Predicting Quarterback Fantasy Score

Kevin Thompson, Sean Kennedy, and Sachin Chavan

Data Science Program, Southern Methodist University, USA

Abstract

Hype.

1 Introduction

Fantasy sports are a big business. Generating nearly 7 billion dollars annually (cite) and with approximately 60 million players in the US/Canada (cite), fantasy sports – particularly football – have become as big as the sports that they mimic. Players can compete head to head in leagues across a wide range of providers (Yahoo, CBS, ESPN, DraftKings, DraftStreet etc) – each with their own rulesets and stakes. Some are just friendly leagues set up between friends or coworkers, no real stakes other than bragging rights, others have significant monetary rewards for those that can get to the top of the leaderboard.

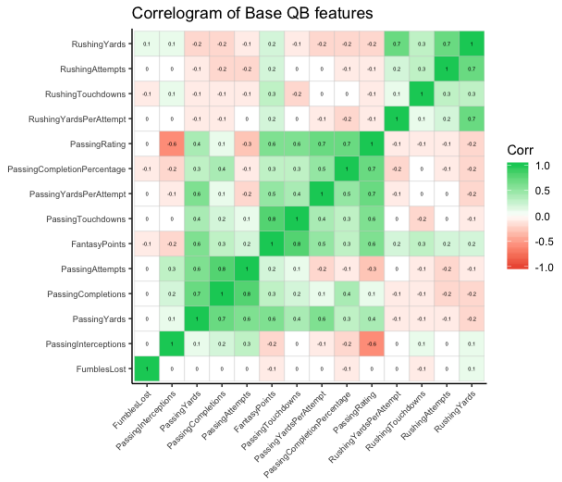
The explosion of weekly leagues over the course of the last few years has seen an already huge business get even larger. In the weekly cash leagues – each player is given a budget and drafts a completely new team every week. Each draft site uses a predictive model to set player salaries based on the number of points the model predicts that player to score. Budget constraints make it impossible to simply select the players that are predicted to score the most points – hence having a predictive model for which players will generate the best return on investment would be a huge advantage. In the following analysis we will attempt to build position specific models that can accurately predict the number of points a given NFL player is likely to score in a given week.

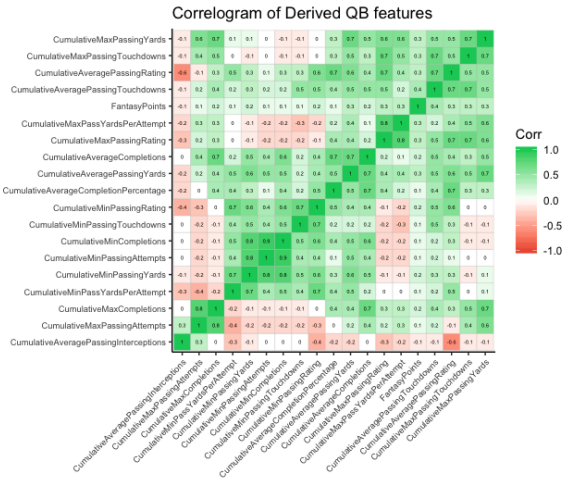
2 Data Description

The **fantasydata.com** is leading sports data company, providing real-time post games feeds across all major sports to both fantasy and other companies. For this exercise NFL data was retrived through API calls for predicting quarterback's performance in next match by estimating fantasypoints. For model building 17 weeks of data was obtained for around 56 players for season 2017. This dataset contains 453 quarterabck's observations from 17 matches and 512 observations of opponent's team. These observations contains 13 explanatory variables for quarterback and 18 derived from defensive statistics i.e. from opponent team. For the first analysis in this paper, we have focused on predicting Fantasypoints in the next match based on data available till current game. Since this is weekly data for individual player, The second analysis expands this anlalys to building time series model to forecast performance in next matches. More information on the details can be found in the analyses that follow.

3 Exploratory Analysis

Data was retrived from real-time post games feed made available by fantasydata website. Quarterback with 453 observations for about 56 players and defensive statistics with 512 observations was analyzed for missing information. Data appeared to be clean. Section 6 of Appendix-I shows data is clean, there are no missing values and therefore no data cleaning operation was required. This dataset contains statistics of weekly performance, All possible variables were examined during exploratory analysis and variables which found to have influence on fantasyPoints (Target Variable) were selected. Thirteen base predictors were found with linear relationship with FantasyPoints and 18 are derived from defensive statistics. Scatterplots of base and derived predictors have been added to section 9 of the Appendix-I. Here is the Corroleogram for base and derived predictors.





4 Objective One

4.1 Model Selection

4.1.1 Type of Selection

Of the tools made available to us in the course, we believe that LASSO estimation is the best option available to us. Subset selection discretely adds and removes variables, leaving far too much room for overfitting. While ridge regression is a great shrinkage method for many scenarios, we believe that it is at least slightly desirable for the coefficients of truly unnecessary variables to actually be zero so that some true form of variable selection is occurring. We are implicitly saying that a small set of variables are necessary to predict fantasy scores, but the nature of football, the size of our dataset, and the disproportionate amount of points that goes to touchdowns indicates that this assumptions may very well be appropriate.

4.1.2 Assumption-Checking

The LASSO model is a linear model and thus assumes that there is a linear relationship between the response and the parameters. Furthermore, it is also important that the variance of the residuals is constant across the predictors in order for our model to adequately capture the variation in the response. Because we are not interested in quantifying our uncertainty, we don't make any assumptions about the distribution of the

residuals.

Fit diagnostics are given in the set of plots represented in below plot.

4.1.2.1 Residual Plots An examination of the residual plots fitted data shows a more randomized pattern for both the regular and studentized residuals. The residual Q-Q plot shows a nice linear trend, and the residual histogram is very nearly normally distributed.

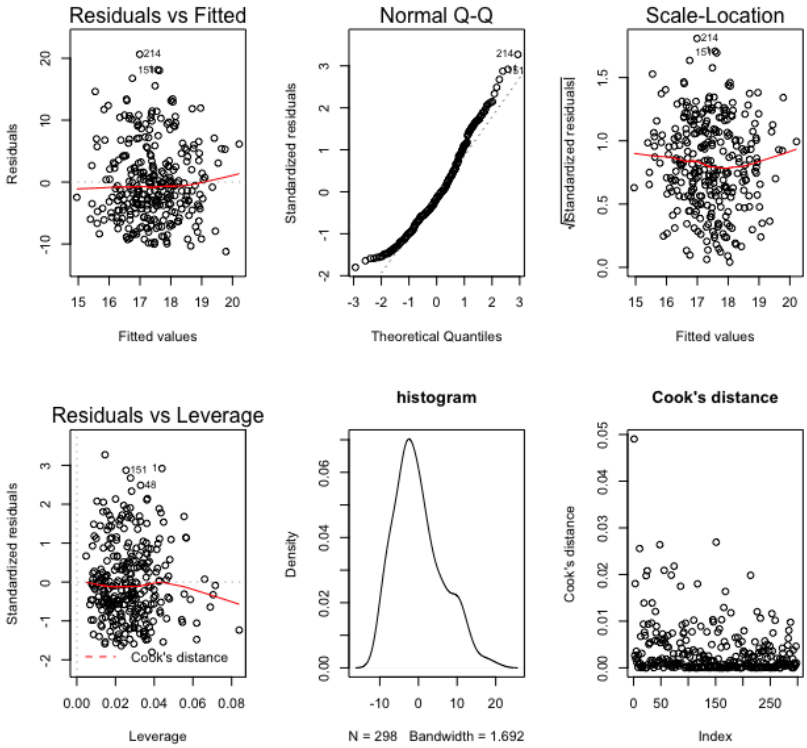
4.1.2.2 Influential point analysis only one observation stood out immediately on the Cook's D plot, so it is necessary to examine this outlier and see what is going on. Upon further inspection, the data point appears to be valid, so there is no good reason to exclude it from the analysis, and we can proceed with caution.

4.1.2.3 Linearity the FantasyPoints by 13 predictors do appear to be linear, as per scatterplots in section 9 of the appendix.

