NBA data analysis

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Github working link

(https://github.com/RohanJayaram/NBA-data-analytics)

We have Used this Reproducable Source code "https://raw.githubusercontent.com/ixarchakos/nba-games/master/data/nba_games_2015_2016.csv"

Short Description:-

The National Basketball Association is a professional basketball league in the United States. It consists of thirty teams distributed into two conferences. Each year, each team plays 82 regular season games, followed by playoffs and championship.

We have taken data from the 2015-2016 regular season and will be taking an in depth look at it. We want to analyze the data to be able to answer a few questions. We are interested in finding the factors that help contribute to a win. We will be analyzing halftime data, home and away teams, and different box score statistics including: three pointers, rebounds, etc.

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.2     v dplyr   1.0.7
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(caret)
```

```
## Loading required package: lattice
```

```
##
## Attaching package: 'caret'

## The following object is masked from 'package:purrr':
##
##     lift
```

```
library(dplyr)
```

Reading the data and getting idea of all the columns and rows.

```
data_url <- url("https://raw.githubusercontent.com/ixarchakos/nba-games/master/data/nba_games_2015_2016
data <- read_csv(data_url)
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   .default = col_double(),
##   date = col_date(format = ""),
##   home_team = col_character(),
##   away_team = col_character(),
##   half_time_score = col_character(),
##   fg_made_attempted_home = col_character(),
##   fg_made_attempted_away = col_character(),
##   `3pt_made_attempted_home` = col_character(),
##   `3pt_made_attempted_away` = col_character(),
##   ft_made_attempted_home = col_character(),
##   ft_made_attempted_away = col_character()
## )
## i Use `spec()` for the full column specifications.
```

```
nba.data <- as_tibble(data)
df <- as_tibble(data)
```

After looking at the data we need to Separate the Half time score column to two different columns namely home half time score and away half time score.

```
nba.data <- nba.data %>%
  separate(half_time_score, c("home_half_time_score", "away_half_time_score"), sep = "-")
nba.data
```

```
## # A tibble: 1,230 x 48
##           id date       home_team home_points away_team away_points
##        <dbl> <date>     <chr>           <dbl> <chr>           <dbl>
##  1 400827888 2015-10-27 ATL                94 DET               106
##  2 400827889 2015-10-27 CHI                97 CLE                95
##  3 400827890 2015-10-27 GS                111 NO                 95
##  4 400827891 2015-10-28 ORL                87 WSH                88
```

```
##  5 400827892 2015-10-28 BOS               112 PHI                95
##  6 400827893 2015-10-28 BKN               100 CHI               115
##  7 400827894 2015-10-28 DET                92 UTAH               87
##  8 400827895 2015-10-28 MIA               104 CHA                94
##  9 400827896 2015-10-28 TOR               106 IND                99
## 10 400827897 2015-10-28 HOU                85 DEN               105
## # ... with 1,220 more rows, and 42 more variables: home_half_time_score <chr>,
## #   away_half_time_score <chr>, fg_made_attempted_home <chr>,
## #   fg_made_attempted_away <chr>, field_goal_%_home <dbl>,
## #   field_goal_%_away <dbl>, 3pt_made_attempted_home <chr>,
## #   3pt_made_attempted_away <chr>, three_point_%_home <dbl>,
## #   three_point_%_away <dbl>, ft_made_attempted_home <chr>,
## #   ft_made_attempted_away <chr>, free_throw_%_home <dbl>,
## #   free_throw_%_away <dbl>, total_rebounds_home <dbl>,
## #   total_rebounds_away <dbl>, offensive_rebounds_home <dbl>,
## #   offensive_rebounds_away <dbl>, defensive_rebounds_home <dbl>,
## #   defensive_rebounds_away <dbl>, team_rebounds_home <dbl>,
## #   team_rebounds_away <dbl>, assists_home <dbl>, assists_away <dbl>,
## #   steals_home <dbl>, steals_away <dbl>, blocks_home <dbl>, blocks_away <dbl>,
## #   turnovers_home <dbl>, turnovers_away <dbl>, points_home <dbl>,
## #   points_away <dbl>, fast_break_points_home <dbl>,
## #   fast_break_points_away <dbl>, points_in_paint_home <dbl>,
## #   points_in_paint_away <dbl>, personal_fouls_home <dbl>,
## #   personal_fouls_away <dbl>, technical_fouls_home <dbl>,
## #   technical_fouls_away <dbl>, flagrant_fouls_home <dbl>,
## #   flagrant_fouls_away <dbl>
```

Adding new columns, if the home points are greater than away points then the winning team will be Home team else away team.

```
nba.data <- nba.data %>%
  mutate(nba.data, H_or_A_win = ifelse(home_points > away_points, 'H', 'A'), H_or_A_halftime = ifelse(h
nba.data
```

```
## # A tibble: 1,230 x 51
##           id date       home_team home_points away_team away_points
##        <dbl> <date>     <chr>           <dbl> <chr>           <dbl>
##  1 400827888 2015-10-27 ATL                94 DET               106
##  2 400827889 2015-10-27 CHI                97 CLE                95
##  3 400827890 2015-10-27 GS                111 NO                 95
##  4 400827891 2015-10-28 ORL                87 WSH                88
##  5 400827892 2015-10-28 BOS               112 PHI                95
##  6 400827893 2015-10-28 BKN               100 CHI               115
##  7 400827894 2015-10-28 DET                92 UTAH               87
##  8 400827895 2015-10-28 MIA               104 CHA                94
##  9 400827896 2015-10-28 TOR               106 IND                99
## 10 400827897 2015-10-28 HOU                85 DEN               105
## # ... with 1,220 more rows, and 45 more variables: home_half_time_score <chr>,
## #   away_half_time_score <chr>, fg_made_attempted_home <chr>,
## #   fg_made_attempted_away <chr>, field_goal_%_home <dbl>,
## #   field_goal_%_away <dbl>, 3pt_made_attempted_home <chr>,
## #   3pt_made_attempted_away <chr>, three_point_%_home <dbl>,
```

