PREDICTING OUTCOMES OF NBA BASKETBALL GAMES

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Predicting Outcomes of NBA Basketball Games

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ABSTRACT

A stratified random sample of 144 NBA basketball games was taken over a three-year period, between 2008 and 2011. Models were developed to predict point spread and to estimate the probability of a specific team winning based on various in-game statistics. Statistics significant in the model were field-goal shooting percentage, three-point shooting percentage, free-throw shooting percentage, offensive rebounds, assists, turnovers, and free-throws attempted. Models were verified using exact in-game statistics for a random sample of 50 NBA games taken during the 2011-2012 season with 88-94% accuracy. Three methods were used to estimate in-game statistics of future games so that the models could be used to predict a winner in games played by Team A and Team B. Models using these methods had accuracies of approximately 62%. Seasonal averages for these in-game statistics were used in the model developed to predict the winner of each game for the 2013-2016 NBA Championships.

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CHAPTER 1. INTRODUCTION TO THE NBA

Over the last three decades, the NBA (National Basketball Association) has extended its reach to engage an increasingly larger audience. Professional basketball is one of the top three most popular sports in the USA and a global sensation. NBA games are viewable in many nations, and the sport has attracted many international participants. Last season (2014-2015), there were 92 international players from 39 different countries playing for NBA teams (Martin, 2014). The United States used to send college athletes to the Olympics for the basketball competition. However, in 1992, the NBA assembled the original "Dream Team" consisting of all-stars from the league to compete on behalf of the USA which transformed the Summer Games — basketball became one of the Olympics most-watched competitions while simultaneously making a huge impact on the NBA's popularity worldwide. Several of the European boys who watched the1992 Barcelona Olympics as children are now playing in the NBA (Eichenhofer, 2014). The NBA has capitalized on its success by continually improving the business model.

For example, The NBA All-Star weekend which takes place in February each year was once just considered a midseason showcase for the top rated and most popular players. However, the event has developed from a single event into a three-day, weekend-long extravaganza, which includes a rookie game, skills challenge, three-point shootout, and slam dunk contest. NBA All-Star weekend attracts global media attention and has become an enormous event for the sport. Additionally, when it comes to television viewership, according to the Nielsen ratings, the NBA finals were the second most watched sporting event after the Super Bowl. (Tack, 2015)

The increased popularity of the organization has translated to an even more successful business model where revenue is at an all-time high. Since 2001-2002, the league's annual

revenue has increased by $2.13 billion. The NBA's basketball related income was projected around $5.18 billion for the 2014-2015 season. In the 2001-2002 season the top salary for an NBA player was $22,400,000. That has increased by $2,600,000 — offering a top salary of $25,000,000 for the 2015-1016 season. (ESPN, 2016)

Because of the popularity and revenue focused on the NBA we would like to focus our attention on in-game statistics and other factors associated with the game of basketball and determine which of these factors are the most significant in determining the final outcome of the game. Specifically, which combination of these factors explains the final point spread of a game, and which of these factors contributes more significantly to a higher probability of winning a game? The project will consist of developing two models. One model will be developed to explain the final point spread of a game based on in-game statistics. The other model developed will estimate the probability of a team winning based on in-game statistics. The developed models will give both fans and coaches an idea as to what in-game statistics their teams should concentrate on to win more games. All models developed will be used to try and predict future games using various techniques to estimate the in-game statistics ahead of time.

CHAPTER 2. NBA STRUCTURE AND RELATED RESEARCH

2.1. Basic NBA Structure

There are 30 teams in the NBA. Each team has 12 players. Five positions comprise the starting line-up which includes the following: point guard, shooting guard, small forward, power forward, and center. The remaining seven team members are usually referred to as the secondary unit. Only five players per team are allowed on the court at any given time.

The teams are separated into 2 conferences (East and West), and each of the conferences are split up into 3 divisions .The 3 divisions in the Eastern conference are the Atlantic, Central, and Southeast. The 3 divisions in the Western conference are Southwest, Northwest, and Pacific. 82 games are played by each of the 30 teams during the regular season. The regular season begins in late October and ends in late April. (NBA, 2016)

The NBA playoffs are a 7-game series elimination tournament consisting of four rounds which begin at the end of April. All rounds are best-of-seven series. Series are played in a 2-2-1-1-1 format, meaning the team with home-court advantage hosts games 1, 2, 5, and 7, while their opponent hosts games 3, 4, and 6, with games 5–7 being played if needed. The four rounds of the playoffs are: conference quarterfinals, conference semifinals, conference finals, and NBA finals. (NBA, 2016)

There are 16 total teams that compete in the playoffs each year. The bracketing for the match-ups is decided by the regular season record. There are eight teams from each of the respective conferences selected for the playoffs based on their regular season record. The first round of the NBA playoffs, or conference quarterfinals, consists of four match-ups in each conference based on the seedings (1–8, 2–7, 3–6, and 4–5), which always equal 9. The team with the best record is the number one seed, the team with the second best record is the number two

seed, etc. The four winners advance to the second round or conference semifinals, with a match-up between the 1–8 and 4–5 winners and a match-up between the 2–7 and 3–6 winners. The two winners advance to the third round or conference finals. The winner from each conference will advance to the final round, or the NBA finals (Figure 1). (NBA, 2016)

Figure 1. NBA Playoff Bracket

Table 1 gives a list of the basketball terminology that will be used to define the variables.

Table 1. Basketball Terminology.

Basketball Term	Definition
Assist	A pass that immediately proceeds and sets up a scored basket.
Defensive Rebound	A rebound of an opponent's missed shot.
Field Goal	A basket scored on a shot, except for a free throw, worth two points.
Free Throw	An unguarded shot taken from behind the free-throw line after a foul. If successful, the shot counts one point.
Foul	A violation resulting from illegal contact with an opposing player.
Offensive Rebound	A rebound of a team's own missed shot.
Rebound	The act of gaining possession of the ball after a missed shot.
Three Point Field Goal	A made basket from behind the three point which is more than nineteen feet and nine inches from the basket.
Turnover	A loss of possession of the ball by means of an error or violation.

2.2. Related Research

Scholars have sought to identify variables that contribute to winning a basketball game in NCAA and NBA games. Magel and Unruh (2013) used regression models to determine key factors that explain victory or defeat in a Division I men's college basketball game. In this research two regression methods were used to develop models to determine key factors explaining outcomes in Division I men's college basketball games. Least Squares regression was used to explain point spread and Logistic regression was used to estimate the probability of a team winning a game. The following are the independent variables that were considered for their models in the study: the differences in the number of free throws attempted; difference in offensive rebounds; difference in defensive rebounds; difference in assists; difference in blocks; difference in players fouled out; difference in fouls committed by starters; difference in turnovers; difference in steals; difference in fouls; and difference in field goals attempted. As a result of sampling 280 games, four factors were identified that influence the outcome of a college basketball game. These factors were differences in assists, difference in turnovers, difference in free throw attempts, and difference in defensive rebounds.

This article by Magel and Unruh (2013) contributed to the work done in this thesis by contributing insight to two particular variables which were not originally considered for model development at the NBA level. Namely, the difference in assists and the difference in turnovers were found to be statistically significantly and included for examination in both regression models conducted in this research. Both of these variables were ultimately used in the models and strengthened their prediction accuracy.

Other modeling techniques have been used for predicting results of college basketball (March Madness). The primary purpose of this work (Shen, Hua, Zhang, Mu, & Magel, 2014) was to introduce a bracketing method for all 63 games in March Madness based on a generalized linear model for the conditional probability of the win/lose result and to provide an estimate for the winning probability of each participating team in each round. This was an extension on earlier work done by West in 2006 and 2008. Fourteen variables were considered for possible usage in the model. This set of fourteen variables included using seasonal averages for the average field goals made per game, average number of 3-point field goals made per game, average number of free throws attempted per game, average number of offensive rebounds per game, average number of defensive rebounds per game, average number of assists per game, average number of personal fouls per game, average scoring margin, seed number, strength of schedule, adjusted offensive efficiency, adjusted defensive efficiency, average assists to turnover ratio, and a team's expected winning percentage against an average D1 team.

The research conducted by (Shen, Hua, Zhang, Mu, & Magel, 2014) was beneficial in two ways. The first was it supported the theory that seasonal averages could potentially be a good method that could be applied to the regression models instead of the 3-game moving

average. Secondly, it supported the idea of incorporating the average points differential for the purpose of making predictions.

The major distinction between developing a model to predict the outcome of college basketball games versus developing models to predict the outcomes of professional basketball games is that the NCAA is a single elimination tournament whereas the NBA is best-of-seven games series where a team needs to defeat their opponent four times before they can advance to the next round. This detail is of particular importance because in the NCAA, if a lower seed team happens to get lucky or if a higher seed team has an off-night; it can have a significant impact on the outcome of the tournament.

CHAPTER 3. METHODS

3.1. Sampling Technique

A stratified random sample will be used to collect data for 30 NBA teams over the span of three seasons. Games will be randomly selected from each of the 30 teams over a three-year span year totaling 144 separate games. A random number generator will be used to assign the games that will be sampled (1 – 82) to insure the games are selected at random. If it is determined data is being collected for two different teams but from the same game, an alternate game will be selected using additional random numbers generated.

3.2. Descriptive Statistics and Comparisons

Data for the variables in Table 1 will be collected for each team playing in a game. The reference team will be referred to as "Team A" and the team they are playing will be referred to as "Team B". Data will come from box scores given on the USA Today website for seasons 2008-2009, 2009-2010, 2010-2011(USA Today, 2008-2011).

The data will be entered into Excel spreadsheets then analyzed using Minitab. Both least squares regression and logistic regression analyses will be conducted. The least squares regression model will use point spread as the dependent variable, and the logistic model will use win or lose as the dependent variable.

Table 2. Description of Variables.

Variable	Code	Description
Win or Lose	W/L	Indicates whether the team of interest won or lost for the game that data was collected
Home or Away	H/A	Indicates whether team of interest is playing on their home court or on the opposing team's court
Team Score	TSC	Total number of points by the team of interest
Opponent Score	OSC	Total number of points scored by opposing team
Point Spread	PSD	Difference in total number of points scored between Team A and Team B

Table 2. Description of Variables (continued).

Variable	Code Name	Description
Team Field Goals Made	TFGM	Total number of field goals made for Team A
Team Field Goals Attempted	TFGA	Total number of field goals attempted for Team A
Team Field Goals Percentage	TFG%	Percentage of field goals made for Team A
Opponent Field Goals Made	OFGM	Total number of field goals made for Team B
Opponent Field Goals Attempted	OFGA	Total number of field goals attempted for Team B
Opponent Field Goal Percentage	OFG%	Percentage of field goals made for Team B
Team 3-Pointers Made	T3M	Total number of 3-pointers made for Team A
Team 3-Pointers Attempted	T3A	Total number of 3-pointers attempted for Team A
Team 3-Pointers Percentage	T3%	Percentage of 3-pointers made for Team A
Opponent 3-Pointers Made	O3M	Total number of 3-pointers made for Team B
Opponent 3-Pointers Attempted	O3A	Total number of 3-pointers attempted for Team B
Opponent 3-Pointers Percentage	O3%	Percentage of 3-pointers made for Team B
Team Offensive Rebounds	TOR	Total number of offensive rebounds by Team A
Team Defensive Rebounds	TDR	Total number of defensive rebounds by Team A
Team Total Rebounds	TTR	Total number of offensive and defensive rebounds by Team A
Opponent Offensive Rebounds	OOR	Total number of offensive rebounds by Team **B**
Opponent Defensive Rebounds	ODR	Total number of defensive rebounds by Team B
Opponent Total Rebounds	OTR	Total number of offensive and defensive rebounds by Team B
Team Free Throws Made	TFTM	Total number of free throws made by Team A
Team Free Throws Attempted	TFTA	Total number of free throws attempted by Team A
Team Free Throw Percentage	TFT%	Percentage of free throws made by Team A
Opponent Free Throws Made	OFTM	Total number of free throws made by Team B
Opponent Free Throws Attempted	OFTA	Total number of free throws attempted by Team B
Opponent Free Throw Percentage	OFT%	Percentage of free throws made by Team B
Team Assists	TAST	Total number of assists by Team A
Opponent Assists	OAST	Total number of assists by Team B
Team Turnovers	TTO	Total number of turnovers by Team A
Opponent Turnovers	OTO	Total number of turnovers by Team B

In addition to the variables listed in Table 1, there will be two additional indicator variables added for consideration for entry into the model. The variable X_1 will equal 1 if the game was played in the 2008-2009 season and 0 otherwise. The variable X_2 will equal 1 if the game was played in the 2009-2010 season and 0 otherwise. If both X_1 and X_2 are 0, this indicates the game was played in the 2010-2011 season. These variables will be tested for significance. If they are not found to be significant, this indicates the year the game was played in does not matter. Hence, the resulting model will be transferrable from year to year.

In order to begin the comparison of the teams, the first step is to collect descriptive statistics on individual team in-game performance for several categories (Table 1). Using the in-game statistics, we created new variables to compare the differences in performance between "Team A" and "Team B" in each of the respective categories. These new variables are listed in Table 3.

Table 3. Variables for Team Comparisons.

Variable	Code Name	Description
Point Spread	PSD	The difference in total number of points scored between Team A and Team B
Field Goal Shooting	FGS	The difference in field goal shooting percentage between Team A and Team B
Three Point Shooting	3PS	The difference in three-point shooting percentage between Team A and Team B
Free Throw Shooting	FTS	The difference in free throw shooting percentage between Team A and Team B
Free Throws Made	FTM	The difference in the number of free throws made between Team A and Team B
Free Throws Attempted	FTA	The difference in the number of free throws attempted between Team A and Team B
Assists	AST	The difference in the number of assists between Team A and Team B
Turnovers	TOS	The difference in the number of turnovers between Team A and Team B
Offensive Rebounds	OR	The difference in the number of offensive rebounds between Team A and Team B
Defensive Rebounds	DR	The difference in the number of defensive rebounds between Team A and Team B
Total Rebounds	TR	The difference in the number of total rebounds between Team A and Team B

3.3. Model Development

Stepwise selection technique will be used to determine which of the variables are significant and to develop both the point spread and the logistic models. The significance level of α=.15 is the standard for stepwise selection and is what will be used to determine which variables are significant. It is noted that the variables found to be significant could be different for each of the models. An ordinary least squares regression model will be developed will be used to estimate the point spread of an NBA game. The model takes the form

$$PSD = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n + \varepsilon$$

However, in this particular case the intercept term (β_0) is not applicable and will be set to zero since it should not matter which team is selected as "Team A" and which team is selected as "Team B". If all of the in-game statistics are equal, the estimated point spread should be zero. If the estimated point spread for "Team A" minus "Team B" is 7, the estimated point spread of "Team B" minus "Team A" should be -7.

The other model is a logistic model. This model estimates the probability of a team winning a game. This model will offer a value between zero and one. If the value is greater than .5, that team is predicted to win the game. The closer to 1.0 indicates a higher probability of winning. The logistic model is of the form

$$\exp[\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n]/1 + \exp[\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n] + \varepsilon.$$

Here again, the intercept term is not applicable and will be omitted from the model.

3.4. Validation of Models

Once the models are developed they will be validated using data collected from the games for the 2011-2012 season. In order to validate the models, a new random sample of 50 games will be collected from the 2011-2012 season. It is noted that none of the games from the 2011-2012 season were used in the development of the models. The actual in-game statistics will be collected from the games sampled and those values will be entered into the models to estimate the point spread and to estimate the probability of "Team A" winning. The results from the models will be compared to actual results to determine how accurate the models are at predicting the winner of a game when the actual in-game statistics are known.

3.5. Using Models for Predictions

After the models are validated they will be used to make predictions for approximately 700 regular season games and also for the playoffs during the 2012-2013, 2013-2014, and 2014-

2015 NBA seasons. There will be various methods implemented for replacing the in-game statistics in the models since these are unknown before the game is played. The predictions will be compared to the actual outcomes to determine the accuracy of the models. The methods will include using a 3-game moving average, a 3-game moving median, a 3-game moving weighted average, and an average point spread differential, among others.