4.1.2.4 Normality As shown in the QQ plot. Residuals are normally distributed, it means FantasyPoints do appear to be linear with defensive variables AvgPassDefense and cumulative sum variables dervived from defensive statistics.

4.1.2.5 Independence for Multiple linear regression, model is used to predict performance of quarterback in the next game based on today's performance taking into consideration oppoent't performance befor playing against them. so data is assumed to be independence.

4.1.2.6 Constant Variance Residual vs fitted plot shows random cloud which indicates there is constant variance.



5 Objective Two

Appendix-I

Exploratory Data Analysis

Kevin Thompson, Sean Kennedy, Sachin Chavan

Oct 5, 2019

#1 : Load required libraries

#2 : Load Quarterback Crosssectional data

```
load("../analysis/data/.RData")
QBCrossSectional = getFootballData(URL) %>% filterUnwantedVariables() %>% filter(Position == 'QB')
summary(QBCrossSectional)
```

```
##     PlayerID         Name                Week          Position
##  Min.   :  611   Length:453         Min.   : 1.000   Length:453
##  1st Qu.: 7242   Class :character   1st Qu.: 5.000   Class :character
##  Median :13723   Mode  :character   Median : 9.000   Mode  :character
##  Mean   :11932                      Mean   : 9.049
##  3rd Qu.:16763                      3rd Qu.:13.000
##  Max.   :19029                      Max.   :17.000
##    Opponent         TeamIsHome        GameDate         PassingCompletions
##  Length:453         Mode :logical   Length:453         Min.   : 5.00
##  Class :character   FALSE:226       Class :character   1st Qu.:18.00
##  Mode  :character   TRUE :227       Mode  :character   Median :21.00
##                                                        Mean   :21.24
##                                                        3rd Qu.:25.00
##                                                        Max.   :44.00
##     Result          PassingAttempts PassingCompletionPercentage
##  Length:453         Min.   :10.00   Min.   :38.70
##  Class :character   1st Qu.:29.00   1st Qu.:57.10
##  Mode  :character   Median :33.00   Median :63.20
##                     Mean   :33.62   Mean   :63.48
##                     3rd Qu.:38.00   3rd Qu.:69.40
##                     Max.   :66.00   Max.   :87.00
##   PassingYards   PassingYardsPerAttempt PassingTouchdowns
##  Min.   : 57.0   Min.   : 3.100         Min.   :0.000
##  1st Qu.:199.0   1st Qu.: 6.200         1st Qu.:1.000
##  Median :241.0   Median : 7.200         Median :1.000
##  Mean   :244.6   Mean   : 7.378         Mean   :1.587
##  3rd Qu.:291.0   3rd Qu.: 8.400         3rd Qu.:2.000
##  Max.   :506.0   Max.   :14.100         Max.   :5.000
##  PassingInterceptions PassingRating    RushingAttempts   RushingYards
##  Min.   :0.00         Min.   : 31.14   Min.   : 0.000   Min.   :-8.00
##  1st Qu.:0.00         1st Qu.: 77.92   1st Qu.: 1.000   1st Qu.: 0.00
##  Median :0.00         Median : 92.94   Median : 3.000   Median : 8.00
##  Mean   :0.66         Mean   : 93.88   Mean   : 3.185   Mean   :14.38
##  3rd Qu.:1.00         3rd Qu.:109.84   3rd Qu.: 5.000   3rd Qu.:23.00
##  Max.   :4.00         Max.   :150.69   Max.   :14.000   Max.   :95.00
##  RushingYardsPerAttempt RushingTouchdowns  FumblesLost     FantasyPoints
##  Min.   :-2.700         Min.   :0.0000    Min.   :0.0000   Min.   : 7.12
##  1st Qu.: 0.000         1st Qu.:0.0000    1st Qu.:0.0000   1st Qu.:11.86
```

```
##  Median : 3.000         Median :0.0000    Median :0.0000   Median :15.86
##  Mean   : 3.839         Mean   :0.1457    Mean   :0.1766   Mean   :16.89
##  3rd Qu.: 6.000         3rd Qu.:0.0000    3rd Qu.:0.0000   3rd Qu.:20.68
##  Max.   :70.000         Max.   :2.0000    Max.   :3.0000   Max.   :37.64
##      Team
##  Length:453
##  Class :character
##  Mode  :character
##
##
##
```

```
attach(QBCrossSectional)
```

```
## The following object is masked from package:ggplot2:
##
##     Position
```

Drop rushing yards per attempt

#3 : Defensive stats

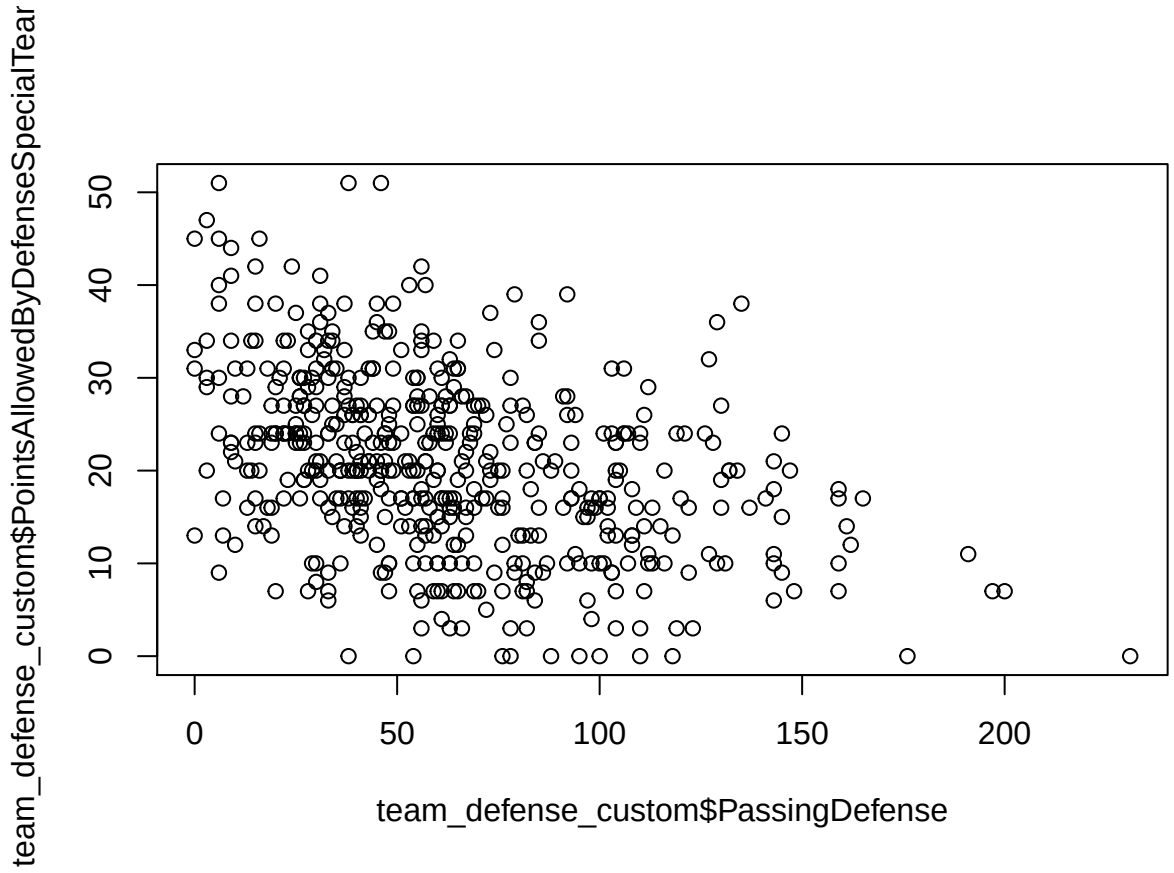
```
##  3.1 : Team Defensive Stats
```

```
team_defense = getFootballData("https://fantasydata.com/FantasyStatsNFL/FantasyStats_Read?sort=FantasyP
team_defense$StatSummary = c(NULL)

defensive_columns = c('Team', 'Week', 'TacklesForLoss', 'Sacks', 'QuarterbackHits', 'Interceptions', 'Fu


team_defense = team_defense %>% dplyr::select(defensive_columns) %>% rename('DefensiveFantasyPoints'='Fa

attach(team_defense)
```

