mlb

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Read in necessary libraries:

```
library(xml2)
library(rvest)
library(ggplot2)
library(plotly)
library(dplyr)
library(tidyverse)
```

The first data will be pulled from a website called Fangraphs. FanGraphs.com is a website run by Fangraphs Inc., located in Arlington, Virginia, and created and owned by David Appelman that provides statistics for every player in Major League Baseball history. This specific link below will take you to a leaderboard of every team and their list of stats from 2000-2021.

```
url <- "https://www.fangraphs.com/leaders.aspx?pos=all&stats=bat&lg=all&qual=0&type=8&season=2021&month=

url_page <- read_html(url)   #Read in the content from a .html file.
                             #This is generalized, reading in all body text.

url_table <- url_page %>% html_nodes("table")  %>% .[17]  %>%#Take the exact
  html_table() %>% .[[1]]                                   #table we need
```

The data has been pulled into RStudio using textreadr (a small collection of convenience tools for reading text documents into R.)

Now let's take the pulled data, clean it up, and put it into a dataframe.

```
df <- as.data.frame(url_table)        #turn data into a dataframe
df <- df[-c(1,3),]                   #remove unnecessary rows
names(df) <- df[1,]                 #make the first row the name of the columns
df <-df[-1,]                       #remove now redundant line
head(df)                          #look at a small part of the top of the data
```

```
##   # Season Team    G   PA  HR   R RBI  SB   BB%    K%  ISO BABIP  AVG  OBP  SLG
## 4 1   2001  SEA 2043 6474 169 927 881 174  9.5% 15.3% .157  .320 .288 .360 .445
## 5 2   2019  HOU 2309 6394 288 920 891  67 10.1% 18.2% .221  .296 .274 .352 .495
## 6 3   2017  HOU 2313 6271 238 896 854  98  8.1% 17.3% .196  .309 .282 .346 .478
## 7 4   2011  NYY 2301 6306 222 867 836 147  9.9% 18.0% .181  .292 .263 .343 .444
## 8 5   2015  TOR 2337 6231 232 891 852  88  9.1% 18.5% .188  .298 .269 .340 .457
## 9 6   2011  BOS 2269 6414 203 875 842 102  9.0% 17.3% .181  .314 .280 .349 .461
##   wOBA xwOBA wRC+   BsR   Off  Def  WAR
```

```
## 4 .347        116  16.2 143.0 84.6 44.4
## 5 .355        124  -9.5 187.8 13.9 42.0
## 6 .349        121  -0.4 162.6  1.5 37.2
## 7 .345        113   6.6 101.6 39.7 37.0
## 8 .344        117  11.0 135.9  6.6 36.7
## 9 .352        117 -12.2 114.3 16.2 36.3
```

For a little extra data to look at I wanted to use the Lahman Database.This database contains pitching, hitting, and fielding statistics for Major League Baseball from 1871 through 2021. It is an incredible resource (https://www.seanlahman.com/baseball-archive/statistics/)

```
df2 <- read.csv("/Users/mathew.katz/Desktop/SPS Python/baseballdatabank-2022.2/core/Teams.csv")
#read in csv
```

We only want the years 2000-2021:

```
df2 = df2[df2$yearID >= "2000", ] #only keep data from 2000 and on
head(df2)                         #look at a small part of the top of the data
```

```
##      yearID lgID teamID franchID divID Rank   G Ghome  W  L DivWin WCWin LgWin
## 2326   2000   AL    ANA      ANA     W    3 162    81 82 80      N     N     N
## 2327   2000   NL    ARI      ARI     W    3 162    81 85 77      N     N     N
## 2328   2000   NL    ATL      ATL     E    1 162    81 95 67      Y     N     N
## 2329   2000   AL    BAL      BAL     E    4 162    81 74 88      N     N     N
## 2330   2000   AL    BOS      BOS     E    2 162    81 85 77      N     N     N
## 2331   2000   AL    CHA      CHW     C    1 162    81 95 67      Y     N     N
##      WSWin   R   AB    H X2B X3B  HR  BB   SO  SB CS HBP SF  RA  ER  ERA CG SHO
## 2326     N 864 5628 1574 309  34 236 608 1024  93 52  47 43 869 805 5.00  5   3
## 2327     N 792 5527 1466 282  44 179 535  975  97 44  59 58 754 698 4.35 16   8
## 2328     N 810 5489 1490 274  26 179 595 1010 148 56  59 45 714 648 4.05 13   9
## 2329     N 794 5549 1508 310  22 184 558  900 126 65  49 54 913 855 5.37 14   6
## 2330     N 792 5630 1503 316  32 167 611 1019  43 30  42 48 745 683 4.23  7  12
## 2331     N 978 5646 1615 325  33 216 591  960 119 42  53 61 839 751 4.66  5   7
##      SV IPouts   HA HRA BBA  SOA   E  DP    FP                 name
## 2326 46   4344 1534 228 662  846 134 182 0.978       Anaheim Angels
## 2327 38   4331 1441 190 500 1220 107 138 0.982 Arizona Diamondbacks
## 2328 53   4321 1428 165 484 1093 129 138 0.979       Atlanta Braves
## 2329 33   4300 1547 202 665 1017 116 151 0.981    Baltimore Orioles
## 2330 46   4358 1433 173 498 1121 109 120 0.982       Boston Red Sox
## 2331 43   4351 1509 195 614 1037 133 190 0.978    Chicago White Sox
##                            park attendance BPF PPF teamIDBR teamIDlahman45
## 2326  Edison International Field    2066982 102 103      ANA            ANA
## 2327           Bank One Ballpark    2942251 105 103      ARI            ARI
## 2328                Turner Field    3234304 101  99      ATL            ATL
## 2329 Oriole Park at Camden Yards    3297031  95  96      BAL            BAL
## 2330              Fenway Park II    2585895 104 103      BOS            BOS
## 2331            Comiskey Park II    1947799 102 102      CHW            CHA
##      teamIDretro
## 2326         ANA
## 2327         ARI
## 2328         ATL
## 2329         BAL
## 2330         BOS
## 2331         CHA
```

Clean up lahman data:

```
names(df2)[names(df2) == 'franchID'] <- 'Team'#change name of lahman category
names(df2)[names(df2) == 'yearID'] <- 'Season' #name to match fangraphs
df2[df2 == 'ANA'] <- 'LAA'   #There were a few teams that move locations
df2[df2 == 'MIA'] <- 'FLA'   #/changed names that needed to be edited
df2[df2 == 'MON'] <- 'WSN'
df2[df2 == 'TBD'] <- 'TBR'
df[df == 'ANA'] <- 'LAA'
df[df == 'MIA'] <- 'FLA'
df[df == 'MON'] <- 'WSN'
df[df == 'TBD'] <- 'TBR'
```