Table 3 and Table 4 give specific examples of how data was collected for two games for the Phoenix Suns ("Team A") during the 2008-2009 season. Game 1 was played on November 14, 2008 and game two was played on March 18, 2009.

Table 4. In-Game Statistics for 11/14/08 game: Suns vs. Kings.

Variable	Phoenix Suns "Team A"	Sacramento Kings "Team B"	Difference
FGM	36	34	+2
FGA	78	80	-2
FG%	.462	.425	+.037
3M	5	4	+1
3A	15	17	-2
3%	.333	.235	+.098
OR	15	9	+6
DR	33	31	+2
TR	48	40	+8
FTM	20	23	-3
FTA	34	30	+4
FT%	.588	.767	-.179
AST	22	17	+5
TO	25	19	+6
SCORE	97	95	+2
W/L	WIN	LOSE	

Table 5. In-Game Statistics for 3/08/09 game: Suns vs. 76ers.

Variable	Phoenix Suns "Team A"	Philadelphia 76ers "Team B"	Difference
FGM	53	45	+8
FGA	92	82	+10
FG%	.576	.549	+.027
3M	6	8	-2
3A	20	17	+3
3%	.30	.471	-.171
OR	15	9	+6
DR	29	22	+7
TR	44	31	+13
FTM	14	18	-4
FTA	19	27	-8
FT%	.737	.667	+.07
AST	25	24	+1
TO	8	20	-12
SCORE	126	116	+10
W/L	WIN	LOSE	

CHAPTER 4. RESULTS

4.1. Point Spread – Model Development

One hundred forty four games were sampled over a three-year span (2008-2011) for the purpose of determining which variables were significant for estimating the point spread of an NBA game. The 10 variables listed in Table 3 were originally examined, and the Stepwise selection procedure was used for determining which of these variables were significant and should be included in the point spread model. Table 5 offers the results from the analysis of variance (Anova table) and shows that a useful model was developed. The model has an adjusted R-Square value of .9145 and predicted R-square value of .9072. This tells us that the model is able to explain approximately 91% of the variation in the point spread. Additionally, the VIF (variance of inflation) values associated with variables ranged from 1.04 to 1.93 and since these values are all less than 2, this implies that there is no evidence of multicollinearity. This should not affect the estimated coefficients.

The seven variables listed in Table 6 were found to be significant at α=.15 for the least squares regression: the difference in field goal shooting percentage (FGS), the difference in 3-point shooting percentage (3PS), the difference in free throw shooting percentage (FTS), the difference in total number of offensive rebounds (ORS), the difference in total number of assists (ASTS), the difference in total number of turnovers (TOS), and the difference in total number of free throws attempted (FTAS). The indicator variables to denote the year the game was played, X_1 and X_2, were not significant which indicates the model is good for any year.

Table 6. Analysis of Variance Table for Point Spread Model.

Source	DF	Sum of Squares	Mean Square	F Value	P Value	Adjusted R-Square
Model	7	22,226	3175.0786	219.57	<.0001	.9145
Error	136	1966.609	14.460			
Source	143					

Table 7. Parameter Estimates and T-tests for Point Spread Model.

Source	DF	Parameter Estimate	Standard Error	t Value	P value
FGS	1	1.485	.059	25.14	<.0001
3PS	1	.169	.020	8.34	<.0001
FTS	1	.196	.025	7.80	<.0001
ORS	1	.879	.062	14.07	<.0001
ASTS	1	.239	.067	3.55	0.0005
TOS	1	-.837	.077	-10.85	<.0001
FTAS	1	.337	.037	8.99	<.0001

Once the parameter estimates are known we can build the ordinary least squares model for estimating the point spread for estimating the probability of a team winning. However, before the actual model is built it is necessary to make sure that the model assumptions for the error term are satisfied. Residual plots were conducted to make the four assumptions of the error terms for the model is correct. These four assumptions are: the variance for the error term is constant,

the mean of the error term is equal to zero, the error terms are normally distributed, and the error terms are independent. The model assumptions are shown by Figures 2 (Standardized Residuals versus Fitted Values), 3 (Normal Probability Plot), 4 (Histogram), and 5 (Versus Order Plot). Figure 2 gives the plot of standardized residuals versus the fitted values. It is noted that most of the standardized residuals are between 2 and -2. This should be true if the error terms are approximately normal with the mean which is one of the model assumptions. The band width is approximately the same for all fitted values indicating the variance is constant for all the error terms. It is also noted that the mean of the residuals appears to be zero indicating the mean of the error term is approximately zero.

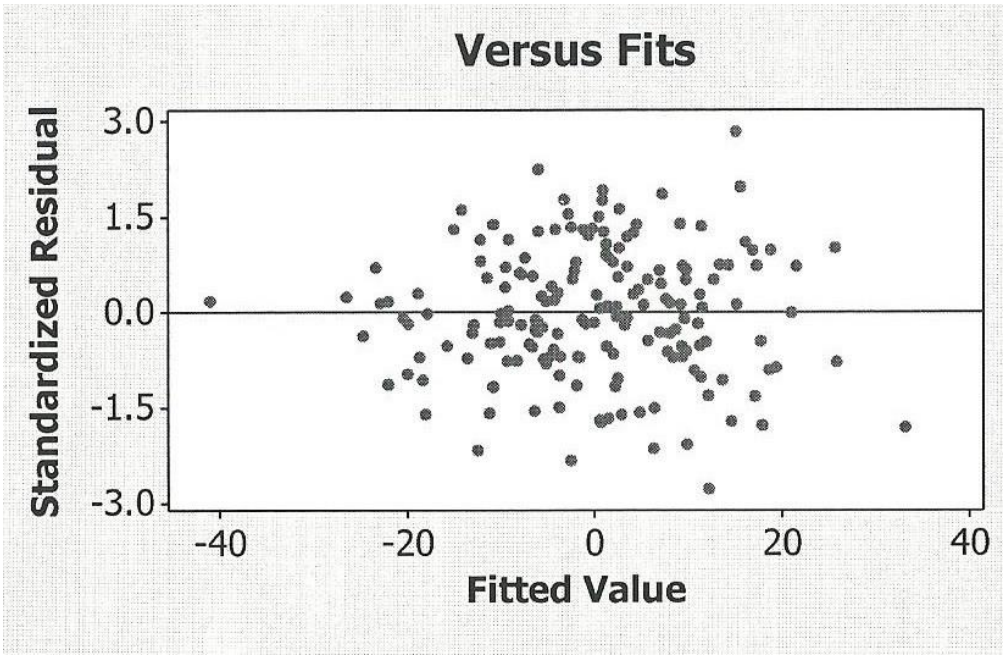

Figure 2. Standardized Residuals versus Fitted Values

Figure 3 gives the normal probability plot. Since the standardized residuals mostly fall on the line, this indicates the error terms are approximately normally distributed.

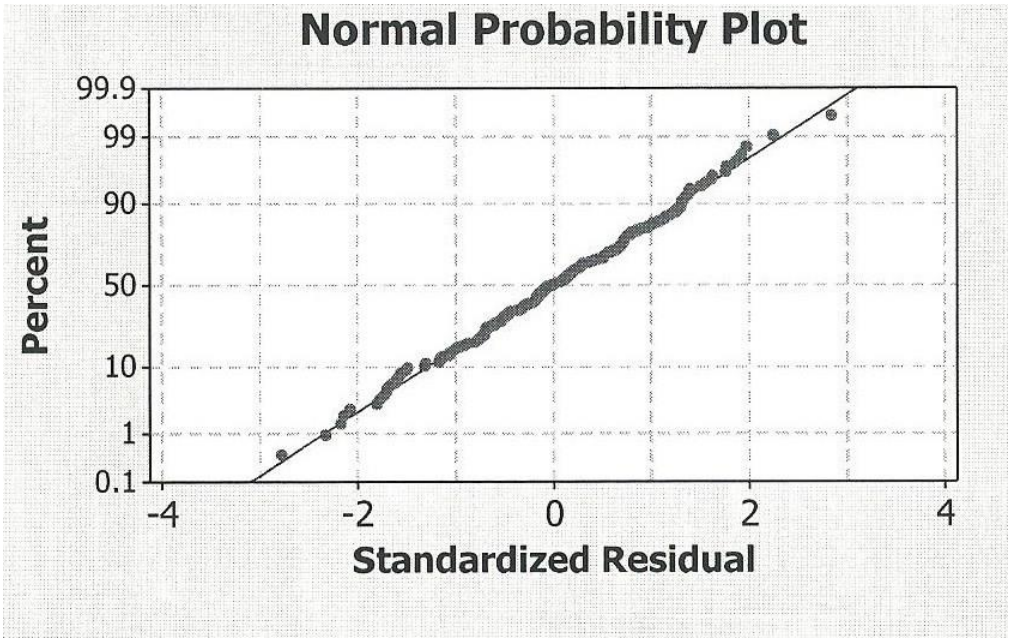

Figure 3. Normal Probability Plot

The shape of the histogram in Figure 4 also indicates the error terms are approximately normally distributed.

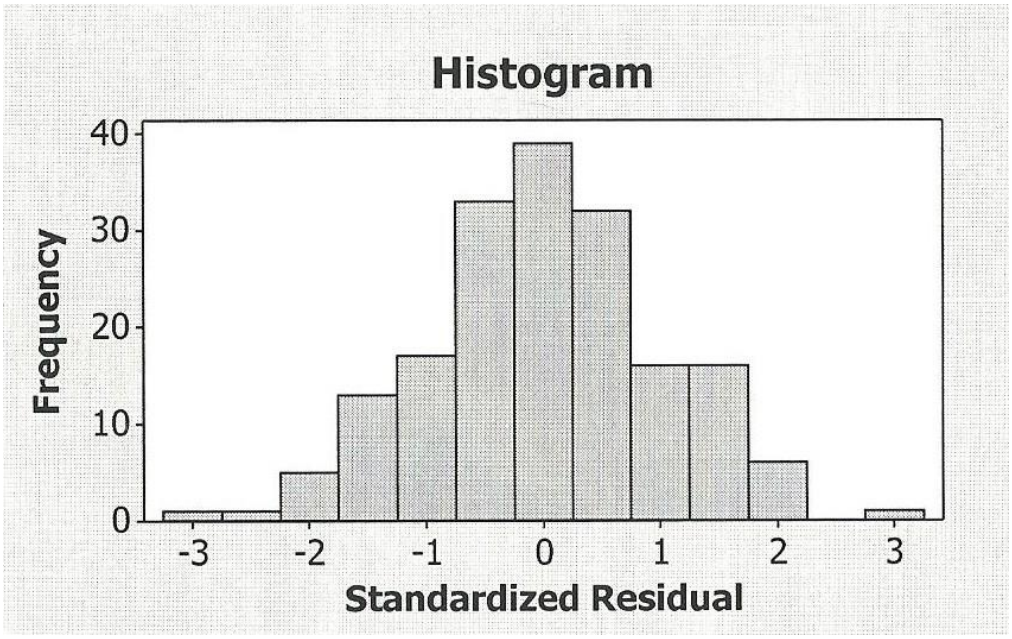

Figure 4. Histogram

Figure 5 does not display any discernable patterns which indicate there is no evidence of correlated error terms over time.

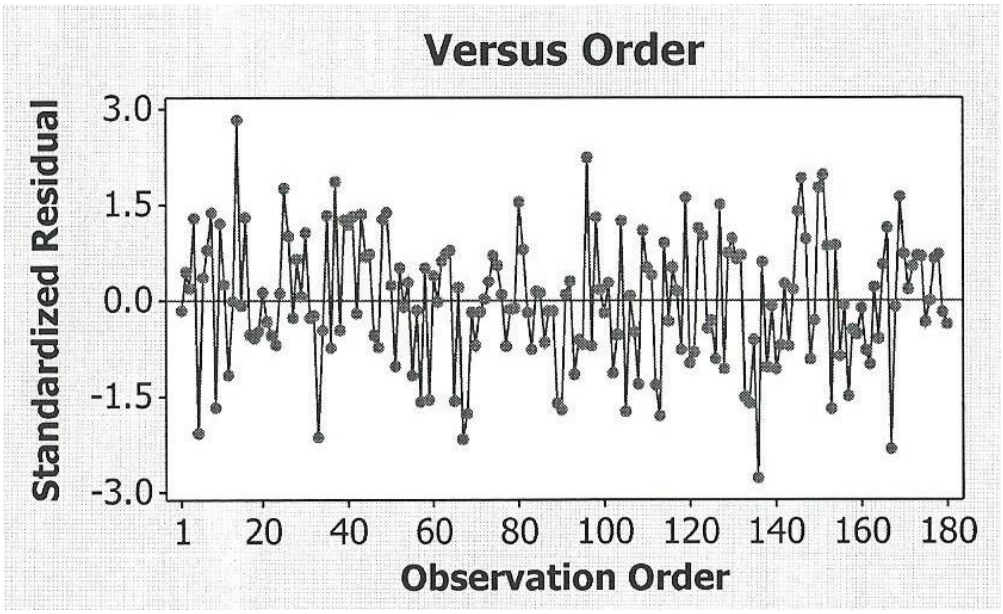

Figure 5. Versus Order Plot

The least squares model for the point spread (PSD) is given in equation one (Eq. 1).

PSD = 1.485(FGS) + .169(3PS) + .196(FTS) + .879(ORS) + .239(ASTS) + (- .837)(TOS) + .337(FTAS) (Eq. 1)

The interpretation is that for every one percent that "Team A" shoots the ball on field goals better than "Team B" the model estimates that "Team A" will score an additional 1.485 points. If "Team A" has a field goal shooting percentage that is 2% than that of "Team B", the model will estimate approximately an additional three points to be scored by "Team A". If there is a one-unit increase for each of the variables, meaning if "Team A" has a FGS that is 1% higher, 3PS that is 1% higher, FTS that is 1% higher, 1 additional ORS, 1 additional AST, 1 additional FTA, and 1fewer TOS than "Team B", the model will estimate an additional 4.142

points to be scored by “Team A”. It is important to note that the coefficient for turnovers is negative because it is advantageous for a team to have fewer turnovers than its opposition.

4.2. Logistic – Model Development

After considering all of the variables given in Table 3 for entry into the model, the stepwise selection technique with alpha equal to .15 for entry and exit into the model, found 7 variables to be significant and these are given in Table 7. The variables found to be significant were the following: the difference in field goal shooting percentage (FGS), the difference in 3-point shooting percentage (3PS), the difference in free throw shooting percentage (FTS), the difference in total number of offensive rebounds (ORS), the difference in total number of assists (ASTS), the difference in total number of turnovers (TOS), and the difference in total number of free throws attempted (FTAS).

Table 8. Parameter Estimates and Chi-Square -tests for Logistic Model.

Predictor Constant	**Coefficient**	**Standard Error Coefficient**	**Chi - Square**	**P Value**
FGS	.985	.253	69.98	0.000
3PS	.168	.0561	27.62	0.000
FTS	.146	.0551	14.37	0.000
ORS	.517	.147	30.12	0.000
AST	.276	.104	9.59	0.002
TOS	-.661	.215	24.01	0.000
FTA	.410	.121	44.98	0.000

The logistic model is of the form and is given by equation two. (Eq. 2)

$$\exp[.985(FGS) + .168(3PS) + .146(FTS) + .517(ORS) + .276(AST) + (-.661)(TOS) + .410(FTA)]/1+ \exp[.985(FGS) + .168(3PS) + .146(FTS) + .517(ORS) + .276(AST) + (-.661)(TOS) + .410(FTA)] \quad \text{(Eq. 2)}$$

4.3. Point Spread – Model Validation

Fifty games were sampled from the 2011-2012 NBA season to validate the point spread model. It is noted that none of these games were used in the development of the model. One division was randomly selected from one of the six conferences and then ten games were randomly selected from each of the five teams in that division. The actual in-game statistics were collected from the box scores (USA Today, 2011-2012) for the games sampled and entered into the model to estimate the point spread. The estimated point spread was then compared to the actual score to determine the accuracy. When the point spread was positive and the team won, the model was said to have predicted the game accurately. When the point spread was negative and the team lost, the model was also said to have predicted the outcome accurately. The point spread model correctly predicted 47 out of 50 games for an accuracy of 94%. Table 9 shows the summary of the validation for the point spread model.

