	Second	0.2238	0.2210
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4280	0.4446
	Second	0.3756	0.3730
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1086	0.0730
	Second	0.0904	0.0726
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3478	0.3472
	Second	0.3002	0.2926
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.6114	0.6270
	Second	0.5300	0.5546
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4122	0.3808
	Second	0.3488	0.3192
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6228	0.5998
	Second	0.5380	0.5046
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.5532	0.5512
	Second	0.4658	0.4742
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8130	0.8038
	Second	0.7358	0.7194

Table F.20. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0558	0.0504
	Second	0.0474	0.0486
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.6264	0.5962
	Second	0.4666	0.4418
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.5376	0.5388
	Second	0.3880	0.3980
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.5428	0.4922
	Second	0.3880	0.3566
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.6200	0.6020
	Second	0.4614	0.4338
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.6346	0.6326
	Second	0.4664	0.4678
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.5546	0.4986
	Second	0.4092	0.3542
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.6938	0.6924
	Second	0.5184	0.5162
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.6936	0.6700
	Second	0.5204	0.4896
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.7700	0.7132
	Second	0.5902	0.5296
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9002	0.9094
	Second	0.7424	0.7558
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9626	0.9576
	Second	0.8554	0.8440
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8588	0.8250
	Second	0.6928	0.6418
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9376	0.9268
	Second	0.7982	0.7972
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9540	0.9536
	Second	0.8430	0.8272
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9098	0.9132
	Second	0.7582	0.7612
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8640	0.8214
	Second	0.7030	0.6436
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.4146	0.4714
	Second	0.2988	0.3472
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.4326	0.4856
	Second	0.3092	0.3510
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.5082	0.5766
	Second	0.3716	0.4272
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.8458	0.8974
	Second	0.6778	0.7316
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.6260	0.6808
	Second	0.4582	0.5090
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5424	0.6012
	Second	0.3878	0.4338
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4172	0.4746
	Second	0.2910	0.3484
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3974	0.3378
	Second	0.2920	0.2438
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3210	0.3064
	Second	0.2338	0.2242
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5334	0.5472
	Second	0.3940	0.3920
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1220	0.0788
	Second	0.1016	0.0738
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4298	0.4080
	Second	0.3052	0.3090
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.7278	0.7488
	Second	0.5432	0.5708
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5068	0.4634
	Second	0.3666	0.3318
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7276	0.7082
	Second	0.5492	0.5342
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6482	0.6770
	Second	0.4814	0.5000
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9008	0.9066
	Second	0.7440	0.7414

Table F.21. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0496
	Second	0.0500	0.0542
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.7574	0.7248
	Second	0.4920	0.4604
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.6708	0.6862
	Second	0.4174	0.4240
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.6634	0.6172
	Second	0.4196	0.3692
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.7490	0.7364
	Second	0.4786	0.4776
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.7518	0.7828
	Second	0.4904	0.5042
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.6786	0.5996
	Second	0.4208	0.3750
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.8248	0.8176
	Second	0.5628	0.5432
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.8236	0.8158
	Second	0.5630	0.5354
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.8766	0.8436
	Second	0.6282	0.5748
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9698	0.9730
	Second	0.7800	0.7876
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9930	0.9902
	Second	0.8914	0.8680
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9416	0.9200
	Second	0.7342	0.6834
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9826	0.9822
	Second	0.8284	0.8264
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9898	0.9894
	Second	0.8706	0.8714
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9714	0.9772
	Second	0.7956	0.8010
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9518	0.9270
	Second	0.7384	0.6852
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.5376	0.6166
	Second	0.3260	0.3784
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.5548	0.6130
	Second	0.3434	0.3834
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.6370	0.7094
	Second	0.3930	0.4524
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9310	0.9684
	Second	0.7192	0.7742
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.7572	0.8152
	Second	0.4808	0.5568
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.6826	0.7548
	Second	0.4448	0.4650
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.5372	0.6048
	Second	0.3306	0.3700
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5030	0.4360
	Second	0.3150	0.2628
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4058	0.3892
	Second	0.2536	0.2316
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6774	0.6704
	Second	0.4180	0.4218
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1380	0.0982
	Second	0.1028	0.0772
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.5494	0.5378
	Second	0.3418	0.3262
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.8524	0.8668
	Second	0.5990	0.6034
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6436	0.5834
	Second	0.3902	0.3646
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.8504	0.8412
	Second	0.5826	0.5724
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7936	0.8010
	Second	0.5336	0.5296
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9710	0.9720
	Second	0.7792	0.7866

Table F.22. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0536	0.0472
	Second	0.0544	0.0434
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.5886	0.5616
	Second	0.5026	0.4690
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.5246	0.5226
	Second	0.4564	0.4414
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.5152	0.4500
	Second	0.4332	0.3864
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.5932	0.5680
	Second	0.5142	0.4964
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.5848	0.6082
	Second	0.4996	0.5260
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.5236	0.4628
	Second	0.4412	0.3924
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.6598	0.6644
	Second	0.5706	0.5680
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.6756	0.6450
	Second	0.5782	0.5636
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.7234	0.6746
	Second	0.6368	0.5914
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.8802	0.8896
	Second	0.8032	0.8118
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9518	0.9400
	Second	0.8986	0.8780
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8462	0.8024
	Second	0.7608	0.7244
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9120	0.9122
	Second	0.8476	0.8442
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9408	0.9420
	Second	0.8904	0.8802
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.8800	0.8966
	Second	0.8028	0.8128
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8504	0.7998
	Second	0.7552	0.7070
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.4072	0.4532
	Second	0.3494	0.3806
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3988	0.4614
	Second	0.3438	0.3944
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.4858	0.5474
	Second	0.4084	0.4634
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.8156	0.8798
	Second	0.7196	0.7982
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5954	0.6624
	Second	0.5022	0.5720
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5214	0.5860
	Second	0.4396	0.4988
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4008	0.4644
	Second	0.3416	0.3904
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3780	0.3088
	Second	0.3194	0.2604
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2946	0.2898
	Second	0.2580	0.2400
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5092	0.5218
	Second	0.4340	0.4466
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1142	0.0774
	Second	0.1078	0.0726
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4082	0.4158
	Second	0.3380	0.3460
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.7008	0.7200
	Second	0.6080	0.6328
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4702	0.4372
	Second	0.4032	0.3676
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6962	0.6978
	Second	0.5972	0.5968
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6328	0.6496
	Second	0.5376	0.5534
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8898	0.8816
	Second	0.8046	0.8012

Table F.23. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0468	0.0536
	Second	0.0482	0.0492
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.7036	0.6760
	Second	0.5244	0.4890
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.6278	0.6294
	Second	0.4474	0.4536
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.6240	0.5550
	Second	0.4496	0.3894
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.7064	0.6780
	Second	0.5188	0.4972
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.7148	0.7080
	Second	0.5366	0.5240
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.6256	0.5642
	Second	0.4554	0.4094
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.7716	0.7718
	Second	0.5850	0.5908
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.7776	0.7566
	Second	0.5920	0.5730
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.8458	0.8062
	Second	0.6638	0.6128
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9506	0.9520
	Second	0.8310	0.8148
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9880	0.9848
	Second	0.9114	0.8964
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9234	0.8998
	Second	0.7562	0.7226
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9702	0.9696
	Second	0.8594	0.8698
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9814	0.9834
	Second	0.8970	0.9008
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9544	0.9620
	Second	0.8276	0.8350
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9262	0.8878
	Second	0.7758	0.7190
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.4924	0.5574
	Second	0.3514	0.4066
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.4970	0.5614
	Second	0.3582	0.4072
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.5746	0.6606
	Second	0.4098	0.4930
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9146	0.9406
	Second	0.7530	0.8230
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.7108	0.7708
	Second	0.5186	0.5856
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.6416	0.7022
	Second	0.4724	0.5218
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4896	0.5644
	Second	0.3400	0.3988
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4498	0.4064
	Second	0.3228	0.2968
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3642	0.3504
	Second	0.2642	0.2568
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6202	0.6380
	Second	0.4478	0.4632
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1292	0.0836
	Second	0.1098	0.0746
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4986	0.4900
	Second	0.3632	0.3472
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.8128	0.8170
	Second	0.6322	0.6400
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5884	0.5310
	Second	0.4106	0.3878
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.8090	0.8020
	Second	0.6290	0.6058
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7328	0.7594
	Second	0.5514	0.5724
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9522	0.9474
	Second	0.8202	0.8214