Merge the fangraphs and lahman data:

```
data <- merge(df,df2,by=c("Team","Season")) #merge the data
head(data)
```

```
##   Team Season   #  G.x   PA HR.x R.x RBI SB.x   BB%    K%  ISO BABIP  AVG  OBP
## 1  ARI   2000 417 2103 6241  179 792 756   97  8.6% 15.6% .164  .290 .265 .333
## 2  ARI   2001 116 2180 6349  208 818 776   71  9.2% 16.6% .175  .294 .267 .341
## 3  ARI   2002 221 2331 6318  165 819 783   92 10.2% 16.1% .156  .298 .267 .346
## 4  ARI   2003 600 2319 6261  152 717 696   76  8.5% 16.1% .153  .295 .263 .330
## 5  ARI   2004 657 2295 6114  135 615 582   53  7.2% 16.7% .140  .286 .253 .310
## 6  ARI   2005 501 2370 6327  191 696 670   67  9.6% 17.3% .165  .285 .256 .332
##    SLG wOBA xwOBA wRC+   BsR    Off   Def  WAR lgID teamID divID Rank G.y Ghome
## 1 .429 .332         88  -0.1 -102.7  59.2 15.6   NL    ARI     W    3 162    81
## 2 .442 .336         97  -2.6  -31.4  88.6 26.0   NL    ARI     W    1 162    81
## 3 .423 .335         97   1.8  -21.0  36.6 22.1   NL    ARI     W    1 162    81
## 4 .417 .323         86 -10.8 -119.9  -6.9  7.7   NL    ARI     W    3 162    81
## 5 .393 .305         74  -7.7 -212.2   2.3 -0.4   NL    ARI     W    5 162    81
## 6 .421 .328         91   1.3  -71.2 -10.7 12.4   NL    ARI     W    2 162    81
##    W   L DivWin WCWin LgWin WSWin R.y   AB    H X2B X3B HR.y  BB   SO SB.y CS
## 1 85  77      N     N     N     N 792 5527 1466 282  44  179 535  975   97 44
## 2 92  70      Y     N     Y     Y 818 5595 1494 284  35  208 587 1052   71 38
## 3 98  64      Y     N     N     N 819 5508 1471 283  41  165 643 1016   92 46
## 4 84  78      N     N     N     N 717 5570 1467 303  47  152 531 1006   76 38
## 5 51 111      N     N     N     N 615 5544 1401 295  38  135 441 1022   53 32
## 6 77  85      N     N     N     N 696 5550 1419 291  27  191 606 1094   67 26
##   HBP SF  RA  ER  ERA CG SHO SV IPouts   HA HRA BBA  SOA   E  DP    FP
## 1  59 58 754 698 4.35 16   8 38   4331 1441 190 500 1220 107 138 0.982
## 2  57 36 677 627 3.87 12  13 34   4379 1352 195 461 1297  84 148 0.986
## 3  50 53 674 630 3.92 14  10 40   4340 1361 170 421 1303  89 116 0.985
## 4  45 52 685 621 3.84  7  11 42   4365 1379 150 526 1291 107 132 0.983
## 5  35 37 899 794 4.98  5   6 33   4308 1480 197 668 1153 139 144 0.977
## 6  55 45 856 783 4.84  6  10 45   4369 1580 193 537 1038  94 159 0.985
##                   name              park attendance BPF PPF teamIDBR
## 1 Arizona Diamondbacks Bank One Ballpark    2942251 105 103      ARI
## 2 Arizona Diamondbacks Bank One Ballpark    2736451 108 107      ARI
## 3 Arizona Diamondbacks Bank One Ballpark    3198977 111 111      ARI
## 4 Arizona Diamondbacks Bank One Ballpark    2805542 108 109      ARI
## 5 Arizona Diamondbacks Bank One Ballpark    2519560 105 107      ARI
## 6 Arizona Diamondbacks Bank One Ballpark    2059424 103 105      ARI
```

```
##   teamIDlahman45 teamIDretro
## 1            ARI         ARI
## 2            ARI         ARI
## 3            ARI         ARI
## 4            ARI         ARI
## 5            ARI         ARI
## 6            ARI         ARI
```

One last dataset pulled from the Sports Reference site to get just pitching data that wasn't available in the lahman database or fangraphs:

```
df3 <- read.csv("/Users/mathew.katz/Desktop/SPS Python/bbref.csv")#read in csv
df3[df3 == 'ANA'] <- 'LAA'
df3[df3 == 'MIA'] <- 'FLA'
df3[df3 == 'MON'] <- 'WSN'
df3[df3 == 'TBD'] <- 'TBR'
df3$OOBP = (df3$H + df3$BB + df3$HBP) / (df3$AB + df3$BB + df3$HBP + df3$SF)
#Create opposing on base percentage category
df3$OSLG = ((df3$X1B) + (df3$X2B*2) + (df3$X3B*3) + (df3$HR*4))/(df3$AB)
#Create opposing slugging percentage category
pitchdf <- df3[, c("Team", "Season", "OOBP", "OSLG")]
#pull specific categories we need
```

Merge the fangraphs lahman data, and baseball reference data:

```
data <- merge(data,pitchdf,by=c("Team","Season"))        #merge the data
```

Create a new category called run differential (Run differential is calculated by subtracting runs allowed from runs scored. Run differential is positive when a team scores more runs than it allows; it is negative when a team allows more runs than it scores.):

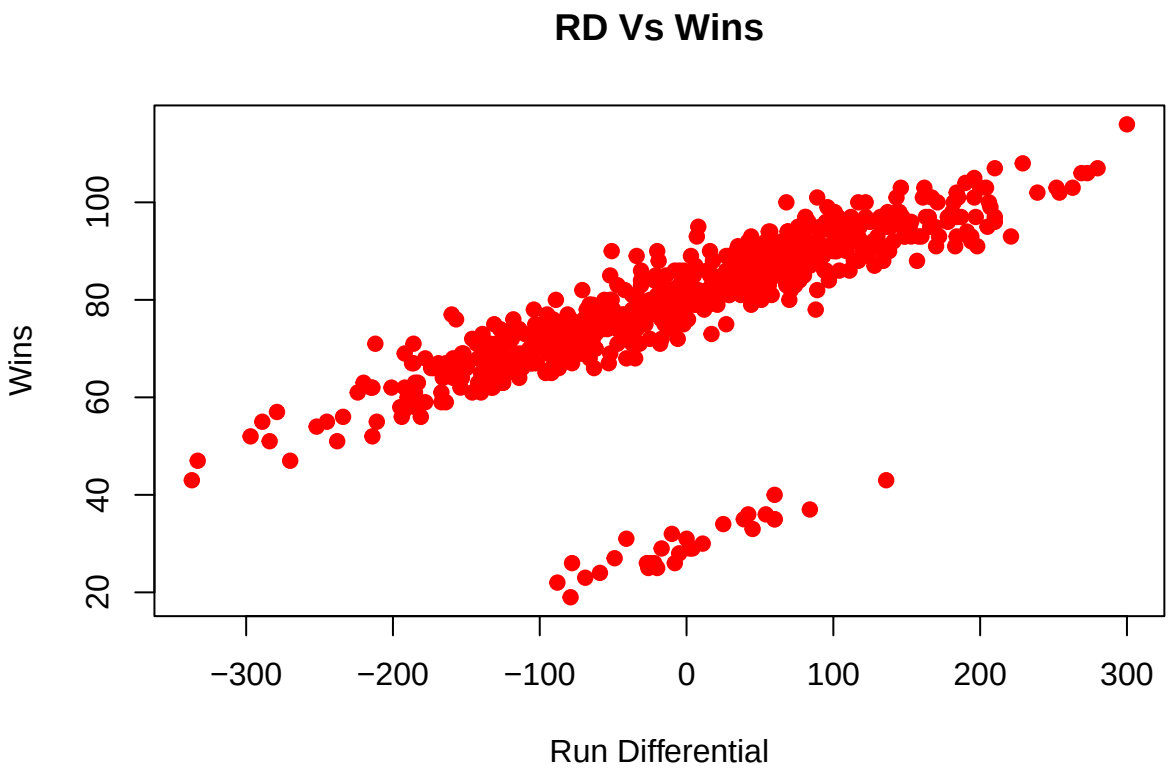
```
data$R.x <- as.integer(data$R.x)  #change data from categorical to numerical
data$RA <- as.integer(data$RA)    #change data from categorical to numerical
data$RunDifferential = data$R.x - data$RA  #change new column
```