Table 9. Point Spread Model Validation Summary.

PSD Model		Actual		
		Win	Lose	Total
Predicted	Win	14	1	15
	Lose	2	33	35
	Total	16	34	50

Table 10 gives a specific example of how data was collected for the point spread model validation. The data for the example in Table 10 was collected from a game between the Phoenix Suns and Los Angeles Lakers played on 1/10/2012.

Table 10. Data Collection Example for Point Spread Model Validation.

Variable	**Phoenix Suns "Team A"**	**Los Angeles Lakers "Team B"**	**Difference**
FGS (%)	42.5	48.8	-6.3
FTS (%)	66.7	82.6	-15.9
3PS (%)	35.0	11.8	23.2
ORS	9	14	-5
FTA	12	23	-11
TOS	11	14	-3
AST	18	27	-9

The values for the difference between "Team A" – "Team B" were then entered into (Eq. 1) to obtain the estimated point spread.

Point Spread = 1.485(-6.3) + 0.169(23.2) + 0.195(-15.9) + 0.879(-5) +
0.337(-11) + 0.239(-9) - 0.837(-3) = -16.27

Since the point spread is negative, a loss was predicted for "Team A". This process was repeated for each of the games listed in Appendix 1.

4.4. Logistic – Model Validation

Fifty games were sampled from the 2011-2012 NBA season to validate the logistic model. It is noted that none of these games were used in the development of the model. One division was randomly selected from one of the six conferences and then ten games were

randomly selected from each of the five teams in that division. The actual in-game statistics were collected from the box scores (USA Today, 2011-2012) for the games sampled and entered into the model to estimate the probability of "Team A" winning. When the logistic model estimated the probability of .50 or greater, the model would predict a win for "Team A", and a loss for estimated probabilities of less than .5. The closer to 1.0 that the probability was estimated, the better of a chance "Team A" has to win the game. The logistic model correctly predicted 44 out of 50games for an accuracy of 88%. Table 11 shows the summary of the validation for the point spread model.

Table 11. Logistic Model Validation Summary.

Logistic Model		Actual		
		Win	Lose	Total
Predicted	Win	12	2	14
	Lose	4	32	36
	Total	16	34	50

Table 12 gives a specific example of how data was collected for the logistic model validation. The data for the example in Table 12 was collected from a game between the Phoenix Suns and Los Angeles Lakers played on 1/10/2012.

Table 12. Data Collection Example for Logistic Model Validation.

Variable	Phoenix Suns "Team A"	Los Angeles Lakers "Team B"	Difference
FGS (%)	42.5	48.8	-6.3
FTS (%)	66.7	82.6	-15.9
3PS (%)	35.0	11.8	23.2
ORS	9	14	-5
FTA	12	23	-11
TOS	11	14	-3
AST	18	27	-9

The values for the difference between "Team A" – "Team B" were then entered into (Eq. 2) to obtain the probability of "Team A" winning.

exp[.985(-6.3) + .168(23.2) + .146(-15.9) + .517(-5) + .276(-9) + (-.661)(-3) + .410(-11)]/1+ exp[.985(-6.3) + .168(23.2) + .146(-15.9) + .517(-5) + .276(-9) + (-.661)(-3) + .410(F-11)] = .00005

Since the probability of "Team A" winning is less than 0.5, a loss was predicted for "Team A". This process was repeated for each of the games listed in Appendix 2.

4.5. Point Spread Model – Determining Best Method

After the point spread model was validated it was used to make predictions for 604 regular season games during the 2012-2013 season. One division was randomly selected from each of the two conferences and predictions were made for approximately sixty games for each of the five teams in respective divisions. There were three different methods implemented for replacing the in-game statistics in the model since these were unknown before the game was

played. These methods included using a 3-game moving average, a 3-game moving median, and a 3-game moving weighted average.

To explain how the prediction method works, let's examine one of the teams that were randomly selected, the Atlanta Hawks ("Team A") versus their opponents ("Team B"). In-game statistics were collected for each of the variables listed in (Eq. 1) from games 1-3 played by "Team A" in order to predict the outcome for game four. Based on the in-game statistics from games 1-3 the mean values were found for the 3-game moving average, the median values were found for the 3-game moving median, and a weighted average was found for the 3-game moving weighted average. The weighted average is obtained by multiplying the median value of the three games by two and multiplying the lowest and highest values by one, adding these values together, and then dividing that sum by four. This is the data necessary for "Team A." Similar data is required for "Team B".

In-game statistics were also collected for each of the variables listed in (Eq. 1) from games 1-3 played by "Team B" and the same process was used for obtaining the values for each of the three methods. After the values for each of the variables was calculated for both teams for each of the three methods the obtained values were entered into (Eq. 1) to estimate the point spread for "Team A" – "Team B". When the point spread was positive "Team A" was predicted to win, and when the point spread was negative, "Team A" was predicted to lose. This prediction process was incremented by one for each successive game of the season for "Team A". The same procedure was followed for each of the ten teams in the sample.

The model correctly predicted the 375 out of the 604 for an accuracy of 62 percent when using the 3-game moving average, 344 out of 604 for an accuracy of 57 percent when using the 3-game moving median, and 362 out of 604 for an accuracy of 60 percent when using the 3-

game moving weighted average. Since the ultimate goal is to predict the champion of the NBA playoffs before the first playoff game has occurred, the 3-game moving average appears to be the best choice for the point spread model.

4.6. Logistic Model – Determining Best Method

After the logistic model was validated it was used to make predictions for 604 regular season games during the 2012-2013 season. One division was randomly selected from each of the two conferences and predictions were made for approximately sixty games for each of the five teams in respective divisions. There were three different methods implemented for replacing the in-game statistics in the model since these were unknown before the game was played. These methods included using a 3-game moving average, a 3-game moving median, and a 3-game moving weighted average.

To explain how the prediction method works, let's examine one of the teams that were randomly selected, the Atlanta Hawks ("Team A") versus their opponents ("Team B"). In-game statistics were collected for each of the variables listed in (Eq. 2) from games 1-3 played by "Team A" in order to predict the outcome for game four. Based on the in-game statistics from games 3-5 the mean values were found for the 3-game moving average, the median values were found for the 3-game moving median, and a weighted average was found for the 3-game moving weighted average. The weighted average obtained by multiplying the median value of the three games by two and multiplying the lowest and highest values by one, adding these values together, and then dividing that sum by four. This is the data necessary for "Team A". Similar data is required for "Team B".

In-game statistics were also collected for each of the variables listed in (Eq. 2) from games 3-5 played by "Team B" and the same process was used for obtaining the values for each

of the three methods. After the values for each of the variables were calculated for both teams for each of the three methods they were entered into (Eq. 2) to estimate the probability of winning for "Team A." When the estimated probability was greater or equal to .50 "Team A" was predicted to win, and when the estimated probability was less than .50, "Team A" was predicted to lose. This prediction process was incremented by one for each successive game of the season for "Team A." The same procedure was followed for each of the ten teams in the sample.

The model correctly predicted 365 out of the 604 for an accuracy of 60 percent when using the 3-game moving average, 326 out of 604 for an accuracy of 54 percent when using the 3-game moving median, and 344 out of 604 for an accuracy of 57 percent when using the 3-game moving weighted average. Since the ultimate goal is to predict the champion of the NBA playoffs before the first playoff game has occurred, the 3-game moving average appears to be the best choice for the logistic model.

4.7. Point Spread Model– Predicting 2013 NBA Playoffs

As a result of sampling 604 games during the regular season it was determined that the point spread model using the 3-game moving average method was the most accurate and was selected for predicting the 2013 NBA playoffs. Since the goal was to predict the winner for each round of the playoffs and to ultimately predict the NBA champions it was necessary to take the 3-game moving average for each of the teams competing during a two-week span in March of 2013. Data collected from games during this time span and only this time span were entered in the model to estimate the point spread for each round of the playoffs before they began.

The first round of the NBA playoffs, or conference quarterfinals, consists of four match-ups in each conference based on the seedings (1–8, 2–7, 3–6, and 4–5), which always equal 9. In the Eastern Conference the respective match-ups were as follows: Miami Heat vs Milwaukee

Bucks, New York Knicks vs Boston Celtics, Indiana Pacers vs Atlanta Hawks, and Brooklyn Nets vs Chicago Bulls. In the Western Conference the respective match-ups were: Oklahoma City Thunder vs Houston Rockets, San Antonio Spurs vs Los Angeles Lakers, Denver Nuggets vs. Golden State Warriors, and Los Angeles Clippers vs Memphis Grizzlies.

Based on the estimated point spread the point spread model predicted the winners of the 1st round for the Eastern Conference would be: Miami Heat, New York Knicks, Atlanta Hawks, and Brooklyn Nets. The teams that actually advanced to the second round of the Eastern Conference playoffs were Miami Heat, New York Knicks, Indiana Pacers, and Chicago Bulls, rendering a prediction accuracy of fifty percent. The predicted winners for the 1st round of the Western Conference were: Oklahoma City Thunder, San Antonio Spurs, Denver Nuggets, and Los Angeles Clippers. The actual winners were: Oklahoma City Thunder, San Antonio Spurs, Golden State Warriors, and Memphis Grizzlies, rendering a prediction accuracy of fifty percent.

For the second round or the conference semifinals for the East, the model predicted that the winners would be the Miami Heat and the New York Knicks. The actual winners were the Miami Heat and Indiana Pacers rendering fifty percent accuracy. For the second round or the conference semifinals for the West, the model predicted that the winners would be the Oklahoma City Thunder and the San Antonio Spurs. The actual winners were the Memphis Grizzlies and the San Antonio Spurs rendering fifty percent accuracy.

For the Eastern conference finals the model predicted the Miami Heat would win and the Heat did emerge victorious. For the Western conference finals the model inaccurately predicted the Oklahoma City Thunder, as the San Antonio Spurs won that series. The model predicted that the Miami Heat would win the NBA championship which they did. In summary, the model accurately predicted 8 out of 15 match-ups for a total of 53%.

4.8. Point Spread Model– New Method for Predicting 2014 NBA Playoffs

The 3-game moving average was not particularly useful for predicting the playoffs. One problem that was observed with the sampling method used for the 2013 playoffs is that there was some disparity in the schedules of the games sampled for the 2 week span in March. For example, in the 1st round of the Eastern conference the games sampled for the Atlanta Hawks were home games where their opposition had losing records. Whereas the games sampled for Indiana Pacers were taken from games where the Pacers were on the road against some of the top Western conference playoff contenders. The point is there was not a fair comparison of data in this particular case and a new method was needed for predicting the 2014 playoffs.

We decided to use seasonal averages instead of the 3-game moving average for replacing the in-game statistics for using the model to estimate the point spread for 62 games during the 2013-2014 season. Forty-four of the 62 were accurately predicted by the model when using the seasonal averages for an overall accuracy of .709. Given that the model was able to explain approximately 70 percent of the point spread, we decided to use a weighted model with a weight of .70 placed on the prediction obtained from the Least Squares model and a weight of .30 placed on the average points differential between the two teams.

4.9. Point Spread Model – Predicting 2014 NBA Playoffs (Round One)

Prior to the start of the 2014 NBA playoffs, seasonal averages were collected for each of the 16 teams competing to make predictions before the first round of the playoffs. The seasonal averages were then entered into the point spread model to obtain the estimated point spread for "Team A" – "Team B." When the point spread was positive "Team A" was predicted to win, and when the point spread was negative, "Team A" was predicted to lose. Tables 13-20 give the first round predictions which are all played in a best of 7 series format. In addition to the comparison

of seasonal averages that were entered into equation one (Eq. 1), the average points differential between "Team A" and "Team B" was considered, and a weighted model was considered giving 70% of the weight to (Eq. 1) and 30% of the weight to the average points differential. It is noted that in some cases the predicted match-ups were different from the actual match-ups. The Hawks and the Pacers played each other in round one. Table 13 gives the regular seasonal averages for the variables of both teams.

Table 13. Regular Seasonal Averages (Hawks vs Pacers).

Variable	**Atlanta Hawks "Team A"**	**Indiana Pacers "Team B"**	**Difference**
FGS (%)	45.7	44.9	.8
FTS (%)	78.1	77.9	.2
3PS (%)	36.3	35.5	.8
ORS	8.8	10.1	-1.3
FTA	21.7	23.4	-1.7
TOS	15.3	15.1	.2
AST	24.8	20.1	4.7
Points Differential	-0.6	4.4	-5

When these differences were placed into the point spread model, the following was obtained:

$$\text{Point Spread} = 1.485(.8) + 0.169(.8) + 0.195(.2) + 0.879(-1.3) + 0.337(-1.7) + 0.239(4.7) - 0.837(.2) = .6025$$

Based on the calculation, a win is predicted for the Atlanta Hawks.

Using the average points differential: -0.6 – 4.4 = -5, which predicts a loss for the Atlanta Hawks.

Using the weighted model: .6025(.7) + -5(.3) = -1.078, which predicts a loss for the Atlanta Hawks.

Based on all of these predictions, the Indiana Pacers would be expected to win more games in the best of 7 series.

The Wizards and the Bulls played each other in round one. Table 14 gives the regular seasonal average statistics for the variables of both teams.

Table 14. Regular Seasonal Averages (Wizards vs Bulls).

Variable	**Washington Wizards "Team A"**	**Chicago Bulls "Team B"**	**Difference**
FGS (%)	45.9	43.2	2.7
FTS (%)	73.1	77.9	-4.8
3PS (%)	38.0	34.8	3.2
ORS	10.8	11.4	-0.6
FTA	20.9	23.3	-2.4
TOS	14.7	14.9	-0.2
AST	23.3	22.7	0.6
Points Differential	1.3	1.9	-0.6

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(2.7) + 0.169(3.2) + 0.195(-4.8) + 0.879(-.6) + 0.337(-2.4) + 0.239(.6) - 0.837(-.2) = 2.5889

Based on the calculation, a win is predicted for the Washington Wizards.

Using the average points differential: 1.3 – 1.9 = -0.6, which predicts a loss for the Washington Wizards.

Using the weighted model: 2.5889(.7) + -.6(.3) = 1.6322, which predicts a win for the Washington Wizards.

It is noted that two methods give us a positive point spread and one method a negative point spread. Anytime a discrepancy was observed in the different methods for predicting the point spread the weighted model was used. Based on all of these predictions, the Washington Wizards would be expected to win more games in the best of 7 series.

The Nets and the Raptors played each other in round one. Table 15 gives the regular seasonal average statistics for the variables of both teams.

Table 15. Regular Seasonal Averages (Nets vs Raptors).

Variable	**Brooklyn Nets "Team A"**	**Toronto Raptors "Team B"**	**Difference**
FGS (%)	45.9	44.5	1.4
FTS (%)	75.3	78.2	-2.9
3PS (%)	36.9	37.2	-0.3
ORS	8.8	11.4	-2.6
FTA	24.4	25.1	-0.7
TOS	14.5	14.1	0.4
AST	20.9	21.1	-0.2
Points Differential	-1	3.2	-4.2

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(1.4) + 0.169(-.3) + 0.195(-2.9) + 0.879(-2.6) + 0.337(-.7) + 0.239(-.2) - 0.837(.4) = -1.441

Based on the calculation, a loss is predicted for the Brooklyn Nets.

Using the average points differential: -1- 3.2 = -4.2, which predicts a loss for the Brooklyn Nets.

Using the weighted model: -1.441(.7) + -4.2(.3) = -2.269, which predicts a loss for the Brooklyn Nets.