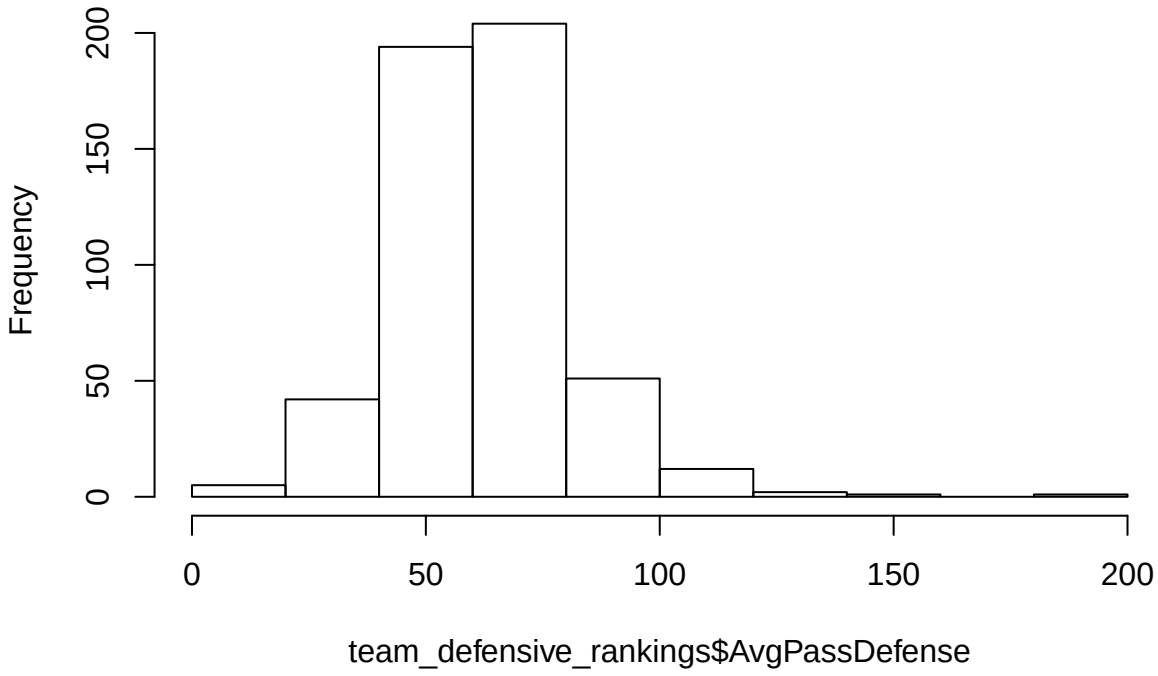
```
## The following objects are masked from QBCrossSectional:
##
##     Team, Week
```

```
## 3.5 : Add defensive matchups
```

```
#This only adds the current weeks matchup - we need next week's matchup as a target

team_defense_custom = sqldf("SELECT Team
                                    ,Week
                                    ,(Sacks * 4
                                    +QuarterbackHits * 3
                                    +Interceptions * 7
                                    +SackYards * 2) as PassingDefense
                                    ,PointsAllowedByDefenseSpecialTeams
                                    FROM team_defense")
#scheme: weight interceptions, qbsacks, quarterbackhits, passesdefended

plot(team_defense_custom$PassingDefense, team_defense_custom$PointsAllowedByDefenseSpecialTeams)
```




```
team_defensive_rankings = team_defense_custom %>%
                            #filter(Week > 1 & Week < 17)
                            group_by(Team) %>%
                            arrange(Week) %>%
                            mutate(
                              AvgPassDefense = cumsum(PassingDefense)/Week #Account for bye week....
                            )
QBCrossSectional$Week = as.numeric(QBCrossSectional$Week)

hist(team_defensive_rankings$AvgPassDefense)
```




```
sqldf("SELECT * FROM team_defensive_rankings WHERE Team = 'LAC'")
```

```
##    Team Week PassingDefense PointsAllowedByDefenseSpecialTeams
## 1   LAC    1            126                                  24
## 2   LAC    2             27                                  19
## 3   LAC    3            101                                  24
## 4   LAC    4             29                                  26
## 5   LAC    5            132                                  20
## 6   LAC    6             33                                  16
## 7   LAC    7             95                                   0
## 8   LAC    8             59                                  19
## 9   LAC   10             76                                  20
## 10  LAC   11             62                                  24
## 11  LAC   12             56                                   6
## 12  LAC   13             63                                  10
## 13  LAC   14             60                                   7
## 14  LAC   15             26                                  30
## 15  LAC   16             76                                   7
## 16  LAC   17             54                                  10
##    AvgPassDefense
## 1       126.00000
## 2        76.50000
## 3        84.66667
## 4        70.75000
## 5        83.00000
## 6        74.66667
## 7        77.57143
## 8        75.25000
## 9        67.80000
## 10       67.27273
```

```
## 11       66.33333
## 12       66.07692
## 13       65.64286
## 14       63.00000
## 15       63.81250
## 16       63.23529
```