Create a new category called Playoffs using an ifelse statement that if the team won the division or if the team won the wildcard, they get a 'Yes,' that they made the playoffs. If the team didn't win the division or if the team didn't win the wildcard, they get a 'No,' that they did NOT make the playoffs:

```
data$Playoffs <- ifelse(data$DivWin == 'Y' | data$WCWin == 'Y', 'Y',
                  ifelse(data$DivWin == 'N' | data$WCWin == 'N', 'N'))
#ifelse statement for if made playoffs
```

I want to look at the correlation between Run Differential and Wins:

```
plot(data$RunDifferential, data$W, xlab="Run Differential", ylab="Wins", pch=19, col="red", main="RD Vs
```

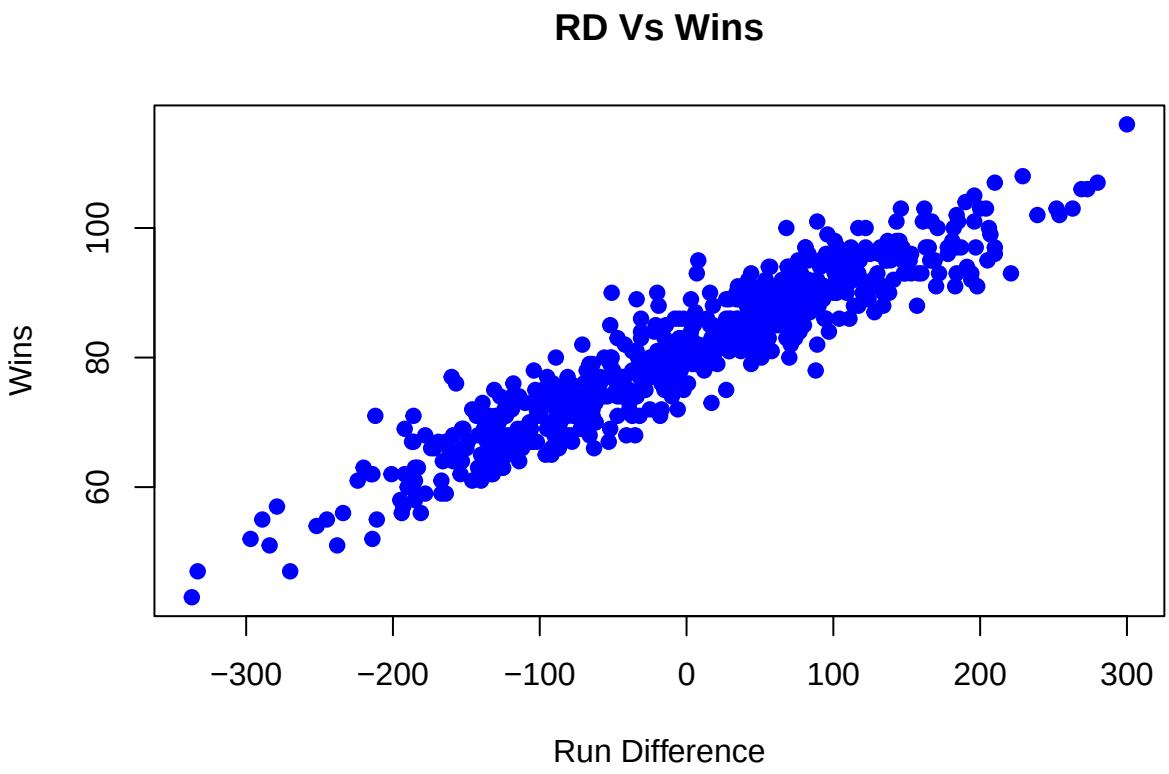



```
#scatterplot
```

It was interesting to see the extreme outliers in that scatterplot. What was that?? The 2020 Major League Baseball season that began on July 23 and ended on September 27 with only 60 games amidst the COVID-19 pandemic. Let's remove 2020 from our data.

```
moneyball <- data[data$Season != 2020, ]  # Remove 2020
```

```
plot(moneyball$RunDifferential, moneyball$W, xlab="Run Difference", ylab="Wins", pch=19, col="blue", ma
```




```
#new scatterplot
```

That's better!

Regression model to predict wins:

```
WinsReg = lm(W ~ RunDifferential, data=moneyball) #regression model
summary(WinsReg)
```

```
##
## Call:
## lm(formula = W ~ RunDifferential, data = moneyball)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11.7089  -2.7634  -0.1221   2.5589  14.0951
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     80.969684   0.162694  497.68   <2e-16 ***
## RunDifferential  0.099310   0.001445   68.75   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.084 on 628 degrees of freedom
```

```
## Multiple R-squared:  0.8827, Adjusted R-squared:  0.8825
## F-statistic:  4726 on 1 and 628 DF,  p-value: < 2.2e-16
```