```
## #   three_point_%_away <dbl>, ft_made_attempted_home <chr>,
## #   ft_made_attempted_away <chr>, free_throw_%_home <dbl>,
## #   free_throw_%_away <dbl>, total_rebounds_home <dbl>,
## #   total_rebounds_away <dbl>, offensive_rebounds_home <dbl>,
## #   offensive_rebounds_away <dbl>, defensive_rebounds_home <dbl>,
## #   defensive_rebounds_away <dbl>, team_rebounds_home <dbl>,
## #   team_rebounds_away <dbl>, assists_home <dbl>, assists_away <dbl>,
## #   steals_home <dbl>, steals_away <dbl>, blocks_home <dbl>, blocks_away <dbl>,
## #   turnovers_home <dbl>, turnovers_away <dbl>, points_home <dbl>,
## #   points_away <dbl>, fast_break_points_home <dbl>,
## #   fast_break_points_away <dbl>, points_in_paint_home <dbl>,
## #   points_in_paint_away <dbl>, personal_fouls_home <dbl>,
## #   personal_fouls_away <dbl>, technical_fouls_home <dbl>,
## #   technical_fouls_away <dbl>, flagrant_fouls_home <dbl>,
## #   flagrant_fouls_away <dbl>, H_or_A_win <chr>, H_or_A_halftime <chr>,
## #   winning_team <chr>
```

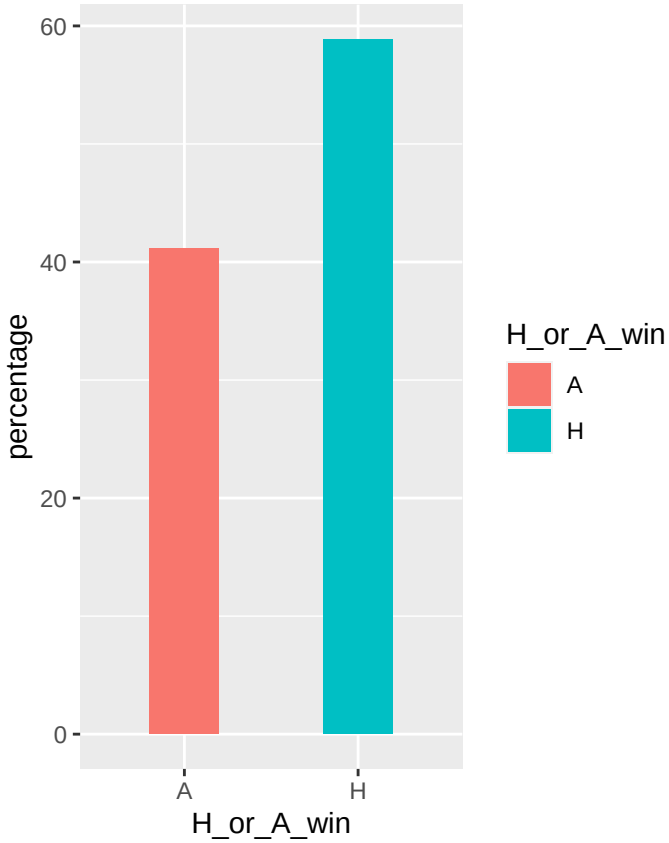
Cleaning the Dataset, eleminating missing values, errors.

```
nba.data.clean <- nba.data %>%
  select(id,date, home_team, home_points, away_team, away_points, winning_team ,H_or_A_win, home_half_t
nba.data.clean
```

```
## # A tibble: 1,230 x 13
##           id date       home_team home_points away_team away_points winning_team
##        <dbl> <date>     <chr>           <dbl> <chr>           <dbl> <chr>
##  1 400827888 2015-10-27 ATL                94 DET               106 DET
##  2 400827889 2015-10-27 CHI                97 CLE                95 CHI
##  3 400827890 2015-10-27 GS                111 NO                 95 GS
##  4 400827891 2015-10-28 ORL                87 WSH                88 WSH
##  5 400827892 2015-10-28 BOS               112 PHI                95 BOS
##  6 400827893 2015-10-28 BKN               100 CHI               115 CHI
##  7 400827894 2015-10-28 DET                92 UTAH               87 DET
##  8 400827895 2015-10-28 MIA               104 CHA                94 MIA
##  9 400827896 2015-10-28 TOR               106 IND                99 TOR
## 10 400827897 2015-10-28 HOU                85 DEN               105 DEN
## # ... with 1,220 more rows, and 6 more variables: H_or_A_win <chr>,
## #   home_half_time_score <chr>, away_half_time_score <chr>,
## #   H_or_A_halftime <chr>, three_point_%_home <dbl>, three_point_%_away <dbl>
```

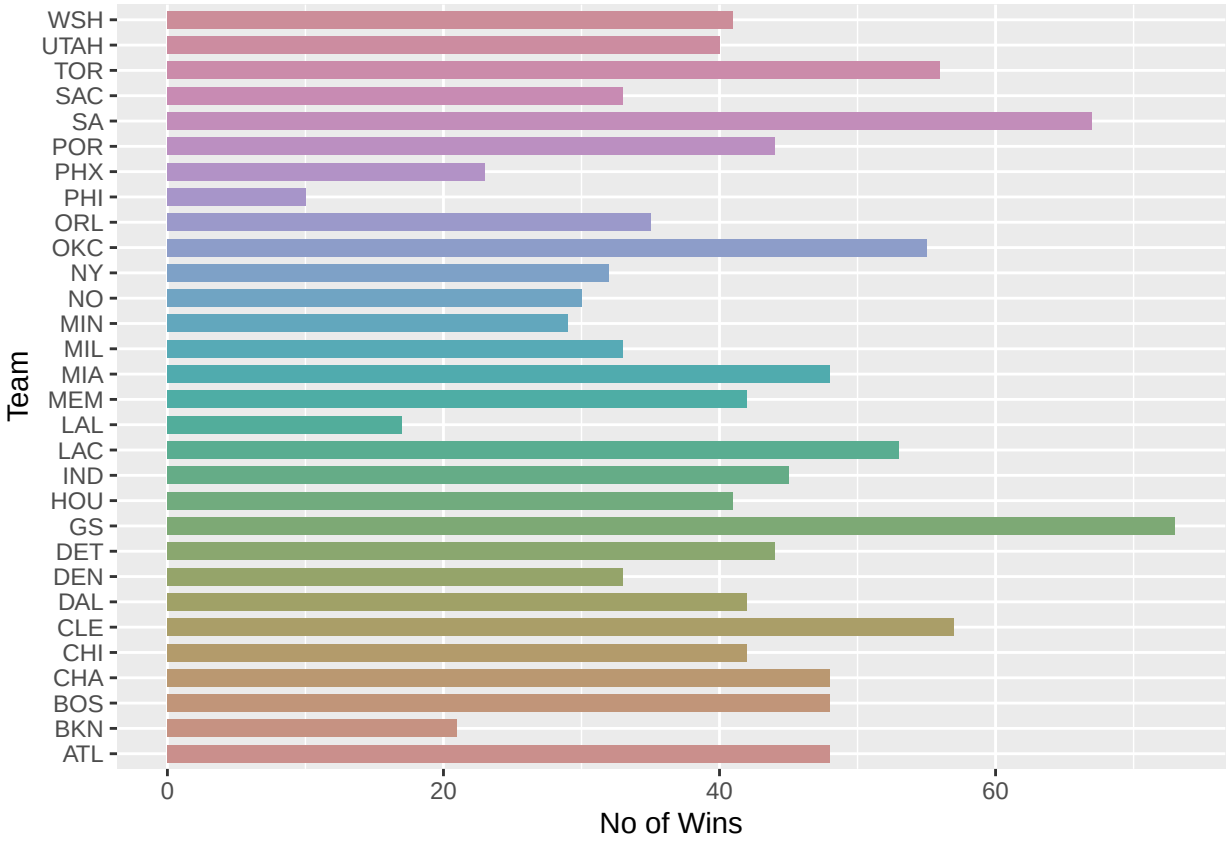
The Bar Chart represents the percentage of home team and away team winning.