3.6 : Add some lag data for QB

CumulativeVariables (these should definitley be combined into a weekly ranking)

```
QBCrossSectionalCumulativePassYards = QBCrossSectional %>% group_by(PlayerID)%>% filter(n() >= 8) %>% a
   mutate(CumulativeAveragePassingYards=cummean(PassingYards)
         , CumulativeAveragePassingTouchdowns=cummean(PassingTouchdowns)
         , CumulativeAveragePassingInterceptions=cummean(PassingInterceptions)
         , CumulativeAveragePassingRating=cummean(PassingRating)
         , CumulativeAverageCompletions = cummean(PassingCompletions) # not sure that completions matter
         , CumulativeAverageCompletionPercentage = cummean(PassingCompletionPercentage)
         , CumulativeMaxPassingTouchdowns = cummax(PassingTouchdowns)
         , CumulativeMaxPassingYards = cummax(PassingYards)
         , CumulativeMaxPassingAttempts = cummax(PassingAttempts)
         , CumulativeMaxPassingRating = cummax(PassingRating)
         , CumulativeMaxCompletions = cummax(PassingCompletions)
         , CumulativeMaxPassYardsPerAttempt = cummax(PassingYardsPerAttempt)
         , CumulativeMinPassingTouchdowns = cummin(PassingTouchdowns)
         , CumulativeMinPassingYards = cummin(PassingYards)   #Let's get mins to capture downside risk
         , CumulativeMinPassingAttempts = cummin(PassingAttempts)
         , CumulativeMinPassingRating = cummin(PassingRating)
         , CumulativeMinCompletions = cummin(PassingCompletions)
         , CumulativeMinPassYardsPerAttempt = cummin(PassingYardsPerAttempt)
         , NextWeekFantasyPoints = lead(FantasyPoints) #Target Variable
         , NextOpponent = lead(Opponent)
         #, NextWeekDefensiveMatchup = lag(WeeklyRank) #Has to be last week's team ranking - not this we
     )


QBCrossSectionalDefensiveOverlayCumulativePassYards = QBCrossSectionalCumulativePassYards %>% left_join

#QBCrossSectionalDefensiveOverlayCumulativePassYards %>% filter(PlayerID == 6739) %>% write.csv('alex_s
attach(QBCrossSectionalDefensiveOverlayCumulativePassYards)
```

```
## The following objects are masked from team_defense:
##
##     PointsAllowedByDefenseSpecialTeams, Team, Week
```

```
## The following objects are masked from QBCrossSectional:
##
##     FantasyPoints, FumblesLost, GameDate, Name, Opponent,
##     PassingAttempts, PassingCompletionPercentage,
##     PassingCompletions, PassingInterceptions, PassingRating,
##     PassingTouchdowns, PassingYards, PassingYardsPerAttempt,
##     PlayerID, Position, Result, RushingAttempts,
##     RushingTouchdowns, RushingYards, RushingYardsPerAttempt, Team,
##     TeamIsHome, Week
```

```
## The following object is masked from package:ggplot2:
```

```
##
##     Position
```

```
summary(QBCrossSectionalDefensiveOverlayCumulativePassYards)
```

```
##     PlayerID         Name                Week          Position
##  Min.   :  611   Length:368         Min.   : 1.000   Length:368
##  1st Qu.: 6739   Class :character   1st Qu.: 4.000   Class :character
##  Median :13320   Mode  :character   Median : 9.000   Mode  :character
##  Mean   :11765                      Mean   : 8.924
##  3rd Qu.:16763                      3rd Qu.:13.000
##  Max.   :18868                      Max.   :17.000
##
##    Opponent         TeamIsHome        GameDate         PassingCompletions
##  Length:368         Mode :logical   Length:368         Min.   : 6.00
##  Class :character   FALSE:184       Class :character   1st Qu.:18.00
##  Mode  :character   TRUE :184       Mode  :character   Median :21.00
##                                                        Mean   :21.39
##                                                        3rd Qu.:25.00
##                                                        Max.   :44.00
##
##     Result           PassingAttempts PassingCompletionPercentage
##  Length:368         Min.   :10.00   Min.   :39.30
##  Class :character   1st Qu.:29.00   1st Qu.:57.40
##  Mode  :character   Median :33.00   Median :63.75
##                     Mean   :33.56   Mean   :63.99
##                     3rd Qu.:38.00   3rd Qu.:70.00
##                     Max.   :66.00   Max.   :87.00
##
##   PassingYards   PassingYardsPerAttempt PassingTouchdowns
##  Min.   : 69.0   Min.   : 3.100         Min.   :0.000
##  1st Qu.:202.8   1st Qu.: 6.300         1st Qu.:1.000
##  Median :242.0   Median : 7.300         Median :1.500
##  Mean   :246.8   Mean   : 7.442         Mean   :1.617
##  3rd Qu.:292.2   3rd Qu.: 8.400         3rd Qu.:2.000
##  Max.   :506.0   Max.   :14.100         Max.   :5.000
##
##  PassingInterceptions PassingRating    RushingAttempts   RushingYards
##  Min.   :0.0000       Min.   : 31.14   Min.   : 0.000   Min.   :-8.00
##  1st Qu.:0.0000       1st Qu.: 79.29   1st Qu.: 1.000   1st Qu.: 0.00
##  Median :0.0000       Median : 94.94   Median : 3.000   Median : 8.00
##  Mean   :0.6114       Mean   : 95.45   Mean   : 3.258   Mean   :14.55
##  3rd Qu.:1.0000       3rd Qu.:110.83   3rd Qu.: 5.000   3rd Qu.:24.00
##  Max.   :4.0000       Max.   :150.69   Max.   :14.000   Max.   :95.00
##
##  RushingYardsPerAttempt RushingTouchdowns  FumblesLost     FantasyPoints
##  Min.   :-2.700         Min.   :0.0000    Min.   :0.0000   Min.   : 7.32
##  1st Qu.: 0.000         1st Qu.:0.0000    1st Qu.:0.0000   1st Qu.:12.61
##  Median : 3.000         Median :0.0000    Median :0.0000   Median :16.16
##  Mean   : 3.818         Mean   :0.1495    Mean   :0.1793   Mean   :17.22
##  3rd Qu.: 6.050         3rd Qu.:0.0000    3rd Qu.:0.0000   3rd Qu.:20.70
##  Max.   :70.000         Max.   :2.0000    Max.   :3.0000   Max.   :37.64
##
##      Team           CumulativeAveragePassingYards
##  Length:368         Min.   :120.5
```

```
##  Class :character   1st Qu.:221.9
##  Mode  :character   Median :247.8
##                     Mean   :246.6
##                     3rd Qu.:271.5
##                     Max.   :369.0
##
##  CumulativeAveragePassingTouchdowns CumulativeAveragePassingInterceptions
##  Min.   :0.000                      Min.   :0.0000
##  1st Qu.:1.250                      1st Qu.:0.4125
##  Median :1.667                      Median :0.5714
##  Mean   :1.584                      Mean   :0.5933
##  3rd Qu.:2.000                      3rd Qu.:0.7500
##  Max.   :4.000                      Max.   :2.0000
##
##  CumulativeAveragePassingRating CumulativeAverageCompletions
##  Min.   : 56.25                 Min.   :10.00
##  1st Qu.: 87.77                 1st Qu.:19.56
##  Median : 97.01                 Median :21.85
##  Mean   : 95.86                 Mean   :21.43
##  3rd Qu.:102.53                 3rd Qu.:23.13
##  Max.   :148.57                 Max.   :29.00
##
##  CumulativeAverageCompletionPercentage CumulativeMaxPassingTouchdowns
##  Min.   :44.40                         Min.   :0.00
##  1st Qu.:61.60                         1st Qu.:2.00
##  Median :64.13                         Median :3.00
##  Mean   :64.42                         Mean   :2.91
##  3rd Qu.:67.37                         3rd Qu.:4.00
##  Max.   :80.00                         Max.   :5.00
##
##  CumulativeMaxPassingYards CumulativeMaxPassingAttempts
##  Min.   :125.0             Min.   :21.00
##  1st Qu.:288.0             1st Qu.:39.00
##  Median :332.0             Median :44.00
##  Mean   :331.3             Mean   :43.31
##  3rd Qu.:368.0             3rd Qu.:49.00
##  Max.   :506.0             Max.   :66.00
##
##  CumulativeMaxPassingRating CumulativeMaxCompletions
##  Min.   : 56.25              Min.   :11.00
##  1st Qu.:110.80              1st Qu.:25.00
##  Median :125.96              Median :28.00
##  Mean   :123.69              Mean   :27.42
##  3rd Qu.:141.79              3rd Qu.:30.00
##  Max.   :150.69              Max.   :44.00
##
##  CumulativeMaxPassYardsPerAttempt CumulativeMinPassingTouchdowns
##  Min.   : 4.800                   Min.   :0.0000
##  1st Qu.: 8.500                   1st Qu.:0.0000
##  Median :10.500                   Median :0.0000
##  Mean   : 9.859                   Mean   :0.4647
##  3rd Qu.:10.900                   3rd Qu.:1.0000
##  Max.   :14.100                   Max.   :4.0000
##
```

```
##  CumulativeMinPassingYards CumulativeMinPassingAttempts
##  Min.   : 69.0             Min.   :10.00
##  1st Qu.:128.0             1st Qu.:21.00
##  Median :158.0             Median :24.00
##  Mean   :168.1             Mean   :24.13
##  3rd Qu.:204.0             3rd Qu.:27.00
##  Max.   :369.0             Max.   :41.00
##
##  CumulativeMinPassingRating CumulativeMinCompletions
##  Min.   : 31.14             Min.   : 6.00
##  1st Qu.: 59.66             1st Qu.:12.00
##  Median : 68.58             Median :14.00
##  Mean   : 69.27             Mean   :14.91
##  3rd Qu.: 77.92             3rd Qu.:17.00
##  Max.   :148.57             Max.   :29.00
##
##  CumulativeMinPassYardsPerAttempt NextWeekFantasyPoints NextOpponent
##  Min.   : 3.100                   Min.   : 7.32         Length:368
##  1st Qu.: 4.800                   1st Qu.:12.79         Class :character
##  Median : 5.800                   Median :16.23         Mode  :character
##  Mean   : 5.704                   Mean   :17.33
##  3rd Qu.: 6.200                   3rd Qu.:20.91
##  Max.   :11.200                   Max.   :37.64
##                                   NA's   :28
##  PassingDefense   PointsAllowedByDefenseSpecialTeams AvgPassDefense
##  Min.   :  0.00   Min.   : 0.00                     Min.   : 13.00
##  1st Qu.: 30.00   1st Qu.:16.00                     1st Qu.: 46.22
##  Median : 54.00   Median :21.00                     Median : 60.17
##  Mean   : 56.76   Mean   :21.48                     Mean   : 59.85
##  3rd Qu.: 76.00   3rd Qu.:27.00                     3rd Qu.: 69.40
##  Max.   :200.00   Max.   :51.00                     Max.   :200.00
##  NA's   :51       NA's   :51                        NA's   :51
```

