```
#Setup
setwd("~/Desktop/Moneyball/Project")
library(tidyverse)
library(rvest)
library(xml2)
library(selectr)
library(stringr)
library(jsonlite)
library(XML)
library(xlsx)
library(readxl)
library(modelr)
library(ggplot2)


#####################################################################


#Bringing in Madden Data
#Creating Team Vectors
#St Louis Rams + San Diego Chargers
teams <- c("new_york_jets", "pittsburgh_steelers", "baltimore_ravens",
"cleveland_browns",
           "cincinnati_bengals", "minnesota_vikings", "green_bay_packers",
"detroit_lions",
           "new_york_giants", "philadelphia_eagles", "dallas_cowboys",
"washington_redskins",
           "carolina_panthers", "atlanta_falcons",
"new_orleans_saints","tampa_bay_buccaneers",
           "arizona_cardinals", "seattle_seahawks", "st._louis_rams",
"san_francisco_49ers",
           "chicago_bears", "new_england_patriots", "buffalo_bills",
"miami_dolphins",
           "indianapolis_colts", "houston_texans", "tennessee_titans",
"jacksonville_jaguars",
           "san_diego_chargers", "denver_broncos", "oakland_raiders",
"kansas_city_chiefs")
#Los Angeles Rams + San Diego Chargers
teams2 <- c("new_york_jets", "pittsburgh_steelers", "baltimore_ravens",
"cleveland_browns",
           "cincinnati_bengals", "minnesota_vikings", "green_bay_packers",
```

```
"detroit_lions",
           "new_york_giants", "philadelphia_eagles", "dallas_cowboys",
"washington_redskins",
           "carolina_panthers", "atlanta_falcons",
"new_orleans_saints","tampa_bay_buccaneers",
           "arizona_cardinals", "seattle_seahawks", "los_angeles_rams",
"san_francisco_49ers",
           "chicago_bears", "new_england_patriots", "buffalo_bills",
"miami_dolphins",
           "indianapolis_colts", "houston_texans", "tennessee_titans",
"jacksonville_jaguars",
           "san_diego_chargers", "denver_broncos", "oakland_raiders",
"kansas_city_chiefs")
#Los Angeles Rams + Los Angeles Chargers
teams3 <- c("new_york_jets", "pittsburgh_steelers", "baltimore_ravens",
"cleveland_browns",
            "cincinnati_bengals", "minnesota_vikings", "green_bay_packers",
"detroit_lions",
            "new_york_giants", "philadelphia_eagles", "dallas_cowboys",
"washington_redskins",
            "carolina_panthers", "atlanta_falcons",
"new_orleans_saints","tampa_bay_buccaneers",
            "arizona_cardinals", "seattle_seahawks", "los_angeles_rams",
"san_francisco_49ers",
            "chicago_bears", "new_england_patriots", "buffalo_bills",
"miami_dolphins",
            "indianapolis_colts", "houston_texans", "tennessee_titans",
"jacksonville_jaguars",
            "los_angeles_chargers", "denver_broncos", "oakland_raiders",
"kansas_city_chiefs")

#2011
MaddenTable2011 <- tibble()
for (t in teams) {
  current <- read_xlsx(paste0("Data/", t, "__madden_nfl_", 12, "_.xlsx"))
  colnames(current)[2] <- "POS"
  colnames(current)[3] <- "OVR"
  colnames(current)[1] <- "Name"
  current <- current %>%
    mutate(Year = 2011,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
```

```
  MaddenTable2011 <- rbind(MaddenTable2011, current)
}

#2012
MaddenTable2012 <- tibble()
for (t in teams) {
  current <- read_xlsx(paste0("Data/", t, "_madden_nfl_", 13, ".xlsx"))
  colnames(current)[4] <- "POS"
  colnames(current)[5] <- "OVR"
  colnames(current)[2] <- "First"
  colnames(current)[3] <- "Last"
  current <- current %>%
    mutate(Name=paste(First,Last, sep=' '),
           Year = 2012,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
  MaddenTable2012 <- rbind(MaddenTable2012, current)
}

#2013
MaddenTable2013 <- tibble()
for (t in teams) {
  current <- read_xlsx(paste0("Data/", t, "_madden_nfl_", 25, ".xlsx"))
  colnames(current)[4] <- "POS"
  colnames(current)[6] <- "OVR"
  colnames(current)[2] <- "First"
  colnames(current)[3] <- "Last"
  current <- current %>%
    mutate(Name=paste(First,Last, sep=' '),
           Year = 2013,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
  MaddenTable2013 <- rbind(MaddenTable2013, current)
}

#2014
MaddenTable2014 <- tibble()
for (t in teams) {
  current <- read_xlsx(paste0("Data/", t, "_madden_nfl_", 15, ".xlsx"))
  colnames(current)[3] <- "POS"
  colnames(current)[5] <- "OVR"
  colnames(current)[1] <- "First"
```

```
  colnames(current)[2] <- "Last"
  current <- current %>%
    mutate(Name=paste(First,Last, sep=' '),
           Year = 2014,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
  MaddenTable2014 <- rbind(MaddenTable2014, current)
}

#2015
MaddenTable2015 <- tibble()
for (t in teams) {
  current <- read_xlsx(paste0("Data/", t, "_(madden_nfl_", 16, ").xlsx"))
  colnames(current)[3] <- "POS"
  colnames(current)[5] <- "OVR"
  colnames(current)[1] <- "First"
  colnames(current)[2] <- "Last"
  current <- current %>%
    mutate(Name=paste(First,Last, sep=' '),
           Year = 2015,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
  MaddenTable2015 <- rbind(MaddenTable2015, current)
}

#2016
MaddenTable2016 <- tibble()
for (t in teams2) {
  current <- read_xlsx(paste0("Data/", t, "__madden_nfl_", 17, "_.xlsx"))
  colnames(current)[4] <- "POS"
  colnames(current)[5] <- "OVR"
  colnames(current)[3] <- "First"
  colnames(current)[2] <- "Last"
  current <- current %>%
    mutate(Name=paste(First,Last, sep=' '),
           Year = 2016,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
  MaddenTable2016 <- rbind(MaddenTable2016, current)
}

#2017
```

```r
MaddenTable2017 <- tibble()
for (t in teams3) {
  current <- read_xlsx(paste0("Data/", t, "__madden_nfl_", 18, "_.xlsx"))
  colnames(current)[4] <- "POS"
  colnames(current)[6] <- "OVR"
  colnames(current)[3] <- "First"
  colnames(current)[2] <- "Last"
  current <- current %>%
    mutate(Name=paste(First,Last, sep=' '),
           Year = 2017,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
  MaddenTable2017 <- rbind(MaddenTable2017, current)
}

#2018
MaddenTable2018 <- tibble()
for (t in teams3) {
  current <- read_xlsx(paste0("Data/", t, "__madden_nfl_", 19, "_.xlsx"))
  colnames(current)[5] <- "POS"
  colnames(current)[6] <- "OVR"
  current <- current %>%
    mutate(Year = 2018,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
  MaddenTable2018 <- rbind(MaddenTable2018, current)
}

#2019
MaddenTable2019 <- tibble()
for (t in teams3) {
  current <- read_xlsx(paste0("Data/", t, "__madden_nfl_", 20, "_.xlsx"))
  colnames(current)[5] <- "POS"
  colnames(current)[6] <- "OVR"
  current <- current %>%
    mutate(Year = 2019,
           Team = t) %>%
    select(Name, Team, POS, OVR, Year)
  MaddenTable2019 <- rbind(MaddenTable2019, current)
}

#Madden Master Sheet
```

```
MaddenTableAll <- rbind(MaddenTable2011, MaddenTable2012, MaddenTable2013,
                        MaddenTable2014, MaddenTable2015, MaddenTable2016,
                        MaddenTable2017, MaddenTable2018, MaddenTable2019)

#Bringing In Salary Data
#Salary2011
Salary2011 <- read_csv("Data/Salary2011.csv")
Salary2011 <- Salary2011 %>%
  select(Name, Salary) %>%
  mutate(Year=2011)

#Salary2012
Salary2012 <- read_csv("Data/Salary2012.csv")
Salary2012 <- Salary2012 %>%
  select(Name, Salary) %>%
  mutate(Year=2012)

#Salary2013
Salary2013 <- read_csv("Data/Salary2013.csv")
Salary2013 <- Salary2013 %>%
  select(Name, Salary) %>%
  mutate(Year=2013)

#Salary2014