Based on all of these predictions, the Toronto Raptors would be expected to win more games in the best of 7 series.

The Hornets and the Heat played each other in round one. Table 16 gives the regular seasonal average statistics for the variables of both teams.

Table 16. Regular Seasonal Averages (Hornets vs Heat).

Variable	**Charlotte Hornets "Team A"**	**Miami Heat "Team B"**	**Difference**
FGS (%)	44.2	50.1	-5.9
FTS (%)	73.7	76.0	-2.3
3PS (%)	35.1	36.4	-1.3
ORS	9.5	7.6	1.9
FTA	24.4	23	1.4
TOS	12.3	14.8	-2.5
AST	21.7	22.5	-0.8
Points Differential	-.2	4.8	-5.0

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-5.9) + 0.169(-1.3) + 0.195(-2.3) + 0.879(1.9) +0.337(1.4) + 0.239(-.8) - 0.837(-2.5) = -3.771

Based on the calculation, a loss is predicted for the Charlotte Hornets.

Using the average points differential: -0.2- 4.8 = -5.0, which predicts a loss for the Charlotte Hornets.

Using the weighted model: -3.771 (.7) + -5.0(.3) = -5.271, which predicts a loss for the Charlotte Hornets.

Based on all of these predictions, the Miami Heat would be expected to win more games in the best of 7 series.

The Mavericks and the Spurs played each other in round one. Table 17 gives the regular seasonal average statistics for the variables of both teams.

Table 17. Regular Seasonal Averages (Mavericks vs Spurs).

Variable	**Dallas Mavericks "Team A"**	**San Antonio Spurs "Team B"**	**Difference**
FGS (%)	47.4	48.6	-1.2
FTS (%)	79.5	78.5	1.0
3PS (%)	38.4	39.7	-1.0
ORS	10.2	9.3	0.9
FTA	21.1	20.0	1.1
TOS	13.5	14.4	-0.9
AST	23.6	25.2	-1.6
Points Differential	2.4	7.7	-5.3

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-1,2) + 0.169(-1.0) + 0.195(1.0) + 0.879(0.9) + 0.337(1.1) + 0.239(-1.6) - 0.837(-0.9) = -.274

Based on the calculation, a loss is predicted for the Dallas Mavericks.

Using the average points differential: 2.4– 7.7 = -5.3, which predicts a loss for the Dallas Mavericks.

Using the weighted model: -.274(.7) + -5.3(.3) = -1.782, which predicts a loss for the Dallas Mavericks.

Based on all of these predictions, the San Antonio Spurs would be expected to win more games in the best of 7 series.

The Blazers and the Rockets played each other in round one. Table 18 gives the regular seasonal average statistics for the variables of both teams.

Table 18. Regular Seasonal Averages (Blazers vs Rockets).

Variable	**Portland Trailblazers "Team A"**	**Houston Rockets "Team B"**	**Difference**
FGS (%)	45.0	47.3	-2.3
FTS (%)	81.6	71.2	10.4
3PS (%)	37.2	35.6	1.6
ORS	12.3	11.2	1.1
FTA	23.5	31.2	-7.7
TOS	13.8	16.2	-2.4
AST	23.1	21.4	1.7
Points Differential	4	4.7	-0.7

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-2.3) + 0.169(1.6) + 0.195(10.4) + 0.879(1.1) + 0.337 (-7.7) + 0.239(1.7) - 0.837(-2.4) = -.33

Based on the calculation, a loss is predicted for the Portland Trailblazers.

Using the average points differential: 4.0 – 4.7 = -0.7, which predicts a loss for the Portland Trailblazers.

Using the weighted model: -.33(.7) + -0.7 (.3) = -.441, which predicts a loss for the Portland Trailblazers.

Based on all of these predictions, the Houston Rockets would be expected to win more games in the best of 7 series.

The Warriors and the Clippers played each other in round one. Table 19 gives the regular seasonal average statistics for the variables of both teams.

Table 19. Regular Seasonal Averages (Warriors vs Clippers).

Variable	**Golden State Warriors "Team A"**	**Los Angeles Clippers "Team B"**	**Difference**
FGS (%)	46.2	47.4	-1.2
FTS (%)	75.3	73.0	2.3
3PS (%)	38.0	35.2	2.8
ORS	10.9	10.5	0.4
FTA	29.1	21.1	8.0
TOS	15.2	13.9	1.3
AST	23.3	24.6	-1.3
Points Differential	4.8	7.0	-2.2

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-1.2) + 0.169(2.8) + 0.195(2.3) + 0.879(0.4) + 0.337 (8.0) + 0.239(-1.3) - 0.837(1.3) = .789

Based on the calculation, a win is predicted for the Golden State Warriors.

Using the average points differential: 4.8 – 7.0 = -2.2, which predicts a loss for the Golden State Warriors.

Using the weighted model: .789(.7) + -2.2 (.3) = -.108, which predicts a loss for the Golden State Warriors.

Based on all of these predictions, the Golden State Warriors would be expected to win more games in the best of 7 series.

The Grizzlies and the Thunder played each other in round one. Table 20 gives the regular seasonal average statistics for the variables of both teams.

Table 20. Regular Seasonal Averages (Grizzlies vs Thunder).

Variable	**Memphis Grizzlies "Team A"**	**Oklahoma City Thunder "Team B"**	**Difference**
FGS (%)	46.4	47.1	-0.7
FTS (%)	74.1	80.6	-6.5
3PS (%)	35.3	36.1	-0.8
ORS	11.6	10.8	0.8
FTA	20.3	25	-4.7
TOS	13.7	15.3	-1.6
AST	21.9	21.9	0
Points Differential	1.6	6.3	-4.7

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-0.7) + 0.169(-0.8) + 0.195(-6.5) + 0.879(0.8) + 0.337(-4.7) + 0.239(0) - 0.837(-1.6) = -1.984

Based on the calculation, a loss is predicted for the Memphis Grizzlies.

Using the average points differential: 1.6 – 6.3 = -4.7, which predicts a loss for the Memphis Grizzlies.

Using the weighted model: -1.984(.7) + -4.7 (.3) = -2.799, which predicts a loss for the Memphis Grizzlies.

Based on all of these predictions, the Oklahoma City Thunder would be expected to win more games in the best of 7 series.

4.10. Point Spread Model – Predicting 2014 NBA Playoffs (Round Two)

Based on the predicted winners from round one, Tables 21-24 give the seasonal averages for which predictions were made for round two of the playoffs which are all played in a best of 7 series format. It is noted that in some cases the predicted match-ups were different from the actual match-ups. It was predicted the Wizards and the Pacers would play each other in round two. Table 21 gives the regular seasonal average statistics for the variables of both teams.

Table 21. Regular Seasonal Averages (Wizards vs Pacers).

Variable	Washington Wizards "Team A"	Indiana Pacers "Team B"	Difference
FGS (%)	45.9	44.9	1.0
FTS (%)	73.1	77.9	-4.8
3PS (%)	38.0	35.5	2.3
ORS	10.8	10.2	0.6
FTA	20.9	23.4	-2.5
TOS	14.7	15.1	-0.4
AST	23.3	20.1	3.2
Points Differential	1.3	4.4	-3.1

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(1.0) + 0.169(2.3) + 0.195(-4.8) + 0.879(0.6) + 0.337 (-2.5) + 0.239(3.2) - 0.837(-0.4) = 1.722

Based on the calculation, a win is predicted for the Washington Wizards.

Using the average points differential: 1.3 – 4.4= -3.1, which predicts a loss for the Washington Wizards.

Using the weighted model: 1.722(.7) + -3.1 (.3) = .276, which predicts a win for the Washington Wizards.

Based on all of these predictions, the Washington Wizards would be expected to win more games in the best of 7 series.

It was predicted the Raptors and the Heat would play each other in round two. Table 22 gives the regular seasonal average statistics for the variables of both teams.

Table 22. Regular Seasonal Averages (Raptors vs Heat).

Variable	Toronto Raptors "Team A"	Miami Heat "Team B"	Difference
FGS (%)	44.5	50.1	-5.6
FTS (%)	78.2	76.0	2.2
3PS (%)	37.2	36.4	0.8
ORS	11.4	7.6	3.8
FTA	25.1	23	2.1
TOS	14.1	14.8	-0.7
AST	21.1	22.5	-1.6
Points Differential	3.2	4.8	-1.6

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-5.6) + 0.169(0.8) + 0.195(2.2) + 0.879(3.8) + 0.337 (2.1) + 0.239(-1.6) - 0.837(-0.7) = -3.5

Based on the calculation, a loss is predicted for the Toronto Raptors.

Using the average points differential: 3.2 – 4.8 = -1.6, which predicts a loss for the Toronto Raptors.

Using the weighted model: -3.5(.7) + -1.6 (.3) = -2.93, which predicts a loss for the Toronto Raptors.

Based on all of these predictions, the Miami Heat would be expected to win more games in the best of 7 series.

It was predicted the Rockets and the Spurs would play each other in round two. Table 23 gives the regular seasonal average statistics for the variables of both teams.

Table 23. Regular Seasonal Averages (Rockets vs Spurs).

Variable	**Houston Rockets "Team A"**	**San Antonio Spurs "Team B"**	**Difference**
FGS (%)	47.3	48.6	-1.3
FTS (%)	71.2	78.5	-7.3
3PS (%)	35.6	39.7	-4.1
ORS	11.2	9.3	1.9
FTA	31.2	20.0	11.2
TOS	16.2	14.4	1.8
AST	21.4	25.2	-3.8
Points Differential	4.7	7.7	-3.0

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-1.3) + 0.169(-4.1) + 0.195(-7.3) + 0.879(1.9) + 0.337(11.2) + 0.239(-3.8) - 0.837(1.8) = -1.017

Based on the calculation, a loss is predicted for the Houston Rockets.

Using the average points differential: 4.7 – 7.7 = -3.0, which predicts a loss for the Houston Rockets.

Using the weighted model: -1.017(.7) + -3.0 (.3) = -1.612, which predicts a loss for the Houston Rockets.

Based on all of these predictions, San Antonio Spurs would be expected to win more games in the best of 7 series.

It was predicted the Clippers and the Thunder would play each other in round two. Table 24 gives the regular seasonal average statistics for the variables of both teams.

Table 24. Regular Seasonal Averages (Clippers vs Thunder).

Variable	**Los Angeles Clippers "Team A"**	**Oklahoma City Thunder "Team B"**	**Difference**
FGS (%)	47.4	47.1	0.3
FTS (%)	73.0	80.6	-7.6
3PS (%)	35.2	36.1	-0.9
ORS	10.5	10.8	-0.3
FTA	21.1	25	-3.9
TOS	13.9	15.3	-1.4
AST	24.6	21.9	2.7
Points Differential	7.0	6.3	0.7

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(0.3) + 0.169(-0.9) + 0.195(-7.6) + 0.879(-0.3) + 0.337 (-3.9) + 0.239(2.7) - 0.837(-1.4) = -0.95

Based on the calculation, a loss is predicted for the Los Angeles Clippers.

Using the average points differential: 7.0 – 6.3 = 0.7, which predicts a win for the Los Angeles Clippers.

Using the weighted model: -10.95(.7) + 0.7(.3) = -.455, which predicts a loss for the Los Angeles Clippers.

Based on all of these predictions, the Oklahoma City Thunder would be expected to win more games in the best of 7 series.

4.11. Point Spread Model – Predicting 2014 NBA Playoffs (Round Three)

Based on the predicted winners from round two, Table 25 and Table 26 give the seasonal averages for which predictions were made for round three of the playoffs. It was predicted the Wizards and the Heat would play each other in round three. Table 25 gives the regular seasonal average statistics for the variables of both teams.

Table 25. Regular Seasonal Averages (Wizards vs Heat).

Variable	**Washington Wizards "Team A"**	**Miami Heat "Team B"**	**Difference**
FGS (%)	45.9	50.1	-4.2
FTS (%)	73.1	76.0	-2.9
3PS (%)	38.0	36.4	1.6
ORS	10.8	7.6	3.2
FTA	20.9	23	-2.1
TOS	14.7	14.8	-0.1
AST	23.3	22.5	0.8
Points Differential	1.3	4.8	-3.5

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-4.2) + 0.169(1.6) + 0.195(-2.9) + 0.879(3.2) + 0.337 (-2.1) + 0.239(0.8) - 0.837(-0.1) = -4.152

Based on the calculation, a loss is predicted for the Washington Wizards.

Using the average points differential: 1.3 – 4.8 = -3.5, which predicts a loss for the Washington Wizards.

Using the weighted model: -4.152(.7) + -3.5 (.3) = -3.956, which predicts a loss for the Washington Wizards.

Based on all of these predictions, the Miami Heat would be expected to win more games in the best of 7 series.

It was predicted the Thunder and the Spurs would play each other in round three. Table 26 gives the regular seasonal average statistics for the variables of both teams.

Table 26. Regular Seasonal Averages (Thunder vs Spurs).

Variable	**Oklahoma City Thunder "Team A"**	**San Antonio Spurs "Team B"**	**Difference**
FGS (%)	47.1	48.6	-1.5
FTS (%)	80.6	78.5	2.1
3PS (%)	36.1	39.7	-3.6
ORS	10.8	9.3	1.5
FTA	25	20.0	5.0
TOS	15.3	14.4	0.9
AST	21.9	25.2	-3.3
Points Differential	6.3	7.7	-1.4

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(-1.5) + 0.169(-3.6) + 0.195(2.1) + 0.879(1.5) +
0.337(5.0) + 0.239(-3.3) - 0.837(0.9) = -.965

Based on the calculation, a loss is predicted for the Oklahoma City Thunder.

Using the average points differential: 6.3 – 7.7= -1.4, which predicts a loss for the Oklahoma City Thunder.

Using the weighted model: -.965(.7) + -1.4 (.3) = -1.095, which predicts a loss for the Oklahoma City Thunder.

Based on all of these predictions, the San Antonio Spurs would be expected to win more games in the best of 7 series.

4.12. Point Spread Model – Predicting 2014 NBA Playoffs (Round Four / Finals)

Based on the predicted winners from round three, Table 27 gives the seasonal averages for which predictions were made for round four of the playoffs. It was predicted the Spurs and the Heat would play each other in round four (NBA Finals). Table 27 gives the regular seasonal average statistics for the variables of both teams.

Table 27. Regular Seasonal Averages (Heat vs Spurs).

Variable	**Miami Heat "Team A"**	**San Antonio Spurs "Team B"**	**Difference**
FGS (%)	50.1	48.6	1.5
FTS (%)	76.0	78.5	-2.5
3PS (%)	36.4	39.7	-3.3
ORS	7.6	9.3	-1.7
FTA	23	20.0	3.0
TOS	14.8	14.4	0.4
AST	22.5	25.2	-2.7
Points Differential	4.8	7.7	-2.9

When these differences were placed into the point spread model, the following was obtained:

Point Spread = 1.485(1.5) + 0.169(-3.3) + 0.195(-2.5) + 0.879(-1.7) +
0.337(3.0) + 0.239(-2.7) - 0.837(0.4) = -.281

Based on the calculation, a loss is predicted for the Miami Heat.

Using the average points differential: 4.8 – 7.7= -2.9, which predicts a loss for the Miami Heat.

Using the weighted model: -.281(.7) + -2.9 (.3) = -1.067, which predicts a loss for the Miami Heat.

Based on all of these predictions, the San Antonio Spurs would be expected to win more games in the best of 7 series.

The actual winners for round one were Pacers, Wizards, Nets, Heat, Spurs, Blazers, Clippers, and Thunder. The actual winners for round two were Pacers, Heat, Spurs, and Thunder. The actual winners for round three were Heat and Spurs. The actual winner for round four (NBA champions) were the Spurs. The model using (Eq. 1) accurately predicted 9 out of 15(60%) correctly. When using the points differential 11 out of 15 (73%) were accurately predicted. When using the weighted model 12 out of 15 (80%) were accurately predicted. Figures 6-11 show the predicted 2014 NBA playoffs outcomes versus the actual 2014 NBA playoffs outcomes.