3.7 : Create indepenent structure for EDA from QBCrossSectional Data

```
eda_base <- QBCrossSectional %>% group_by(Week) %>%
                        select(Week,
                               FantasyPoints,
                               PassingCompletions,
                               PassingAttempts,
                               PassingCompletionPercentage,
                               PassingYards,
                               PassingYardsPerAttempt,
                               PassingTouchdowns,
                               PassingInterceptions,
                               PassingRating,
                               RushingAttempts,
                               RushingYards,
                               RushingYardsPerAttempt,
                               RushingTouchdowns,
                               FumblesLost
                               )

eda_base$Week <- as.factor(eda_base$Week)
```

```
 ## 3.8 : Create indepenent structure for derived features for EDA
          from QBCrossSectionalDefensiveOverlayCumulativePassYards Data
```

```
eda_derived <- QBCrossSectionalDefensiveOverlayCumulativePassYards %>% group_by(Week)%>%
               select(Week,
                      FantasyPoints,
                      CumulativeAveragePassingYards,
                      CumulativeAveragePassingTouchdowns,
                      CumulativeAveragePassingInterceptions,
                      CumulativeAveragePassingRating,
                      CumulativeAverageCompletions,
                      CumulativeAverageCompletionPercentage,
                      CumulativeMaxPassingTouchdowns,
                      CumulativeMaxPassingYards,
                      CumulativeMaxPassingAttempts,
                      CumulativeMaxPassingRating,
                      CumulativeMaxCompletions,
                      CumulativeMaxPassYardsPerAttempt,
                      CumulativeMinPassingTouchdowns,
                      CumulativeMinPassingYards,
                      CumulativeMinPassingAttempts,
                      CumulativeMinPassingRating,
                      CumulativeMinCompletions,
                      CumulativeMinPassYardsPerAttempt)
eda_derived$Week <- as.factor(eda_derived$Week)
```

4 : Structures QBCrossSectional (Quarterbacks)

```
summary(QBCrossSectional)
```

```
##     PlayerID         Name                Week          Position
##  Min.   :  611   Length:453         Min.   : 1.000   Length:453
##  1st Qu.: 7242   Class :character   1st Qu.: 5.000   Class :character
##  Median :13723   Mode  :character   Median : 9.000   Mode  :character
##  Mean   :11932                      Mean   : 9.049
##  3rd Qu.:16763                      3rd Qu.:13.000
##  Max.   :19029                      Max.   :17.000
##    Opponent         TeamIsHome        GameDate         PassingCompletions
##  Length:453         Mode :logical   Length:453         Min.   : 5.00
##  Class :character   FALSE:226       Class :character   1st Qu.:18.00
##  Mode  :character   TRUE :227       Mode  :character   Median :21.00
##                                                        Mean   :21.24
##                                                        3rd Qu.:25.00
##                                                        Max.   :44.00
##     Result          PassingAttempts PassingCompletionPercentage
##  Length:453         Min.   :10.00   Min.   :38.70
##  Class :character   1st Qu.:29.00   1st Qu.:57.10
##  Mode  :character   Median :33.00   Median :63.20
##                     Mean   :33.62   Mean   :63.48
##                     3rd Qu.:38.00   3rd Qu.:69.40
##                     Max.   :66.00   Max.   :87.00
##   PassingYards   PassingYardsPerAttempt PassingTouchdowns
##  Min.   : 57.0   Min.   : 3.100         Min.   :0.000
```

```
##  1st Qu.:199.0   1st Qu.: 6.200         1st Qu.:1.000
##  Median :241.0   Median : 7.200         Median :1.000
##  Mean   :244.6   Mean   : 7.378         Mean   :1.587
##  3rd Qu.:291.0   3rd Qu.: 8.400         3rd Qu.:2.000
##  Max.   :506.0   Max.   :14.100         Max.   :5.000
##  PassingInterceptions PassingRating    RushingAttempts   RushingYards
##  Min.   :0.00         Min.   : 31.14   Min.   : 0.000   Min.   :-8.00
##  1st Qu.:0.00         1st Qu.: 77.92   1st Qu.: 1.000   1st Qu.: 0.00
##  Median :0.00         Median : 92.94   Median : 3.000   Median : 8.00
##  Mean   :0.66         Mean   : 93.88   Mean   : 3.185   Mean   :14.38
##  3rd Qu.:1.00         3rd Qu.:109.84   3rd Qu.: 5.000   3rd Qu.:23.00
##  Max.   :4.00         Max.   :150.69   Max.   :14.000   Max.   :95.00
##  RushingYardsPerAttempt RushingTouchdowns  FumblesLost     FantasyPoints
##  Min.   :-2.700         Min.   :0.0000    Min.   :0.0000   Min.   : 7.12
##  1st Qu.: 0.000         1st Qu.:0.0000    1st Qu.:0.0000   1st Qu.:11.86
##  Median : 3.000         Median :0.0000    Median :0.0000   Median :15.86
##  Mean   : 3.839         Mean   :0.1457    Mean   :0.1766   Mean   :16.89
##  3rd Qu.: 6.000         3rd Qu.:0.0000    3rd Qu.:0.0000   3rd Qu.:20.68
##  Max.   :70.000         Max.   :2.0000    Max.   :3.0000   Max.   :37.64
##      Team
##  Length:453
##  Class :character
##  Mode  :character
##
##
##
```