```
counttable <- dplyr::count(nba.data.clean, H_or_A_win)
counttable <- counttable %>%
  mutate(percentage = n/sum(n)*100) %>%
  ggplot(aes(x = H_or_A_win, y = percentage, fill=H_or_A_win)) + geom_bar(stat="identity", width = 0.4)
      theme(aspect.ratio = 2/1)
counttable
```



The Graph gives an overview of all Teams and there number of wins.

```
barplot_winning_team <-
  ggplot(nba.data.clean, aes(x = winning_team, fill = winning_team)) + geom_bar(width = 0.7) + coord_fli
  scale_fill_hue(c = 40) +
  theme(legend.position="none") + labs(y = 'No of Wins', x= 'Team')
barplot_winning_team
```



Half time analysis

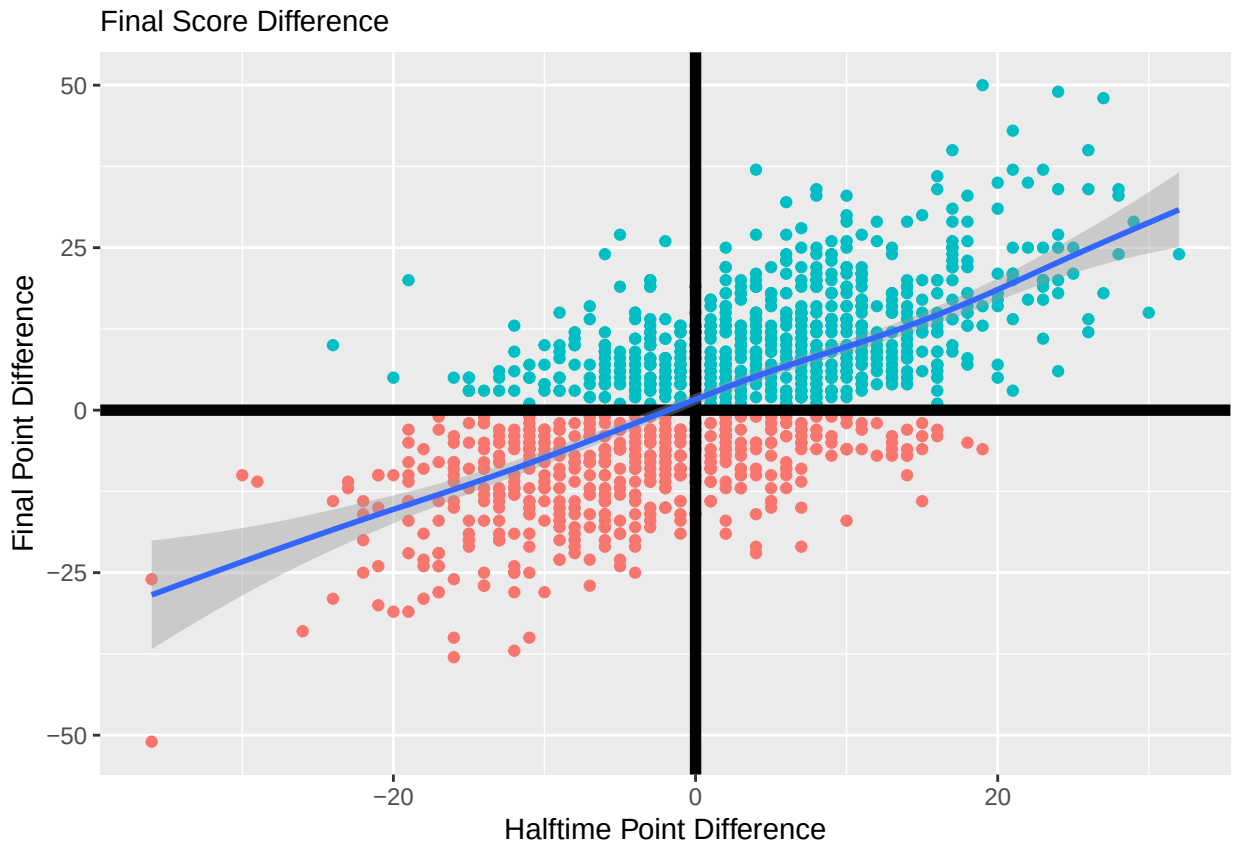
```
df = as_tibble(nba.data)
halftime = df %>%
  separate(fg_made_attempted_home, into = c("fg_made_home", "fg_attemps_home")) %>%
  separate(fg_made_attempted_away, into = c("fg_made_away", "fg_attemps_away")) %>%
  separate(`3pt_made_attempted_home`, into = c("3pt_made_home", "3pt_attemps_home")) %>%
  separate(`3pt_made_attempted_away`, into = c("3pt_made_away", "3pt_attemps_away")) %>%
  separate(ft_made_attempted_home, into = c("ft_made_home", "ft_attemps_home")) %>%
  separate(ft_made_attempted_away, into = c("ft_made_away", "ft_attemps_away"))
```

```
halftime2 = halftime %>%
  mutate_if(is.character, as.integer) %>%
  mutate(point_difference = home_points - away_points) %>%
  mutate(final_score_home = home_points - away_points) %>%
  mutate(halftime_difference_home = home_half_time_score - away_half_time_score)
```

If the team is winning in the first half then the percentage of that team wins the game increses.