<table>
<tr><td>PACERS</td><td rowspan="2">PACERS</td><td rowspan="4">WIZARDS</td><td rowspan="8">HEAT</td></tr>
<tr><td>HAWKS</td></tr>
<tr><td>BULLS</td><td rowspan="2">WIZARDS</td></tr>
<tr><td>WIZARDS</td></tr>
<tr><td>RAPTORS</td><td rowspan="2">RAPTORS</td><td rowspan="4">HEAT</td></tr>
<tr><td>NETS</td></tr>
<tr><td>HEAT</td><td rowspan="2">HEAT</td></tr>
<tr><td>BOBCATS</td></tr>
</table>

Figure 6. Predicted 2014 NBA Playoffs Eastern Conference Outcome

<table>
<tr><td>PACERS</td><td rowspan="2">PACERS</td><td rowspan="4">*PACERS</td><td rowspan="8">HEAT</td></tr>
<tr><td>HAWKS</td></tr>
<tr><td>BULLS</td><td rowspan="2">WIZARDS</td></tr>
<tr><td>WIZARDS</td></tr>
<tr><td>RAPTORS</td><td rowspan="2">*NETS</td><td rowspan="4">HEAT</td></tr>
<tr><td>NETS</td></tr>
<tr><td>HEAT</td><td rowspan="2">HEAT</td></tr>
<tr><td>BOBCATS</td></tr>
</table>

Figure 7. Actual 2014 NBA Playoffs Eastern Conference Outcome

* When actual differs from predicted

<table>
<tr><td>SPURS</td><td rowspan="2">SPURS</td><td rowspan="4">SPURS</td><td rowspan="8">SPURS</td></tr>
<tr><td>MAVERICKS</td></tr>
<tr><td>ROCKETS</td><td rowspan="2">ROCKETS</td></tr>
<tr><td>BLAZERS</td></tr>
<tr><td>CLIPPERS</td><td rowspan="2">CLIPPERS</td><td rowspan="4">THUNDER</td></tr>
<tr><td>WARRIORS</td></tr>
<tr><td>THUNDER</td><td rowspan="2">THUNDER</td></tr>
<tr><td>GRIZZLIES</td></tr>
</table>

Figure 8. Predicted 2014 NBA Playoffs Western Conference Outcome

<table>
<tr><td>SPURS</td><td rowspan="2">SPURS</td><td rowspan="4">SPURS</td><td rowspan="8">SPURS</td></tr>
<tr><td>MAVERICKS</td></tr>
<tr><td>ROCKETS</td><td rowspan="2">*BLAZERS</td></tr>
<tr><td>BLAZERS</td></tr>
<tr><td>CLIPPERS</td><td rowspan="2">CLIPPERS</td><td rowspan="4">THUNDER</td></tr>
<tr><td>WARRIORS</td></tr>
<tr><td>THUNDER</td><td rowspan="2">THUNDER</td></tr>
<tr><td>GRIZZLIES</td></tr>
</table>

Figure 9. Actual 2014 NBA Playoffs Western Conference Outcome

* When actual differs from predicted

<table>
<tr><td>SPURS</td><td rowspan="2">SPURS</td></tr>
<tr><td>HEAT</td></tr>
</table>

Figure 10. Predicted 2014 NBA Finals

<table>
<tr><td>SPURS</td><td rowspan="2">SPURS</td></tr>
<tr><td>HEAT</td></tr>
</table>

Figure 11. Actual 2014 NBA Finals

4.13. Point Spread Model – Predicting 2015 NBA Playoffs

The same process was repeated for predicting the 2015 NBA playoffs. The results of the predicted and actual outcomes are shown in figures 12-17.

HAWKS	HAWKS	HAWKS	CAVALIERS
NETS			
RAPTORS	RAPTORS		
WIZARDS			
BULLS	BUCKS	CAVALIERS	
BUCKS			
CAVALIERS	CAVALIERS		
CELTICS			

Figure 12. Predicted 2015 NBA Playoffs Eastern Conference Outcome

HAWKS	HAWKS	HAWKS	CAVALIERS
NETS			
RAPTORS	*WIZARDS		
WIZARDS			
BULLS	*BULLS	CAVALIERS	
BUCKS			
CAVALIERS	CAVALIERS		
CELTICS			

Figure 13. Actual 2015 NBA Playoffs Eastern Conference Outcome

* When actual differs from predicted

<table>
<tr><td>WARRIORS</td><td rowspan="2">WARRIORS</td><td rowspan="4">WARRIORS</td><td rowspan="8">WARRIORS</td></tr>
<tr><td>PELICANS</td></tr>
<tr><td>BLAZERS</td><td rowspan="2">GRIZZLIES</td></tr>
<tr><td>GRIZZLIES</td></tr>
<tr><td>CLIPPERS</td><td rowspan="2">CLIPPERS</td><td rowspan="4">CLIPPERS</td></tr>
<tr><td>SPURS</td></tr>
<tr><td>ROCKETS</td><td rowspan="2">MAVERICKS</td></tr>
<tr><td>MAVERICKS</td></tr>
</table>

Figure 14. Predicted 2015 NBA Playoffs Western Conference Outcome

<table>
<tr><td>WARRIORS</td><td rowspan="2">WARRIORS</td><td rowspan="4">WARRIORS</td><td rowspan="8">WARRIORS</td></tr>
<tr><td>PELICANS</td></tr>
<tr><td>BLAZERS</td><td rowspan="2">GRIZZLIES</td></tr>
<tr><td>GRIZZLIES</td></tr>
<tr><td>CLIPPERS</td><td rowspan="2">CLIPPERS</td><td rowspan="4">*ROCKETS</td></tr>
<tr><td>SPURS</td></tr>
<tr><td>ROCKETS</td><td rowspan="2">*ROCKETS</td></tr>
<tr><td>MAVERICKS</td></tr>
</table>

Figure 15. Actual 2015 NBA Playoffs Western Conference Outcome

* When actual differs from predicted

WARRIORS	WARRIORS
CAVALIERS	

Figure 16. Predicted 2015 NBA Finals

WARRIORS	WARRRIORS
CAVALIERS	

Figure 17. Actual 2015 NBA Finals

The model using (Eq. 1) accurately predicted 9 out of 15(60%) correctly. When using the points differential 10 out of 15 (67%) were accurately predicted. When using the weighted model 11 out of 15 (73%) were accurately predicted.

4.14. Point Spread Model – Predicting 2016 NBA Playoffs

The same process was repeated for predicting the 2016 NBA playoffs. The results of the predicted outcomes are shown in figures 18-20.

<table>
<tr><td>CAVALIERS</td><td rowspan="2">CAVALIERS</td><td rowspan="4">CAVALIERS</td><td rowspan="8">CAVALIERS</td></tr>
<tr><td>PISTONS</td></tr>
<tr><td>HAWKS</td><td rowspan="2">HAWKS</td></tr>
<tr><td>CELTICS</td></tr>
<tr><td>HEAT</td><td rowspan="2">HEAT</td><td rowspan="4">RAPTORS</td></tr>
<tr><td>HORNETS</td></tr>
<tr><td>RAPTORS</td><td rowspan="2">RAPTORS</td></tr>
<tr><td>PACERS</td></tr>
</table>

Figure 18. Predicted 2016 NBA Playoffs Eastern Conference Outcome

<table>
<tr><td>WARRIORS</td><td rowspan="2">WARRIORS</td><td rowspan="4">WARRIORS</td><td rowspan="8">WARRIORS</td></tr>
<tr><td>ROCKETS</td></tr>
<tr><td>CLIPPERS</td><td rowspan="2">CLIPPERS</td></tr>
<tr><td>BLAZERS</td></tr>
<tr><td>THUNDER</td><td rowspan="2">THUNDER</td><td rowspan="4">SPURS</td></tr>
<tr><td>MAVERICKS</td></tr>
<tr><td>SPURS</td><td rowspan="2">SPURS</td></tr>
<tr><td>GRIZZLIES</td></tr>
</table>

Figure 19. Predicted 2016 NBA Playoffs Western Conference Outcome

<table>
<tr><td>WARRIORS</td><td rowspan="2">WARRIORS</td></tr>
<tr><td>CAVALIERS</td></tr>
</table>

Figure 20. Predicted 2016 NBA Finals

CHAPTER 5. CONCLUSION

A point spread model was developed that explained 94% of the variation in point spread for one season of NBA basketball games, and a logistic model was developed to estimate the probability of a team winning a game. The models were validated and worked well when the actual in-game statistics were known. The point spread model developed was used to make predictions and various methods of estimation for the in-game statistics were used: 3-game moving average, 3-game moving median, 3-game moving weighted average, and seasonal averages. It was found that seasonal averages were more accurate for making predictions and easier to calculate.

The outcome of the NBA playoffs was predicted for three consecutive years. Three approaches were used each year to make this prediction. The first approach used the point spread model only for all of the rounds. The second approach considered only the seasonal average points differential between the two teams. The third approach involved calculating the weighted average of .70 times the estimated point margin obtained from the model plus .30 times the average seasonal points differential. The last method did slightly better in predicting the outcomes of the playoffs.

In the future various weights between the model and the average points differential can be used to see if improvements can be made to the prediction accuracy. Additionally, it might be worth exploring other factors that could improve the performance of the model or lead to new models.

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APPENDIX A. POINT SPREAD MODEL VALIDATION 2011-12 SEASON

Date: TEAMS	TFG%	OFG%		TFT%	OFT%		T3%	O3T%		TOR	OOR		TFTA	OFTA		TTOS	OTOS		TAST	OAST		A-B : PSD
1/10/12: PHX vs LAL	0.425	0.488	-6.3	0.667	0.826	-16	0.35	0.118	23.2	9	14	-5	12	23	-11	11	14	-3	18	27	-9	-16.2772
1/12/12: CLE vs PHX	0.438	0.453	-1.5	0.619	0.7	-8.1	0.526	0.381	14.5	15	9	6	21	20	1	12	15	-3	22	23	-1	6.5265
1/13/12: NJ vs PHX	0.5	0.519	-1.9	0.789	0.813	-2.4	0.469	0.364	10.5	8	9	-1	19	16	3	12	13	-1	18	26	-8	-2.458
1/15/12: PHX vs SA	0.418	0.494	-7.6	0.714	0.739	-2.5	0.333	0.263	7	10	8	2	14	23	-9	12	13	-1	20	27	-7	-12.7015
1/17/12: PHX vs CHI	0.514	0.534	-2	0.842	0.792	5	0.455	0.5	-4.5	7	12	-5	19	24	-5	19	6	13	19	31	-12	-22.5845
2/7/12: PHX vs MIL	0.479	0.481	-0.2	1	0.9	10	0.36	0.45	-9	16	10	6	8	20	-12	12	13	-1	28	25	3	2.916
2/9/12: HOU vs PHX	0.488	0.473	1.5	0.667	0.626	4.1	0.5	0.333	16.7	12	5	7	6	16	-10	11	13	-2	26	25	1	10.5453
2/11/12: PHX vs SAC	0.5	0.351	14.9	0.8	0.786	1.4	0.348	0.381	-3.3	7	16	-9	15	28	-13	15	16	-1	27	16	11	13.0158
2/13/12: PHX vs GS	0.463	0.453	1	0.789	0.81	-2.1	0.2	0.389	-19	11	15	-4	19	21	-2	14	10	4	29	17	12	-6.7886
2/14/12: PHX vs DEN	0.333	0.513	-18	0.895	0.735	16	0.375	0.286	8.9	18	10	8	19	34	-15	20	24	-4	20	19	1	-16.5419
1/3/12: HOU vs LAL	0.427	0.526	-9.9	0.857	0.778	7.9	0.355	0.357	-0.2	10	10	0	7	27	-20	8	15	-7	27	25	2	-13.5978
1/5/12: LAL vs POR	0.468	0.461	0.7	0.815	0.769	4.6	0	0.417	-42	13	10	3	27	26	1	13	4	9	15	20	-5	-10.8648
1/6/12: GS vs LAL	0.494	0.481	1.3	0.526	0.69	-16	0.286	0.273	1.3	10	15	-5	19	29	-10	18	19	-1	19	27	-8	-9.8878
1/8/12: MEM vs LAL	0.409	0.473	-6.4	0.5	0.667	-17	0.111	0.316	-21	9	13	-4	10	21	-11	9	27	-18	23	24	-1	-8.621
1/11/12: LAL vs UTA	0.427	0.387	4	0.842	0.688	15.4	0.444	0.286	15.8	8	10	-2	19	16	3	17	11	6	17	22	-5	4.6492
2/3/12: LAL vs DEN	0.474	0.44	3.4	0.6	0.783	-18	0.308	0.217	9.1	8	5	3	25	23	2	11	12	-1	19	20	-1	6.9274
2/4/12: LAL vs UTA	0.387	0.448	-6.1	0.833	0.7	13.3	0.286	0.333	-4.7	16	18	-2	30	20	10	13	10	3	12	25	-13	-11.2653
2/6/12: LAL vs PHI	0.42	0.469	-4.9	0.75	0.647	10.3	0.292	0.471	-18	21	8	13	20	17	3	16	4	12	23	27	-4	-6.8551
2/9/12: LAL vs BOS	0.396	0.392	0.4	0.75	1	-25	0.067	0.316	-25	15	12	3	20	5	15	11	9	2	13	22	-9	-4.6221
2/10/12: LAL vs NY	0.375	0.429	-5.4	0.826	0.618	20.8	0.25	0.238	1.2	12	8	4	23	34	-11	17	14	3	13	16	-3	-7.1792
1/4/12: HOU vs LAC	0.461	0.573	-11	0.706	0.708	-0.2	0.438	0.375	6.3	6	5	1	17	24	-7	19	7	12	15	30	-15	-30.7153
1/7/12: MIL vs LAC	0.363	0.5	-14	0.815	0.65	16.5	0.3	0.211	8.9	13	8	5	27	40	-13	14	13	1	18	17	1	-16.2069
1/10/12: LAC vs POR	0.446	0.514	-6.8	0.708	0.813	-11	0.261	0.357	-9.6	13	7	6	24	32	-8	14	11	3	18	21	-3	-14.4179
1/11/12: MIA vs LAC	0.395	0.419	-2.4	0.588	0.739	-15	0.313	0.353	-4	13	10	3	34	23	11	18	15	3	18	22	-4	-4.3075
1/14/12: LAL vs LAC	0.455	0.412	4.3	0.76	0.767	-0.7	0.417	0.429	-1.2	11	17	-6	25	30	-5	9	9	0	24	17	7	0.7602
2/4/12: LAC vs WAS	0.542	0.375	16.7	0.353	0.609	-26	0.478	0.389	8.9	17	13	4	17	23	-6	23	13	10	32	17	15	18.0206
2/6/12: LAC vs ORL	0.439	0.465	-2.6	0.88	0.688	19.2	0.419	0.367	5.2	10	10	0	25	16	9	12	13	-1	21	27	-6	3.1978
2/8/12: LAC vs CLE	0.41	0.507	-9.7	0.862	0.769	9.3	0.2	0.389	-19	15	10	5	29	26	3	13	15	-2	20	24	-4	-9.6611
2/10/12: LAC vs PHI	0.388	0.408	-2	0.667	0.652	1.5	0.105	0.267	-16	15	9	6	15	23	-8	7	10	-3	24	19	5	0.8687
2/11/12: LAC vs CHA	0.526	0.351	17.5	0.875	0.767	10.8	0.4	0.071	32.9	11	9	2	24	43	-19	8	4	4	29	18	11	28.2896
1/25/12: POR vs GS	0.41	0.519	-11	0.85	0.571	27.9	0.381	0.55	-17	12	5	7	20	14	6	12	11	1	25	33	-8	-8.1761
1/27/12: OKC vs GS	0.477	0.471	0.6	0.865	0.789	7.6	0.235	0.429	-19	19	10	9	37	19	18	22	20	2	23	30	-7	9.7244
1/31/12: SAC vs GS	0.427	0.407	2	0.737	0.846	-11	0.375	0.333	4.2	12	9	3	19	13	6	18	8	10	21	26	-5	-3.3517
2/2/12: UTA vs GS	0.456	0.469	-1.3	0.765	0.84	-7.5	0.25	0.333	-8.3	15	22	-7	34	25	9	14	8	6	24	23	1	-12.6987
2/4/12: GS vs SAC	0.433	0.439	-0.6	0.923	0.857	6.6	0.552	0.455	9.7	10	20	-10	13	21	-8	16	18	-2	25	21	4	-6.8207
2/20/12: LAC vs GS	0.429	0.458	-2.9	0.741	0.792	-5.1	0.423	0.391	3.2	17	13	4	27	24	3	17	9	8	14	22	-8	-8.8412
2/22/12: GS vs PHX	0.464	0.478	-1.4	0.864	0.7	16.4	0.45	0.211	23.9	13	20	-7	22	20	2	7	10	-3	19	23	-4	1.2341
2/28/12: GS vs IND	0.341	0.44	-9.9	0.708	0.719	-1.1	0.136	0.455	-32	19	16	3	24	32	-8	15	14	1	15	21	-6	-22.6371
2/29/12: GS vs ATL	0.41	0.337	7.3	0.941	0.615	32.6	0.083	0.222	-14	9	18	-9	17	26	-9	11	9	2	20	17	3	2.9474
3/2/12: GS vs PHI	0.402	0.472	-7	0.857	0.813	4.4	0.278	0.471	-19	7	11	-4	14	16	-2	9	9	0	18	21	-3	-17.7057
1/10/12: SAC vs PHI	0.395	0.566	-17	0.619	0.684	-6.5	0.211	0.385	-17	13	4	9	21	19	2	15	10	5	16	30	-14	-28.5476
1/11/12: SAC vs TOR	0.37	0.425	-5.5	0.912	0.81	10.2	0.292	0.3	-0.8	14	9	5	34	21	13	16	14	2	13	20	-7	-0.8847
1/13/12: SAC vs HOU	0.438	0.449	-1.1	0.938	0.789	14.9	0.2	0.381	-18	6	18	-12	16	19	-3	11	12	-1	17	22	-5	-13.7039
1/14/12: SAC vs DAL	0.256	0.457	-20	0.778	0.72	5.8	0.095	0.438	-34	16	12	4	18	25	-7	15	16	-1	10	19	-9	-34.6712
1/16/12: SAC vs MIN	0.443	0.463	-2	0.6	0.789	-19	0.235	0.385	-15	9	9	0	20	19	1	16	13	3	20	24	-4	-12.3205
2/17/12: SAC vs DET	0.5	0.462	3.8	0.818	0.88	-6.2	0.364	0.5	-14	8	16	-8	22	25	-3	12	12	0	25	21	4	-4.9514
2/19/12: SAC vs CLE	0.376	0.36	1.6	0.72	0.733	-1.3	0.211	0.318	-11	18	19	-1	25	30	-5	12	11	1	21	15	6	-1.6528
2/21/12: SAC vs MIA	0.449	0.556	-11	0.789	0.87	-8.1	0.481	0.435	4.6	15	9	6	19	23	-4	15	12	3	24	28	-4	-16.2326
2/22/12: SAC vs WAS	0.448	0.488	-4	0.926	0.593	33.3	0.235	0.391	-16	18	12	6	27	27	0	10	18	-8	18	22	-4	8.9311
2/28/12: UTA vs SAC	0.471	0.44	3.1	0.5	0.828	-33	0.385	0.25	13.5	13	16	-3	22	29	-7	16	17	-1	27	23	4	-2.714