Table F.24. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak 4: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0520	0.0488
	Second	0.0514	0.0466
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.8382	0.8214
	Second	0.5636	0.5396
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.7472	0.7662
	Second	0.4726	0.4930
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.7540	0.6972
	Second	0.4898	0.4326
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.8366	0.8092
	Second	0.5610	0.5256
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.8432	0.8498
	Second	0.5612	0.5676
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.7646	0.6924
	Second	0.4760	0.4212
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.8908	0.8908
	Second	0.6122	0.6222
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.8958	0.8802
	Second	0.6184	0.5880
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.9394	0.9068
	Second	0.6946	0.6416
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9866	0.9904
	Second	0.8500	0.8498
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9986	0.9972
	Second	0.9318	0.9180
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9806	0.9660
	Second	0.8042	0.7480
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9948	0.9944
	Second	0.8948	0.8846
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9974	0.9980
	Second	0.9216	0.9196
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9884	0.9904
	Second	0.8528	0.8588
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9782	0.9632
	Second	0.8024	0.7608
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.6212	0.6972
	Second	0.3790	0.4244
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.6166	0.7066
	Second	0.3640	0.4350
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.7304	0.7864
	Second	0.4472	0.5056
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.9698	0.9882
	Second	0.7770	0.8388
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.8350	0.8926
	Second	0.5558	0.6128
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.7648	0.8338
	Second	0.4798	0.5454
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.6240	0.6814
	Second	0.3800	0.4128
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.5772	0.5146
	Second	0.3424	0.3076
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4682	0.4684
	Second	0.2828	0.2818
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.7722	0.7660
	Second	0.4858	0.4726
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1562	0.0942
	Second	0.1036	0.0756
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6204	0.6174
	Second	0.3824	0.3696
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.9198	0.9262
	Second	0.6626	0.6776
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7204	0.6700
	Second	0.4410	0.4112
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.9150	0.9056
	Second	0.6722	0.6352
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.8710	0.8770
	Second	0.5984	0.6024
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9884	0.9892
	Second	0.8560	0.8528

Table F.25. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 3, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0462	0.0522
	Second	0.0474	0.0502
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.2008	0.2056
	Second	0.1836	0.1844
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.1836	0.1778
	Second	0.1670	0.1698
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.1794	0.1766
	Second	0.1698	0.1690
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.2040	0.1988
	Second	0.1848	0.1836
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.2044	0.2174
	Second	0.1830	0.1952
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.1884	0.1684
	Second	0.1722	0.1578
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.2408	0.2456
	Second	0.2174	0.2160
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.2386	0.2202
	Second	0.2128	0.2044
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.2670	0.2380
	Second	0.2398	0.2172
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.3540	0.3350
	Second	0.3228	0.2962
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.4092	0.3982
	Second	0.3766	0.3680
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.3190	0.2822
	Second	0.2868	0.2620
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.3726	0.3652
	Second	0.3320	0.3272
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.4092	0.3946
	Second	0.3618	0.3650
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.3382	0.3526
	Second	0.2968	0.3160
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.3136	0.2866
	Second	0.2824	0.2600
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.1558	0.1668
	Second	0.1406	0.1502
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.1480	0.1782
	Second	0.1370	0.1580
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.1834	0.1932
	Second	0.1546	0.1852
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.2988	0.3366
	Second	0.2678	0.3032
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.1946	0.2174
	Second	0.1792	0.2080
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.1896	0.2024
	Second	0.1794	0.1912
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1504	0.1644
	Second	0.1364	0.1526
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1504	0.1318
	Second	0.1376	0.1216
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1220	0.1196
	Second	0.1110	0.1188
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1752	0.1858
	Second	0.1640	0.1748
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0690	0.0622
	Second	0.0666	0.0682
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.1502	0.1572
	Second	0.1380	0.1378
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.2436	0.2558
	Second	0.2300	0.2290
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.1762	0.1646
	Second	0.1580	0.1502
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2386	0.2484
	Second	0.2168	0.2336
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2252	0.2120
	Second	0.1988	0.1974
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.3400	0.3430
	Second	0.3172	0.3032

Table F.26. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 6, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0504	0.0512
	Second	0.0474	0.0490
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.2482	0.2262
	Second	0.1938	0.1792
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.2222	0.2188
	Second	0.1814	0.1806
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.2090	0.1988
	Second	0.1770	0.1642
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.2400	0.2230
	Second	0.1860	0.1774
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.2488	0.2494
	Second	0.1982	0.1970
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.2154	0.1926
	Second	0.1730	0.1660
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.2828	0.2660
	Second	0.2260	0.2082
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.2820	0.2726
	Second	0.2308	0.2066
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.3154	0.2896
	Second	0.2444	0.2312
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.4218	0.4360
	Second	0.3358	0.3426
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.5162	0.4970
	Second	0.4094	0.3952
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.3906	0.3516
	Second	0.3088	0.2816
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.4650	0.4500
	Second	0.3610	0.3514
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.4940	0.4930
	Second	0.3966	0.3910
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.4134	0.4260
	Second	0.3188	0.3400
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.3732	0.3534
	Second	0.3024	0.2886
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.1740	0.1912
	Second	0.1472	0.1594
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.1784	0.2062
	Second	0.1362	0.1728
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.1970	0.2288
	Second	0.1588	0.1926
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.3740	0.4020
	Second	0.2916	0.3220
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2518	0.2796
	Second	0.1980	0.2204
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2272	0.2334
	Second	0.1886	0.1876
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.1732	0.1918
	Second	0.1500	0.1566
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1638	0.1602
	Second	0.1420	0.1300
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1530	0.1398
	Second	0.1260	0.1218
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2232	0.2140
	Second	0.1850	0.1782
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0904	0.0626
	Second	0.0768	0.0674
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.1742	0.1758
	Second	0.1444	0.1422
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.2942	0.3118
	Second	0.2350	0.2408
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.1958	0.1848
	Second	0.1668	0.1488
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3038	0.2884
	Second	0.2418	0.2376
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2686	0.2666
	Second	0.2172	0.2172
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.4098	0.4310
	Second	0.3266	0.3406

Table F.27. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 12, n= 6.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0494	0.0488
	Second	0.0540	0.0496
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.3134	0.2834
	Second	0.2424	0.2154
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.2678	0.2772
	Second	0.2154	0.2074
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.2724	0.2452
	Second	0.2148	0.1816
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.3044	0.3020
	Second	0.2352	0.2224
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.3028	0.3110
	Second	0.2368	0.2364
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.2744	0.2502
	Second	0.2180	0.1910
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.3606	0.3420
	Second	0.2678	0.2524
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.3452	0.3404
	Second	0.2724	0.2436
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.3966	0.3594
	Second	0.3020	0.2764
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.5370	0.5404
	Second	0.4060	0.4022
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.6556	0.6192
	Second	0.5026	0.4576
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.4904	0.4448
	Second	0.3838	0.3200
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.5702	0.5722
	Second	0.4268	0.4254
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.6244	0.6218
	Second	0.4626	0.4660
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.5306	0.5530
	Second	0.4004	0.3942
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.4862	0.4464
	Second	0.3660	0.3212
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2112	0.2504
	Second	0.1740	0.1890
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.2136	0.2270
	Second	0.1672	0.1756
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2516	0.2816
	Second	0.1954	0.2118
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.4536	0.5158
	Second	0.3542	0.3736
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3102	0.3532
	Second	0.2362	0.2580
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2678	0.3052
	Second	0.2078	0.2300
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2124	0.2454
	Second	0.1652	0.1858
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2030	0.1752
	Second	0.1638	0.1336
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1846	0.1602
	Second	0.1472	0.1370
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2766	0.2684
	Second	0.2120	0.1932
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0786	0.0644
	Second	0.0766	0.0608
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2144	0.2114
	Second	0.1740	0.1644
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.3714	0.3920
	Second	0.2864	0.2922
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2468	0.2328
	Second	0.1992	0.1814
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3640	0.3652
	Second	0.2780	0.2688
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3514	0.3376
	Second	0.2776	0.2528
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.5360	0.5274
	Second	0.4040	0.3910