5 : struture with Derived features

```
summary(eda_derived)
```

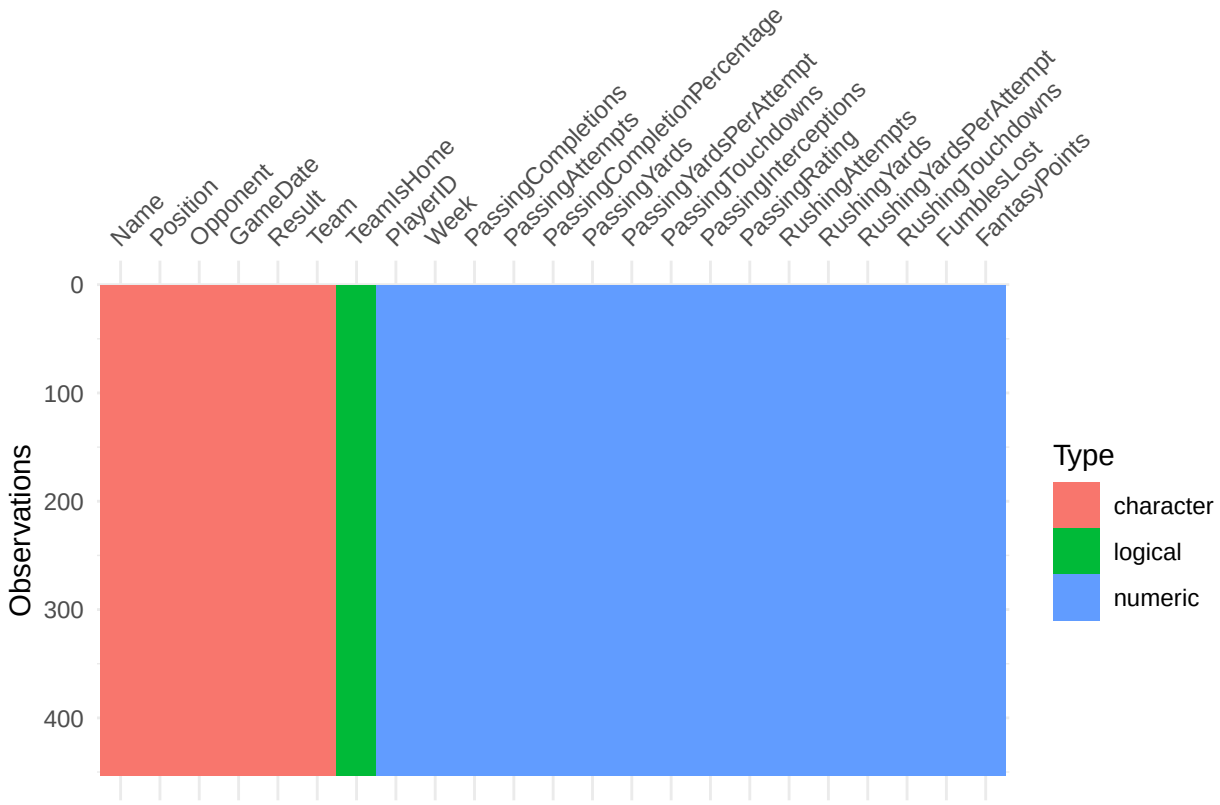
```
##       Week     FantasyPoints   CumulativeAveragePassingYards
##  2      : 25   Min.   : 7.32   Min.   :120.5
##  3      : 24   1st Qu.:12.61   1st Qu.:221.9
##  4      : 24   Median :16.16   Median :247.8
##  13     : 24   Mean   :17.22   Mean   :246.6
##  14     : 24   3rd Qu.:20.70   3rd Qu.:271.5
##  7      : 23   Max.   :37.64   Max.   :369.0
##  (Other):224
##  CumulativeAveragePassingTouchdowns CumulativeAveragePassingInterceptions
##  Min.   :0.000                      Min.   :0.0000
##  1st Qu.:1.250                      1st Qu.:0.4125
##  Median :1.667                      Median :0.5714
##  Mean   :1.584                      Mean   :0.5933
##  3rd Qu.:2.000                      3rd Qu.:0.7500
##  Max.   :4.000                      Max.   :2.0000
##
##  CumulativeAveragePassingRating CumulativeAverageCompletions
##  Min.   : 56.25                 Min.   :10.00
##  1st Qu.: 87.77                 1st Qu.:19.56
##  Median : 97.01                 Median :21.85
##  Mean   : 95.86                 Mean   :21.43
##  3rd Qu.:102.53                 3rd Qu.:23.13
```

```
##  Max.   :148.57                Max.   :29.00
##
##  CumulativeAverageCompletionPercentage CumulativeMaxPassingTouchdowns
##  Min.   :44.40                         Min.   :0.00
##  1st Qu.:61.60                         1st Qu.:2.00
##  Median :64.13                         Median :3.00
##  Mean   :64.42                         Mean   :2.91
##  3rd Qu.:67.37                         3rd Qu.:4.00
##  Max.   :80.00                         Max.   :5.00
##
##  CumulativeMaxPassingYards CumulativeMaxPassingAttempts
##  Min.   :125.0             Min.   :21.00
##  1st Qu.:288.0             1st Qu.:39.00
##  Median :332.0             Median :44.00
##  Mean   :331.3             Mean   :43.31
##  3rd Qu.:368.0             3rd Qu.:49.00
##  Max.   :506.0             Max.   :66.00
##
##  CumulativeMaxPassingRating CumulativeMaxCompletions
##  Min.   : 56.25             Min.   :11.00
##  1st Qu.:110.80             1st Qu.:25.00
##  Median :125.96             Median :28.00
##  Mean   :123.69             Mean   :27.42
##  3rd Qu.:141.79             3rd Qu.:30.00
##  Max.   :150.69             Max.   :44.00
##
##  CumulativeMaxPassYardsPerAttempt CumulativeMinPassingTouchdowns
##  Min.   : 4.800                   Min.   :0.0000
##  1st Qu.: 8.500                   1st Qu.:0.0000
##  Median :10.500                   Median :0.0000
##  Mean   : 9.859                   Mean   :0.4647
##  3rd Qu.:10.900                   3rd Qu.:1.0000
##  Max.   :14.100                   Max.   :4.0000
##
##  CumulativeMinPassingYards CumulativeMinPassingAttempts
##  Min.   : 69.0             Min.   :10.00
##  1st Qu.:128.0             1st Qu.:21.00
##  Median :158.0             Median :24.00
##  Mean   :168.1             Mean   :24.13
##  3rd Qu.:204.0             3rd Qu.:27.00
##  Max.   :369.0             Max.   :41.00
##
##  CumulativeMinPassingRating CumulativeMinCompletions
##  Min.   : 31.14             Min.   : 6.00
##  1st Qu.: 59.66             1st Qu.:12.00
##  Median : 68.58             Median :14.00
##  Mean   : 69.27             Mean   :14.91
##  3rd Qu.: 77.92             3rd Qu.:17.00
##  Max.   :148.57             Max.   :29.00
##
##  CumulativeMinPassYardsPerAttempt
##  Min.   : 3.100
##  1st Qu.: 4.800
##  Median : 5.800
```

```
##  Mean   : 5.704
##  3rd Qu.: 6.200
##  Max.   :11.200
##
```