APPENDIX B. LOGISTIC MODEL VALIDATION 2011-12 SEASON

Date: TEAMS	TFG%	OFG%		TFT%	OFT%		T3%	O3T%		TOR	OOR		TFTA	OFTA		TTOS	OTOS		TAST	OAST		A-B : Log
1/10/12: PHX vs LAL	0.425	0.488	-6.3	0.667	0.826	-15.9	0.35	0.118	23.2	9	14	-5	12	23	-11	11	14	-3	18	27	-9	4.9E-06
1/12/12: CLE vs PHX	0.438	0.453	-1.5	0.619	0.7	-8.1	0.526	0.381	14.5	15	9	6	21	20	1	12	15	-3	22	23	-1	0.993273
1/13/12: NJ vs PHX	0.5	0.519	-1.9	0.789	0.813	-2.4	0.469	0.364	10.5	8	9	-1	19	16	3	12	13	-1	18	26	-8	0.215531
1/15/12: PHX vs SA	0.418	0.494	-7.6	0.714	0.739	-2.5	0.333	0.263	7	10	8	2	14	23	-9	12	13	-1	20	27	-7	2.49E-05
1/17/12: PHX vs CHI	0.514	0.534	-2	0.842	0.792	5	0.455	0.5	-4.5	7	12	-5	19	24	-5	19	6	13	19	31	-12	8.91E-09
2/7/12: PHX vs MIL	0.479	0.481	-0.2	1	0.9	10	0.36	0.45	-9	16	10	6	8	20	-12	12	13	-1	28	25	3	0.359393
2/9/12: HOU vs PHX	0.488	0.473	1.5	0.667	0.626	4.1	0.5	0.333	16.7	12	5	7	6	16	-10	11	13	-2	26	25	1	0.997524
2/11/12: PHX vs SAC	0.5	0.351	14.9	0.8	0.786	1.4	0.348	0.381	-3.3	7	16	-9	15	28	-13	15	16	-1	27	16	11	0.999678
2/13/12: PHX vs GS	0.463	0.453	1	0.789	0.81	-2.1	0.2	0.389	-18.9	11	15	-4	19	21	-2	14	10	4	29	17	12	0.008864
2/14/12: PHX vs DEN	0.333	0.513	-18	0.895	0.735	16	0.375	0.286	8.9	18	10	8	19	34	-15	20	24	-4	20	19	1	2.28E-06
1/3/12: HOU vs LAL	0.427	0.526	-9.9	0.857	0.778	7.9	0.355	0.357	-0.2	10	10	0	7	27	-20	8	15	-7	27	25	2	8.7E-06
1/5/12: LAL vs POR	0.468	0.461	0.7	0.815	0.769	4.6	0	0.417	-41.7	13	10	3	27	26	1	13	4	9	15	20	-5	1.65E-05
1/6/12: GS vs LAL	0.494	0.481	1.3	0.526	0.69	-16.4	0.286	0.273	1.3	10	15	-5	19	29	-10	18	19	-1	19	27	-8	0.000109
1/8/12: MEM vs LAL	0.409	0.473	-6.4	0.5	0.667	-16.7	0.111	0.316	-20.5	9	13	-4	10	21	-11	9	27	-18	23	24	-1	0.00079
1/11/12: LAL vs UTA	0.427	0.387	4	0.842	0.688	15.4	0.444	0.286	15.8	8	10	-2	19	16	3	17	11	6	17	22	-5	0.975703
2/3/12: LAL vs DEN	0.474	0.44	3.4	0.6	0.783	-18.3	0.308	0.217	9.1	8	5	3	25	23	2	11	12	-1	19	20	-1	0.99305
2/4/12: LAL vs UTA	0.387	0.448	-6.1	0.833	0.7	13.3	0.286	0.333	-4.7	16	18	-2	30	20	10	13	10	3	12	25	-13	0.000635
2/6/12: LAL vs PHI	0.42	0.469	-4.9	0.75	0.647	10.3	0.292	0.471	-17.9	21	8	13	20	17	3	16	4	12	23	27	-4	0.000602
2/9/12: LAL vs BOS	0.396	0.392	0.4	0.75	1	-25	0.067	0.316	-24.9	15	12	3	20	5	15	11	9	2	13	22	-9	0.02808
2/10/12: LAL vs NY	0.375	0.429	-5.4	0.826	0.618	20.8	0.25	0.238	1.2	12	8	4	23	34	-11	17	14	3	13	16	-3	0.000653
1/4/12: HOU vs LAC	0.461	0.573	-11.2	0.706	0.708	-0.2	0.438	0.375	6.3	6	5	1	17	24	-7	19	7	12	15	30	-15	2.46E-11
1/7/12: MIL vs LAC	0.363	0.5	-13.7	0.815	0.65	16.5	0.3	0.211	8.9	13	8	5	27	40	-13	14	13	1	18	17	1	2.99E-06
1/10/12: LAC vs POR	0.446	0.514	-6.8	0.708	0.813	-10.5	0.261	0.357	-9.6	13	7	6	24	32	-8	14	11	3	18	21	-3	2.67E-06
1/11/12: MIA vs LAC	0.395	0.419	-2.4	0.588	0.739	-15.1	0.313	0.353	-4	13	10	3	34	23	11	18	15	3	18	22	-4	0.093927
1/14/12: LAL vs LAC	0.455	0.412	4.3	0.76	0.767	-0.7	0.417	0.429	-1.2	11	17	-6	25	30	-5	9	9	0	24	17	7	0.670777
2/4/12: LAC vs WAS	0.542	0.375	16.7	0.353	0.609	-25.6	0.478	0.389	8.9	17	13	4	17	23	-6	23	13	10	32	17	15	0.999988
2/6/12: LAC vs ORL	0.439	0.465	-2.6	0.88	0.688	19.2	0.419	0.367	5.2	10	10	0	25	16	9	12	13	-1	21	27	-6	0.978349
2/8/12: LAC vs CLE	0.41	0.507	-9.7	0.862	0.769	9.3	0.2	0.389	-18.9	15	10	5	29	26	3	13	15	-2	20	24	-4	0.000649
2/10/12: LAC vs PHI	0.388	0.408	-2	0.667	0.652	1.5	0.105	0.267	-16.2	15	9	6	15	23	-8	7	10	-3	24	19	5	0.216259
2/11/12: LAC vs CHA	0.526	0.351	17.5	0.875	0.767	10.8	0.4	0.071	32.9	11	9	2	24	43	-19	8	4	4	29	18	11	1
1/25/12: POR vs GS	0.41	0.519	-10.9	0.85	0.571	27.9	0.381	0.55	-16.9	12	5	7	20	14	6	12	11	1	25	33	-8	0.001847
1/27/12: OKC vs GS	0.477	0.471	0.6	0.865	0.789	7.6	0.235	0.429	-19.4	19	10	9	37	19	18	22	20	2	23	30	-7	0.999269
1/31/12: SAC vs GS	0.427	0.407	2	0.737	0.846	-10.9	0.375	0.333	4.2	12	9	3	19	13	6	18	8	10	21	26	-5	0.052411
2/2/12: UTA vs GS	0.456	0.469	-1.3	0.765	0.84	-7.5	0.25	0.333	-8.3	15	22	-7	34	25	9	14	8	6	24	23	1	0.000618
2/4/12: GS vs SAC	0.433	0.439	-0.6	0.923	0.857	6.6	0.552	0.455	9.7	10	20	-10	13	21	-8	16	18	-2	25	21	4	0.017605
2/20/12: LAC vs GS	0.429	0.458	-2.9	0.741	0.792	-5.1	0.423	0.391	3.2	17	13	4	27	24	3	17	9	8	14	22	-8	0.000702
2/22/12: GS vs PHX	0.464	0.478	-1.4	0.864	0.7	16.4	0.45	0.211	23.9	13	20	-7	22	20	2	7	10	-3	19	23	-4	0.957328
2/28/12: GS vs IND	0.341	0.44	-9.9	0.708	0.719	-1.1	0.136	0.455	-31.9	19	16	3	24	32	-8	15	14	1	15	21	-6	4.08E-09
2/29/12: GS vs ATL	0.41	0.337	7.3	0.941	0.615	32.6	0.083	0.222	-13.9	9	18	-9	17	26	-9	11	9	2	20	17	3	0.685227
3/2/12: GS vs PHI	0.402	0.472	-7	0.857	0.813	4.4	0.278	0.471	-19.3	7	11	-4	14	16	-2	9	9	0	18	21	-3	1.83E-06
1/10/12: SAC vs PHI	0.395	0.566	-17.1	0.619	0.684	-6.5	0.211	0.385	-17.4	13	4	9	21	19	2	15	10	5	16	30	-14	1.85E-10
1/11/12: SAC vs TOR	0.37	0.425	-5.5	0.912	0.81	10.2	0.292	0.3	-0.8	14	9	5	34	21	13	16	14	2	13	20	-7	0.645267
1/13/12: SAC vs HOU	0.438	0.449	-1.1	0.938	0.789	14.9	0.2	0.381	-18.1	6	18	-12	16	19	-3	11	12	-1	17	22	-5	4.1E-05
1/14/12: SAC vs DAL	0.256	0.457	-20.1	0.778	0.72	5.8	0.095	0.438	-34.3	16	12	4	18	25	-7	15	16	-1	10	19	-9	1.34E-12
1/16/12: SAC vs MIN	0.443	0.463	-2	0.6	0.789	-18.9	0.235	0.385	-15	9	9	0	20	19	1	16	13	3	20	24	-4	4.89E-05
2/17/12: SAC vs DET	0.5	0.462	3.8	0.818	0.88	-6.2	0.364	0.5	-13.6	8	16	-8	22	25	-3	12	12	0	25	21	4	0.023916
2/19/12: SAC vs CLE	0.376	0.36	1.6	0.72	0.733	-1.3	0.211	0.318	-10.7	18	19	-1	25	30	-5	12	11	1	21	15	6	0.120957
2/21/12: SAC vs MIA	0.449	0.556	-10.7	0.789	0.87	-8.1	0.481	0.435	4.6	15	9	6	19	23	-4	15	12	3	24	28	-4	3.46E-06
2/22/12: SAC vs WAS	0.448	0.488	-4	0.926	0.593	33.3	0.235	0.391	-15.6	18	12	6	27	27	0	10	18	-8	18	22	-4	0.996268
2/28/12: UTA vs SAC	0.471	0.44	3.1	0.5	0.828	-32.8	0.385	0.25	13.5	13	16	-3	22	29	-7	16	17	-1	27	23	4	0.106853