Table F.28. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0526	0.0514
	Second	0.0484	0.0490
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.2864	0.2700
	Second	0.2514	0.2264
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.2296	0.2502
	Second	0.2062	0.2142
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.2460	0.2190
	Second	0.2158	0.1950
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.2830	0.2836
	Second	0.2624	0.2406
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.2886	0.2980
	Second	0.2514	0.2564
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.2526	0.2228
	Second	0.2214	0.1950
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.3358	0.3284
	Second	0.2934	0.2786
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.3244	0.3140
	Second	0.2724	0.2766
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.3760	0.3288
	Second	0.3204	0.2820
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.4880	0.4800
	Second	0.4198	0.4128
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.6000	0.5694
	Second	0.5228	0.5016
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.4412	0.4090
	Second	0.3836	0.3442
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.5282	0.5284
	Second	0.4624	0.4490
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.5838	0.5690
	Second	0.5048	0.5020
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.4800	0.5162
	Second	0.4248	0.4410
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.4496	0.4048
	Second	0.3892	0.3534
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.1926	0.2122
	Second	0.1768	0.1934
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.1942	0.2240
	Second	0.1684	0.2070
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2374	0.2528
	Second	0.2070	0.2210
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.4116	0.4822
	Second	0.3676	0.4192
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2870	0.3252
	Second	0.2402	0.2762
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2498	0.2796
	Second	0.2188	0.2490
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2000	0.2168
	Second	0.1664	0.1854
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1826	0.1674
	Second	0.1614	0.1558
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1596	0.1540
	Second	0.1452	0.1402
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2420	0.2432
	Second	0.2186	0.2208
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0780	0.0690
	Second	0.0758	0.0672
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2044	0.1898
	Second	0.1838	0.1680
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.3434	0.3514
	Second	0.2992	0.3036
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2400	0.2268
	Second	0.2078	0.1952
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3402	0.3422
	Second	0.2960	0.2928
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2946	0.3138
	Second	0.2596	0.2652
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.4796	0.4860
	Second	0.4062	0.4194

Table F.29. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0516	0.0482
	Second	0.0524	0.0508
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.3498	0.3194
	Second	0.2628	0.2434
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.2922	0.3076
	Second	0.2292	0.2270
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.3036	0.2778
	Second	0.2334	0.2104
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.3374	0.3286
	Second	0.2626	0.2450
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.3412	0.3568
	Second	0.2694	0.2656
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.2900	0.2710
	Second	0.2336	0.2064
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.3872	0.3990
	Second	0.3026	0.2928
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.3936	0.3710
	Second	0.3114	0.2828
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.4388	0.3988
	Second	0.3290	0.2926
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.5886	0.5818
	Second	0.4580	0.4484
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.7038	0.6678
	Second	0.5444	0.5096
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.5348	0.4960
	Second	0.4088	0.3732
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.6444	0.6468
	Second	0.4904	0.4964
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.6808	0.6816
	Second	0.5394	0.5304
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.5840	0.5924
	Second	0.4424	0.4394
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.5400	0.5114
	Second	0.4124	0.3844
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2402	0.2608
	Second	0.1924	0.2046
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.2372	0.2672
	Second	0.1852	0.2022
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.2782	0.3172
	Second	0.2234	0.2372
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.5088	0.5798
	Second	0.3928	0.4392
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3418	0.4010
	Second	0.2564	0.3010
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.2992	0.3302
	Second	0.2262	0.2488
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2332	0.2798
	Second	0.1900	0.2072
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2120	0.1888
	Second	0.1756	0.1530
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.1860	0.1740
	Second	0.1544	0.1340
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3122	0.2978
	Second	0.2418	0.2338
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0894	0.0700
	Second	0.0816	0.0630
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2418	0.2280
	Second	0.1966	0.1868
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.4026	0.4398
	Second	0.3140	0.3084
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.2740	0.2496
	Second	0.2220	0.1942
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4082	0.3998
	Second	0.3208	0.3064
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3596	0.3780
	Second	0.2802	0.2794
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.5896	0.6040
	Second	0.4580	0.4512

Table F.30. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 20, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0480	0.0512
	Second	0.0508	0.0490
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.4452	0.4284
	Second	0.2976	0.2804
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.3782	0.3862
	Second	0.2488	0.2576
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.3852	0.3312
	Second	0.2560	0.2302
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.4464	0.4152
	Second	0.2868	0.2756
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.4366	0.4608
	Second	0.2932	0.3078
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.3832	0.3416
	Second	0.2520	0.2324
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.5230	0.5040
	Second	0.3432	0.3376
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.4968	0.4790
	Second	0.3300	0.3192
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.5586	0.5158
	Second	0.3714	0.3512
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.7204	0.7404
	Second	0.4942	0.5128
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.8414	0.8220
	Second	0.6062	0.5880
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6850	0.6196
	Second	0.4538	0.4150
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.7706	0.7826
	Second	0.5382	0.5468
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.8122	0.8170
	Second	0.5820	0.5836
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.7230	0.7308
	Second	0.4978	0.5064
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6636	0.6278
	Second	0.4462	0.4212
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3016	0.3322
	Second	0.2026	0.2218
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3106	0.3462
	Second	0.2074	0.2352
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3392	0.3932
	Second	0.2246	0.2594
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.6318	0.7114
	Second	0.4266	0.4818
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4242	0.4836
	Second	0.2792	0.3230
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3934	0.4342
	Second	0.2536	0.2882
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2928	0.3356
	Second	0.1904	0.2306
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2884	0.2474
	Second	0.1964	0.1770
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2256	0.2102
	Second	0.1628	0.1596
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3812	0.3824
	Second	0.2506	0.2530
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1046	0.0750
	Second	0.0784	0.0660
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3122	0.2972
	Second	0.2048	0.2032
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.5324	0.5642
	Second	0.3562	0.3712
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3528	0.3306
	Second	0.2356	0.2228
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5386	0.5134
	Second	0.3534	0.3424
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4748	0.4868
	Second	0.3220	0.3280
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.7222	0.7226
	Second	0.4904	0.4880

Table F.31. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 8, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0522	0.0498
	Second	0.0470	0.0536
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.3878	0.3700
	Second	0.3352	0.3086
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.3252	0.3310
	Second	0.2870	0.2870
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.3406	0.2920
	Second	0.2894	0.2532
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.3870	0.3776
	Second	0.3342	0.3248
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.3948	0.3950
	Second	0.3272	0.3372
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.3444	0.3022
	Second	0.2918	0.2566
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.4516	0.4552
	Second	0.3824	0.3922
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.4550	0.4234
	Second	0.3858	0.3574
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.4946	0.4596
	Second	0.4114	0.3888
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.6500	0.6572
	Second	0.5746	0.5672
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.7712	0.7416
	Second	0.6838	0.6508
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6032	0.5606
	Second	0.5042	0.4806
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.7098	0.6912
	Second	0.6140	0.5980
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.7510	0.7484
	Second	0.6586	0.6588
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.6534	0.6704
	Second	0.5714	0.5782
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.5976	0.5654
	Second	0.5132	0.4806
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2644	0.2952
	Second	0.2246	0.2488
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.2686	0.2994
	Second	0.2300	0.2602
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3170	0.3580
	Second	0.2730	0.2942
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.5622	0.6342
	Second	0.4850	0.5448
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3830	0.4376
	Second	0.3304	0.3660
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3384	0.3862
	Second	0.2886	0.3340
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.2626	0.3040
	Second	0.2208	0.2606
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2456	0.2234
	Second	0.2182	0.2006
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2078	0.1934
	Second	0.1854	0.1716
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3326	0.3416
	Second	0.2908	0.2900
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.0916	0.0706
	Second	0.0838	0.0678
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.2944	0.2670
	Second	0.2284	0.2230
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.4812	0.4920
	Second	0.4046	0.4168
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3132	0.2848
	Second	0.2618	0.2468
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4798	0.4634
	Second	0.4146	0.3864
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4250	0.4390
	Second	0.3546	0.3642
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.6488	0.6524
	Second	0.5744	0.5592