Regression model to predict runs scored: {RS=OBP$x1$+SLGx2+BA*x3}

```
RunsReg = lm(R.x ~ OBP + SLG + AVG, data=moneyball) #regression model
summary(RunsReg)
```

```
##
## Call:
## lm(formula = R.x ~ OBP + SLG + AVG, data = moneyball)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -68.06 -12.31   0.00  12.35  68.47
##
## Coefficients: (7 not defined because of singularities)
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   568.88      51.99  10.943  < 2e-16 ***
## OBP.293       -55.88      57.54  -0.971 0.332036
## OBP.294       267.27      56.88   4.698 3.66e-06 ***
## OBP.296       340.32      59.37   5.732 2.02e-08 ***
## OBP.297       288.30      60.28   4.783 2.47e-06 ***
## OBP.298       303.76      53.72   5.654 3.07e-08 ***
## OBP.299       314.61      52.43   6.000 4.58e-09 ***
## OBP.300       302.96      50.71   5.975 5.28e-09 ***
## OBP.301       283.78      60.88   4.662 4.34e-06 ***
## OBP.302       314.26      50.76   6.191 1.54e-09 ***
## OBP.303       324.48      51.81   6.263 1.02e-09 ***
## OBP.304       314.91      51.74   6.087 2.80e-09 ***
## OBP.305       332.50      51.66   6.436 3.67e-10 ***
## OBP.306       349.15      51.16   6.824 3.48e-11 ***
## OBP.307       336.50      50.56   6.655 9.86e-11 ***
## OBP.308       334.85      50.56   6.623 1.20e-10 ***
## OBP.309       349.40      49.98   6.991 1.22e-11 ***
## OBP.310       353.61      50.12   7.055 8.18e-12 ***
## OBP.311       348.71      49.59   7.032 9.44e-12 ***
## OBP.312       343.72      49.50   6.943 1.65e-11 ***
## OBP.313       343.22      50.04   6.858 2.82e-11 ***
## OBP.314       348.56      49.35   7.063 7.75e-12 ***
## OBP.315       347.18      49.78   6.974 1.36e-11 ***
## OBP.316       363.96      49.81   7.307 1.61e-12 ***
## OBP.317       368.49      48.45   7.605 2.24e-13 ***
## OBP.318       372.03      49.36   7.536 3.54e-13 ***
## OBP.319       367.49      49.58   7.412 8.10e-13 ***
## OBP.320       378.24      49.41   7.655 1.59e-13 ***
## OBP.321       376.65      49.22   7.652 1.63e-13 ***
## OBP.322       380.53      49.11   7.749 8.46e-14 ***
## OBP.323       390.36      49.31   7.916 2.69e-14 ***
## OBP.324       384.30      49.41   7.778 6.92e-14 ***
## OBP.325       387.58      49.22   7.874 3.59e-14 ***
## OBP.326       375.55      49.57   7.576 2.72e-13 ***
## OBP.327       386.29      49.40   7.820 5.19e-14 ***
```

```
## OBP.328       394.62      49.47   7.978 1.76e-14 ***
## OBP.329       396.77      49.27   8.054 1.03e-14 ***
## OBP.330       397.40      49.42   8.042 1.12e-14 ***
## OBP.331       386.28      49.41   7.818 5.29e-14 ***
## OBP.332       401.68      49.41   8.130 6.05e-15 ***
## OBP.333       403.02      49.39   8.159 4.93e-15 ***
## OBP.334       399.17      49.60   8.048 1.07e-14 ***
## OBP.335       398.37      49.63   8.027 1.25e-14 ***
## OBP.336       413.43      49.62   8.332 1.44e-15 ***
## OBP.337       400.49      49.59   8.075 8.89e-15 ***
## OBP.338       415.14      49.13   8.449 6.23e-16 ***
## OBP.339       419.21      49.11   8.537 3.30e-16 ***
## OBP.340       437.44      49.47   8.843  < 2e-16 ***
## OBP.341       429.17      49.76   8.625  < 2e-16 ***
## OBP.342       419.05      50.19   8.350 1.27e-15 ***
## OBP.343       427.21      49.69   8.597  < 2e-16 ***
## OBP.344       435.35      51.58   8.441 6.61e-16 ***
## OBP.345       449.36      49.94   8.998  < 2e-16 ***
## OBP.346       426.58      49.88   8.552 2.96e-16 ***
## OBP.347       433.31      52.03   8.328 1.48e-15 ***
## OBP.348       448.44      51.55   8.700  < 2e-16 ***
## OBP.349       452.24      50.79   8.905  < 2e-16 ***
## OBP.350       443.47      50.22   8.830  < 2e-16 ***
## OBP.351       436.93      52.97   8.249 2.62e-15 ***
## OBP.352       433.88      44.82   9.680  < 2e-16 ***
## OBP.353       468.36      55.98   8.367 1.13e-15 ***
## OBP.354       476.72      50.94   9.359  < 2e-16 ***
## OBP.355       484.53      64.39   7.525 3.82e-13 ***
## OBP.356       468.43      52.71   8.887  < 2e-16 ***
## OBP.357       484.06      52.70   9.185  < 2e-16 ***
## OBP.358       437.54      57.43   7.619 2.04e-13 ***
## OBP.360       490.38      51.47   9.527  < 2e-16 ***
## OBP.361       519.64      57.13   9.096  < 2e-16 ***
## OBP.362       438.65      52.05   8.428 7.25e-16 ***
## OBP.363       453.00      68.38   6.624 1.19e-10 ***
## OBP.366       563.72      77.78   7.248 2.36e-12 ***
## OBP.367       462.90      77.46   5.976 5.25e-09 ***
## SLG.339      -306.25      49.44  -6.195 1.51e-09 ***
## SLG.342       -33.88      57.54  -0.589 0.556280
## SLG.348           NA         NA      NA       NA
## SLG.349      -236.79      46.10  -5.136 4.47e-07 ***
## SLG.357      -232.78      47.13  -4.939 1.17e-06 ***
## SLG.359      -277.29      42.26  -6.562 1.73e-10 ***
## SLG.360      -262.10      39.25  -6.677 8.60e-11 ***
## SLG.362      -227.77      45.18  -5.041 7.15e-07 ***
## SLG.363      -200.06      44.41  -4.505 8.83e-06 ***
## SLG.364      -243.56      39.79  -6.121 2.31e-09 ***
## SLG.365      -270.08      55.03  -4.908 1.37e-06 ***
## SLG.366      -227.45      44.25  -5.140 4.40e-07 ***
## SLG.367      -270.77      42.04  -6.440 3.59e-10 ***
## SLG.368      -252.65      36.79  -6.867 2.66e-11 ***
## SLG.369      -232.91      35.36  -6.587 1.49e-10 ***
## SLG.371      -224.09      38.83  -5.771 1.63e-08 ***
## SLG.372      -236.76      53.72  -4.407 1.36e-05 ***
```

```
## SLG.373      -241.90      38.51  -6.281 9.15e-10 ***
## SLG.374      -226.78      35.97  -6.304 8.02e-10 ***
## SLG.375      -221.31      35.36  -6.258 1.05e-09 ***
## SLG.376      -190.41      35.65  -5.342 1.58e-07 ***
## SLG.378      -222.50      34.58  -6.434 3.73e-10 ***
## SLG.379      -213.53      36.26  -5.889 8.50e-09 ***
## SLG.380      -212.47      34.20  -6.212 1.37e-09 ***
## SLG.381      -217.95      34.36  -6.343 6.39e-10 ***
## SLG.382      -214.88      36.13  -5.948 6.13e-09 ***
## SLG.383      -218.11      36.89  -5.912 7.51e-09 ***
## SLG.384      -238.93      36.36  -6.571 1.64e-10 ***
## SLG.385      -196.37      39.91  -4.920 1.29e-06 ***
## SLG.386      -229.70      35.33  -6.502 2.48e-10 ***
## SLG.387      -232.17      34.64  -6.702 7.39e-11 ***
## SLG.388      -207.86      34.21  -6.077 2.97e-09 ***
## SLG.389      -187.50      34.34  -5.460 8.58e-08 ***
## SLG.390      -199.28      33.88  -5.883 8.82e-09 ***
## SLG.391      -194.83      33.81  -5.762 1.71e-08 ***
## SLG.392      -200.18      35.93  -5.572 4.77e-08 ***
## SLG.393      -198.58      35.15  -5.650 3.14e-08 ***
## SLG.394      -211.18      34.31  -6.154 1.91e-09 ***
## SLG.395      -173.13      34.38  -5.036 7.34e-07 ***
## SLG.396      -186.49      33.64  -5.544 5.53e-08 ***
## SLG.397      -172.27      34.08  -5.055 6.70e-07 ***
## SLG.398      -183.83      34.32  -5.356 1.47e-07 ***
## SLG.399      -161.01      33.87  -4.753 2.84e-06 ***
## SLG.400      -189.60      33.98  -5.579 4.59e-08 ***
## SLG.401      -177.08      33.41  -5.300 1.97e-07 ***
## SLG.402      -175.02      33.89  -5.165 3.89e-07 ***
## SLG.403      -160.89      33.83  -4.756 2.81e-06 ***
## SLG.404      -175.50      34.77  -5.047 6.96e-07 ***
## SLG.405      -162.22      33.39  -4.858 1.73e-06 ***
## SLG.406      -169.09      33.78  -5.006 8.50e-07 ***
## SLG.407      -152.15      33.44  -4.550 7.22e-06 ***
## SLG.408      -167.77      33.65  -4.986 9.36e-07 ***
## SLG.409      -155.49      33.46  -4.647 4.64e-06 ***
## SLG.410      -154.32      34.46  -4.479 9.93e-06 ***
## SLG.411      -158.60      33.73  -4.702 3.61e-06 ***
## SLG.412      -151.64      33.47  -4.531 7.86e-06 ***
## SLG.413      -146.97      33.51  -4.386 1.50e-05 ***
## SLG.414      -146.93      34.02  -4.318 2.00e-05 ***
## SLG.415      -146.93      33.50  -4.386 1.49e-05 ***
## SLG.416      -157.57      34.10  -4.622 5.22e-06 ***
## SLG.417      -152.52      33.41  -4.565 6.75e-06 ***
## SLG.418      -154.99      34.21  -4.530 7.88e-06 ***
## SLG.419      -135.04      33.78  -3.998 7.66e-05 ***
## SLG.420      -152.78      33.75  -4.526 8.03e-06 ***
## SLG.421      -146.21      34.31  -4.261 2.57e-05 ***
## SLG.422      -149.54      33.25  -4.497 9.15e-06 ***
## SLG.423      -127.40      33.54  -3.799 0.000169 ***
## SLG.424      -124.96      33.55  -3.724 0.000225 ***
## SLG.425      -133.58      33.03  -4.045 6.34e-05 ***
## SLG.426      -127.48      33.85  -3.766 0.000192 ***
## SLG.427      -105.15      34.66  -3.033 0.002583 **
```

```
## SLG.428      -128.01      35.43  -3.613 0.000343 ***
## SLG.429      -106.56      33.42  -3.189 0.001546 **
## SLG.430      -102.33      33.93  -3.015 0.002738 **
## SLG.431      -108.41      33.49  -3.237 0.001314 **
## SLG.432      -117.93      33.67  -3.503 0.000515 ***
## SLG.433      -119.30      33.58  -3.552 0.000430 ***
## SLG.434      -113.32      34.44  -3.291 0.001092 **
## SLG.435      -108.25      33.60  -3.221 0.001386 **
## SLG.436      -111.63      33.80  -3.303 0.001048 **
## SLG.437      -110.65      34.87  -3.173 0.001632 **
## SLG.438      -118.94      34.75  -3.423 0.000688 ***
## SLG.439       -91.49      35.14  -2.603 0.009591 **
## SLG.440      -124.17      36.21  -3.430 0.000670 ***
## SLG.441      -105.92      37.60  -2.817 0.005102 **
## SLG.442      -111.23      35.26  -3.154 0.001737 **
## SLG.443      -120.12      35.21  -3.412 0.000714 ***
## SLG.444       -74.35      33.96  -2.189 0.029207 *
## SLG.445       -92.07      34.65  -2.657 0.008211 **
## SLG.446       -85.92      32.91  -2.611 0.009380 **
## SLG.447       -71.68      34.83  -2.058 0.040285 *
## SLG.448       -83.20      35.90  -2.318 0.020993 *
## SLG.449       -66.25      33.75  -1.963 0.050353 .
## SLG.450       -86.68      44.67  -1.940 0.053055 .
## SLG.451       -81.48      35.44  -2.299 0.022029 *
## SLG.452       -62.50      37.59  -1.663 0.097145 .
## SLG.453       -80.98      35.55  -2.278 0.023275 *
## SLG.454       -68.89      32.60  -2.113 0.035238 *
## SLG.455       -75.05      34.85  -2.154 0.031887 *
## SLG.456       -68.84      37.55  -1.833 0.067516 .
## SLG.457       -46.86      35.18  -1.332 0.183620
## SLG.458       -68.80      34.15  -2.014 0.044681 *
## SLG.460       -97.33      38.26  -2.544 0.011368 *
## SLG.461       -68.44      40.76  -1.679 0.093942 .
## SLG.462       -77.48      48.78  -1.588 0.113044
## SLG.463      -164.61      52.19  -3.154 0.001738 **
## SLG.464       -30.19      49.38  -0.611 0.541305
## SLG.466       -40.25      37.62  -1.070 0.285321
## SLG.468       -29.78      41.85  -0.712 0.477193
## SLG.469       -61.33      43.04  -1.425 0.154943
## SLG.470       -59.32      58.83  -1.008 0.313988
## SLG.471       -38.51      45.06  -0.855 0.393305
## SLG.472       -36.71      33.87  -1.084 0.279117
## SLG.475       -70.41      51.02  -1.380 0.168402
## SLG.477       -94.94      52.20  -1.819 0.069704 .
## SLG.478       -33.03      41.02  -0.805 0.421277
## SLG.483      -122.61      57.22  -2.143 0.032758 *
## SLG.490        25.78      41.50   0.621 0.534811
## SLG.491       -98.26      57.75  -1.702 0.089657 .
## SLG.494        30.89      42.26   0.731 0.465269
## SLG.495           NA         NA      NA       NA
## AVG.231           NA         NA      NA       NA
## AVG.232        10.16      56.36   0.180 0.857041
## AVG.233       -12.88      45.77  -0.282 0.778474
## AVG.234       -57.29      42.36  -1.352 0.177065
```

```
## AVG.235       -27.72      43.23  -0.641 0.521761
## AVG.236       -53.39      42.99  -1.242 0.215003
## AVG.237       -71.59      40.43  -1.771 0.077367 .
## AVG.238       -44.12      38.18  -1.155 0.248634
## AVG.239       -43.52      38.36  -1.135 0.257293
## AVG.240       -46.29      39.61  -1.169 0.243174
## AVG.241       -48.62      41.09  -1.183 0.237447
## AVG.242       -64.09      37.28  -1.719 0.086391 .
## AVG.243       -43.44      36.01  -1.206 0.228407
## AVG.244       -58.21      38.28  -1.521 0.129165
## AVG.245       -64.62      38.14  -1.694 0.091071 .
## AVG.246       -70.95      38.05  -1.865 0.062987 .
## AVG.247       -54.60      38.31  -1.425 0.154904
## AVG.248       -64.78      38.59  -1.679 0.094057 .
## AVG.249       -62.49      37.43  -1.670 0.095808 .
## AVG.250       -76.45      37.84  -2.020 0.044061 *
## AVG.251       -67.15      38.25  -1.756 0.079962 .
## AVG.252       -70.73      38.20  -1.851 0.064875 .
## AVG.253       -82.33      37.98  -2.168 0.030777 *
## AVG.254       -60.55      38.26  -1.583 0.114331
## AVG.255       -61.27      38.37  -1.597 0.111103
## AVG.256       -71.48      37.94  -1.884 0.060327 .
## AVG.257       -78.60      38.01  -2.068 0.039324 *
## AVG.258       -72.74      38.14  -1.907 0.057225 .
## AVG.259       -75.79      37.96  -1.997 0.046566 *
## AVG.260       -71.22      37.83  -1.883 0.060489 .
## AVG.261       -78.42      38.22  -2.052 0.040877 *
## AVG.262       -73.32      38.38  -1.910 0.056828 .
## AVG.263       -79.09      37.92  -2.086 0.037672 *
## AVG.264       -76.25      38.18  -1.997 0.046534 *
## AVG.265       -63.08      38.27  -1.648 0.100139
## AVG.266       -74.81      38.49  -1.944 0.052662 .
## AVG.267       -70.87      38.15  -1.858 0.063966 .
## AVG.268       -71.45      38.21  -1.870 0.062285 .
## AVG.269       -70.29      38.63  -1.820 0.069599 .
## AVG.270       -75.91      38.29  -1.983 0.048108 *
## AVG.271       -78.68      38.82  -2.027 0.043352 *
## AVG.272       -86.14      38.66  -2.228 0.026474 *
## AVG.273       -80.56      39.86  -2.021 0.043964 *
## AVG.274       -82.77      38.44  -2.153 0.031940 *
## AVG.275       -75.72      38.85  -1.949 0.051990 .
## AVG.276       -80.74      40.75  -1.982 0.048248 *
## AVG.277       -87.93      39.31  -2.237 0.025889 *
## AVG.278       -55.58      40.59  -1.369 0.171702
## AVG.279       -48.82      41.10  -1.188 0.235577
## AVG.280       -89.74      42.51  -2.111 0.035424 *
## AVG.281       -82.14      41.99  -1.956 0.051157 .
## AVG.282       -58.83      41.04  -1.433 0.152549
## AVG.283       -67.12      41.45  -1.619 0.106169
## AVG.284       -43.72      46.99  -0.930 0.352755
## AVG.285       -23.44      50.75  -0.462 0.644478
## AVG.286           NA         NA      NA       NA
## AVG.287       -57.28      41.74  -1.372 0.170713
## AVG.288       -22.47      44.97  -0.500 0.617613
```

```
## AVG.289           NA         NA      NA       NA
## AVG.290           NA         NA      NA       NA
## AVG.292           NA         NA      NA       NA
## AVG.294        35.51      52.42   0.677 0.498537
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 24.66 on 382 degrees of freedom
## Multiple R-squared:  0.9459, Adjusted R-squared:  0.9109
## F-statistic: 27.03 on 247 and 382 DF,  p-value: < 2.2e-16
```