```
ggplot(halftime2, aes( x = halftime_difference_home, y = final_score_home)) +
  geom_point(aes(color = final_score_home > 0), show.legend = FALSE) + labs(x = "Halftime Point Differe
                        subtitle = "Final Score Difference") + geom_hline(yintercept=0, color = "Black",
```

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```



Creating confusion Matrix, prediction for home and away team is obtained. From this results home team playing a Home game has more advantage and the count we received was 545.

```
halftime_lead <- factor(nba.data.clean$H_or_A_halftime)
fulltime_win <- factor(nba.data.clean$H_or_A_win)

#Creating confusion matrix
cm <- confusionMatrix(data=fulltime_win, reference = halftime_lead)

#Display results
cm
```

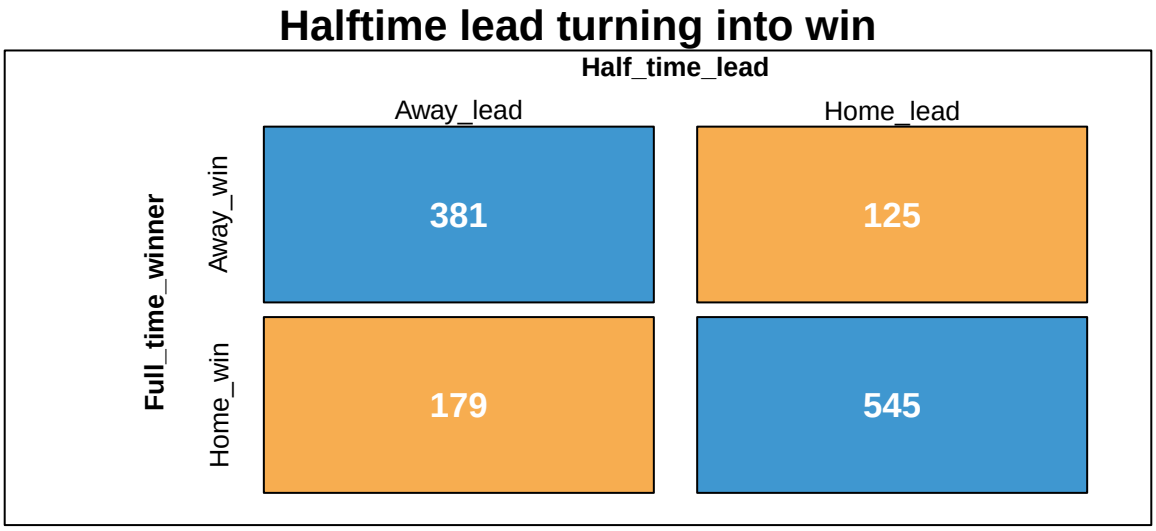
```
## Confusion Matrix and Statistics
```

```
##
##           Reference
## Prediction   A   H
##          A 381 125
##          H 179 545
##
##                Accuracy : 0.7528
##                  95% CI : (0.7277, 0.7767)
##     No Information Rate : 0.5447
##     P-Value [Acc > NIR] : < 2.2e-16
##
##                   Kappa : 0.4977
##
##  Mcnemar's Test P-Value : 0.002368
##
##             Sensitivity : 0.6804
##             Specificity : 0.8134
##          Pos Pred Value : 0.7530
##          Neg Pred Value : 0.7528
##              Prevalence : 0.4553
##          Detection Rate : 0.3098
##    Detection Prevalence : 0.4114
##       Balanced Accuracy : 0.7469
##
##        'Positive' Class : A
##
```

```r
draw_confusion_matrix <- function(cm) {
  layout(matrix(c(1,1,2)))
  par(mar=c(2,2,2,2))
  plot(c(100, 345), c(300, 450), type = "n", xlab="", ylab="", xaxt='n', yaxt='n')
  title('Halftime lead turning into win', cex.main=2)
  # create the matrix
  rect(150, 430, 240, 370, col='#3F97D0')
  text(195, 435, 'Away_lead', cex=1.2)
  rect(250, 430, 340, 370, col='#F7AD50')
  text(295, 435, 'Home_lead', cex=1.2)
  text(125, 370, 'Full_time_winner', cex=1.3, srt=90, font=2)
  text(245, 450, 'Half_time_lead', cex=1.3, font=2)
  rect(150, 305, 240, 365, col='#F7AD50')
  rect(250, 305, 340, 365, col='#3F97D0')
  text(140, 400, 'Away_win', cex=1.2, srt=90)
  text(140, 335, 'Home_win', cex=1.2, srt=90)
  #add in the cm results
  res <- as.numeric(cm$table)
  text(195, 400, res[1], cex=1.6, font=2, col='white')
  text(195, 335, res[2], cex=1.6, font=2, col='white')
  text(295, 400, res[3], cex=1.6, font=2, col='white')
  text(295, 335, res[4], cex=1.6, font=2, col='white')
}
```

The above confusion matrix function was taken from stackoverflow. url - https://stackoverflow.com/questions/23891140/r-how-to-visualize-confusion-matrix-using-the-caret-package