Table F.32. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 16, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0486	0.0496
	Second	0.0460	0.0474
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.4802	0.4516
	Second	0.3434	0.3256
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.4026	0.4304
	Second	0.2986	0.3044
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.4120	0.3622
	Second	0.3010	0.2690
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.4694	0.4508
	Second	0.3368	0.3240
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.4682	0.4898
	Second	0.3424	0.3512
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.4090	0.3798
	Second	0.2990	0.2660
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.5456	0.5358
	Second	0.3900	0.3926
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.5472	0.5164
	Second	0.3992	0.3826
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.6114	0.5558
	Second	0.4476	0.4116
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.7644	0.7694
	Second	0.5950	0.5872
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.8670	0.8544
	Second	0.6998	0.6842
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.7208	0.6730
	Second	0.5362	0.5080
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.8118	0.8092
	Second	0.6306	0.6298
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.8466	0.8496
	Second	0.6790	0.6740
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.7568	0.7834
	Second	0.5830	0.6116
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.7140	0.6826
	Second	0.5354	0.5162
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3206	0.3740
	Second	0.2268	0.2752
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3390	0.3696
	Second	0.2418	0.2600
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3928	0.4324
	Second	0.2874	0.3124
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.6834	0.7592
	Second	0.5164	0.5814
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4590	0.5444
	Second	0.3388	0.3990
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.4130	0.4810
	Second	0.3012	0.3556
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3144	0.3532
	Second	0.2372	0.2602
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3016	0.2542
	Second	0.2074	0.1892
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2546	0.2258
	Second	0.1914	0.1770
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4120	0.4216
	Second	0.3106	0.3036
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1068	0.0784
	Second	0.0856	0.0680
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3208	0.3314
	Second	0.2396	0.2362
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.5654	0.5840
	Second	0.4096	0.4396
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3838	0.3554
	Second	0.2818	0.2564
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5736	0.5534
	Second	0.4126	0.4066
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.5144	0.5148
	Second	0.3762	0.3826
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.7708	0.7690
	Second	0.5996	0.5864

Table F.33. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 32, n= 16.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0492	0.0504
	Second	0.0492	0.0528
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.6088	0.5686
	Second	0.3754	0.3500
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.5250	0.5328
	Second	0.3304	0.3248
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.5202	0.4654
	Second	0.3352	0.2894
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.5976	0.5700
	Second	0.3740	0.3546
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.6074	0.6216
	Second	0.3662	0.3800
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.5212	0.4654
	Second	0.3258	0.2914
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.6692	0.6730
	Second	0.4274	0.4298
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.6784	0.6634
	Second	0.4368	0.4058
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.7320	0.6928
	Second	0.4712	0.4362
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.8838	0.8852
	Second	0.6376	0.6276
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9512	0.9398
	Second	0.7472	0.7102
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8568	0.8088
	Second	0.5954	0.5394
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9184	0.9122
	Second	0.6846	0.6724
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9386	0.9450
	Second	0.7216	0.7222
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.8826	0.9030
	Second	0.6316	0.6478
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8356	0.7884
	Second	0.5788	0.5344
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.4046	0.4742
	Second	0.2542	0.2896
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.4106	0.4746
	Second	0.2664	0.2892
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.4836	0.5528
	Second	0.3000	0.3312
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.8124	0.8790
	Second	0.5534	0.6066
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5872	0.6748
	Second	0.3692	0.4296
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.5222	0.6002
	Second	0.3230	0.3614
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4054	0.4698
	Second	0.2620	0.2798
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3762	0.3394
	Second	0.2358	0.2092
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3110	0.2766
	Second	0.2028	0.1792
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.5148	0.5240
	Second	0.3154	0.3182
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1178	0.0860
	Second	0.0948	0.0720
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4248	0.4112
	Second	0.2538	0.2542
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.7204	0.7242
	Second	0.4612	0.4662
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4726	0.4578
	Second	0.2992	0.2772
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7108	0.6910
	Second	0.4544	0.4340
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.6416	0.6586
	Second	0.4004	0.4120
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8892	0.8898
	Second	0.6340	0.6288

Table F.34. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 10, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0488	0.0530
	Second	0.0508	0.0532
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.4446	0.4298
	Second	0.3816	0.3602
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.4000	0.3972
	Second	0.3412	0.3386
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.3942	0.3512
	Second	0.3402	0.2876
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.4502	0.4178
	Second	0.3840	0.3500
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.4474	0.4584
	Second	0.3794	0.3910
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.3918	0.3534
	Second	0.3320	0.2934
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.5222	0.5104
	Second	0.4376	0.4246
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.5150	0.5062
	Second	0.4414	0.4264
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.5730	0.5428
	Second	0.4798	0.4500
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.7430	0.7460
	Second	0.6526	0.6460
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.8512	0.8294
	Second	0.7630	0.7416
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6876	0.6562
	Second	0.5912	0.5570
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.7904	0.7702
	Second	0.6960	0.6844
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.8250	0.8292
	Second	0.7442	0.7270
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.7366	0.7608
	Second	0.6484	0.6656
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.6970	0.6518
	Second	0.6040	0.5600
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2984	0.3524
	Second	0.2528	0.2994
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3054	0.3518
	Second	0.2640	0.2974
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.3744	0.4216
	Second	0.3126	0.3638
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.6512	0.7272
	Second	0.5606	0.6256
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4418	0.5114
	Second	0.3778	0.4294
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.3920	0.4436
	Second	0.3380	0.3704
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3000	0.3492
	Second	0.2666	0.3034
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.2852	0.2402
	Second	0.2514	0.2012
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2412	0.2162
	Second	0.2034	0.1862
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3896	0.3942
	Second	0.3380	0.3310
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1088	0.0722
	Second	0.0998	0.0744
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3096	0.3000
	Second	0.2562	0.2554
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.5332	0.5640
	Second	0.4652	0.4686
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.3798	0.3348
	Second	0.3174	0.2784
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5602	0.5290
	Second	0.4844	0.4522
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4876	0.4874
	Second	0.4094	0.4144
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.7440	0.7480
	Second	0.6502	0.6498

Table F.35. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 20, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0480	0.0566
	Second	0.0468	0.0532
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.5496	0.5242
	Second	0.3938	0.3762
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.4790	0.5022
	Second	0.3424	0.3522
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.4774	0.4246
	Second	0.3472	0.3108
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.5452	0.5358
	Second	0.3948	0.3854
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.5590	0.5668
	Second	0.4012	0.4022
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.4712	0.4354
	Second	0.3422	0.3062
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.6228	0.6302
	Second	0.4528	0.4440
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.6156	0.5840
	Second	0.4496	0.4362
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.6910	0.6394
	Second	0.5012	0.4644
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.8482	0.8528
	Second	0.6712	0.6630
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9280	0.9128
	Second	0.7794	0.7546
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.7958	0.7572
	Second	0.6062	0.5650
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.8798	0.8804
	Second	0.7136	0.7068
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9110	0.9042
	Second	0.7646	0.7610
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.8440	0.8562
	Second	0.6642	0.6746
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8144	0.7626
	Second	0.6270	0.5698
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3736	0.4228
	Second	0.2670	0.2974
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.3736	0.4318
	Second	0.2778	0.3020
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.4484	0.5164
	Second	0.3212	0.3678
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.7766	0.8334
	Second	0.5952	0.6442
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5438	0.6178
	Second	0.3950	0.4532
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.4860	0.5506
	Second	0.3490	0.3924
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.3780	0.4158
	Second	0.2738	0.2892
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.3428	0.2968
	Second	0.2434	0.2214
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.2902	0.2820
	Second	0.2102	0.2096
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.4648	0.4784
	Second	0.3438	0.3402
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1152	0.0826
	Second	0.0912	0.0722
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.3834	0.3826
	Second	0.2778	0.2660
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.6596	0.6726
	Second	0.4862	0.4974
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.4506	0.4158
	Second	0.3216	0.2910
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.6566	0.6354
	Second	0.4896	0.4458
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.5904	0.6014
	Second	0.4388	0.4404
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.8424	0.8302
	Second	0.6702	0.6612