APPENDIX C. 144 GAMES RAW DATA

Team	W / L	H / A	TSC	OSC	PSD	TFGM	TFGA	TGF%	OFGM	OFGA	OFG%	FGS	T3M	T3A	T3%	O3M	O3A	O3%	3PS	TFTM	TFTA	TFT%	OFTM	OFTA	OFT%	FTS	TOR	OOR	ORS	TAST	OAST	ASTS	TTO	OTO	TOS
MIA	1	0	105	103	2	42	85	0.494	39	72	0.542	-4.755	7	20	0.350	10	21	0.476	-12.619	14	21	0.667	10	21	0.476	19.048	10	4	6	25	24	1	14	20	-6
MIA	1	0	98	95	3	32	72	0.444	37	81	0.457	-1.235	12	29	0.414	7	21	0.333	8.046	22	30	0.733	14	17	0.824	-9.020	11	15	-4	21	20	1	13	16	-3
MIA	1	1	103	89	14	38	68	0.559	34	83	0.410	14.918	8	15	0.533	7	22	0.318	21.515	19	26	0.731	14	18	0.778	-4.701	4	18	-14	21	21	0	18	22	-4
MIA	1	1	109	77	32	38	76	0.500	30	89	0.337	16.292	13	30	0.433	5	25	0.200	23.333	20	23	0.870	12	18	0.667	20.290	4	14	-10	28	20	8	10	13	-3
MIA	1	0	108	94	14	37	78	0.474	37	86	0.430	4.413	15	28	0.536	9	24	0.375	16.071	19	29	0.655	11	18	0.611	4.406	11	10	1	31	25	6	12	12	0
MIA	0	0	97	101	-4	37	77	0.481	40	85	0.471	0.993	7	20	0.350	8	22	0.364	-1.364	16	23	0.696	13	18	0.722	-2.657	6	12	-6	15	27	-12	13	18	-5
MIA	1	0	108	89	19	42	69	0.609	34	74	0.459	14.924	14	27	0.519	5	18	0.278	24.074	10	16	0.625	16	18	0.889	-26.389	3	11	-8	30	19	11	13	19	-6
MIA	1	0	88	86	2	33	71	0.465	35	79	0.443	2.175	12	28	0.429	7	24	0.292	13.690	10	15	0.667	9	16	0.563	10.417	3	13	-10	23	26	-3	10	12	-2
NY	1	0	90	83	7	32	69	0.464	29	76	0.382	8.219	8	23	0.348	9	19	0.474	-12.586	18	25	0.720	16	24	0.667	5.333	8	19	-11	18	17	1	12	17	-5
NY	1	1	106	94	12	40	76	0.526	38	79	0.481	4.530	15	34	0.441	5	17	0.294	14.706	11	16	0.688	13	18	0.722	-3.472	10	14	-4	20	18	2	11	16	-5
NY	1	1	99	94	5	38	71	0.535	36	79	0.456	7.952	10	22	0.455	11	32	0.344	11.080	13	24	0.542	11	14	0.786	-24.405	9	9	0	16	19	-3	12	13	-1
NY	1	1	110	84	26	41	79	0.519	34	76	0.447	7.162	7	19	0.368	4	23	0.174	19.451	21	23	0.913	12	18	0.667	24.638	11	11	0	11	18	-7	11	18	-7
NY	1	0	100	85	15	39	90	0.433	31	69	0.449	-1.594	8	28	0.286	6	20	0.300	-1.429	14	18	0.778	17	22	0.773	0.505	15	7	8	23	20	3	12	19	-7
NY	1	1	108	101	7	38	74	0.514	33	70	0.471	4.208	13	31	0.419	6	21	0.286	13.364	19	22	0.864	29	35	0.829	3.506	7	10	-3	18	14	4	11	16	-5
NY	1	1	111	102	9	38	77	0.494	34	73	0.466	2.775	9	19	0.474	10	26	0.385	8.907	26	30	0.867	24	31	0.774	9.247	12	10	2	14	18	-4	13	17	-4
NY	1	1	108	89	19	35	72	0.486	32	74	0.432	5.368	14	27	0.519	7	25	0.280	23.852	24	31	0.774	18	23	0.783	-0.842	10	9	1	23	12	11	11	10	1
IND	1	0	111	90	21	39	88	0.443	35	92	0.380	6.275	8	22	0.364	6	24	0.250	11.364	25	29	0.862	14	21	0.667	19.540	15	16	-1	29	21	8	14	11	3
IND	1	1	95	73	22	34	87	0.391	28	88	0.318	7.262	6	23	0.261	3	15	0.200	6.087	21	24	0.875	14	21	0.667	20.833	15	10	5	18	12	6	15	10	5
IND	1	1	102	78	24	38	79	0.481	31	101	0.307	17.408	3	12	0.250	3	19	0.158	9.211	23	30	0.767	13	22	0.591	17.576	11	22	-11	23	17	6	14	8	6
IND	0	0	84	87	-3	30	78	0.385	35	81	0.432	-4.748	5	14	0.357	3	11	0.273	8.442	19	24	0.792	14	22	0.636	15.530	9	12	-3	13	21	-8	7	10	-3
IND	1	1	100	94	6	40	84	0.476	36	80	0.450	2.619	8	23	0.348	7	21	0.333	1.449	12	15	0.800	15	25	0.600	20.000	15	10	5	18	18	0	20	16	4
IND	1	0	100	91	9	35	78	0.449	32	83	0.386	6.318	6	18	0.333	6	21	0.286	4.762	24	28	0.857	21	26	0.808	4.945	9	15	-6	20	18	2	12	14	-2
IND	1	0	103	78	25	40	84	0.476	32	83	0.386	9.065	7	15	0.467	4	14	0.286	18.095	16	26	0.615	10	14	0.714	-9.890	15	7	8	22	18	4	13	11	2
IND	1	0	112	104	8	37	80	0.463	40	82	0.488	-2.530	4	15	0.267	6	12	0.500	-23.333	34	46	0.739	18	19	0.947	-20.824	19	9	10	18	30	-12	14	16	-2
BKN	0	0	93	105	-12	36	86	0.419	44	84	0.524	-10.520	8	23	0.348	8	21	0.381	-3.313	13	16	0.813	9	13	0.692	12.019	17	9	8	17	30	-13	16	11	5
BKN	1	0	119	82	37	45	83	0.542	34	78	0.436	10.627	9	21	0.429	1	18	0.056	37.302	20	23	0.870	13	15	0.867	0.290	13	10	3	21	20	1	9	15	-6
BKN	1	0	113	96	17	45	89	0.506	40	80	0.500	0.562	7	21	0.333	7	19	0.368	-3.509	16	21	0.762	9	15	0.600	16.190	13	7	6	21	19	2	9	11	-2
BKN	0	0	95	101	-6	34	74	0.459	37	79	0.468	-0.889	9	25	0.360	9	26	0.346	1.385	18	24	0.750	18	24	0.750	0.000	10	12	-2	27	19	8	15	15	0
BKN	1	0	102	100	2	35	76	0.461	41	99	0.414	4.638	4	14	0.286	6	21	0.286	0.000	28	31	0.903	12	17	0.706	19.734	15	25	-10	19	22	-3	16	10	6
BKN	1	0	111	93	18	46	95	0.484	36	82	0.439	4.519	5	20	0.250	8	18	0.444	-19.444	14	25	0.560	13	21	0.619	-5.905	19	13	6	24	22	2	9	14	-5
BKN	0	0	87	109	-22	32	79	0.405	42	74	0.568	-16.250	5	20	0.250	4	14	0.286	-3.571	18	36	0.500	21	31	0.677	-17.742	24	8	16	18	23	-5	19	12	7
BKN	0	0	107	116	-9	42	81	0.519	45	81	0.556	-3.704	8	23	0.348	10	17	0.588	-24.041	15	19	0.789	16	24	0.667	12.281	15	10	5	25	27	-2	17	10	7
CHI	1	0	113	95	18	43	83	0.518	34	76	0.447	7.070	8	16	0.500	3	14	0.214	28.571	19	22	0.864	24	30	0.800	6.364	11	7	4	28	16	12	14	12	2
CHI	0	1	118	119	-1	47	96	0.490	46	100	0.460	2.958	8	21	0.381	7	20	0.350	3.095	16	19	0.842	20	27	0.741	10.136	12	20	-8	29	26	3	14	13	1
CHI	0	0	89	99	-10	39	89	0.438	41	84	0.488	-4.989	4	14	0.286	10	21	0.476	-19.048	7	11	0.636	7	10	0.700	-6.364	9	8	1	30	19	11	8	14	-6
CHI	1	1	87	84	3	35	81	0.432	30	78	0.385	4.748	3	11	0.273	5	14	0.357	-8.442	14	22	0.636	19	24	0.792	-15.530	12	9	3	21	13	8	10	7	3
CHI	1	0	104	97	7	41	89	0.461	39	78	0.500	-3.933	6	12	0.500	10	26	0.385	11.538	13	19	0.684	12	17	0.706	-2.167	6	20	-14	27	25	2	13	14	-1
CHI	1	1	101	97	4	40	85	0.471	37	77	0.481	-0.993	8	22	0.364	7	20	0.350	1.364	13	18	0.722	16	23	0.696	2.657	12	6	6	27	15	12	18	13	5
CHI	0	0	98	100	-2	38	80	0.475	40	79	0.506	-3.133	12	21	0.571	6	18	0.333	23.810	10	18	0.556	14	18	0.778	-22.222	11	9	2	24	24	0	12	11	1
CHI	1	1	95	94	1	30	76	0.395	36	72	0.500	-10.526	8	23	0.348	7	16	0.438	-8.967	27	40	0.675	15	22	0.682	-0.682	10	8	2	19	22	-3	9	16	-7
MIL	1	1	115	109	6	40	90	0.444	47	93	0.505	-6.093	12	27	0.444	5	21	0.238	20.635	23	26	0.885	10	15	0.667	21.795	13	11	2	25	21	4	14	12	2
MIL	1	1	102	95	7	42	87	0.483	36	83	0.434	4.902	9	19	0.474	13	26	0.500	-2.632	9	13	0.692	10	13	0.769	-7.692	15	13	2	29	24	5	11	17	-6
MIL	0	0	90	98	-8	37	99	0.374	38	79	0.481	-10.728	8	19	0.421	8	18	0.444	-2.339	8	11	0.727	14	17	0.824	-9.626	16	9	7	20	26	-6	10	16	-6
MIL	0	0	78	102	-24	31	101	0.307	38	79	0.481	-17.408	3	19	0.158	3	12	0.250	-9.211	13	22	0.591	23	30	0.767	-17.576	22	11	11	17	23	-6	8	14	-6
MIL	0	1	99	104	-5	42	92	0.457	39	78	0.500	-4.348	5	21	0.238	10	26	0.385	-14.652	10	18	0.556	16	21	0.762	-20.635	19	7	12	26	28	-2	15	13	2
MIL	0	0	92	100	-8	37	89	0.416	42	89	0.472	-5.618	6	24	0.250	8	16	0.500	-25.000	12	13	0.923	8	9	0.889	3.419	14	14	0	18	28	-10	14	15	-1
MIL	1	1	113	103	10	45	93	0.484	34	77	0.442	4.231	7	19	0.368	5	20	0.250	11.842	16	22	0.727	30	39	0.769	-4.196	15	11	4	22	19	3	12	18	-6
MIL	0	1	99	109	-10	37	98	0.378	40	75	0.533	-15.578	12	29	0.414	4	16	0.250	16.379	13	15	0.867	25	32	0.781	8.542	19	10	9	24	24	0	9	13	-4
BOS	0	1	103	105	-2	39	72	0.542	42	85	0.494	4.755	10	21	0.476	7	20	0.350	12.619	15	24	0.625	14	21	0.667	-4.167	4	10	-6	24	25	-1	20	14	6
BOS	0	0	86	87	-1	33	72	0.458	31	71	0.437	2.171	4	14	0.286	5	16	0.313	-2.679	16	17	0.941	20	26	0.769	17.195	4	11	-7	20	20	0	13	18	-5
BOS	0	0	94	104	-10	32	77	0.416	38	82	0.463	-4.783	5	17	0.294	6	19	0.316	-2.167	25	27	0.926	22	28	0.786	14.021	10	13	-3	19	26	-7	19	26	-7
BOS	0	0	106	110	-4	38	74	0.514	43	94	0.457	5.607	9	20	0.450	4	11	0.364	8.636	21	28	0.750	20	24	0.833	-8.333	7	16	-9	19	26	-7	14	8	6
BOS	0	1	85	100	-15	31	69	0.449	39	90	0.433	1.594	6	20	0.300	8	28	0.286	1.429	17	22	0.773	14	18	0.778	-0.505	7	15	-8	20	11	9	19	8	11
BOS	1	0	93	92	1	34	76	0.447	38	86	0.442	0.551	5	14	0.357	7	17	0.412	-5.462	20	28	0.714	9	14	0.643	7.143	2	9	-7	27	26	1	15	18	-3
BOS	1	1	118	107	11	45	83	0.542	40	88	0.455	8.762	11	23	0.478	8	20	0.400	7.826	17	21	0.810	19	24	0.792	1.786	9	10	-1	25	28	-3	12	13	-1
BOS	0	0	89	108	-19	32	74	0.432	35	72	0.486	-5.368	7	25	0.280	14	27	0.519	-23.852	18	23	0.783	24	31	0.774	0.842	9	10	-1	12	23	-11	10	11	-1
ATL	0	1	113	127	-14	42	75	0.560	51	89	0.573	-1.303	8	21	0.381	13	22	0.591	-20.996	21	29	0.724	12	14	0.857	-13.300	5	10	-5	26	33	-7	15	12	3
ATL	1	1	98	90	8	38	79	0.481	37	99	0.374	10.728	8	18	0.444	8	19	0.421	2.339	14	17	0.824	8	11	0.727	9.626	9	16	-7	26	20	6	16	10	6
ATL	0	1	93	104	-11	37	83	0.446	41	87	0.471	-2.548	12	16	0.750	10	18	0.556	19.444	12	16	0.750	12	16	0.750	0.000	6	10	-4	27	22	5	11	9	2
ATL	1	0	104	99	5	39	78	0.500	42	92	0.457	4.348	10	26	0.385	5	21	0.238	14.652	16	21	0.762	10	18	0.556	20.635	7	19	-12	28	26	2	13	15	-2
ATL	0	0	94	100	-6	36	80	0.450	40	84	0.476	-2.619	7	21	0.333	8	23	0.348	-1.449	15	25	0.600	12	15	0.800	-20.000	10	15	-5	18	18	0	16	20	-4
ATL	1	0	107	88	19	40	81	0.494	35	78	0.449	4.511	10	21	0.476	4	17	0.235	24.090	17	20	0.850	14	20	0.700	15.000	8	10	-2	27	20	7	11	19	-8
ATL	0	0	107	118	-11	40	88	0.455	45	83	0.542	-8.762	8	20	0.400	11	23	0.478	-7.826	19	24	0.792	17	21	0.810	-1.786	10	9	1	28	25	3	13	12	1
ATL	1	1	97	88	9	34	78	0.436	34	87	0.391	4.509	6	21	0.286	4	13	0.308	-2.198	23	31	0.742	16	27	0.593	14.934	9	17	-8	18	12	6	16	17	-1
OKC	1	0	109	99	10	40	75	0.533	37	98	0.378	15.578	4	16	0.250	12	29	0.414	-16.379	25	32	0.781	13	15	0.867	-8.542	10	19	-9	24	24	0	13	9	4
OKC	0	0	93	101	-8	36	79	0.456	37	83	0.446	0.991	5	16	0.313	5	15	0.333	-2.083	16	20	0.800	22	27	0.815	-1.481	11	13	-2	16	20	-4	16	10	6
OKC	1	1	103	80	23	29	63	0.460	27	84	0.321	13.889	8	14	0.571	5	20	0.250	32.143	37	41	0.902	21	29	0.724	17.830	7	16	-9	20	17	3	14	15	-1
OKC	1	1	103	83	20	43	82	0.524	32	79	0.405	11.933	4	11	0.364	10	26	0.385	-2.098	13	18	0.722	9	13	0.692	2.991	9	7	2	23	22	1	10	17	-7
OKC	1	0	97	89	8	34	80	0.425	38	92	0.413	1.196	5	21	0.238	5	16	0.313	-7.440	24	33	0.727	8	10	0.800	-7.273	10	11	-1	17	20	-3	13	14	-1
OKC	0	0	89	90	-1	30	84	0.357	32	89	0.360	-0.241	2	18	0.111	6	15	0.400	-28.889	27	32	0.844	20	24	0.833	1.042	14	19	-5	9	11	-2	15	19	-4
OKC	0	1	104	114	-10	37	85	0.435	43	96	0.448	-1.262	4	25	0.160	4	21	0.190	-3.048	26	31	0.839	24	29	0.828	1.112	12	17	-5	21	23	-2	14	12	2
OKC	1	0	107	101	6	39	80	0.488	38	83	0.458	2.967	5	21	0.238	9	21	0.429	-19.048	24	30	0.800	16	16	1.000	-20.000	12	8	4	17	18	-1	16	14	2