Salary2014 <- read_csv("Data/Salary2014.csv")
Salary2014 <- Salary2014 %>%
  select(Name, Salary) %>%
  mutate(Year=2014)

#Salary2015
Salary2015 <- read_csv("Data/Salary2015.csv")
Salary2015 <- Salary2015 %>%
  select(Name, Salary) %>%
  mutate(Year=2015)

#Salary2016
Salary2016 <- read_csv("Data/Salary2016.csv")
Salary2016 <- Salary2016 %>%
  select(Name, Salary) %>%
  mutate(Year=2016)

#Salary2017
```

```r
Salary2017 <- read_csv("Data/Salary2017.csv")
Salary2017 <- Salary2017 %>%
  select(Name, Salary) %>%
  mutate(Year=2017)

#Salary2018
Salary2018 <- read_csv("Data/Salary2018.csv")
Salary2018 <- Salary2018 %>%
  select(Name, Salary) %>%
  mutate(Year=2018)

#Salary2019
Salary2019 <- read_csv("Data/Salary2019.csv")
Salary2019 <- Salary2019 %>%
  select(Name, Salary) %>%
  mutate(Year=2019)

#Salary Master Sheet
SalaryTableAll <- rbind(Salary2011, Salary2012, Salary2013,
                        Salary2014, Salary2015, Salary2016,
                        Salary2017, Salary2018, Salary2019)


#######################################################################


#Combining Madden Rating tbl with Salary tbl
MasterSheet <- left_join(MaddenTableAll, SalaryTableAll, by = "Name")
MasterSheet <- MasterSheet %>%
  drop_na()
MasterSheet$Salary <- gsub("\\$|,","", MasterSheet$Salary)
MasterSheet <- MasterSheet %>%
  mutate(OVR = as.numeric(OVR),
         Salary = as.numeric(Salary),
         Year = as.numeric(Year.y)) %>%
  select(Name, Team, Year, POS, OVR, Salary)


#######################################################################


#Seperating Master Sheet by Year
```

```
#2011
Data2011 <- left_join(MaddenTable2011, Salary2011, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2011$Salary <- gsub("\\$|,","", Data2011$Salary)
Data2011 <- Data2011 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))
#2012
Data2012 <- left_join(MaddenTable2012, Salary2012, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2012$Salary <- gsub("\\$|,","", Data2012$Salary)
Data2012 <- Data2012 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))
#2013
Data2013 <- left_join(MaddenTable2013, Salary2013, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2013$Salary <- gsub("\\$|,","", Data2013$Salary)
Data2013 <- Data2013 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))
#2014
Data2014 <- left_join(MaddenTable2014, Salary2014, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2014$Salary <- gsub("\\$|,","", Data2014$Salary)
Data2014 <- Data2014 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))
#2015
Data2015 <- left_join(MaddenTable2015, Salary2015, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2015$Salary <- gsub("\\$|,","", Data2015$Salary)
```

```
Data2015 <- Data2015 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))
#2016
Data2016 <- left_join(MaddenTable2016, Salary2016, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2016$Salary <- gsub("\\$|,","", Data2016$Salary)
Data2016 <- Data2016 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))
#2017
Data2017 <- left_join(MaddenTable2017, Salary2017, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2017$Salary <- gsub("\\$|,","", Data2017$Salary)
Data2017 <- Data2017 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))
#2018
Data2018 <- left_join(MaddenTable2018, Salary2018, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2018$Salary <- gsub("\\$|,","", Data2018$Salary)
Data2018 <- Data2018 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))
#2019
Data2019 <- left_join(MaddenTable2011, Salary2019, by = "Name") %>%
  drop_na() %>%
  mutate(Year=Year.x) %>%
  select(Name, Year, POS, OVR, Salary)
Data2019$Salary <- gsub("\\$|,","", Data2019$Salary)
Data2019 <- Data2019 %>%
  mutate(Salary= as.numeric(Salary),
         OVR= as.numeric(OVR))


#####################################################################
```

```
#Scatter Plot OVR vs Salary
OVRSalaryPlot <- ggplot(MasterSheet, aes(x=OVR, y=Salary)) +
  geom_point(mapping=aes(x=OVR, y=Salary), alpha=.1) +
  geom_abline(intercept = -9559719.7, slope = 174518.9, color="red",
size=1.2) +
  labs(x="Overall Madden Rating",
       y="Salary",
       title="Expected Pay")

#Least Regression Line (not sorted by position)
fit <- lm(Salary ~ OVR, data=MasterSheet)
fit[["coefficients"]]
summary(fit)
cor(MasterSheet[["OVR"]], MasterSheet[["Salary"]])


#######################################################################


#Graphing OVR vs Salary for Every Year by Position With Least Squares Line

#2011 - Regression
FitLine2011 <- lm(Salary~OVR*POS, data=Data2011)
Data2011PlotPredictions <-Data2011 %>%
  add_predictions(model=FitLine2011, type="response", var="Prediction")
#2011 - Plotting
Data2011Plot <- ggplot(Data2011PlotPredictions) +
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2011 Salary Based on Overall Rating by Position")+
  theme_bw()

#2012 - Regression
FitLine2012 <- lm(Salary~OVR*POS, data=Data2012)
Data2012PlotPredictions <- Data2012 %>%
  add_predictions(model=FitLine2012, type="response", var="Prediction")
#2012 - Plotting
```

```
Data2012Plot <- ggplot(Data2012PlotPredictions)+
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2012 Salary Based on Overall Rating by Position")+
  theme_bw()

#2013 - Regression
FitLine2013 <- lm(Salary~OVR*POS, data=Data2013)
Data2013PlotPredictions <- Data2013 %>%
  add_predictions(model=FitLine2013, type="response", var="Prediction")
#2013 - Plotting
Data2013Plot <- ggplot(Data2013PlotPredictions)+
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2013 Salary Based on Overall Rating by Position")+
  theme_bw()

#2014 - Regression
FitLine2014 <- lm(Salary~OVR*POS, data=Data2014)
Data2014PlotPredictions <- Data2014 %>%
  add_predictions(model=FitLine2014, type="response", var="Prediction")
#2014 - Plotting
Data2014Plot <- ggplot(Data2014PlotPredictions)+
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2014 Salary Based on Overall Rating by Position")+
  theme_bw()

#2015 - Regression
FitLine2015 <- lm(Salary~OVR*POS, data=Data2015)
Data2015PlotPredictions <- Data2015 %>%
  add_predictions(model=FitLine2015, type="response", var="Prediction")
#2015 - Plotting
```

```
Data2015Plot <- ggplot(Data2015PlotPredictions)+
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2015 Salary Based on Overall Rating by Position")+
  theme_bw()

#2016 - Regression
FitLine2016 <- lm(Salary~OVR*POS, data=Data2016)
Data2016PlotPredictions <- Data2016 %>%
  add_predictions(model=FitLine2016, type="response", var="Prediction")
#2016 - Plotting
Data2016Plot <- ggplot(Data2016PlotPredictions)+
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2016 Salary Based on Overall Rating by Position")+
  theme_bw()

#2017 - Regression
FitLine2017 <- lm(Salary~OVR*POS, data=Data2017)
Data2017PlotPredictions <- Data2017 %>%
  add_predictions(model=FitLine2017, type="response", var="Prediction")
#2017 - Plotting
Data2017Plot <- ggplot(Data2017PlotPredictions)+
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2017 Salary Based on Overall Rating by Position")+
  theme_bw()

#2018 - Regression
FitLine2018 <- lm(Salary~OVR*POS, data=Data2018)
Data2018PlotPredictions <- Data2018 %>%
  add_predictions(model=FitLine2018, type="response", var="Prediction")
#2018 - Plotting
```

```
Data2018Plot <- ggplot(Data2018PlotPredictions)+