```
# cm <- confusionMatrix(reference = nba.data.clean$fulltime_win, data =  nba.data.clean$halftime_lead)
draw_confusion_matrix(cm)
```



Rebound analysis

We created a new column which is the difference between the total rebounds by home team and total rebounds by away team. We also analysed the point difference by getting difference from home points and away points.

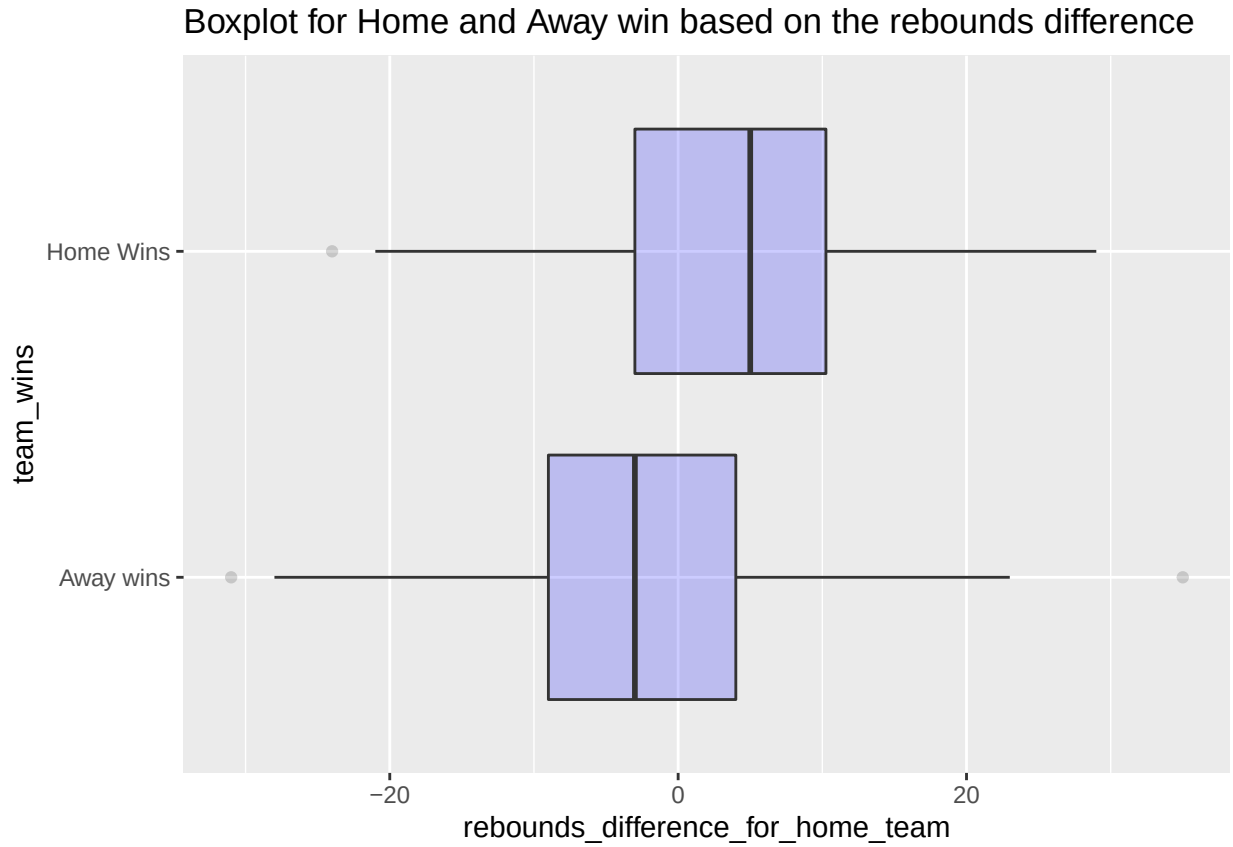
```
halftime2 = halftime %>%
  mutate_if(is.character, as.integer)
halftime2<-mutate(halftime2,rebounds_difference_for_home_team=total_rebounds_home-total_rebounds_away)
halftime2<-mutate(halftime2, points_difference=home_points-away_points)
halftime2
```

```
## # A tibble: 1,230 x 59
##           id date       home_team home_points away_team away_points
##        <dbl> <date>         <int>       <dbl>     <int>       <dbl>
##  1 400827888 2015-10-27        NA          94        NA         106
##  2 400827889 2015-10-27        NA          97        NA          95
##  3 400827890 2015-10-27        NA         111        NA          95
```

```
##  4 400827891 2015-10-28        NA          87        NA          88
##  5 400827892 2015-10-28        NA         112        NA          95
##  6 400827893 2015-10-28        NA         100        NA         115
##  7 400827894 2015-10-28        NA          92        NA          87
##  8 400827895 2015-10-28        NA         104        NA          94
##  9 400827896 2015-10-28        NA         106        NA          99
## 10 400827897 2015-10-28        NA          85        NA         105
## # ... with 1,220 more rows, and 53 more variables: home_half_time_score <int>,
## #   away_half_time_score <int>, fg_made_home <int>, fg_attemps_home <int>,
## #   fg_made_away <int>, fg_attemps_away <int>, field_goal_%_home <dbl>,
## #   field_goal_%_away <dbl>, 3pt_made_home <int>, 3pt_attemps_home <int>,
## #   3pt_made_away <int>, 3pt_attemps_away <int>, three_point_%_home <dbl>,
## #   three_point_%_away <dbl>, ft_made_home <int>, ft_attemps_home <int>,
## #   ft_made_away <int>, ft_attemps_away <int>, free_throw_%_home <dbl>,
## #   free_throw_%_away <dbl>, total_rebounds_home <dbl>,
## #   total_rebounds_away <dbl>, offensive_rebounds_home <dbl>,
## #   offensive_rebounds_away <dbl>, defensive_rebounds_home <dbl>,
## #   defensive_rebounds_away <dbl>, team_rebounds_home <dbl>,
## #   team_rebounds_away <dbl>, assists_home <dbl>, assists_away <dbl>,
## #   steals_home <dbl>, steals_away <dbl>, blocks_home <dbl>, blocks_away <dbl>,
## #   turnovers_home <dbl>, turnovers_away <dbl>, points_home <dbl>,
## #   points_away <dbl>, fast_break_points_home <dbl>,
## #   fast_break_points_away <dbl>, points_in_paint_home <dbl>,
## #   points_in_paint_away <dbl>, personal_fouls_home <dbl>,
## #   personal_fouls_away <dbl>, technical_fouls_home <dbl>,
## #   technical_fouls_away <dbl>, flagrant_fouls_home <dbl>,
## #   flagrant_fouls_away <dbl>, H_or_A_win <int>, H_or_A_halftime <int>,
## #   winning_team <int>, rebounds_difference_for_home_team <dbl>,
## #   points_difference <dbl>
```

If the point difference is greater than 0 then the Home team wins. The median of the Boxplot when its towards the positive side of the graph then the chances of winning the game are high.