Table F.36. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak 4: Blocks= 40, n= 20.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0554
	Second	0.0520	0.0512
(0.0 , 0.0 , 0.0 , 0.5 , 0.0)	First	0.6908	0.6514
	Second	0.4320	0.3892
(0.0 , 0.0 , 0.0 , 0.5 , 0.2)	First	0.6082	0.6016
	Second	0.3718	0.3576
(0.2 , 0.2 , 0.2 , 0.6 , 0.0)	First	0.5964	0.5416
	Second	0.3582	0.3166
(0.0 , 0.2 , 0.2 , 0.5 , 0.0)	First	0.6906	0.6646
	Second	0.4314	0.4076
(0.0 , 0.0 , 0.2 , 0.5 , 0.2)	First	0.6918	0.6962
	Second	0.4280	0.4140
(0.2 , 0.4 , 0.4 , 0.6 , 0.0)	First	0.6014	0.5418
	Second	0.3598	0.3280
(0.0 , 0.4 , 0.4 , 0.6 , 0.2)	First	0.7672	0.7496
	Second	0.4976	0.4680
(0.0 , 0.0 , 0.2 , 0.5 , 0.0)	First	0.7532	0.7336
	Second	0.4704	0.4582
(0.2 , 0.2 , 0.4 , 0.7 , 0.0)	First	0.8150	0.7644
	Second	0.5350	0.4846
(0.0 , 0.0 , 0.4 , 0.7 , 0.2)	First	0.9386	0.9434
	Second	0.7084	0.7038
(0.0 , 0.2 , 0.5 , 0.8 , 0.0)	First	0.9790	0.9728
	Second	0.8072	0.7784
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.9072	0.8814
	Second	0.6436	0.6046
(0.0 , 0.4 , 0.6 , 0.8 , 0.2)	First	0.9614	0.9588
	Second	0.7572	0.7374
(0.0 , 0.2 , 0.6 , 0.8 , 0.2)	First	0.9756	0.9766
	Second	0.8014	0.7840
(0.0 , 0.2 , 0.4 , 0.8 , 0.4)	First	0.9384	0.9440
	Second	0.7024	0.7112
(0.2 , 0.4 , 0.6 , 0.8 , 0.0)	First	0.8974	0.8688
	Second	0.6570	0.5996
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.4866	0.5318
	Second	0.2912	0.3136
(0.0 , 0.2 , 0.2 , 0.5 , 0.5)	First	0.4862	0.5472
	Second	0.2912	0.3252
(0.0 , 0.0 , 0.2 , 0.5 , 0.5)	First	0.5544	0.6318
	Second	0.3350	0.3818
(0.0 , 0.2 , 0.5 , 0.8 , 0.8)	First	0.8902	0.9356
	Second	0.6222	0.6736
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.6838	0.7492
	Second	0.4210	0.4752
(0.0 , 0.2 , 0.5 , 0.5 , 0.5)	First	0.6150	0.6784
	Second	0.3640	0.4130
(0.0 , 0.5 , 0.5 , 0.5 , 0.5)	First	0.4708	0.5358
	Second	0.2816	0.3174
(0.2 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.4282	0.3816
	Second	0.2638	0.2274
(0.2 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.3562	0.3270
	Second	0.2202	0.2048
(0.0 , 0.5 , 0.5 , 0.5 , 0.2)	First	0.6072	0.6018
	Second	0.3668	0.3592
(0.5 , 0.5 , 0.5 , 0.5 , 0.0)	First	0.1358	0.0866
	Second	0.1004	0.0704
(0.2 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.4864	0.4770
	Second	0.2958	0.2692
(0.0 , 0.0 , 0.5 , 0.5 , 0.2)	First	0.7806	0.8128
	Second	0.5070	0.5154
(0.2 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.5640	0.5308
	Second	0.3402	0.3196
(0.0 , 0.2 , 0.5 , 0.5 , 0.0)	First	0.7988	0.7816
	Second	0.5158	0.5056
(0.0 , 0.2 , 0.5 , 0.5 , 0.2)	First	0.7264	0.7296
	Second	0.4512	0.4640
(0.0 , 0.3 , 0.7 , 0.7 , 0.2)	First	0.9408	0.9330
	Second	0.7126	0.6954

APPENDIX G. 3 TREATMENTS WITH PEAK UNKNOWN

Table G.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0522	0.0438
	Second	0.0522	0.0406
(0.5 , 0.0 , 0.0)	First	0.3378	0.3286
	Second	0.2986	0.2678
(0.7 , 0.5 , 0.0)	First	0.6246	0.5982
	Second	0.5732	0.5188
(0.0 , 0.5 , 1.0)	First	0.8624	0.8522
	Second	0.8104	0.7724
(0.0 , 0.5 , 0.5)	First	0.4086	0.4146
	Second	0.3734	0.3610
(0.0 , 0.7 , 0.0)	First	0.7184	0.7198
	Second	0.6590	0.6234
(0.0 , 0.7 , 0.5)	First	0.5368	0.5180
	Second	0.4762	0.4390

Table G.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0488	0.0506
	Second	0.0558	0.0458
(0.5 , 0.0 , 0.0)	First	0.4500	0.4436
	Second	0.3174	0.3014
(0.7 , 0.5 , 0.0)	First	0.7494	0.7476
	Second	0.5864	0.5744
(0.0 , 0.5 , 1.0)	First	0.9504	0.9392
	Second	0.8462	0.8188
(0.0 , 0.5 , 0.5)	First	0.5370	0.5468
	Second	0.4130	0.4002
(0.0 , 0.7 , 0.0)	First	0.8668	0.8540
	Second	0.7088	0.6690
(0.0 , 0.7 , 0.5)	First	0.6622	0.6640
	Second	0.5064	0.4804

Table G.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 3 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0486	0.0484
	Second	0.0568	0.0414
(0.5 , 0.0 , 0.0)	First	0.6066	0.6154
	Second	0.3668	0.3608
(0.7 , 0.5 , 0.0)	First	0.8954	0.8786
	Second	0.6778	0.6294
(0.0 , 0.5 , 1.0)	First	0.9914	0.9888
	Second	0.8910	0.8780
(0.0 , 0.5 , 0.5)	First	0.6758	0.6830
	Second	0.4534	0.4242
(0.0 , 0.7 , 0.0)	First	0.9562	0.9624
	Second	0.7928	0.7534
(0.0 , 0.7 , 0.5)	First	0.8164	0.8206
	Second	0.5990	0.5378

Table G.4. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0490	0.0446
	Second	0.0548	0.0478
(0.5 , 0.0 , 0.0)	First	0.1788	0.1836
	Second	0.1552	0.1524
(0.7 , 0.5 , 0.0)	First	0.3452	0.3616
	Second	0.3072	0.2806
(0.0 , 0.5 , 1.0)	First	0.6182	0.6014
	Second	0.5522	0.5146
(0.0 , 0.5 , 0.5)	First	0.2284	0.2394
	Second	0.2124	0.1926
(0.0 , 0.7 , 0.0)	First	0.4526	0.4410
	Second	0.4024	0.3744
(0.0 , 0.7 , 0.5)	First	0.3248	0.3192
	Second	0.2920	0.2606