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2018 Salary Based on Overall Rating by Position")+
  theme_bw()

#2019 - Regression
FitLine2019 <- lm(Salary~OVR*POS, data=Data2019)
Data2019PlotPredictions <- Data2019 %>%
  add_predictions(model=FitLine2019, type="response", var="Prediction")
#2019 - Plotting
Data2019Plot <- ggplot(Data2019PlotPredictions)+
  geom_point(mapping=aes(x=OVR, y=Salary))+
  facet_wrap(~POS)+
  geom_line(mapping=aes(x=OVR, y=Prediction), color="red")+
  labs(x="Overall Rating",
       y="Salary",
       title="2019 Salary Based on Overall Rating by Position")+
  theme_bw()

#Correlation Coefficients - OVR and Salary by Year
cor(Data2011[["OVR"]], Data2011[["Salary"]])
cor(Data2012[["OVR"]], Data2012[["Salary"]])
cor(Data2013[["OVR"]], Data2013[["Salary"]])
cor(Data2014[["OVR"]], Data2014[["Salary"]])
cor(Data2015[["OVR"]], Data2015[["Salary"]])
cor(Data2016[["OVR"]], Data2016[["Salary"]])
cor(Data2017[["OVR"]], Data2017[["Salary"]])
cor(Data2018[["OVR"]], Data2018[["Salary"]])
cor(Data2019[["OVR"]], Data2019[["Salary"]])


##################################################################


#Comparing Expected Pay to Actual Pay of Players on Superbowl Winning Teams

#Superbowl 46 - 2011 - NY Giants vs NE Patriots
#Giants 2011 - Superbowl 46
```

```
Data2011 <- Data2011 %>%
  add_predictions(model=FitLine2011, type="response", var="ExpectedPay")
%>%
  mutate(Residual=Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value))

GiantsSB46 <- read_xlsx("Data/new_york_giants__madden_nfl_12_.xlsx")
colnames(GiantsSB46)[2] <- "POS"
colnames(GiantsSB46)[3] <- "OVR"
GiantsSB46 <- GiantsSB46 %>%
  mutate(Year=2011)%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
GiantsSB46 <- left_join(GiantsSB46, Data2011, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2011, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)

#Patriots 2011 - Superbowl 46
PatsSB46 <- read_xlsx("Data/new_england_patriots__madden_nfl_12_.xlsx")
colnames(PatsSB46)[2] <- "POS"
colnames(PatsSB46)[3] <- "OVR"
PatsSB46 <- PatsSB46 %>%
  mutate(Year=2011)%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
PatsSB46 <- left_join(PatsSB46, Data2011, by= "Name")%>%
  drop_na()%>%
```

```
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2011, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)


#Superbowl 47 - 2012 - Ravens vs 49ers
#Ravens 2012 - Superbowl 47
Data2012 <- Data2012 %>%
  add_predictions(model=FitLine2012, type="response", var="ExpectedPay")
%>%
  mutate(Residual=Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value))

RavensSB47 <- read_xlsx("Data/baltimore_ravens_madden_nfl_13.xlsx")
colnames(RavensSB47)[4] <- "POS"
colnames(RavensSB47)[5] <- "OVR"
colnames(RavensSB47)[2] <- "First"
colnames(RavensSB47)[3] <- "Last"
RavensSB47 <- RavensSB47 %>%
  mutate(Year=2012,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
RavensSB47 <- left_join(RavensSB47, Data2012, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
```

```
  add_predictions(model= FitLine2012, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)

#49ers 2012 - Superbowl 47
SF49ersSB47 <- read_xlsx("Data/san_francisco_49ers_madden_nfl_13.xlsx")
colnames(SF49ersSB47)[4] <- "POS"
colnames(SF49ersSB47)[5] <- "OVR"
colnames(SF49ersSB47)[2] <- "First"
colnames(SF49ersSB47)[3] <- "Last"
SF49ersSB47 <- SF49ersSB47 %>%
  mutate(Year=2012,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
SF49ersSB47 <- left_join(SF49ersSB47, Data2012, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2012, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)


#Seahawks 2013 - Superbowl 48
Data2013 <- Data2013 %>%
  add_predictions(model=FitLine2013, type="response", var="ExpectedPay")
%>%
```

```
  mutate(Residual=Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value))

SeahawksSB48 <- read_xlsx("Data/seattle_seahawks_madden_nfl_25.xlsx")
colnames(SeahawksSB48)[4] <- "POS"
colnames(SeahawksSB48)[6] <- "OVR"
colnames(SeahawksSB48)[2] <- "First"
colnames(SeahawksSB48)[3] <- "Last"
SeahawksSB48 <- SeahawksSB48 %>%
  mutate(Year=2013,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
SeahawksSB48 <- left_join(SeahawksSB48, Data2013, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2013, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)

#Broncos 2013 - Superbowl 48
BroncosSB48 <- read_xlsx("Data/denver_broncos_madden_nfl_25.xlsx")
colnames(BroncosSB48)[4] <- "POS"
colnames(BroncosSB48)[6] <- "OVR"
colnames(BroncosSB48)[2] <- "First"
colnames(BroncosSB48)[3] <- "Last"
BroncosSB48 <- BroncosSB48 %>%
  mutate(Year=2013,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR) %>%
```

```
  mutate(OVR=as.numeric(OVR))
BroncosSB48 <- left_join(BroncosSB48, Data2013, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2013, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)


#Patriots 2014 - Superbowl 49
Data2014 <- Data2014 %>%
  add_predictions(model=FitLine2014, type="response", var="ExpectedPay")
%>%
  mutate(Residual=Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value))

PatsSB49 <- read_xlsx("Data/new_england_patriots_madden_nfl_15.xlsx")
colnames(PatsSB49)[3] <- "POS"
colnames(PatsSB49)[5] <- "OVR"
colnames(PatsSB49)[1] <- "First"
colnames(PatsSB49)[2] <- "Last"
PatsSB49 <- PatsSB49 %>%
  mutate(Year=2014,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
PatsSB49 <- left_join(PatsSB49, Data2014, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
```

```
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2014, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)

#Seahawks 2014 - Superbowl 49
SeahawksSB49 <- read_xlsx("Data/seattle_seahawks_madden_nfl_15.xlsx")
colnames(SeahawksSB49)[3] <- "POS"
colnames(SeahawksSB49)[5] <- "OVR"
colnames(SeahawksSB49)[1] <- "First"
colnames(SeahawksSB49)[2] <- "Last"
SeahawksSB49 <- SeahawksSB49 %>%
  mutate(Year=2014,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
SeahawksSB49 <- left_join(SeahawksSB49, Data2014, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2014, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)


#Broncos 2015 - Superbowl 50
Data2015 <- Data2015 %>%
```

```
  add_predictions(model=FitLine2015, type="response", var="ExpectedPay")
%>%
  mutate(Residual=Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value))

BroncosSB50 <- read_xlsx("Data/denver_broncos_(madden_nfl_16).xlsx")
colnames(BroncosSB50)[3] <- "POS"
colnames(BroncosSB50)[5] <- "OVR"
colnames(BroncosSB50)[1] <- "First"
colnames(BroncosSB50)[2] <- "Last"
BroncosSB50 <- BroncosSB50 %>%
  mutate(Year=2015,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
BroncosSB50 <- left_join(BroncosSB50, Data2015, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2015, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)

#Panthers 2015 - Superbowl 50
PanthersSB50 <- read_xlsx("Data/carolina_panthers_(madden_nfl_16).xlsx")
colnames(PanthersSB50)[3] <- "POS"
colnames(PanthersSB50)[5] <- "OVR"
colnames(PanthersSB50)[1] <- "First"
colnames(PanthersSB50)[2] <- "Last"
PanthersSB50 <- PanthersSB50 %>%
  mutate(Year=2015,
```

```
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR) %>%
  mutate(OVR=as.numeric(OVR))
PanthersSB50 <- left_join(PanthersSB50, Data2015, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2015, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)