```
halftime2<-halftime2 %>%
  group_by(points_difference,rebounds_difference_for_home_team) %>%
  mutate(team_wins=ifelse(points_difference>0,'Home Wins','Away wins'))
ggplot(data=halftime2,aes(x=team_wins,y=rebounds_difference_for_home_team))+geom_boxplot(fill='blue',al
labs(title = 'Boxplot for Home and Away win based on the rebounds difference')+coord_flip()
```



##Three pointer

```
three_pt <- lm((`three_point_%_home`) ~ (H_or_A_win), data = nba.data.clean)
summary(three_pt)$coef
```

```
##              Estimate Std. Error  t value     Pr(>|t|)
## (Intercept) 31.629249  0.4218076 74.98502 0.000000e+00
## H_or_A_winH  6.901138  0.5497911 12.55229 4.329793e-34
```

Feature Analysis

Cleaning Data

```
df <- df %>%
  separate(`3pt_made_attempted_home`, into = c("3pt_attemps_home", "3pt_made_home")) %>%
  separate(`3pt_made_attempted_away`, into = c("3pt_attemps_away", "3pt_made_away"))
df$`3pt_made_home` <- as.numeric(df$`3pt_made_home`)
df$`3pt_made_away` <- as.numeric(df$`3pt_made_away`)
df = df %>%
  separate(ft_made_attempted_home, into = c("ft_attemps_home", "ft_made_home")) %>%
  separate(ft_made_attempted_away, into = c("ft_attemps_away", "ft_made_away"))
df <- df %>%
  mutate(Winning_freethrow_attempts = ifelse(ft_attemps_home > ft_attemps_away, ft_attemps_home, ft_att
df <- df %>%
  mutate(Winning_Team = ifelse(home_points > away_points, home_team, away_team))
```

```
df <- df %>%
  mutate(Won = ifelse(home_points > away_points, 1, 0))
df <- df %>%
  mutate(Winning_points = ifelse(home_points > away_points, home_points, away_points))
ft_attemps_home <- as.double(df$ft_attemps_home)
ft_attemps_away <- as.double(df$ft_attemps_away)
#2
df <- df %>%
  mutate( Losing_freethrow_attempts= ifelse(ft_attemps_home <ft_attemps_away, ft_attemps_home, ft_attemp
df <- df %>%
  mutate(Winning_points = ifelse(home_points > away_points, home_points, away_points))
df <- df %>%
  mutate(Losing_points = ifelse(home_points < away_points, home_points, away_points))
df <- df %>%
  mutate(Losing_Team = ifelse(home_points < away_points, home_team, away_team))
df <- df %>%
  mutate(Lost = ifelse(home_points < away_points, 0, 1))
df$Winning_freethrow_attempts <- as.double(df$Winning_freethrow_attempts)
df$Losing_freethrow_attempts <- as.double(df$Losing_freethrow_attempts)
```

Free Throw Attempts By Team

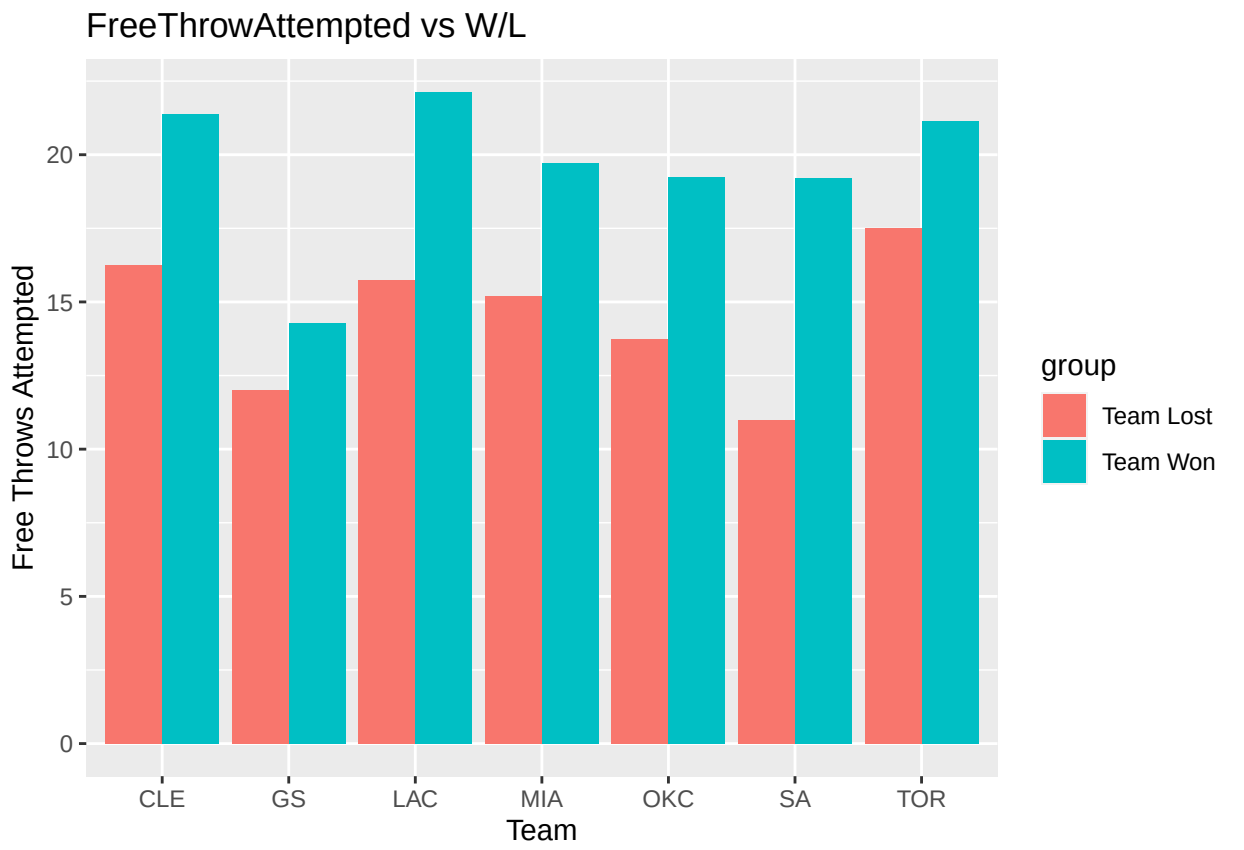
```
df[c('Winning_Team', 'Winning_freethrow_attempts', 'Losing_Team', 'Losing_freethrow_attempts')]
```