Table G.5. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0504	0.0494
	Second	0.0496	0.0454
(0.5 , 0.0 , 0.0)	First	0.2226	0.2182
	Second	0.1612	0.1528
(0.7 , 0.5 , 0.0)	First	0.4610	0.4452
	Second	0.3354	0.3142
(0.0 , 0.5 , 1.0)	First	0.7490	0.7494
	Second	0.5868	0.5638
(0.0 , 0.5 , 0.5)	First	0.3012	0.3064
	Second	0.2330	0.2088
(0.0 , 0.7 , 0.0)	First	0.5792	0.5612
	Second	0.4304	0.3734
(0.0 , 0.7 , 0.5)	First	0.4204	0.4084
	Second	0.3166	0.2920

Table G.6. Estimated rejection percentages of tests for mixed design under the normal distribution for 3 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0436	0.0476
	Second	0.0516	0.0420
(0.5 , 0.0 , 0.0)	First	0.3182	0.3208
	Second	0.1974	0.1776
(0.7 , 0.5 , 0.0)	First	0.6020	0.6282
	Second	0.3846	0.3800
(0.0 , 0.5 , 1.0)	First	0.8932	0.8836
	Second	0.6592	0.6340
(0.0 , 0.5 , 0.5)	First	0.4122	0.4114
	Second	0.2762	0.2490
(0.0 , 0.7 , 0.0)	First	0.7382	0.7410
	Second	0.5052	0.4650
(0.0 , 0.7 , 0.5)	First	0.5520	0.5586
	Second	0.3620	0.3404

Table G.7. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0432	0.0480
	Second	0.0544	0.0490
(0.5 , 0.0 , 0.0)	First	0.1230	0.1226
	Second	0.1188	0.1108
(0.7 , 0.5 , 0.0)	First	0.2476	0.2544
	Second	0.2252	0.2122
(0.0 , 0.5 , 1.0)	First	0.4282	0.4100
	Second	0.3906	0.3558
(0.0 , 0.5 , 0.5)	First	0.1840	0.1624
	Second	0.1692	0.1424
(0.0 , 0.7 , 0.0)	First	0.3122	0.3016
	Second	0.2704	0.2592
(0.0 , 0.7 , 0.5)	First	0.2400	0.2260
	Second	0.2196	0.2012

Table G.8. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0)	First	0.0506	0.0410
	Second	0.0532	0.0425
(0.5 , 0.0 , 0.0)	First	0.1564	0.1604
	Second	0.1228	0.1178
(0.7 , 0.5 , 0.0)	First	0.3268	0.3172
	Second	0.2388	0.2270
(0.0 , 0.5 , 1.0)	First	0.5534	0.5452
	Second	0.4122	0.3808
(0.0 , 0.5 , 0.5)	First	0.2232	0.2104
	Second	0.1684	0.1510
(0.0 , 0.7 , 0.0)	First	0.4030	0.3912
	Second	0.3078	0.2664
(0.0 , 0.7 , 0.5)	First	0.3008	0.2992
	Second	0.2300	0.2136

Table G.9. Estimated rejection percentages of tests for mixed design under the t distribution for 3 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0)	First	0.0526	0.0470
	Second	0.0570	0.0448
(0.5 , 0.0 , 0.0)	First	0.2212	0.2142
	Second	0.1516	0.1208
(0.7 , 0.5 , 0.0)	First	0.4454	0.4348
	Second	0.2886	0.2476
(0.0 , 0.5 , 1.0)	First	0.7160	0.7282
	Second	0.4798	0.4558
(0.0 , 0.5 , 0.5)	First	0.2874	0.2862
	Second	0.1962	0.1742
(0.0 , 0.7 , 0.0)	First	0.5412	0.5390
	Second	0.3496	0.3230
(0.0 , 0.7 , 0.5)	First	0.3914	0.4118
	Second	0.2722	0.2452

APPENDIX H. 4 TREATMENTS WITH PEAK UNKNOWN

Table H.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0528
	Second	0.0462	0.0544
(1.0 , 0.0 , 0.0 , 0.0)	First	0.6994	0.7374
	Second	0.6082	0.6222
(1.0 , 0.75 , 0.5 , 0.25)	First	0.7244	0.7096
	Second	0.6420	0.6242
(0.75 , 0.75 , 0.5 , 0.0)	First	0.7298	0.7358
	Second	0.6530	0.6452
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3968	0.4184
	Second	0.3516	0.3544
(0.5 , 1.0 , 0.2 , 0.2)	First	0.6930	0.7288
	Second	0.6142	0.6258
(0.8 , 1.0 , 0.75 , 0.2)	First	0.6842	0.7074
	Second	0.6138	0.6194
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3812	0.3948
	Second	0.3484	0.3388
(0.2 , 0.75 , 1.0 , 0.75)	First	0.6902	0.7024
	Second	0.6172	0.6096
(0.0 , 0.5 , 0.75 , 0.75)	First	0.7348	0.7460
	Second	0.6582	0.6434
(0.0 , 0.0 , 0.25 , 1.0)	First	0.8506	0.8576
	Second	0.7802	0.7752
(0.0 , 0.0 , 0.75 , 0.75)	First	0.8158	0.8420
	Second	0.7470	0.7538

Table H.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0484	0.0474
	Second	0.0522	0.0528
(1.0 , 0.0 , 0.0 , 0.0)	First	0.8462	0.8744
	Second	0.6420	0.6684
(1.0 , 0.75 , 0.5 , 0.25)	First	0.8442	0.8562
	Second	0.6732	0.6728
(0.75 , 0.75 , 0.5 , 0.0)	First	0.8476	0.8596
	Second	0.6886	0.6918
(0.5 , 0.5 , 0.5 , 0.0)	First	0.4948	0.5262
	Second	0.3724	0.3772
(0.5 , 1.0 , 0.2 , 0.2)	First	0.8466	0.8614
	Second	0.6758	0.6552
(0.8 , 1.0 , 0.75 , 0.2)	First	0.8192	0.8398
	Second	0.6616	0.6614
(0.0 , 0.25 , 0.5 , 0.25)	First	0.4888	0.5128
	Second	0.3688	0.3644
(0.2 , 0.75 , 1.0 , 0.75)	First	0.8152	0.8380
	Second	0.6568	0.6610
(0.0 , 0.5 , 0.75 , 0.75)	First	0.8470	0.8602
	Second	0.6860	0.6840
(0.0 , 0.0 , 0.25 , 1.0)	First	0.9518	0.9528
	Second	0.8250	0.8116
(0.0 , 0.0 , 0.75 , 0.75)	First	0.9186	0.9350
	Second	0.7696	0.7796

Table H.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 4 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0434	0.0516
	Second	0.0468	0.0520
(1.0 , 0.0 , 0.0 , 0.0)	First	0.9556	0.9706
	Second	0.7320	0.7572
(1.0 , 0.75 , 0.5 , 0.25)	First	0.9550	0.9532
	Second	0.7730	0.7416
(0.75 , 0.75 , 0.5 , 0.0)	First	0.9496	0.9560
	Second	0.7544	0.7622
(0.5 , 0.5 , 0.5 , 0.0)	First	0.6508	0.6776
	Second	0.4284	0.4266
(0.5 , 1.0 , 0.2 , 0.2)	First	0.9570	0.9582
	Second	0.7538	0.7530
(0.8 , 1.0 , 0.75 , 0.2)	First	0.9300	0.9424
	Second	0.7276	0.7436
(0.0 , 0.25 , 0.5 , 0.25)	First	0.6746	0.6806
	Second	0.4292	0.4368
(0.2 , 0.75 , 1.0 , 0.75)	First	0.9236	0.9358
	Second	0.7130	0.7238
(0.0 , 0.5 , 0.75 , 0.75)	First	0.9470	0.9572
	Second	0.7624	0.7594
(0.0 , 0.0 , 0.25 , 1.0)	First	0.9954	0.9938
	Second	0.8864	0.8736
(0.0 , 0.0 , 0.75 , 0.75)	First	0.9830	0.9848
	Second	0.8522	0.8542