#Patriots 2016 - Superbowl 51
Data2016 <- Data2016 %>%
  add_predictions(model=FitLine2016, type="response", var="ExpectedPay")
  mutate(Residual=Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value))

PatsSB51 <- read_xlsx("Data/new_england_patriots__madden_nfl_17_.xlsx")
colnames(PatsSB51)[4] <- "POS"
colnames(PatsSB51)[5] <- "OVR"
colnames(PatsSB51)[3] <- "First"
colnames(PatsSB51)[2] <- "Last"
PatsSB51 <- PatsSB51 %>%
  mutate(Year=2016,
         Name=paste(First, Last, sep=' '))%>%
  select(Name, Year, POS, OVR)
PatsSB51<-  left_join(PatsSB51, Data2016, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
```

```
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2016, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)

#Falcons 2016 - Superbowl 51
FalconsSB51 <- read_xlsx("Data/atlanta_falcons__madden_nfl_17_.xlsx")
colnames(FalconsSB51)[4] <- "POS"
colnames(FalconsSB51)[5] <- "OVR"
colnames(FalconsSB51)[3] <- "First"
colnames(FalconsSB51)[2] <- "Last"
FalconsSB51 <- FalconsSB51 %>%
  mutate(Year=2016,
         Name=paste(First, Last, sep=' '))%>%
  select(Name, Year, POS, OVR)
FalconsSB51<-  left_join(FalconsSB51, Data2016, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2016, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)


#Eagles 2017 - Superbowl 52
Data2017 <- Data2017 %>%
  add_predictions(model=FitLine2017, type="response", var="ExpectedPay")
```

```
%>%
  mutate(Residual=Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value))

EaglesSB52 <- read_xlsx("Data/philadelphia_eagles__madden_nfl_18_.xlsx")
colnames(EaglesSB52)[4] <- "POS"
colnames(EaglesSB52)[2] <- "Last"
colnames(EaglesSB52)[3] <- "First"
colnames(EaglesSB52)[6] <- "OVR"
EaglesSB52 <- EaglesSB52 %>%
  mutate(Year=2017,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR)
EaglesSB52 <- left_join(EaglesSB52, Data2017, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2017, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)

#Patriots 2017 - Superbowl 52
PatsSB52 <- read_xlsx("Data/new_england_patriots__madden_nfl_18_.xlsx")
colnames(PatsSB52)[4] <- "POS"
colnames(PatsSB52)[2] <- "Last"
colnames(PatsSB52)[3] <- "First"
colnames(PatsSB52)[6] <- "OVR"
PatsSB52 <- PatsSB52 %>%
  mutate(Year=2017,
         Name=paste(First,Last, sep=' '))%>%
  select(Name, Year, POS, OVR)
```

```
PatsSB52 <- left_join(PatsSB52, Data2017, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2017, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)


#Patriots 2018 - Superbowl 53
Data2018 <- Data2018 %>%
  add_predictions(model=FitLine2018, type="response", var="ExpectedPay")
%>%
  mutate(Residual=Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value))

PatsSB53 <- read_xlsx("Data/new_england_patriots__madden_nfl_19_.xlsx")
colnames(PatsSB53)[5] <- "POS"
colnames(PatsSB53)[6] <- "OVR"
PatsSB53 <- PatsSB53 %>%
  mutate(Year=2018)%>%
  select(Name, Year, POS, OVR)
PatsSB53 <- left_join(PatsSB53, Data2017, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2018, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
```

```
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)

#Rams 2018 - Superbowl 53
RamsSB53 <- read_xlsx("Data/los_angeles_rams__madden_nfl_19_.xlsx")
colnames(RamsSB53)[5] <- "POS"
colnames(RamsSB53)[6] <- "OVR"
RamsSB53 <- RamsSB53 %>%
  mutate(Year=2018)%>%
  select(Name, Year, POS, OVR)
RamsSB53 <- left_join(RamsSB53, Data2017, by= "Name")%>%
  drop_na()%>%
  mutate(Year = Year.x,
         OVR=OVR.x,
         POS=POS.x)%>%
  select(Name, Year, POS, OVR, Salary) %>%
  add_predictions(model= FitLine2018, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary-ExpectedPay) %>%
  mutate(Value= case_when(
    Residual<0 ~ "1",
    Residual>= 0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  mutate(ValueAboveAverage=100*(mean(Value) - .590))%>%
  mutate_if(is.numeric, round, 0)


#######################################################################


#Breaking Down Value Above Average by Position

#Superbowl 46 - 2011 - Giants vs Patriots
#Giants 2011 - Superbowl 46
GiantsSB46 <- GiantsSB46 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
```

```
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="NY Giants", SeasonID="GiantsSB46") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)
#Patriots 2011 - Superbowl 46
PatsSB46 <- PatsSB46 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="NE Patriots", SeasonID="PatsSB46") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)


#Ravens 2012 - Superbowl 47
RavensSB47 <- RavensSB47 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="BAL Ravens", SeasonID="RavensSB47") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)
#49ers 2012 - Superbowl 47
SF49ersSB47 <- SF49ersSB47 %>%
  group_by(POS) %>%
```

```
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="SF 49ers", SeasonID="SF49ersSB47") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)

#Seahawks 2013 - Superbowl 48
SeahawksSB48 <- SeahawksSB48 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= (sum(ExpectedPay)-sum(Salary))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="SEA Seahawks", SeasonID="SeahawksSB48") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)
#Broncos 2013 - Superbowl 48
BroncosSB48 <- BroncosSB48 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= (sum(ExpectedPay)-sum(Salary))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="DEN Broncos", SeasonID="BroncosSB48") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)
```

```
#Patriots 2014 - Superbowl 49
PatsSB49 <- PatsSB49 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="NE Patriots", SeasonID="PatsSB49") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)
#Seahawks 2014 - Superbowl 49
SeahawksSB49 <- SeahawksSB49 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="SEA Seahawks", SeasonID="SeahawksSB49") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)

#Broncos 2015 - Superbowl 50
BroncosSB50 <- BroncosSB50 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="DEN Broncos", SeasonID="BroncosSB50") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
```

```
         Value, ValueAboveAverage, PositionalValue)
#Panthers 2015 - Superbowl 50
PanthersSB50 <- PanthersSB50 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= sum(Residual)) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(Residual)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="CAR Panthers", SeasonID="PanthersSB50") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)

#Patriots 2016 - Superbowl 51
PatsSB51 <- PatsSB51 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue))  %>%
  mutate(Team="NE Patriots", SeasonID="PatsSB51") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)
#Falcons 2016 - Superbowl 51
FalconsSB51 <- FalconsSB51 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue))  %>%
  mutate(Team="ATL Falcons", SeasonID="FalconsSB51") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
```

```
Residual,
         Value, ValueAboveAverage, PositionalValue)

#Eagles 2017 - Superbowl 52
EaglesSB52 <- EaglesSB52 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="PHI Eagles", SeasonID="EaglesSB52") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)