SA	0	1	86	88	-2	35	79	0.443	33	71	0.465	-2.175	7	24	0.292	12	28	0.429	-13.690	9	16	0.563	10	15	0.667	-10.417	13	3	10	26	23	3	12	10	2
SA	1	1	104	102	2	39	74	0.527	41	81	0.506	2.085	6	15	0.400	8	19	0.421	-2.105	20	21	0.952	12	21	0.571	38.095	6	12	-6	29	26	3	9	9	0
SA	1	1	100	99	1	35	76	0.461	42	88	0.477	-1.675	10	15	0.667	0	10	0.000	66.667	20	27	0.741	15	17	0.882	-14.161	11	14	-3	20	26	-6	18	15	3
SA	0	0	95	96	-1	33	78	0.423	32	80	0.400	2.308	10	22	0.455	9	26	0.346	10.839	19	21	0.905	23	27	0.852	5.291	7	12	-5	19	19	0	16	13	3
SA	1	1	104	97	7	39	84	0.464	41	96	0.427	3.720	8	20	0.400	8	17	0.471	-7.059	18	24	0.750	7	12	0.583	16.667	8	11	-3	23	23	0	17	16	1
SA	1	1	104	93	11	41	85	0.482	37	84	0.440	4.188	8	26	0.308	6	12	0.500	-19.231	14	15	0.933	13	15	0.867	6.667	8	12	-4	27	16	11	12	16	-4
SA	1	1	119	113	6	45	78	0.577	43	85	0.506	7.104	6	17	0.353	7	15	0.467	-11.373	23	29	0.793	20	31	0.645	14.794	11	9	2	32	22	10	18	10	8
SA	1	1	92	91	1	37	84	0.440	37	83	0.446	-0.531	5	13	0.385	8	19	0.421	-3.644	13	17	0.765	9	10	0.900	-13.529	11	6	5	31	21	10	15	11	4
DEN	1	1	109	87	22	42	74	0.568	32	79	0.405	16.250	4	14	0.286	5	20	0.250	3.571	21	31	0.677	18	36	0.500	17.742	8	24	-16	23	18	5	12	19	-7
DEN	0	0	99	100	-1	42	88	0.477	35	76	0.461	1.675	0	10	0.000	10	15	0.667	-66.667	15	17	0.882	20	27	0.741	14.161	14	11	3	26	20	6	15	18	-3
DEN	0	0	86	110	-24	25	66	0.379	41	85	0.482	-10.357	5	16	0.313	14	25	0.560	-24.750	31	39	0.795	14	15	0.933	-13.846	11	17	-6	14	30	-16	13	12	1
DEN	1	1	101	95	6	37	85	0.435	39	86	0.453	-1.819	4	14	0.286	8	28	0.286	0.000	23	32	0.719	9	17	0.529	18.934	13	10	3	25	24	1	15	14	1
DEN	1	1	101	100	1	37	76	0.487	43	78	0.551	-6.444	7	11	0.636	7	18	0.389	24.747	20	27	0.741	7	11	0.636	10.438	11	7	4	18	27	-9	19	22	-3
DEN	1	0	114	104	10	43	96	0.448	37	85	0.435	1.262	4	21	0.190	4	25	0.160	3.048	24	29	0.828	26	31	0.839	-1.112	17	12	5	23	21	2	12	14	-2
DEN	1	0	119	118	1	46	100	0.460	47	96	0.490	-2.958	7	20	0.350	8	21	0.381	-3.095	20	27	0.741	16	19	0.842	-10.136	20	12	8	26	29	-3	13	14	-1
DEN	1	1	87	80	7	35	77	0.455	30	85	0.353	10.160	1	12	0.083	4	12	0.333	-25.000	16	22	0.727	16	19	0.842	-11.483	13	20	-7	18	16	2	16	14	2
LAC	0	0	81	98	-17	31	78	0.397	35	80	0.438	-4.006	7	22	0.318	9	24	0.375	-5.682	12	14	0.857	19	27	0.704	15.344	7	12	-5	15	17	-2	18	20	-2
LAC	0	0	102	104	-2	41	81	0.506	39	74	0.527	-2.085	8	19	0.421	6	15	0.400	2.105	12	21	0.571	20	21	0.952	-38.095	12	6	6	26	29	-3	9	9	0
LAC	1	0	105	91	14	34	73	0.466	35	71	0.493	-2.720	13	29	0.448	4	14	0.286	16.256	24	28	0.857	17	24	0.708	14.881	12	10	2	18	19	-1	9	11	-2
LAC	0	0	102	109	-7	38	85	0.447	40	82	0.488	-4.075	10	33	0.303	6	23	0.261	4.216	16	25	0.640	23	27	0.852	-21.185	11	8	3	19	23	-4	17	15	2
LAC	1	1	101	95	6	37	79	0.468	34	74	0.459	0.889	9	26	0.346	9	25	0.360	-1.385	18	24	0.750	18	24	0.750	0.000	12	10	2	19	27	-8	15	15	0
LAC	1	1	101	72	29	41	78	0.526	29	79	0.367	15.855	6	20	0.300	6	20	0.300	0.000	13	19	0.684	8	10	0.800	-11.579	8	10	-2	24	22	2	14	19	-5
LAC	0	0	101	116	-15	36	80	0.450	37	73	0.507	-5.685	9	26	0.346	14	28	0.500	-15.385	20	26	0.769	28	34	0.824	-5.430	11	8	3	30	25	5	17	15	2
LAC	1	1	93	80	13	34	75	0.453	29	81	0.358	9.531	8	28	0.286	12	26	0.462	-17.582	17	31	0.548	10	14	0.714	-16.590	12	7	5	20	21	-1	12	9	3
MEM	1	0	99	86	13	37	73	0.507	29	67	0.433	7.401	6	10	0.600	5	16	0.313	28.750	19	27	0.704	23	34	0.676	2.723	5	8	-3	25	19	6	9	16	-7
MEM	1	1	103	94	9	40	79	0.506	34	81	0.420	8.658	4	11	0.364	9	27	0.333	3.030	19	21	0.905	17	21	0.810	9.524	13	15	-2	24	19	5	14	14	0
MEM	0	0	101	108	-7	33	70	0.471	38	74	0.514	-4.208	6	21	0.286	13	31	0.419	-13.364	29	35	0.829	19	22	0.864	-3.506	10	7	3	14	18	-4	16	11	5
MEM	0	0	94	107	-13	34	77	0.442	36	72	0.500	-5.844	6	16	0.375	5	13	0.385	-0.962	20	22	0.909	30	44	0.682	22.727	9	10	-1	17	17	0	16	12	4
MEM	1	1	110	106	4	43	94	0.457	38	74	0.514	-5.607	4	11	0.364	9	20	0.450	-8.636	20	24	0.833	21	28	0.750	8.333	16	7	9	26	19	7	8	14	-6
MEM	0	0	83	90	-7	30	73	0.411	36	76	0.474	-6.273	3	10	0.300	4	14	0.286	1.429	20	25	0.800	14	18	0.778	2.222	11	16	-5	14	19	-5	11	15	-4
MEM	1	1	90	89	1	32	89	0.360	30	84	0.357	0.241	6	15	0.400	2	18	0.111	28.889	20	24	0.833	27	32	0.844	-1.042	19	14	5	11	9	2	19	15	4
MEM	1	1	92	77	15	40	82	0.488	29	86	0.337	15.060	5	16	0.313	6	24	0.250	6.250	7	11	0.636	13	18	0.722	-8.586	11	14	-3	19	14	5	13	11	2
GS	1	1	125	98	27	47	87	0.540	33	86	0.384	15.651	9	20	0.450	8	23	0.348	10.217	22	27	0.815	24	29	0.828	-1.277	11	11	0	22	23	-1	10	10	0
GS	0	1	98	105	-7	41	90	0.456	41	90	0.456	0.000	5	24	0.208	11	28	0.393	-18.452	11	13	0.846	12	21	0.571	27.473	13	16	-3	30	24	6	14	15	-1
GS	1	1	109	103	6	43	90	0.478	36	91	0.396	8.217	10	23	0.435	6	26	0.231	20.401	13	19	0.684	25	36	0.694	-1.023	9	15	-6	22	17	5	11	9	2
GS	1	1	101	92	9	37	75	0.493	36	88	0.409	8.424	10	20	0.500	7	17	0.412	8.824	17	22	0.773	13	16	0.813	-3.977	8	12	-4	25	20	5	21	12	9
GS	0	0	93	104	-11	37	84	0.440	41	85	0.482	-4.188	6	12	0.500	8	26	0.308	19.231	13	15	0.867	14	15	0.933	-6.667	12	8	4	16	27	-11	16	12	4
GS	1	0	93	72	21	35	70	0.500	28	83	0.337	16.265	10	19	0.526	3	17	0.176	34.985	13	15	0.867	13	13	1.000	-13.333	6	13	-7	21	17	4	16	13	3
GS	1	0	108	78	30	44	96	0.458	28	86	0.326	13.275	13	26	0.500	9	35	0.257	24.286	7	9	0.778	13	16	0.813	-3.472	8	12	-4	27	16	11	10	15	-5
GS	0	1	95	113	-18	34	76	0.447	43	83	0.518	-7.070	3	14	0.214	8	16	0.500	-28.571	24	30	0.800	19	22	0.864	-6.364	7	11	-4	16	28	-12	12	14	-2
HOU	1	1	98	81	17	35	80	0.438	31	78	0.397	4.006	9	24	0.375	7	22	0.318	5.682	19	27	0.704	12	14	0.857	-15.344	12	7	5	17	15	2	20	18	2
HOU	0	0	94	103	-9	34	81	0.420	40	79	0.506	-8.658	9	27	0.333	4	11	0.364	-3.030	17	21	0.810	19	21	0.905	-9.524	15	13	2	19	24	-5	14	14	0
HOU	0	1	91	100	-9	32	83	0.386	35	78	0.449	-6.318	6	21	0.286	6	18	0.333	-4.762	21	26	0.808	24	28	0.857	-4.945	15	9	6	18	20	-2	14	12	2
HOU	1	1	96	95	1	32	80	0.400	33	78	0.423	-2.308	9	26	0.346	10	22	0.455	-10.839	23	27	0.852	19	21	0.905	-5.291	12	7	5	19	19	0	13	16	-3
HOU	1	1	116	78	38	44	77	0.571	31	86	0.360	21.096	10	29	0.345	4	20	0.200	14.483	18	27	0.667	12	15	0.800	-13.333	13	10	3	26	14	12	22	14	8
HOU	1	1	100	93	7	34	76	0.447	36	79	0.456	-0.833	6	23	0.261	5	17	0.294	-3.325	26	32	0.813	16	20	0.800	1.250	9	5	4	15	19	-4	15	14	1
HOU	0	1	78	108	-30	28	86	0.326	44	96	0.458	-13.275	9	35	0.257	13	26	0.500	-24.286	13	16	0.813	7	9	0.778	3.472	12	8	4	16	27	-11	15	10	5
HOU	1	1	108	100	8	36	74	0.486	39	81	0.481	0.501	11	31	0.355	6	24	0.250	10.484	25	31	0.806	16	20	0.800	0.645	12	9	3	25	25	0	18	13	5
LAL	1	0	103	98	5	38	82	0.463	39	86	0.453	0.993	10	30	0.333	7	24	0.292	4.167	17	26	0.654	13	16	0.813	-15.865	15	16	-1	28	19	9	7	11	-4
LAL	0	0	103	113	-10	34	77	0.442	45	93	0.484	-4.231	5	20	0.250	7	19	0.368	-11.842	30	39	0.769	16	22	0.727	4.196	11	15	-4	19	22	-3	18	12	6
LAL	1	0	120	117	3	44	82	0.537	45	97	0.464	7.267	10	22	0.455	5	17	0.294	16.043	22	38	0.579	22	30	0.733	-15.439	12	17	-5	27	23	4	21	15	6
LAL	0	0	103	109	-6	36	91	0.396	43	90	0.478	-8.217	6	26	0.231	10	23	0.435	-20.401	25	36	0.694	13	19	0.684	1.023	15	9	6	17	22	-5	9	11	-2
LAL	0	1	100	103	-3	39	81	0.481	40	87	0.460	2.171	11	23	0.478	11	26	0.423	5.518	11	17	0.647	12	16	0.750	-10.294	9	6	3	27	28	-1	17	9	8
LAL	0	0	76	99	-23	29	87	0.333	42	87	0.483	-14.943	5	22	0.227	8	20	0.400	-17.273	13	16	0.813	7	15	0.467	34.583	14	14	0	15	21	-6	18	16	2
LAL	1	1	113	102	11	41	72	0.569	42	96	0.438	13.194	12	28	0.429	10	31	0.323	10.599	19	29	0.655	8	8	1.000	-34.483	6	7	-1	28	21	7	13	5	8
LAL	1	0	99	93	6	33	78	0.423	37	99	0.374	4.934	13	26	0.500	12	27	0.444	5.556	20	30	0.667	7	9	0.778	-11.111	7	17	-10	27	17	10	15	16	-1
UTA	1	1	116	107	9	45	81	0.556	42	81	0.519	3.704	10	17	0.588	8	23	0.348	24.041	16	24	0.667	15	19	0.789	-12.281	10	15	-5	27	25	2	10	17	-7
UTA	1	0	105	95	10	43	86	0.500	33	67	0.493	0.746	4	19	0.211	6	13	0.462	-25.101	15	18	0.833	23	32	0.719	11.458	13	6	7	25	22	3	10	16	-6
UTA	1	1	103	88	15	44	85	0.518	34	76	0.447	7.028	6	15	0.400	6	16	0.375	2.500	9	13	0.692	14	19	0.737	-4.453	12	8	4	30	27	3	16	17	-1
UTA	1	1	107	91	16	41	84	0.488	32	83	0.386	10.255	7	14	0.500	4	14	0.286	21.429	18	21	0.857	23	28	0.821	3.571	14	14	0	22	9	13	15	13	2
UTA	0	0	108	113	-5	42	82	0.512	38	70	0.543	-3.066	7	17	0.412	9	18	0.500	-8.824	17	21	0.810	28	33	0.848	-3.896	12	7	5	23	23	0	18	19	-1
UTA	0	0	97	104	-7	41	96	0.427	39	84	0.464	-3.720	8	17	0.471	8	20	0.400	7.059	7	12	0.583	18	24	0.750	-16.667	11	8	3	23	23	0	16	17	-1
UTA	0	0	93	100	-7	36	79	0.456	34	76	0.447	0.833	5	17	0.294	6	23	0.261	3.325	16	20	0.800	26	32	0.813	-1.250	5	9	-4	19	15	4	14	15	-1
UTA	0	1	83	90	-7	29	76	0.382	32	69	0.464	-8.219	9	19	0.474	8	23	0.348	12.586	16	24	0.667	18	25	0.720	-5.333	19	8	11	17	18	-1	17	12	5
DAL	1	1	100	98	2	40	79	0.506	38	80	0.475	3.133	6	18	0.333	12	21	0.571	-23.810	14	18	0.778	10	18	0.556	22.222	9	11	-2	24	24	0	11	12	-1
DAL	0	1	78	103	-25	32	83	0.386	40	84	0.476	-9.065	4	14	0.286	7	15	0.467	-18.095	10	14	0.714	16	26	0.615	9.890	7	15	-8	18	22	-4	11	13	-2
DAL	1	1	109	102	7	40	82	0.488	38	85	0.447	4.075	6	23	0.261	10	33	0.303	-4.216	23	27	0.852	16	25	0.640	21.185	8	11	-3	23	19	4	15	17	-2
DAL	1	1	113	108	5	38	70	0.543	42	82	0.512	3.066	9	18	0.500	7	17	0.412	8.824	28	33	0.848	17	21	0.810	3.896	7	12	-5	23	23	0	19	18	1
DAL	1	1	104	94	10	38	82	0.463	32	77	0.416	4.783	6	19	0.316	5	17	0.294	2.167	22	28	0.786	25	27	0.926	-14.021	13	10	3	26	19	7	14	14	0
DAL	0	1	96	113	-17	40	80	0.500	45	89	0.506	-0.562	7	19	0.368	7	21	0.333	3.509	9	15	0.600	16	21	0.762	-16.190	7	13	-6	19	21	-2	11	9	2
DAL	1	0	127	113	14	51	89	0.573	42	75	0.560	1.303	13	22	0.591	8	21	0.381	20.996	12	14	0.857	21	29	0.724	13.300	10	5	5	33	26	7	12	15	-3
DAL	0	1	101	107	-6	38	83	0.458	39	80	0.488	-2.967	9	21	0.429	5	21	0.238	19.048	16	16	1.000	24	30	0.800	20.000	8	12	-4	18	17	1	14	16	-2