```
## # A tibble: 1,230 x 4
##    Winning_Team Winning_freethrow_attempts Losing_Team Losing_freethrow_attempts
##    <chr>                             <dbl> <chr>                            <dbl>
##  1 DET                                  20 ATL                                 12
##  2 CHI                                  16 CLE                                 10
##  3 GS                                   20 NO                                  19
##  4 WSH                                   8 ORL                                 15
##  5 BOS                                  26 PHI                                 20
##  6 CHI                                  22 BKN                                 17
##  7 DET                                  25 UTAH                                15
##  8 MIA                                  22 CHA                                 20
##  9 TOR                                  27 IND                                 26
## 10 DEN                                  17 HOU                                 12
## # ... with 1,220 more rows
```

Visualization for free throws attempted ## The Graph represents win or loss by taking the mean of winning free throw attempts and losing freee throw attempts.

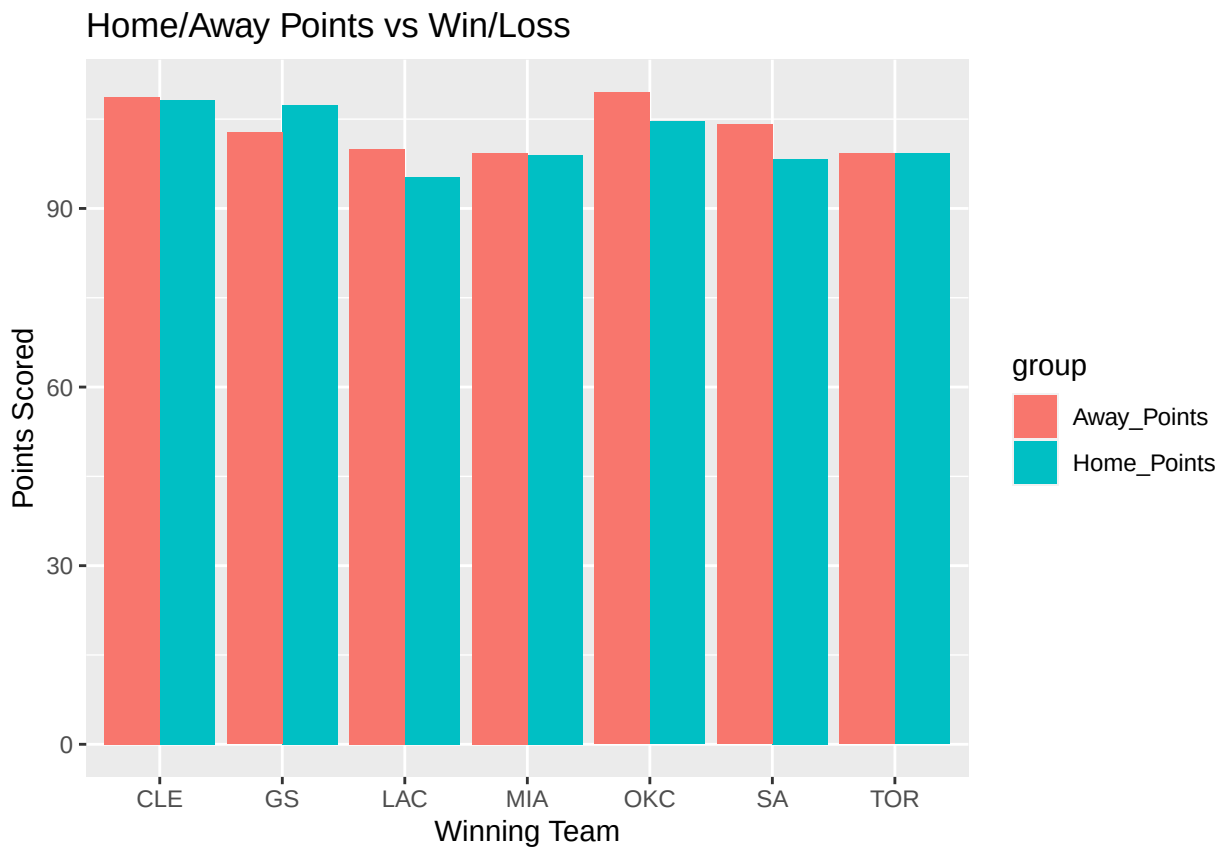
```
df1 <- df %>%
  group_by(Winning_Team) %>%
  filter(Winning_Team == c('GS', 'SA', 'CLE', 'TOR', 'OKC', 'MIA', 'LAC')) %>%
  summarise(Win_Free = mean(Winning_freethrow_attempts))
df2 <- df %>%
  group_by(Losing_Team) %>%
  filter(Losing_Team == c('GS', 'SA', 'CLE', 'TOR', 'OKC', 'MIA', 'LAC')) %>%
  summarise(Losing_Free = mean(Losing_freethrow_attempts)) %>%
  as.data.frame()
colnames(df2) = c('Winning_Team', 'Win_Free')
```

```
v3 <- rbind(df1, df2)
v3$group <- c(rep("Team Won", nrow(df1)), rep("Team Lost", nrow(df2)))
v3 %>%
  ggplot(aes(x=Winning_Team, y=Win_Free, fill = group)) +
  geom_bar(stat="identity", position = 'dodge') + labs(x = 'Team', y = 'Free Throws Attempted', title =
```



Visualization for home vs away points scored # The Graph Represents Win or Loss from the Home points and away points.