#Patriots 2017 - Superbowl 52
PatsSB52 <- PatsSB52 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="NE Patriots", SeasonID="PatsSB52") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)

#Patriots 2018 - Superbowl 53
PatsSB53 <- PatsSB53 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
```

```
  mutate(Team="NE Patriots", SeasonID="PatsSB53") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)
#Rams 2018 - Superbowl 53
RamsSB53 <- RamsSB53 %>%
  group_by(POS) %>%
  mutate(PositionalMoneySaved= ((sum(ExpectedPay)-sum(Salary)))) %>%
  ungroup() %>%
  mutate(MoneySaved=sum(ExpectedPay)-sum(Salary)) %>%
  mutate(PositionalValue=100*(PositionalMoneySaved/MoneySaved)) %>%
  select(Name, Year, POS, OVR, Salary, ExpectedPay, Residual,
         Value, ValueAboveAverage, PositionalValue)%>%
  arrange(desc(PositionalValue)) %>%
  mutate(Team="LA Rams", SeasonID="RamsSB53") %>%
  select(Name, SeasonID, Year, Team, POS, OVR, Salary, ExpectedPay,
Residual,
         Value, ValueAboveAverage, PositionalValue)


#################################################################

#Teams Who Did Not Find Value: GiantsSB46, SF49ersSB47, SeahawksSB48,
PatsSB49
#Create scatter plot, by position, for the percentage of value that each
#position made up for each team

PositionalValueAll <- rbind(PatsSB46, RavensSB47,
                            BroncosSB48, SeahawksSB49,
                            BroncosSB50, PanthersSB50, PatsSB51,
FalconsSB51,
                            EaglesSB52, PatsSB52, PatsSB53, RamsSB53) %>%
  group_by(SeasonID)

SeasonIDvsPositionalValue <- ggplot(data=PositionalValueAll,
aes(x=SeasonID, y=PositionalValue,
                                    col=SeasonID, fill=SeasonID))+
  geom_bar(stat="identity", width=.5)+
  labs(title="Where Super Bowl Victors Found Value",
       subtitle="Separated By Position and Season",
       x= "Team",
       y="Percent of Team's Total Value")+
```

```
  facet_wrap(~POS)+
  ylim(-100,100)+
  theme(axis.text.x = element_text(angle=90, vjust=.6))

PositionalValuePlot <- ggplot(data=PositionalValueAll, aes(x=POS,
y=PositionalValue,
                                                            col=POS,
fill=POS))+
  geom_bar(stat="identity", width=.5)+
  labs(title="Where Super Bowl Teams Found Value",
       subtitle="Separated By Team and Season",
       x= "Team",
       y="Percent of Team's Total Value")+
  facet_wrap(~SeasonID)+
  ylim(-100,100)+
  theme(axis.text.x = element_text(angle=90, vjust=.6))+
  geom_hline(yintercept=0, size=.5)


PositionalValueForTeams <- PositionalValueAll %>%
  group_by(SeasonID)

ggplot(PositionalValueForTeams)+
  geom_hline(yintercept=16, col="red1", size=1.5)+
  geom_hline(yintercept=7, col="darkmagenta", size=1.5)+
  geom_hline(yintercept=4, col="orange", size=1.5)+
  geom_hline(yintercept=5, col="chartreuse1", size=1.5)+
  geom_hline(yintercept=4.5, col="orange", size=1.5)+
  geom_hline(yintercept=9, col="cyan1", size=1.5)+
  geom_hline(yintercept=8, col="red1", size=1.5)+
  geom_hline(yintercept=14, col="red3", size=1.5)+
  geom_hline(yintercept=7, col="turquoise4", size=1.5)+
  geom_hline(yintercept=1, col="red2", size=1.5)+
  geom_hline(yintercept=9, col="red2", size=1.5)+
  geom_hline(yintercept=6, col="gold", size=1.5)+
  ylim(0,20)+
  labs(y="Percentage Above League Average For Value Found")

ggplot(PositionalValueAll, aes(x=SeasonID, y=(ValueAboveAverage/32),
fill=Team))+
  geom_bar(stat="identity")+
  theme(axis.text.x = element_text(angle=90, vjust=.6))+
```

```
  labs(x=" ",
       y="Value Above Average",
       title="")


#######################################################################


#Creating Table of Teams and Value by Position

GiantsValueChart <- GiantsSB46 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Giants", Year="2011", SeasonID="GiantsSB46") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, RG, LG, LT,
         DT, SS, FS, CB, LOLB, MLB, ROLB, RE, LE,
         K)

PatriotsValueChart1 <- PatsSB46 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Patriots", Year="2011", SeasonID="PatsSB46") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, C, RG, LG, RT, LT,
         DT, SS, FS, CB, LOLB, MLB, ROLB, RE, LE,
         K)

RavensValueChart <- RavensSB47 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Ravens", Year="2012", SeasonID="RavensSB47") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, FB, C, RG, LG, RT, LT,
         DT, SS, FS, CB, LOLB, MLB, ROLB, RE,
        P)

SF49ersValueChart <- SF49ersSB47 %>%
  group_by(POS) %>%
```

```
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "49ers", Year="2012", SeasonID="SF49ersSB47") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, C, RG, LG, RT, LT,
         DT, SS, FS, CB, LOLB, MLB, ROLB, RE, LE,
         K, P)

SeahawksValueChart1 <- SeahawksSB48 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Seahawks", Year="2013", SeasonID="SeahawksSB48") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, C, RG, LG, RT, LT,
         DT, SS, FS, CB, MLB, ROLB, RE, LE,
         P)

BroncosValueChart1 <- BroncosSB48 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Broncos", Year="2013", SeasonID="BroncosSB48") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, RG, LG, RT, LT,
         DT, SS, FS, CB, LOLB, MLB, ROLB, RE, LE,
         K, P)

PatriotsValueChart2 <- PatsSB49 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Patriots", Year="2014", SeasonID="PatsSB49") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, C, RG, LG, RT, LT,
         DT, SS, FS, CB, MLB, ROLB, RE, LE,
         K)

SeahawksValueChart2 <- SeahawksSB49 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
```

```
  mutate(Team= "Seahawks", Year="2014", SeasonID="SeahawksSB49") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, C, LG, LT,
         DT, SS, CB, MLB, ROLB, RE, LE,
         K, P)

BroncosValueChart2 <- BroncosSB50 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Broncos", Year="2015", SeasonID="BroncosSB50") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, C, RG, RT, LT,
         DT, FS, CB, LOLB, MLB, ROLB, RE, LE,
         P)

PanthersValueChart <- PanthersSB50 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Panthers", Year="2015", SeasonID="PanthersSB50") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, FB, C, LG, RT, LT,
         DT, SS, FS, CB, LOLB, MLB, ROLB, RE, LE,
         K)

PatriotsValueChart3 <- PatsSB51 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Patriots", Year="2016", SeasonID="PatsSB51") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, FB, C, RT, LT,
         DT, SS, FS, CB, LOLB, MLB, ROLB, RE, LE,
         K, P)

FalconsValueChart <- FalconsSB51 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Falcons", Year="2016", SeasonID="FalconsSB51") %>%
  select(Team, Year, SeasonID,
```

```
         QB, HB, WR, TE, FB, C, RG, LG, RT, LT,
         DT, SS, CB, LOLB, MLB, RE, LE,
         K, P)

EaglesValueChart <- EaglesSB52 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Eagles", Year="2017", SeasonID="EaglesSB52") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, C, RG, LG, RT, LT,
         DT, SS, FS, LOLB, MLB, ROLB, RE, LE,
         K, P)