Lets try removing BAVG as some analysts say it isn't as important:

```
RunsReg2 = lm(R.x ~ OBP + SLG, data=moneyball) #regression model
summary(RunsReg2)
```

```
##
## Call:
## lm(formula = R.x ~ OBP + SLG, data = moneyball)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -58.42 -13.71   0.00  13.09  78.99
##
## Coefficients: (2 not defined because of singularities)
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   556.00      25.17  22.090  < 2e-16 ***
## OBP.293       -43.00      35.60  -1.208 0.227690
## OBP.294       254.47      44.00   5.784 1.39e-08 ***
## OBP.296       284.91      48.56   5.868 8.72e-09 ***
## OBP.297       263.64      47.86   5.509 6.16e-08 ***
## OBP.298       260.80      43.89   5.942 5.75e-09 ***
## OBP.299       277.35      42.50   6.526 1.87e-10 ***
## OBP.300       253.39      41.08   6.168 1.57e-09 ***
## OBP.301       218.90      50.02   4.376 1.51e-05 ***
## OBP.302       268.64      41.29   6.506 2.10e-10 ***
## OBP.303       280.92      42.00   6.688 6.90e-11 ***
## OBP.304       267.14      42.17   6.335 5.87e-10 ***
## OBP.305       279.98      42.18   6.637 9.45e-11 ***
## OBP.306       285.78      41.49   6.888 1.97e-11 ***
## OBP.307       278.76      40.93   6.811 3.21e-11 ***
## OBP.308       285.65      41.14   6.944 1.38e-11 ***
## OBP.309       288.97      40.55   7.127 4.25e-12 ***
## OBP.310       293.69      40.72   7.213 2.42e-12 ***
## OBP.311       286.39      40.29   7.109 4.77e-12 ***
## OBP.312       284.55      40.06   7.102 4.98e-12 ***
## OBP.313       282.78      40.51   6.981 1.09e-11 ***
## OBP.314       285.93      39.98   7.152 3.60e-12 ***
## OBP.315       289.82      40.34   7.184 2.93e-12 ***
## OBP.316       298.65      40.45   7.384 7.79e-13 ***
## OBP.317       309.25      39.85   7.761 5.99e-14 ***
## OBP.318       311.92      39.97   7.805 4.41e-14 ***
## OBP.319       305.53      39.94   7.649 1.29e-13 ***
```

```
## OBP.320       310.66      39.86   7.795 4.73e-14 ***
## OBP.321       312.33      39.79   7.849 3.24e-14 ***
## OBP.322       314.07      39.69   7.914 2.06e-14 ***
## OBP.323       324.08      39.84   8.134 4.31e-15 ***
## OBP.324       317.67      40.09   7.923 1.92e-14 ***
## OBP.325       318.42      39.84   7.993 1.17e-14 ***
## OBP.326       306.92      40.03   7.668 1.14e-13 ***
## OBP.327       320.23      39.99   8.008 1.06e-14 ***
## OBP.328       326.22      40.21   8.112 5.02e-15 ***
## OBP.329       328.08      39.71   8.263 1.70e-15 ***
## OBP.330       327.61      39.88   8.215 2.39e-15 ***
## OBP.331       316.36      39.81   7.946 1.63e-14 ***
## OBP.332       332.36      39.77   8.357 8.55e-16 ***
## OBP.333       334.56      39.88   8.389 6.78e-16 ***
## OBP.334       327.98      39.97   8.206 2.56e-15 ***
## OBP.335       333.00      40.43   8.237 2.05e-15 ***
## OBP.336       342.79      40.10   8.548  < 2e-16 ***
## OBP.337       326.81      39.99   8.172 3.28e-15 ***
## OBP.338       346.65      39.65   8.744  < 2e-16 ***
## OBP.339       347.25      39.74   8.737  < 2e-16 ***
## OBP.340       371.05      40.25   9.219  < 2e-16 ***
## OBP.341       357.37      40.15   8.900  < 2e-16 ***
## OBP.342       351.36      40.69   8.636  < 2e-16 ***
## OBP.343       353.68      40.24   8.790  < 2e-16 ***
## OBP.344       368.51      41.84   8.808  < 2e-16 ***
## OBP.345       378.03      40.29   9.383  < 2e-16 ***
## OBP.346       360.72      40.88   8.825  < 2e-16 ***
## OBP.347       366.10      42.53   8.609  < 2e-16 ***
## OBP.348       394.87      41.74   9.461  < 2e-16 ***
## OBP.349       374.31      41.58   9.002  < 2e-16 ***
## OBP.350       387.48      40.62   9.538  < 2e-16 ***
## OBP.351       369.18      43.63   8.462 3.96e-16 ***
## OBP.352       364.00      35.60  10.226  < 2e-16 ***
## OBP.353       401.92      48.16   8.345 9.31e-16 ***
## OBP.354       399.20      41.66   9.582  < 2e-16 ***
## OBP.355       414.20      54.80   7.559 2.40e-13 ***
## OBP.356       383.25      44.03   8.705  < 2e-16 ***
## OBP.357       405.14      43.34   9.347  < 2e-16 ***
## OBP.358       351.75      48.61   7.235 2.08e-12 ***
## OBP.360       445.66      41.87  10.644  < 2e-16 ***
## OBP.361       454.66      48.61   9.354  < 2e-16 ***
## OBP.362       413.24      41.39   9.984  < 2e-16 ***
## OBP.363       438.09      50.95   8.598  < 2e-16 ***
## OBP.366       553.87      54.85  10.097  < 2e-16 ***
## OBP.367       355.25      56.62   6.275 8.41e-10 ***
## SLG.339      -303.80      43.89  -6.921 1.59e-11 ***
## SLG.342       -21.00      35.60  -0.590 0.555519
## SLG.348           NA         NA      NA       NA
## SLG.349      -242.98      42.18  -5.760 1.58e-08 ***
## SLG.357      -247.92      42.00  -5.902 7.17e-09 ***
## SLG.359      -268.93      39.98  -6.727 5.43e-11 ***
## SLG.360      -242.88      36.72  -6.615 1.08e-10 ***
## SLG.362      -225.92      42.00  -5.379 1.22e-07 ***
## SLG.363      -205.64      41.29  -4.981 9.13e-07 ***
```

```