Table H.4. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0470	0.0534
	Second	0.0504	0.0518
(1.0 , 0.0 , 0.0 , 0.0)	First	0.4688	0.5070
	Second	0.4122	0.4250
(1.0 , 0.75 , 0.5 , 0.25)	First	0.3966	0.4308
	Second	0.3404	0.3574
(0.75 , 0.75 , 0.5 , 0.0)	First	0.4348	0.4850
	Second	0.3852	0.4124
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2220	0.2492
	Second	0.1978	0.2046
(0.5 , 1.0 , 0.2 , 0.2)	First	0.4236	0.4520
	Second	0.3744	0.3868
(0.8 , 1.0 , 0.75 , 0.2)	First	0.4330	0.4656
	Second	0.3826	0.3952
(0.0 , 0.25 , 0.5 , 0.25)	First	0.1962	0.2150
	Second	0.1854	0.1698
(0.2 , 0.75 , 1.0 , 0.75)	First	0.4274	0.4540
	Second	0.3792	0.3796
(0.0 , 0.5 , 0.75 , 0.75)	First	0.4554	0.4974
	Second	0.4008	0.4126
(0.0 , 0.0 , 0.25 , 1.0)	First	0.5854	0.6102
	Second	0.5080	0.5054
(0.0 , 0.0 , 0.75 , 0.75)	First	0.5678	0.6022
	Second	0.4838	0.5002

Table H.5. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0432	0.0486
	Second	0.0532	0.0446
(1.0 , 0.0 , 0.0 , 0.0)	First	0.6082	0.6578
	Second	0.4338	0.4544
(1.0 , 0.75 , 0.5 , 0.25)	First	0.5148	0.5488
	Second	0.3732	0.3884
(0.75 , 0.75 , 0.5 , 0.0)	First	0.5854	0.6098
	Second	0.4338	0.4446
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2732	0.3138
	Second	0.2122	0.2232
(0.5 , 1.0 , 0.2 , 0.2)	First	0.5504	0.5918
	Second	0.4032	0.4154
(0.8 , 1.0 , 0.75 , 0.2)	First	0.5468	0.5742
	Second	0.4080	0.4134
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2562	0.2644
	Second	0.1940	0.1890
(0.2 , 0.75 , 1.0 , 0.75)	First	0.5314	0.5730
	Second	0.4008	0.4046
(0.0 , 0.5 , 0.75 , 0.75)	First	0.5754	0.6076
	Second	0.4440	0.4336
(0.0 , 0.0 , 0.25 , 1.0)	First	0.7176	0.7522
	Second	0.5360	0.5436
(0.0 , 0.0 , 0.75 , 0.75)	First	0.7002	0.7364
	Second	0.5296	0.5550

Table H.6. Estimated rejection percentages of tests for mixed design under the normal distribution for 4 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0478	0.0554
	Second	0.0486	0.0528
(1.0 , 0.0 , 0.0 , 0.0)	First	0.8026	0.8240
	Second	0.5256	0.5284
(1.0 , 0.75 , 0.5 , 0.25)	First	0.6916	0.7268
	Second	0.4280	0.4458
(0.75 , 0.75 , 0.5 , 0.0)	First	0.7440	0.7892
	Second	0.5020	0.5018
(0.5 , 0.5 , 0.5 , 0.0)	First	0.3874	0.4080
	Second	0.2494	0.2432
(0.5 , 1.0 , 0.2 , 0.2)	First	0.7322	0.7438
	Second	0.4728	0.4812
(0.8 , 1.0 , 0.75 , 0.2)	First	0.7204	0.7364
	Second	0.4598	0.4746
(0.0 , 0.25 , 0.5 , 0.25)	First	0.3370	0.3664
	Second	0.2080	0.2288
(0.2 , 0.75 , 1.0 , 0.75)	First	0.6998	0.7172
	Second	0.4606	0.4662
(0.0 , 0.5 , 0.75 , 0.75)	First	0.7458	0.7796
	Second	0.4920	0.5114
(0.0 , 0.0 , 0.25 , 1.0)	First	0.8790	0.8970
	Second	0.6266	0.6296
(0.0 , 0.0 , 0.75 , 0.75)	First	0.8574	0.8820
	Second	0.6072	0.6174

Table H.7. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0516	0.0542
	Second	0.0448	0.0560
(1.0 , 0.0 , 0.0 , 0.0)	First	0.3194	0.3356
	Second	0.2708	0.2704
(1.0 , 0.75 , 0.5 , 0.25)	First	0.2646	0.2956
	Second	0.2382	0.2490
(0.75 , 0.75 , 0.5 , 0.0)	First	0.3264	0.3420
	Second	0.2818	0.2874
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1668	0.1862
	Second	0.1598	0.1590
(0.5 , 1.0 , 0.2 , 0.2)	First	0.2986	0.3228
	Second	0.2610	0.2638
(0.8 , 1.0 , 0.75 , 0.2)	First	0.3052	0.3342
	Second	0.2794	0.2820
(0.0 , 0.25 , 0.5 , 0.25)	First	0.1552	0.1652
	Second	0.1462	0.1362
(0.2 , 0.75 , 1.0 , 0.75)	First	0.2974	0.3276
	Second	0.2624	0.2728
(0.0 , 0.5 , 0.75 , 0.75)	First	0.3198	0.3402
	Second	0.2810	0.2760
(0.0 , 0.0 , 0.25 , 1.0)	First	0.3912	0.4178
	Second	0.3390	0.3374
(0.0 , 0.0 , 0.75 , 0.75)	First	0.4028	0.4306
	Second	0.3566	0.3594

Table H.8. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0420	0.0532
	Second	0.0452	0.0494
(1.0 , 0.0 , 0.0 , 0.0)	First	0.4122	0.4610
	Second	0.2852	0.3060
(1.0 , 0.75 , 0.5 , 0.25)	First	0.3596	0.3880
	Second	0.2580	0.2586
(0.75 , 0.75 , 0.5 , 0.0)	First	0.4234	0.4488
	Second	0.2956	0.3166
(0.5 , 0.5 , 0.5 , 0.0)	First	0.1982	0.2290
	Second	0.1544	0.1702
(0.5 , 1.0 , 0.2 , 0.2)	First	0.3968	0.4256
	Second	0.2948	0.3048
(0.8 , 1.0 , 0.75 , 0.2)	First	0.3914	0.4224
	Second	0.2980	0.2996
(0.0 , 0.25 , 0.5 , 0.25)	First	0.1758	0.2008
	Second	0.1482	0.1508
(0.2 , 0.75 , 1.0 , 0.75)	First	0.3650	0.3946
	Second	0.2836	0.2804
(0.0 , 0.5 , 0.75 , 0.75)	First	0.4086	0.4340
	Second	0.3044	0.3024
(0.0 , 0.0 , 0.25 , 1.0)	First	0.5284	0.5500
	Second	0.3676	0.3690
(0.0 , 0.0 , 0.75 , 0.75)	First	0.5142	0.5502
	Second	0.3780	0.3818

Table H.9. Estimated rejection percentages of tests for mixed design under the t distribution for 4 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0534
	Second	0.0534	0.0532
(1.0 , 0.0 , 0.0 , 0.0)	First	0.6078	0.6524
	Second	0.3670	0.3690
(1.0 , 0.75 , 0.5 , 0.25)	First	0.4972	0.5308
	Second	0.2934	0.3130
(0.75 , 0.75 , 0.5 , 0.0)	First	0.5546	0.5890
	Second	0.3474	0.3542
(0.5 , 0.5 , 0.5 , 0.0)	First	0.2822	0.2950
	Second	0.1998	0.1854
(0.5 , 1.0 , 0.2 , 0.2)	First	0.5184	0.5550
	Second	0.3174	0.3414
(0.8 , 1.0 , 0.75 , 0.2)	First	0.5086	0.5750
	Second	0.3220	0.3468
(0.0 , 0.25 , 0.5 , 0.25)	First	0.2444	0.2582
	Second	0.1648	0.1706
(0.2 , 0.75 , 1.0 , 0.75)	First	0.5222	0.5402
	Second	0.3220	0.3320
(0.0 , 0.5 , 0.75 , 0.75)	First	0.5472	0.5966
	Second	0.3466	0.3624
(0.0 , 0.0 , 0.25 , 1.0)	First	0.7016	0.7294
	Second	0.4288	0.4366
(0.0 , 0.0 , 0.75 , 0.75)	First	0.6736	0.7146
	Second	0.4272	0.4474