PatriotsValueChart4 <- PatsSB52 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Patriots", Year="2017", SeasonID="PatsSB52") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, FB, C, RT, LT,
         DT, SS, FS, CB, LOLB, MLB, RE, LE,
         K, P)

PatriotsValueChart5 <- PatsSB53 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Patriots", Year="2018", SeasonID="PatsSB53") %>%
  select(Team, Year, SeasonID,
         QB, HB, WR, TE, FB, C, RT, LT,
         DT, SS, FS, CB, LE,
         K, P)

RamsValueChart <- RamsSB53 %>%
  group_by(POS) %>%
  summarise(Value = mean(PositionalValue)) %>%
  spread(POS, Value) %>%
  mutate(Team= "Rams", Year="2018", SeasonID="RamsSB53") %>%
  select(Team, Year, SeasonID,
         QB, WR, TE, C, RG, RT, LT,
         DT, CB, MLB, RE, LE,
```

```
         K, P)

ValueChartAll <- bind_rows(BroncosValueChart1, BroncosValueChart2,
EaglesValueChart,
                       FalconsValueChart, GiantsValueChart,
PanthersValueChart,
                       PatriotsValueChart1, PatriotsValueChart2,
PatriotsValueChart3,
                       PatriotsValueChart4, PatriotsValueChart5,
RavensValueChart,
                       SeahawksValueChart1, SeahawksValueChart2,
SF49ersValueChart,
                       RamsValueChart) %>%
  arrange(desc(Year)) %>%
  mutate_if(is.numeric, round, 0)

PatsAll <- rbind(PatsSB46, PatsSB49, PatsSB51, PatsSB52, PatsSB53)%>%
  ungroup() %>%
  group_by(POS) %>%
  mutate(AvgPositionalValue=mean(PositionalValue))

ggplot(PatsAll)+
  geom_point(aes(x=mean(POS), y=AvgPositionalValue))+
  xlim(-100,100)+
  ylim(-100,100)

#####################################################################


#Creating Table For Lines of Best Fit With Slopes, Intercepts, and
Correlation

Pos <- c("QB", "HB", "WR", "TE", "RG", "LG", "RT", "LT", "DT", "SS", "FS",
         "CB", "LOLB", "MLB", "ROLB", "RE", "LE", "K", "P", "C", "FB")

FitLineTable <- tibble(StatOne = character(),
  StatTwo = character(),
  Intercept = numeric(),
  Slope = numeric(),
  Cor = numeric(),
  PValue = numeric())
for (p in Pos) {
```

```
  for (h in Pos){
  current <- lm(reformulate(p,h), data=ValueChartAll)
  x <- rsquare(current, data = ValueChartAll)
  x <- sqrt(x)
  y <- (summary(current)$coefficients[,4][2])
  FitLineTable <<- add_row(FitLineTable,
                           StatOne = p,
                           StatTwo = h,
                           Intercept = current$coefficients[1],
                           Slope = current$coefficients[2],
                           Cor = x,
                           PValue = y)
}
}

FitLineTable <- FitLineTable %>%
  arrange(PValue)

#Graphing Scatter Plots Between Value To Find Corellation Between
Overspending On One
#Position and Underspending On Another

#Plug in New Positions In Place of Old Ones to Compare Various Positions
FitLine <- lm(DT ~ QB, data=ValueChartAll)
ggplot(data=ValueChartAll) +
  geom_point(mapping=aes(x=QB, y=DT, col = Team), size=2)+
  labs(title="Correlation Between QB Value Found And DT Value Found",
       x="Percent of Team's Value QB Makes Up",
       y="Percent of Team's Value DT Makes UP")+
  ylim(-60,60)+
  xlim(-60,60)+
  geom_hline(yintercept=0, size=.25)+
  geom_vline(xintercept=0, size=.25)+
  geom_abline(intercept=FitLine$coefficients[1],
slope=FitLine$coefficients[2],
              col="red", linetype="dashed")+
  theme_bw()


#######################################################################
```

```
MasterSheetRes2011 <- MasterSheet %>%
  add_predictions(model=FitLine2011, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2011)

MasterSheetRes2012 <- MasterSheet %>%
  add_predictions(model=FitLine2012, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2012)

MasterSheetRes2013 <- MasterSheet %>%
  add_predictions(model=FitLine2013, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2013)

MasterSheetRes2014 <- MasterSheet %>%
  add_predictions(model=FitLine2014, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2014)

MasterSheetRes2015 <- MasterSheet %>%
  add_predictions(model=FitLine2015, type="response", var="ExpectedPay")
```

```
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2015)

MasterSheetRes2016 <- MasterSheet %>%
  add_predictions(model=FitLine2016, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2016)

MasterSheetRes2017 <- MasterSheet %>%
  add_predictions(model=FitLine2017, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2017)

MasterSheetRes2018 <- MasterSheet %>%
  add_predictions(model=FitLine2018, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2018)

MasterSheetRes2019 <- MasterSheet %>%
  add_predictions(model=FitLine2019, type="response", var="ExpectedPay")
%>%
  mutate(Residual = Salary - ExpectedPay) %>%
```

```
  mutate(Value = case_when(
    Residual<0 ~ "1",
    Residual>=0 ~ "0")) %>%
  mutate(Value=as.numeric(Value)) %>%
  filter(Year==2019)

MasterSheetResAll <- rbind(MasterSheetRes2011, MasterSheetRes2012,
                           MasterSheetRes2013, MasterSheetRes2014,
                           MasterSheetRes2015, MasterSheetRes2016,
                           MasterSheetRes2017, MasterSheetRes2018,
                           MasterSheetRes2019) %>%
  group_by(Team, Year) %>%
  mutate(SeasonalValue=mean(Value)) %>%
  ungroup()

MasterSheetResByTeam <- MasterSheetResAll %>%
  select(Team, Year, ExpectedPay, SeasonalValue) %>%
  distinct(.keep_all = FALSE)


#Loading In Regular Season Data
RegSeason2011 <- read_csv("Data/reg_games_2011.csv") %>%
  mutate(HomeWins = case_when(home_score > away_score ~ 1,
                              TRUE ~ 0)) %>%
  mutate(AwayWins = case_when(home_score > away_score ~ 0,
                              TRUE ~ 1))
RegSeason2012 <- read_csv("Data/reg_games_2012.csv") %>%
  mutate(HomeWins = case_when(home_score > away_score ~ 1,
                              TRUE ~ 0)) %>%
  mutate(AwayWins = case_when(home_score > away_score ~ 0,
                              TRUE ~ 1))
RegSeason2013 <- read_csv("Data/reg_games_2013.csv") %>%
  mutate(HomeWins = case_when(home_score > away_score ~ 1,
                              TRUE ~ 0)) %>%
  mutate(AwayWins = case_when(home_score > away_score ~ 0,
                              TRUE ~ 1))
RegSeason2014 <- read_csv("Data/reg_games_2014.csv") %>%
  mutate(HomeWins = case_when(home_score > away_score ~ 1,
                              TRUE ~ 0)) %>%
  mutate(AwayWins = case_when(home_score > away_score ~ 0,
                              TRUE ~ 1))
RegSeason2015 <- read_csv("Data/reg_games_2015.csv") %>%
```

```
  mutate(HomeWins = case_when(home_score > away_score ~ 1,
                              TRUE ~ 0)) %>%
  mutate(AwayWins = case_when(home_score > away_score ~ 0,
                              TRUE ~ 1))
RegSeason2016 <- read_csv("Data/reg_games_2016.csv") %>%
  mutate(HomeWins = case_when(home_score > away_score ~ 1,
                              TRUE ~ 0)) %>%
  mutate(AwayWins = case_when(home_score > away_score ~ 0,
                              TRUE ~ 1))
RegSeason2017 <- read_csv("Data/reg_games_2017.csv") %>%
  mutate(HomeWins = case_when(home_score > away_score ~ 1,
                              TRUE ~ 0)) %>%
  mutate(AwayWins = case_when(home_score > away_score ~ 0,
                              TRUE ~ 1))
RegSeason2018 <- read_csv("Data/reg_games_2018.csv") %>%