```
dp1 <- df %>%
  group_by(Winning_Team) %>%
  filter(Winning_Team == c('GS', 'SA', 'CLE', 'TOR', 'OKC', 'MIA', 'LAC')) %>%
  summarise(Home_Points = mean(home_points)) %>%
  as.data.frame()
dp2 <- df %>%
  group_by(Winning_Team) %>%
  filter(Winning_Team == c('GS', 'SA', 'CLE', 'TOR', 'OKC', 'MIA', 'LAC')) %>%
  summarise(away_points = mean(away_points)) %>%
  as.data.frame()
colnames(dp2) = c('Winning_Team', 'Home_Points')
v3 <- rbind(dp1, dp2)
v3$group <- c(rep("Home_Points", nrow(dp1)), rep("Away_Points", nrow(dp2)))
v3 %>%
  ggplot(aes(x=Winning_Team, y=Home_Points, fill = group)) +
  geom_bar(stat="identity", position = 'dodge') + labs(x = 'Winning Team', y = 'Points Scored', title =
```



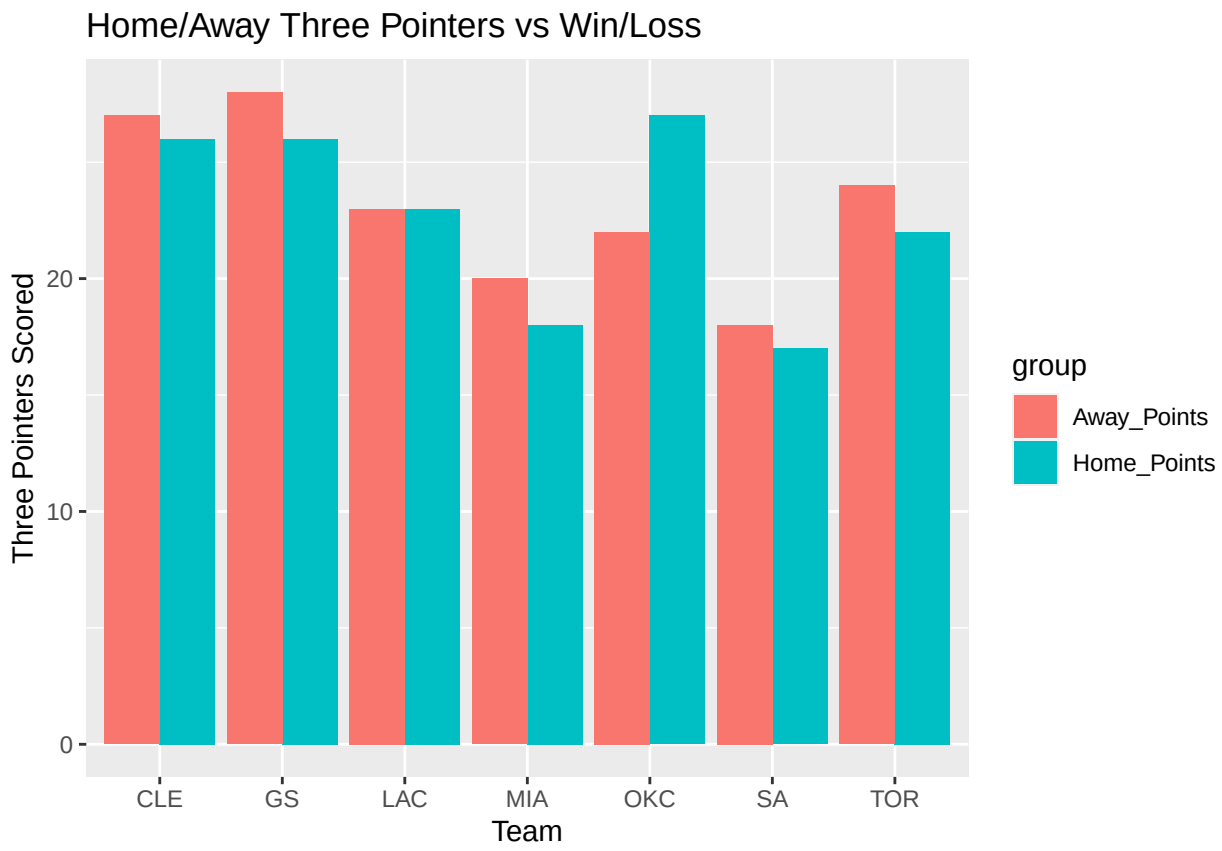
Visualization for 3 pointers scored in home vs away

```
df <- df %>%
  mutate(Won = ifelse(home_points > away_points, 1, 0))

de1 <- df %>%
  group_by(Winning_Team) %>%
  filter(Winning_Team == c('GS', 'SA', 'CLE', 'TOR', 'OKC', 'MIA', 'LAC')) %>%
  summarise(ThreeP_Home = mean(`3pt_made_home`))

de2 <- df %>%
  group_by(Winning_Team) %>%
  filter(Winning_Team == c('GS', 'SA', 'CLE', 'TOR', 'OKC', 'MIA', 'LAC')) %>%
  summarise(ThreeP_Away = mean(`3pt_made_away`))

colnames(de2) = c('Winning_Team', 'ThreeP_Home')
v3 <- rbind(de1, de2)
v3$ThreeP_Home <- as.integer(v3$ThreeP_Home)
v3$group <- c(rep("Home_Points", nrow(dp1)), rep("Away_Points", nrow(dp2)))
v3 %>%
  ggplot(aes(x=Winning_Team, y=ThreeP_Home, fill = group)) +
  geom_bar(stat="identity", position = 'dodge') + labs(x = 'Team', y = 'Three Pointers Scored', title =
```



Logistic Regression Model

Using Logistic Regression Model we received an Accuracy 0f 86% for the Home Team winning.

```
smp_size <- floor(0.75 * nrow(df))
set.seed(123)
train_ind <- sample(seq_len(nrow(df)), size = smp_size)
train <- df[train_ind, ]
test <- df[-train_ind, ]
#train$fast_break_points_home
#test$points_in_paint_home
train$Won <- factor(train$Won)
model <- glm(Won ~ home_points +`3pt_made_home`    + fast_break_points_home +offensive_rebounds_home  + V
predictions<-model %>% predict(test)
predicted.classes <- ifelse(predictions > 0.5, 1, 0)

test$Predicted_Win_Loss <- predicted.classes
mean(test$Predicted_Win_Loss == test$Won) * 100
```

```
## [1] 84.09091
```

Conclusion:-

The important parameters we considered for the Analysis are :- In Home Game, Home team has higher chances of winning the game. In Half time Analysis the wining team in high time has more percentage of winning the game. In rebound If the boxplot has median towards the positive side the winning chances are more for the team. The Accuracy of Logistic Regression of Home Team winning is 84%.

Bias:-

We have done our analysis for only 2015-16 season. For a good analysis, we should consider the trend of these variables and also for the latest seasons to predict more accurately.

Also we have considered three point percentage made by the home team and predicted that if they convert 28% of their 3 pointers, they might win the game. It also depends on how many three pointer attempts were made by the team. If the team attempts only 3 three pointers and convert one of them, would this lead to a win? These questions can be answered through further analysis.