## SLG.364      -224.31      36.05  -6.221 1.15e-09 ***
## SLG.365      -245.91      48.56  -5.064 6.04e-07 ***
## SLG.366      -222.78      41.49  -5.369 1.28e-07 ***
## SLG.367      -253.25      39.85  -6.355 5.21e-10 ***
## SLG.368      -242.80      34.12  -7.116 4.55e-12 ***
## SLG.369      -221.91      33.02  -6.720 5.68e-11 ***
## SLG.371      -220.95      35.84  -6.165 1.60e-09 ***
## SLG.372      -193.80      43.89  -4.415 1.27e-05 ***
## SLG.373      -237.61      36.10  -6.582 1.33e-10 ***
## SLG.374      -218.52      33.84  -6.458 2.82e-10 ***
## SLG.375      -210.00      32.64  -6.433 3.27e-10 ***
## SLG.376      -190.18      33.31  -5.709 2.09e-08 ***
## SLG.378      -219.49      32.38  -6.779 3.90e-11 ***
## SLG.379      -211.76      33.98  -6.232 1.08e-09 ***
## SLG.380      -202.64      31.99  -6.335 5.88e-10 ***
## SLG.381      -206.53      32.11  -6.431 3.31e-10 ***
## SLG.382      -209.47      33.36  -6.279 8.20e-10 ***
## SLG.383      -207.62      34.30  -6.054 3.04e-09 ***
## SLG.384      -229.27      34.13  -6.717 5.76e-11 ***
## SLG.385      -164.90      35.14  -4.692 3.62e-06 ***
## SLG.386      -219.32      33.18  -6.609 1.12e-10 ***
## SLG.387      -218.41      32.46  -6.729 5.36e-11 ***
## SLG.388      -203.94      31.93  -6.387 4.32e-10 ***
## SLG.389      -178.50      32.07  -5.566 4.53e-08 ***
## SLG.390      -194.57      31.57  -6.163 1.62e-09 ***
## SLG.391      -186.60      31.53  -5.918 6.59e-09 ***
## SLG.392      -188.95      33.48  -5.643 3.00e-08 ***
## SLG.393      -195.47      32.29  -6.053 3.05e-09 ***
## SLG.394      -203.02      32.04  -6.336 5.84e-10 ***
## SLG.395      -169.69      32.08  -5.290 1.93e-07 ***
## SLG.396      -178.54      31.29  -5.706 2.13e-08 ***
## SLG.397      -159.66      31.66  -5.042 6.74e-07 ***
## SLG.398      -177.73      32.11  -5.536 5.34e-08 ***
## SLG.399      -155.82      31.88  -4.887 1.44e-06 ***
## SLG.400      -182.61      31.82  -5.739 1.78e-08 ***
## SLG.401      -165.81      31.17  -5.319 1.66e-07 ***
## SLG.402      -165.57      31.66  -5.230 2.63e-07 ***
## SLG.403      -149.29      31.62  -4.721 3.17e-06 ***
## SLG.404      -159.16      32.50  -4.897 1.37e-06 ***
## SLG.405      -158.65      31.45  -5.045 6.65e-07 ***
## SLG.406      -157.55      31.47  -5.006 8.05e-07 ***
## SLG.407      -140.64      31.04  -4.531 7.57e-06 ***
## SLG.408      -155.99      31.22  -4.996 8.46e-07 ***
## SLG.409      -148.08      31.13  -4.757 2.67e-06 ***
## SLG.410      -146.38      32.15  -4.553 6.85e-06 ***
## SLG.411      -151.62      31.46  -4.820 1.98e-06 ***
## SLG.412      -142.67      31.21  -4.571 6.31e-06 ***
## SLG.413      -140.58      31.24  -4.500 8.73e-06 ***
## SLG.414      -142.78      31.76  -4.495 8.91e-06 ***
## SLG.415      -139.90      31.24  -4.478 9.61e-06 ***
## SLG.416      -151.22      32.00  -4.726 3.09e-06 ***
## SLG.417      -139.25      31.16  -4.469 1.00e-05 ***
## SLG.418      -150.66      31.93  -4.718 3.20e-06 ***
## SLG.419      -127.88      31.54  -4.054 5.96e-05 ***
```

```
## SLG.420      -144.64      31.55  -4.584 5.96e-06 ***
## SLG.421      -140.01      32.02  -4.373 1.53e-05 ***
## SLG.422      -141.10      31.08  -4.540 7.29e-06 ***
## SLG.423      -119.29      31.44  -3.794 0.000169 ***
## SLG.424      -118.63      31.33  -3.787 0.000174 ***
## SLG.425      -120.69      31.02  -3.890 0.000116 ***
## SLG.426      -117.72      31.56  -3.729 0.000217 ***
## SLG.427      -100.06      32.91  -3.040 0.002508 **
## SLG.428      -123.27      33.10  -3.725 0.000221 ***
## SLG.429       -90.32      31.44  -2.873 0.004264 **
## SLG.430       -95.98      31.79  -3.019 0.002684 **
## SLG.431       -99.77      31.24  -3.193 0.001509 **
## SLG.432      -115.42      31.42  -3.674 0.000269 ***
## SLG.433      -112.29      31.30  -3.587 0.000371 ***
## SLG.434      -106.59      31.57  -3.377 0.000799 ***
## SLG.435       -99.20      31.42  -3.157 0.001704 **
## SLG.436      -109.27      31.92  -3.423 0.000678 ***
## SLG.437      -104.24      32.00  -3.258 0.001211 **
## SLG.438      -104.92      32.38  -3.240 0.001284 **
## SLG.439       -82.53      32.90  -2.508 0.012488 *
## SLG.440      -114.43      33.75  -3.391 0.000761 ***
## SLG.441       -85.14      33.77  -2.521 0.012056 *
## SLG.442      -103.66      33.10  -3.132 0.001855 **
## SLG.443      -102.72      33.04  -3.109 0.002000 **
## SLG.444       -73.15      31.76  -2.303 0.021721 *
## SLG.445       -78.69      31.99  -2.459 0.014302 *
## SLG.446       -76.26      30.54  -2.497 0.012906 *
## SLG.447       -62.75      33.11  -1.895 0.058726 .
## SLG.448       -72.46      33.77  -2.146 0.032451 *
## SLG.449       -62.06      31.93  -1.943 0.052595 .
## SLG.450       -84.20      41.66  -2.021 0.043886 *
## SLG.451       -69.85      33.06  -2.113 0.035181 *
## SLG.452       -51.08      35.40  -1.443 0.149841
## SLG.453       -65.57      33.19  -1.976 0.048802 *
## SLG.454       -57.36      30.65  -1.871 0.061950 .
## SLG.455       -48.93      31.84  -1.536 0.125146
## SLG.456       -55.50      35.37  -1.569 0.117352
## SLG.457       -39.96      32.38  -1.234 0.217943
## SLG.458       -60.92      32.44  -1.878 0.061067 .
## SLG.460       -83.31      34.13  -2.441 0.015051 *
## SLG.461       -64.09      36.46  -1.758 0.079473 .
## SLG.462       -54.20      41.66  -1.301 0.193960
## SLG.463      -141.87      41.74  -3.399 0.000737 ***
## SLG.464       -39.36      40.69  -0.967 0.333840
## SLG.466       -31.83      35.46  -0.898 0.369865
## SLG.468       -19.08      39.71  -0.480 0.631180
## SLG.469       -52.37      40.15  -1.304 0.192796
## SLG.470        38.75      44.03   0.880 0.379240
## SLG.471       -34.51      41.84  -0.825 0.409941
## SLG.472       -42.39      30.99  -1.368 0.172046
## SLG.475       -23.31      41.58  -0.561 0.575394
## SLG.477       -72.66      48.61  -1.495 0.135667
## SLG.478       -37.48      36.00  -1.041 0.298458
## SLG.483       -32.20      41.66  -0.773 0.439997
```

```
## SLG.490        39.75      39.74   1.000 0.317767
## SLG.491       -40.66      41.87  -0.971 0.332000
## SLG.494        36.35      39.65   0.917 0.359706
## SLG.495           NA         NA      NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 25.17 on 439 degrees of freedom
## Multiple R-squared:  0.9352, Adjusted R-squared:  0.9072
## F-statistic: 33.35 on 190 and 439 DF,  p-value: < 2.2e-16
```