APPENDIX I. 5 TREATMENTS WITH PEAK UNKNOWN

Table I.1. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	Standardized	Non Modification	Distance Modification
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0450	0.0524
	Second	0.0530	0.0476
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.5990	0.6456
	Second	0.4932	0.5096
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.7138	0.7424
	Second	0.6114	0.6184
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.8842	0.8846
	Second	0.8130	0.7968
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4872	0.5076
	Second	0.4196	0.4142
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5834	0.6212
	Second	0.5134	0.5058
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6148	0.6340
	Second	0.5358	0.5276
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3326	0.3614
	Second	0.2912	0.2964
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.5498	0.5586
	Second	0.4614	0.4678
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.6044	0.6364
	Second	0.5320	0.5504
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.9180	0.9184
	Second	0.8452	0.8392

Table I.2. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0502	0.0510
	Second	0.0484	0.0480
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.7592	0.8050
	Second	0.5266	0.5642
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.8542	0.8766
	Second	0.6450	0.6728
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9606	0.9654
	Second	0.8556	0.8396
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.6264	0.6426
	Second	0.4546	0.4474
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.7380	0.7542
	Second	0.5560	0.5526
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.7526	0.7664
	Second	0.5656	0.5802
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.4428	0.4874
	Second	0.3002	0.3288
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.7028	0.7244
	Second	0.4984	0.5014
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.7452	0.7686
	Second	0.5554	0.5900
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.9820	0.9804
	Second	0.8870	0.8734

Table I.3. Estimated rejection percentages of tests for mixed design under the exponential distribution for 5 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0464	0.0530
	Second	0.0474	0.0552
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.9190	0.9426
	Second	0.6188	0.6766
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.9600	0.9676
	Second	0.7470	0.7608
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9930	0.9968
	Second	0.8986	0.8940
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.7888	0.8060
	Second	0.5242	0.5270
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.8870	0.9002
	Second	0.6278	0.6306
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.8860	0.9062
	Second	0.6358	0.6514
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.6162	0.6622
	Second	0.3476	0.3852
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.8694	0.8752
	Second	0.5724	0.5906
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.8846	0.9058
	Second	0.6300	0.6534
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.9990	0.9980
	Second	0.9418	0.9266

Table I.4. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0460	0.0494
	Second	0.0538	0.0474
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.3988	0.4314
	Second	0.3230	0.3486
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.4212	0.4546
	Second	0.3530	0.3546
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.6036	0.6430
	Second	0.5188	0.5500
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2268	0.2494
	Second	0.1940	0.2124
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3020	0.3358
	Second	0.2562	0.2798
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3406	0.3736
	Second	0.2992	0.3050
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.1920	0.2088
	Second	0.1736	0.1708
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2800	0.2934
	Second	0.2386	0.2344
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3468	0.3874
	Second	0.2906	0.3122
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.6534	0.6794
	Second	0.5558	0.5762

Table I.5. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0474	0.0532
	Second	0.0526	0.0508
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.5354	0.5778
	Second	0.3534	0.3626
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.5712	0.6102
	Second	0.3988	0.3972
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7468	0.7806
	Second	0.5564	0.5834
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.3052	0.3472
	Second	0.2142	0.2452
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.4040	0.4300
	Second	0.2734	0.2836
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4442	0.4894
	Second	0.3216	0.3376
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2332	0.2606
	Second	0.1748	0.1884
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3822	0.4074
	Second	0.2620	0.2736
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4438	0.4788
	Second	0.3146	0.3264
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.8108	0.8250
	Second	0.6126	0.6136

Table I.6. Estimated rejection percentages of tests for mixed design under the normal distribution for 5 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0496	0.0502
	Second	0.0472	0.0466
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.7336	0.7574
	Second	0.4180	0.4454
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.7554	0.7928
	Second	0.4494	0.4728
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.9012	0.9184
	Second	0.6336	0.6612
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.4476	0.4826
	Second	0.2642	0.2760
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.5468	0.5800
	Second	0.3240	0.3444
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.6016	0.6382
	Second	0.3678	0.3884
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.3124	0.3522
	Second	0.1862	0.2132
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.5166	0.5592
	Second	0.2916	0.3170
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.5946	0.6458
	Second	0.3548	0.3858
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.9318	0.9446
	Second	0.6882	0.6932

Table I.7. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak unknown: Blocks= 5, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0462	0.0496
	Second	0.0510	0.0442
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.2644	0.2808
	Second	0.2172	0.2230
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.2750	0.2988
	Second	0.2268	0.2312
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.4280	0.4600
	Second	0.3728	0.3788
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.1790	0.1750
	Second	0.1554	0.1610
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2064	0.2246
	Second	0.1814	0.1830
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.2378	0.2802
	Second	0.2114	0.2350
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.1370	0.1648
	Second	0.1310	0.1338
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.1922	0.2170
	Second	0.1690	0.1780
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.2406	0.2638
	Second	0.2166	0.2190
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.4494	0.4732
	Second	0.3782	0.3878

Table I.8. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak unknown: Blocks= 10, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0500	0.0562
	Second	0.0494	0.0534
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.3782	0.4016
	Second	0.2442	0.2546
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.3692	0.4054
	Second	0.2416	0.2594
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.5484	0.5886
	Second	0.3900	0.4102
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2164	0.2404
	Second	0.1528	0.1612
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.2754	0.3050
	Second	0.1884	0.2072
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.3154	0.3488
	Second	0.2266	0.2392
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.1740	0.1964
	Second	0.1364	0.1458
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.2568	0.2750
	Second	0.1766	0.1842
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.3050	0.3540
	Second	0.2114	0.2446
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.5974	0.6332
	Second	0.4134	0.4350

Table I.9. Estimated rejection percentages of tests for mixed design under the t distribution for 5 treatments at peak unknown: Blocks= 20, n= 10.

Location Parameter	**Standardized**	**Non Modification**	**Distance Modification**
(0.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.0466	0.0478
	Second	0.0484	0.0490
(1.0 , 0.0 , 0.0 , 0.0 , 0.0)	First	0.5304	0.5562
	Second	0.2806	0.2896
(1.0 , 0.2 , 0.2 , 0.2 , 0.0)	First	0.5610	0.5734
	Second	0.3084	0.3178
(0.8 , 0.8 , 0.5 , 0.2 , 0.0)	First	0.7198	0.7546
	Second	0.4584	0.4756
(0.5 , 0.5 , 0.2 , 0.2 , 0.0)	First	0.2986	0.3118
	Second	0.1818	0.1802
(0.5 , 0.5 , 0.2 , 0.0 , 0.0)	First	0.3686	0.4164
	Second	0.2152	0.2380
(0.5 , 0.5 , 0.5 , 0.0 , 0.0)	First	0.4308	0.4800
	Second	0.2538	0.2766
(0.2 , 0.2 , 0.5 , 0.0 , 0.0)	First	0.2256	0.2530
	Second	0.1442	0.1630
(0.0 , 0.0 , 0.0 , 0.5 , 0.5)	First	0.3588	0.3934
	Second	0.2068	0.2174
(0.0 , 0.0 , 0.5 , 0.5 , 0.5)	First	0.4360	0.4808
	Second	0.2580	0.2796
(0.0 , 0.0 , 0.0 , 0.5 , 1.0)	First	0.7710	0.7946
	Second	0.4800	0.4960