  mutate(HomeWins = case_when(home_score > away_score ~ 1,
                              TRUE ~ 0)) %>%
  mutate(AwayWins = case_when(home_score > away_score ~ 0,
                              TRUE ~ 1))


#2011
#Finding a team's home wins in a season
RegSeason2011Home <- RegSeason2011 %>%
  group_by(home_team) %>%
  summarise(HomeWins = sum(HomeWins),
            HomePointsFor = sum(home_score),
            HomePointsAgainst = sum(away_score))
#Finding a team's away wins in a season
RegSeason2011Away <- RegSeason2011 %>%
  group_by(away_team) %>%
  summarise(AwayWins = sum(AwayWins),
            AwayPointsFor = sum(away_score),
            AwayPointsAgainst = sum(home_score))
#Finding a team's total wins in a season
RegSeason2011Teams <- RegSeason2011Home %>%
  left_join(RegSeason2011Away, by = c("home_team" = "away_team")) %>%
  mutate(Year=2011, Wins = HomeWins + AwayWins,
         PointsFor=HomePointsFor+AwayPointsFor,
         PointsAgainst=HomePointsAgainst+AwayPointsAgainst,
         PointDifferential=PointsFor-PointsAgainst,
         PointTotal=PointsFor+PointsAgainst,
```

```
         PythagWinExpectation=16*((PointDifferential/PointTotal)+.5)) %>%
  mutate_if(is.numeric, round, 0) %>%
  select(home_team, Year, PointsFor, PointsAgainst,
         PointDifferential, Wins, PythagWinExpectation)



#2012
#Finding a team's home wins in a season
RegSeason2012Home <- RegSeason2012 %>%
  group_by(home_team) %>%
  summarise(HomeWins = sum(HomeWins),
            HomePointsFor = sum(home_score),
            HomePointsAgainst = sum(away_score))
#Finding a team's away wins in a season
RegSeason2012Away <- RegSeason2012 %>%
  group_by(away_team) %>%
  summarise(AwayWins = sum(AwayWins),
            AwayPointsFor = sum(away_score),
            AwayPointsAgainst = sum(home_score))
#Finding a team's total wins in a season
RegSeason2012Teams <- RegSeason2012Home %>%
  left_join(RegSeason2011Away, by = c("home_team" = "away_team")) %>%
  mutate(Year=2012, Wins = HomeWins + AwayWins,
         PointsFor=HomePointsFor+AwayPointsFor,
         PointsAgainst=HomePointsAgainst+AwayPointsAgainst,
         PointDifferential=PointsFor-PointsAgainst,
         PointTotal=PointsFor+PointsAgainst,
         PythagWinExpectation=16*((PointDifferential/PointTotal)+.5)) %>%
  mutate_if(is.numeric, round, 0) %>%
  select(home_team, Year, PointsFor, PointsAgainst,
         PointDifferential, Wins, PythagWinExpectation)

#2013
#Finding a team's home wins in a season
RegSeason2013Home <- RegSeason2013 %>%
  group_by(home_team) %>%
  summarise(HomeWins = sum(HomeWins),
            HomePointsFor = sum(home_score),
            HomePointsAgainst = sum(away_score))
#Finding a team's away wins in a season
RegSeason2013Away <- RegSeason2013 %>%
```

```
  group_by(away_team) %>%
  summarise(AwayWins = sum(AwayWins),
            AwayPointsFor = sum(away_score),
            AwayPointsAgainst = sum(home_score))
#Finding a team's total wins in a season
RegSeason2013Teams <- RegSeason2013Home %>%
  left_join(RegSeason2013Away, by = c("home_team" = "away_team")) %>%
  mutate(Year=2013, Wins = HomeWins + AwayWins,
         PointsFor=HomePointsFor+AwayPointsFor,
         PointsAgainst=HomePointsAgainst+AwayPointsAgainst,
         PointDifferential=PointsFor-PointsAgainst,
         PointTotal=PointsFor+PointsAgainst,
         PythagWinExpectation=16*((PointDifferential/PointTotal)+.5)) %>%
  mutate_if(is.numeric, round, 0) %>%
  select(home_team, Year, PointsFor, PointsAgainst,
         PointDifferential, Wins, PythagWinExpectation)
#2014
#Finding a team's home wins in a season
RegSeason2014Home <- RegSeason2014 %>%
  group_by(home_team) %>%
  summarise(HomeWins = sum(HomeWins),
            HomePointsFor = sum(home_score),
            HomePointsAgainst = sum(away_score))
#Finding a team's away wins in a season
RegSeason2014Away <- RegSeason2014 %>%
  group_by(away_team) %>%
  summarise(AwayWins = sum(AwayWins),
            AwayPointsFor = sum(away_score),
            AwayPointsAgainst = sum(home_score))
#Finding a team's total wins in a season
RegSeason2014Teams <- RegSeason2014Home %>%
  left_join(RegSeason2014Away, by = c("home_team" = "away_team")) %>%
  mutate(Year=2014, Wins = HomeWins + AwayWins,
         PointsFor=HomePointsFor+AwayPointsFor,
         PointsAgainst=HomePointsAgainst+AwayPointsAgainst,
         PointDifferential=PointsFor-PointsAgainst,
         PointTotal=PointsFor+PointsAgainst,
         PythagWinExpectation=16*((PointDifferential/PointTotal)+.5)) %>%
  mutate_if(is.numeric, round, 0) %>%
  select(home_team, Year, PointsFor, PointsAgainst,
         PointDifferential, Wins, PythagWinExpectation)
```

```r
#2015
#Finding a team's home wins in a season
RegSeason2015Home <- RegSeason2015 %>%
  group_by(home_team) %>%
  summarise(HomeWins = sum(HomeWins),
            HomePointsFor = sum(home_score),
            HomePointsAgainst = sum(away_score))
#Finding a team's away wins in a season
RegSeason2015Away <- RegSeason2015 %>%
  group_by(away_team) %>%
  summarise(AwayWins = sum(AwayWins),
            AwayPointsFor = sum(away_score),
            AwayPointsAgainst = sum(home_score))
#Finding a team's total wins in a season
RegSeason2015Teams <- RegSeason2015Home %>%
  left_join(RegSeason2015Away, by = c("home_team" = "away_team")) %>%
  mutate(Year=2015, Wins = HomeWins + AwayWins,
         PointsFor=HomePointsFor+AwayPointsFor,
         PointsAgainst=HomePointsAgainst+AwayPointsAgainst,
         PointDifferential=PointsFor-PointsAgainst,
         PointTotal=PointsFor+PointsAgainst,
         PythagWinExpectation=16*((PointDifferential/PointTotal)+.5)) %>%
  mutate_if(is.numeric, round, 0) %>%
  select(home_team, Year, PointsFor, PointsAgainst,
         PointDifferential, Wins, PythagWinExpectation)

#2016
#Finding a team's home wins in a season
RegSeason2016Home <- RegSeason2016 %>%
  group_by(home_team) %>%
  summarise(HomeWins = sum(HomeWins),
            HomePointsFor = sum(home_score),
            HomePointsAgainst = sum(away_score))
#Finding a team's away wins in a season
RegSeason2016Away <- RegSeason2016 %>%
  group_by(away_team) %>%
  summarise(AwayWins = sum(AwayWins),
            AwayPointsFor = sum(away_score),
            AwayPointsAgainst = sum(home_score))
#Finding a team's total wins in a season
RegSeason2016Teams <- RegSeason2016Home %>%
  left_join(RegSeason2016Away, by = c("home_team" = "away_team")) %>%
```

```
  mutate(Year=2016, Wins = HomeWins + AwayWins,
         PointsFor=HomePointsFor+AwayPointsFor,
         PointsAgainst=HomePointsAgainst+AwayPointsAgainst,
         PointDifferential=PointsFor-PointsAgainst,
         PointTotal=PointsFor+PointsAgainst,
         PythagWinExpectation=16*((PointDifferential/PointTotal)+.5)) %>%
  mutate_if(is.numeric, round, 0) %>%
  select(home_team, Year, PointsFor, PointsAgainst,
         PointDifferential, Wins, PythagWinExpectation)

#2017
#Finding a team's home wins in a season
RegSeason2017Home <- RegSeason2017 %>%
  group_by(home_team) %>%
  summarise(HomeWins = sum(HomeWins),
            HomePointsFor = sum(home_score),
            HomePointsAgainst = sum(away_score))
#Finding a team's away wins in a season
RegSeason2017Away <- RegSeason2017 %>%
  group_by(away_team) %>%
  summarise(AwayWins = sum(AwayWins),
            AwayPointsFor = sum(away_score),