Regression model to predict runs allowed: {RA=OOBPx1+OSLG*x2}

```
RunsReg3 = lm(RA ~ OOBP + OSLG, data=moneyball) #regression model
summary(RunsReg3)
```

```
##
## Call:
## lm(formula = RA ~ OOBP + OSLG, data = moneyball)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -85.130 -17.869   0.615  18.900  72.671
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -779.11      22.25  -35.01   <2e-16 ***
## OOBP         2265.72     114.82   19.73   <2e-16 ***
## OSLG         1876.04      66.42   28.24   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 27.35 on 627 degrees of freedom
## Multiple R-squared:  0.9059, Adjusted R-squared:  0.9056
## F-statistic:  3017 on 2 and 627 DF,  p-value: < 2.2e-16
```

Predicting Formula:

```
PRW = function(obp = 0, slg = 0, oobp = 0, oslg = 0){
  dat = data.frame(OBP = obp,
                   SLG = slg,
                   OOBP = oobp,
                   OSLG = oslg)
  RS = predict(RunsReg2, dat)
  RA = predict(RunsReg3, dat)
  RunDifferential = RS - RA
  W = predict(WinsReg, data.frame(RunDifferential))
  res = c(RS,RA,W)
  return(res)
}
```

Predict Year 2016 from 2015 data:

```
dat_2015 = moneyball %>% dplyr::filter(Season == 2015) %>% dplyr::filter(Team == 'NYM')
predict_2016 = PRW(dat_2015$OBP, dat_2015$SLG, dat_2015$OOBP, dat_2015$OSLG)
#predicting mets 2016 season wins
```

Compare with Real Data:

```
dat_2016 = moneyball %>% filter(Season == 2016) %>% filter(Team == 'NYM') %>% select(R.x, RA, W)
#looking at mets 2016 season stats

compare = rbind(predict_2016, dat_2016) #compare preds and actual data
colnames(compare) = c('Run Scored', 'Run Allowed', 'Win')
rownames(compare) = c('PREDICT', 'REAL')

knitr::kable(compare)
```

	Run Scored	Run Allowed	Win
PREDICT	657.9368	597.4063	86.98094
REAL	671.0000	617.0000	87.00000