6 : QBCrossSectional - Check Missing Data

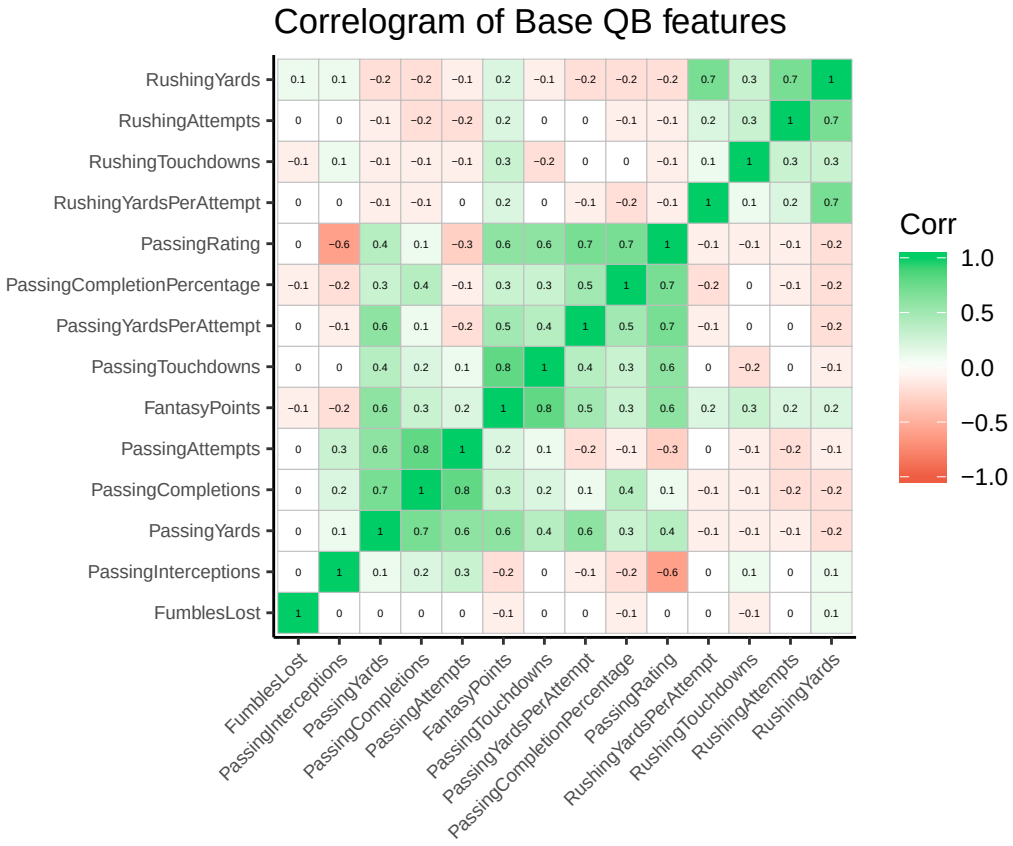
```
vis_dat(QBCrossSectional)
```



7 : Corrrelogram

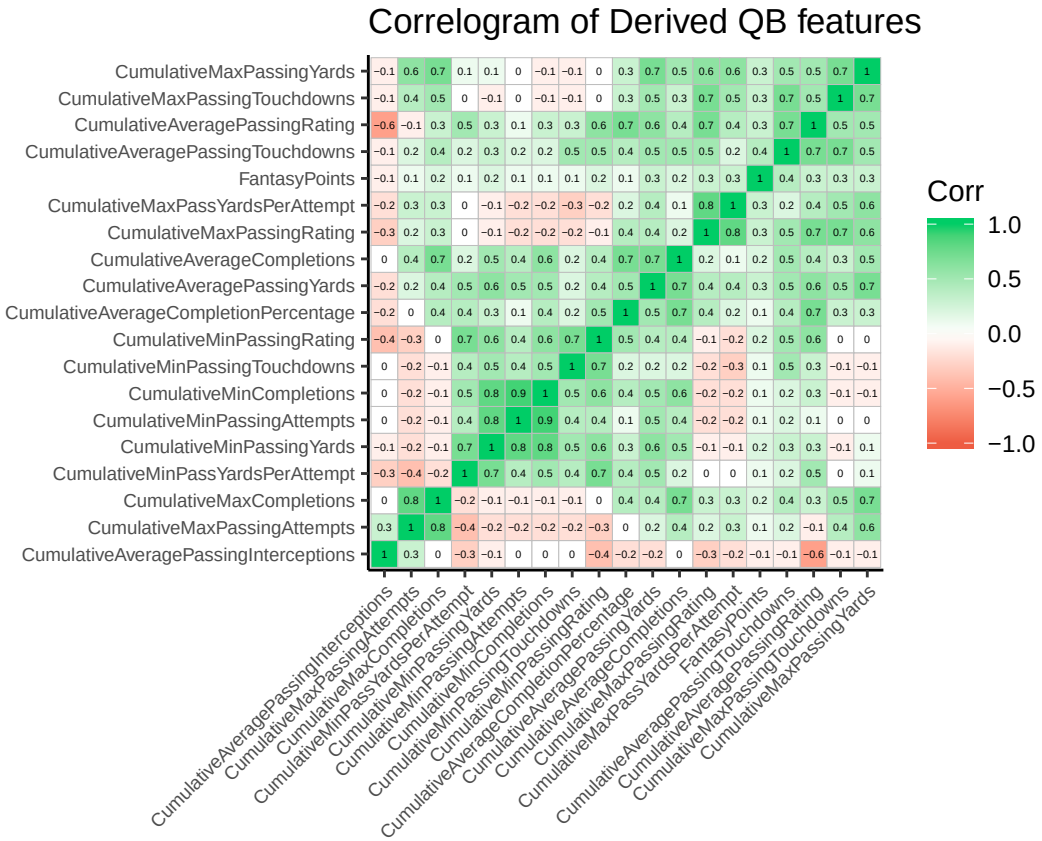
```
## 7.1 : Base Feature Set
```

```
corr <- round(cor(eda_base[-1]), 1)

ggcorrplot(corr, hc.order = TRUE,
           type = "full",
           lab = TRUE,
           lab_size = 1.5,
           method="square",
           colors = c("tomato2", "white", "springgreen3"),
           title  ="Correlogram of Base QB features",
           tl.cex = 7,pch=2,pch.col =3,show.diag = T,
           ggtheme=theme_classic)
```



7.2 : Derived Feature Set

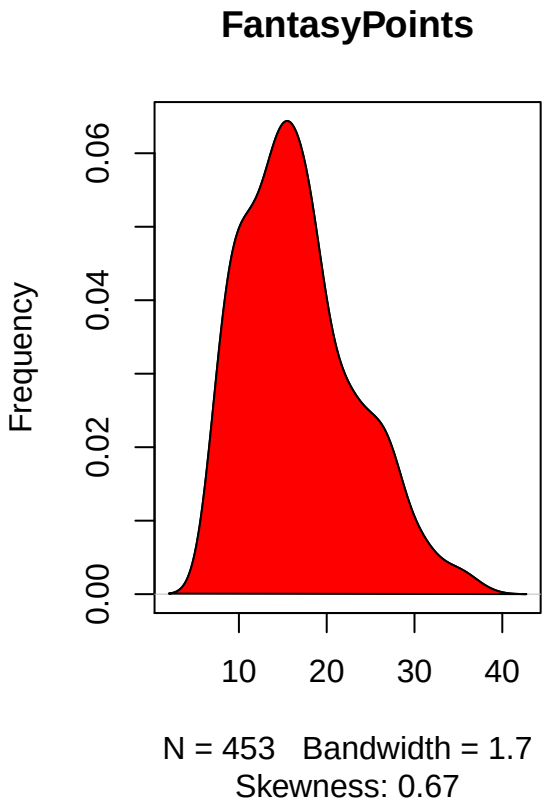
```
corr <- round(cor(eda_derived[-1]), 1)

ggcorrplot(corr, hc.order = TRUE,
           type = "full",
           lab = TRUE,
           lab_size = 1.5,
           method="square",
           colors = c("tomato2", "white", "springgreen3"),
           title  = "Correlogram of Derived QB features",
           tl.cex = 7,pch=2,pch.col =3,show.diag = T,
           ggtheme=theme_classic)
```



8 : Distributions

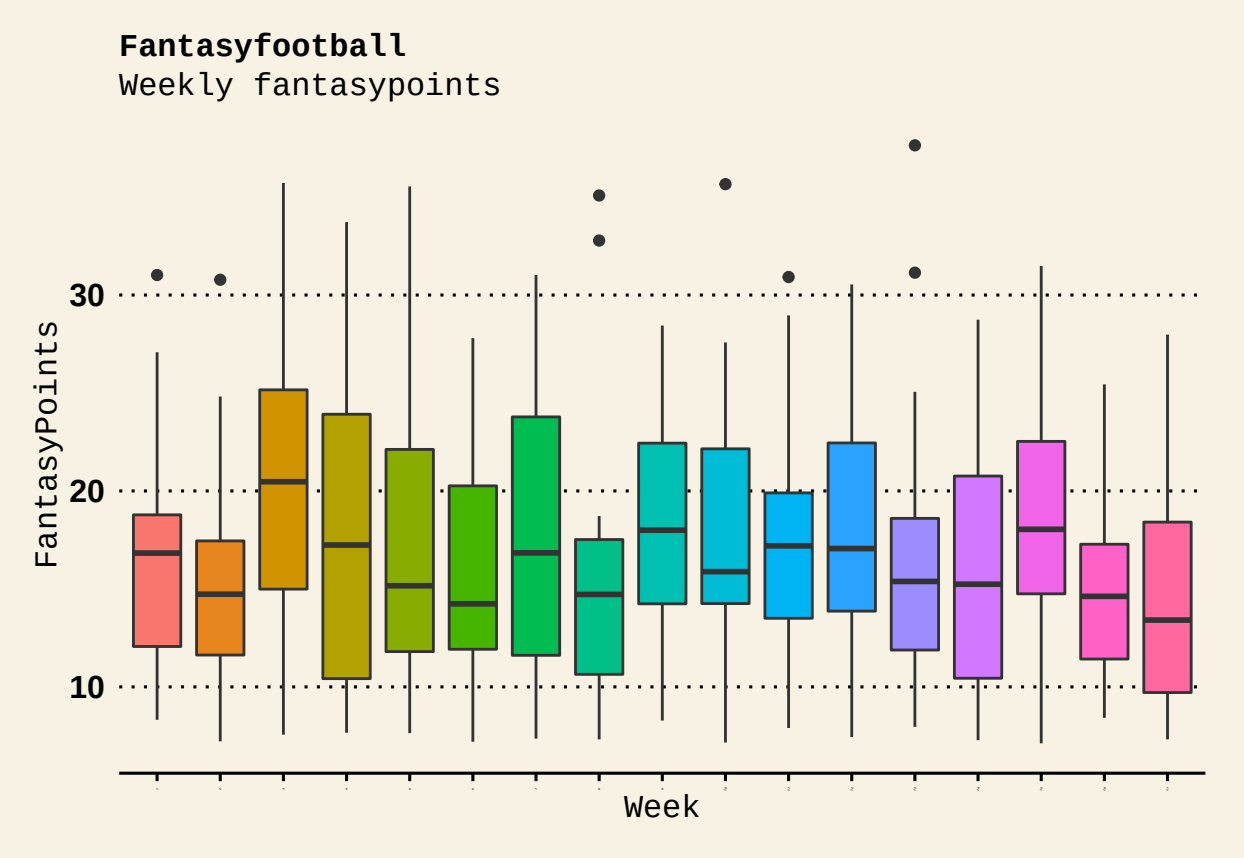
```
## 8.1 Density plot for Fantasypoints is approxmiately Normal
```

```
par(mfrow=c(1, 2))  # divide graph area in 2 columns
target <- QBCrossSectional$FantasyPoints
plot(density(target), main="FantasyPoints", ylab="Frequency", sub=paste("Skewness:", round(e1071::skewn
polygon(density(target), col="red")
```