            AwayPointsAgainst = sum(home_score))
#Finding a team's total wins in a season
RegSeason2017Teams <- RegSeason2017Home %>%
  left_join(RegSeason2017Away, by = c("home_team" = "away_team")) %>%
  mutate(Year=2017, Wins = HomeWins + AwayWins,
         PointsFor=HomePointsFor+AwayPointsFor,
         PointsAgainst=HomePointsAgainst+AwayPointsAgainst,
         PointDifferential=PointsFor-PointsAgainst,
         PointTotal=PointsFor+PointsAgainst,
         PythagWinExpectation=16*((PointDifferential/PointTotal)+.5)) %>%
  mutate_if(is.numeric, round, 0) %>%
  select(home_team, Year, PointsFor, PointsAgainst,
         PointDifferential, Wins, PythagWinExpectation)

#2018
#Finding a team's home wins in a season
RegSeason2018Home <- RegSeason2018 %>%
  group_by(home_team) %>%
  summarise(HomeWins = sum(HomeWins),
            HomePointsFor = sum(home_score),
```

```
            HomePointsAgainst = sum(away_score))
#Finding a team's away wins in a season
RegSeason2018Away <- RegSeason2018 %>%
  group_by(away_team) %>%
  summarise(AwayWins = sum(AwayWins),
            AwayPointsFor = sum(away_score),
            AwayPointsAgainst = sum(home_score))
#Finding a team's total wins in a season
RegSeason2018Teams <- RegSeason2018Home %>%
  left_join(RegSeason2018Away, by = c("home_team" = "away_team")) %>%
  mutate(Year=2018, Wins = HomeWins + AwayWins,
         PointsFor=HomePointsFor+AwayPointsFor,
         PointsAgainst=HomePointsAgainst+AwayPointsAgainst,
         PointDifferential=PointsFor-PointsAgainst,
         PointTotal=PointsFor+PointsAgainst,
         PythagWinExpectation=16*((PointDifferential/PointTotal)+.5)) %>%
  mutate_if(is.numeric, round, 0) %>%
  select(home_team, Year, PointsFor, PointsAgainst,
         PointDifferential, Wins, PythagWinExpectation)

#2011-2018
RegSeasonAll <- rbind(RegSeason2011Teams, RegSeason2012Teams,
RegSeason2013Teams,
                      RegSeason2014Teams, RegSeason2015Teams,
RegSeason2016Teams,
                      RegSeason2017Teams, RegSeason2018Teams) %>%
  mutate(Team = home_team) %>%
  select(Team, Year, Wins, PythagWinExpectation)

MasterSheetResAll <- MasterSheetResAll %>%
  distinct(.keep_all = FALSE)

RegSeasonAllTeam <- MasterSheetResAll %>%
  group_by(Team, Year) %>%
  mutate(ExpectedPay = sum(ExpectedPay)) %>%
  select(Team, Year, ExpectedPay, SeasonalValue) %>%
  distinct(.keep_all = FALSE)

RegSeasonAllTeam$Team <- sub("new_york_jets", "NYJ", RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("pittsburgh_steelers", "PIT",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("baltimore_ravens", "BAL",
```

```
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("buffalo_bills", "BUF", RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("carolina_panthers", "CAR",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("chicago_bears", "CHI", RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("cincinnati_bengals", "CIN",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("cleveland_browns", "CLE",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("dallas_cowboys", "DAL",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("denver_broncos", "DEN",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("detroit_lions", "DET", RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("green_bay_packers", "GB",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("houston_texans", "HOU",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("indianapolis_colts", "IND",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("jacksonville_jaguars", "JAC",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("kansas_city_chiefs", "KC",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("miami_dolphins", "MIA",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("minnesota_vikings", "MIN",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("new_england_patriots", "NE",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("new_orleans_saints", "NO",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("new_york_giants", "NYG",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("oakland_raiders", "OAK",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("philadelphia_eagles", "PHI",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("san_diego_chargers", "SD",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("los_angeles_chargers", "LAC",
RegSeasonAllTeam$Team)
```

```
RegSeasonAllTeam$Team <- sub("seattle_seahawks", "SEA",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("san_francisco_49ers", "SF",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("st._louis_rams", "STL",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("tampa_bay_buccaneers", "TB",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("tennessee_titans", "TEN",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("washington_redskins", "WAS",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("atlanta_falcons", "ATL",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("arizona_cardinals", "AZ",
RegSeasonAllTeam$Team)
RegSeasonAllTeam$Team <- sub("los_angeles_rams", "LAR",
RegSeasonAllTeam$Team)

RegSeasonAllTeam <- RegSeasonAllTeam %>%
  left_join(RegSeasonAll, by = c("Team", "Year")) %>%
  distinct(.keep_all = FALSE)


#Graphing wins based on Seasonal Value Found
ValueWinsFitLine <- lm(Wins ~ SeasonalValue, data=RegSeasonAllTeam)
ValueWinsFitLine[["coefficients"]]
#Has an r value of about 0.07
#Has a p-value of about .267

ValueVsWins <- ggplot(RegSeasonAllTeam) +
  geom_point(mapping=aes(x=SeasonalValue, y=Wins, col=Team))+
  ylim(0,16)+
  xlim(0,1)+
  labs(x="Percentage of Positions Where Value Is Found",
       y="Wins",
       title="Value Found vs Wins",
       subtitle="Done By Season")+
  geom_abline(intercept=6.580206, slope=2.756467, col="red2", size=.8)+
  theme_bw()
```

```
#Graphing pythagorean expectation wins based on Seasonal Value
ValuePythagWinsFitLine <- lm(PythagWinExpectation ~ SeasonalValue,
data=RegSeasonAllTeam)
ValuePythagWinsFitLine[["coefficients"]]
#Has an r value of about 0.07
#Has a p-value of .258

ValueVsExpectedWins <- ggplot(RegSeasonAllTeam) +
  geom_point(mapping=aes(x=SeasonalValue, y=PythagWinExpectation,
col=Team))+
  ylim(0,16)+
  xlim(0,1)+
  labs(x="Percentage of Positions Where Value Is Found",
       y="Pythagorean Win Expectation",
       title="Value Found vs Pythagorean Win Expectation",
       subtitle="Done By Season")+
  geom_abline(intercept=6.899768, slope=1.985866, col="red2", size=.8)+
  theme_bw()

PositionalSpending <- PositionalValueAll %>%
  group_by(POS) %>%
  mutate(PositionalSpending = mean(Salary)) %>%
  arrange(desc(PositionalSpending))

ggplot(PositionalSpending, aes(x=POS, y=PositionalSpending)) +
  geom_bar(stat="identity")+
  scale_fill_manual( values = c( "yes"="tomato", "no"="gray" ), guide =
FALSE )

#####################################################################
#OVRSalaryPlot - Scatter Plot of Overall Madden Rating and Salary With Fit
Line
#SeasonIDvsPositionalValue - Bar Chart of Value Found Teams, Faceted by
Position
#PositionalValuePlot - Bar Chart of Value Found By Teams, Faceted by Team
#####################################################################
#Remove all: remove(list=ls())
#Clear Clonse: cat("\014")
```