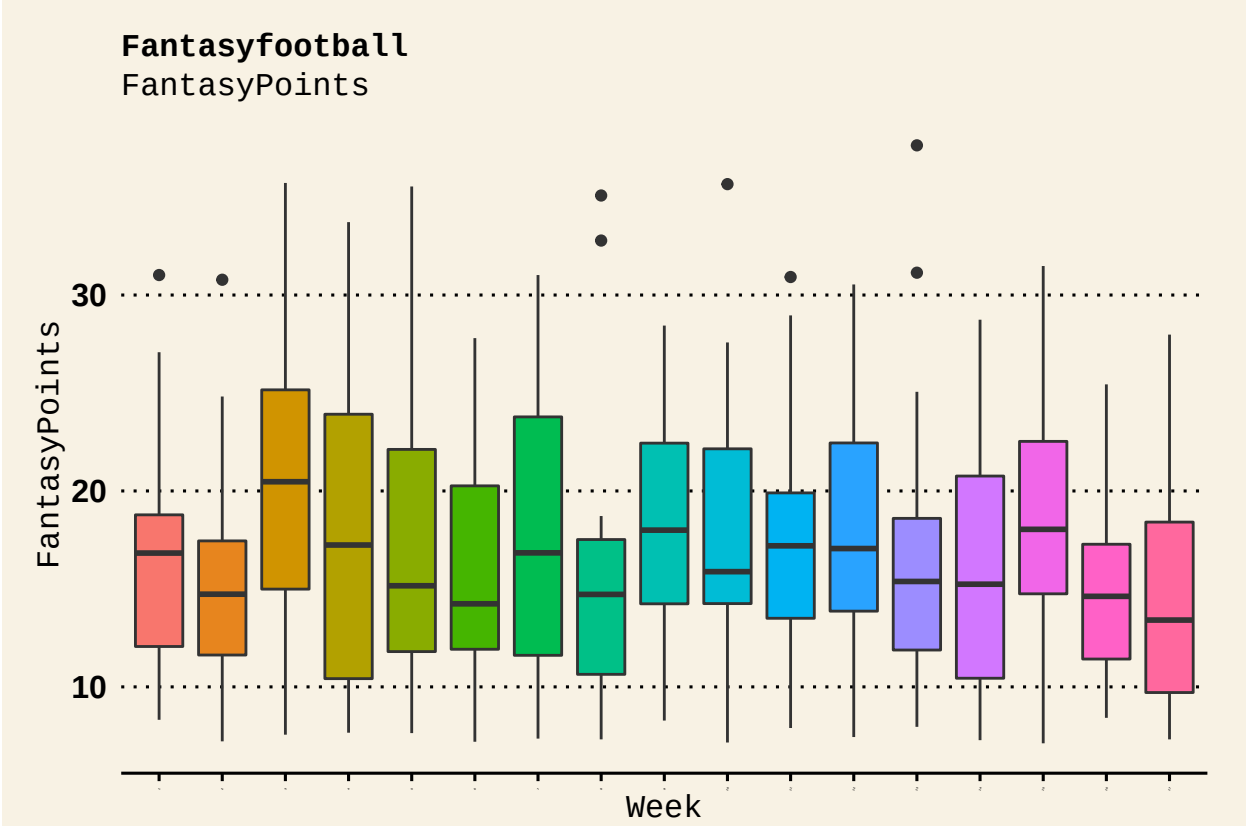


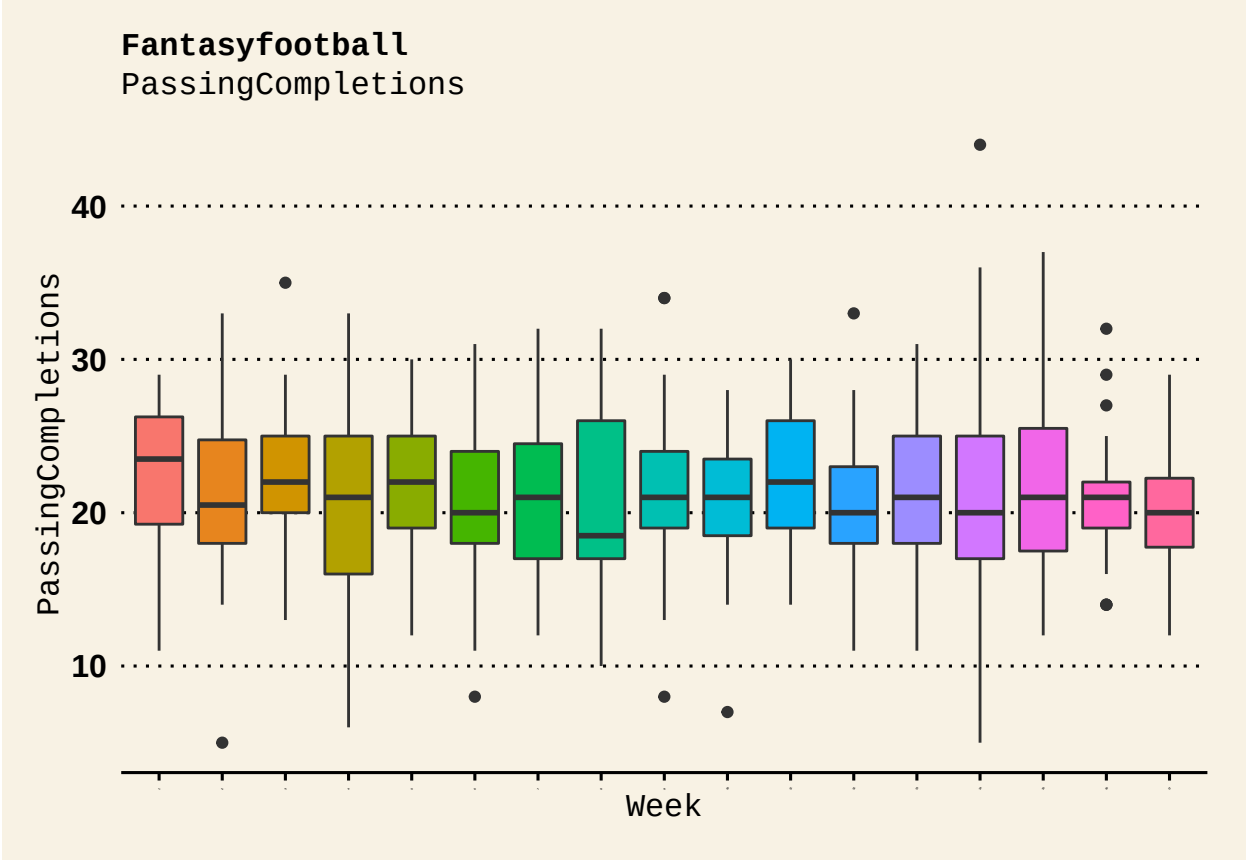

```
# 8.2 : Boxplots - Target and Individual Predictor Bevavior for per Team

## 8.2.1 Base Feature set
```

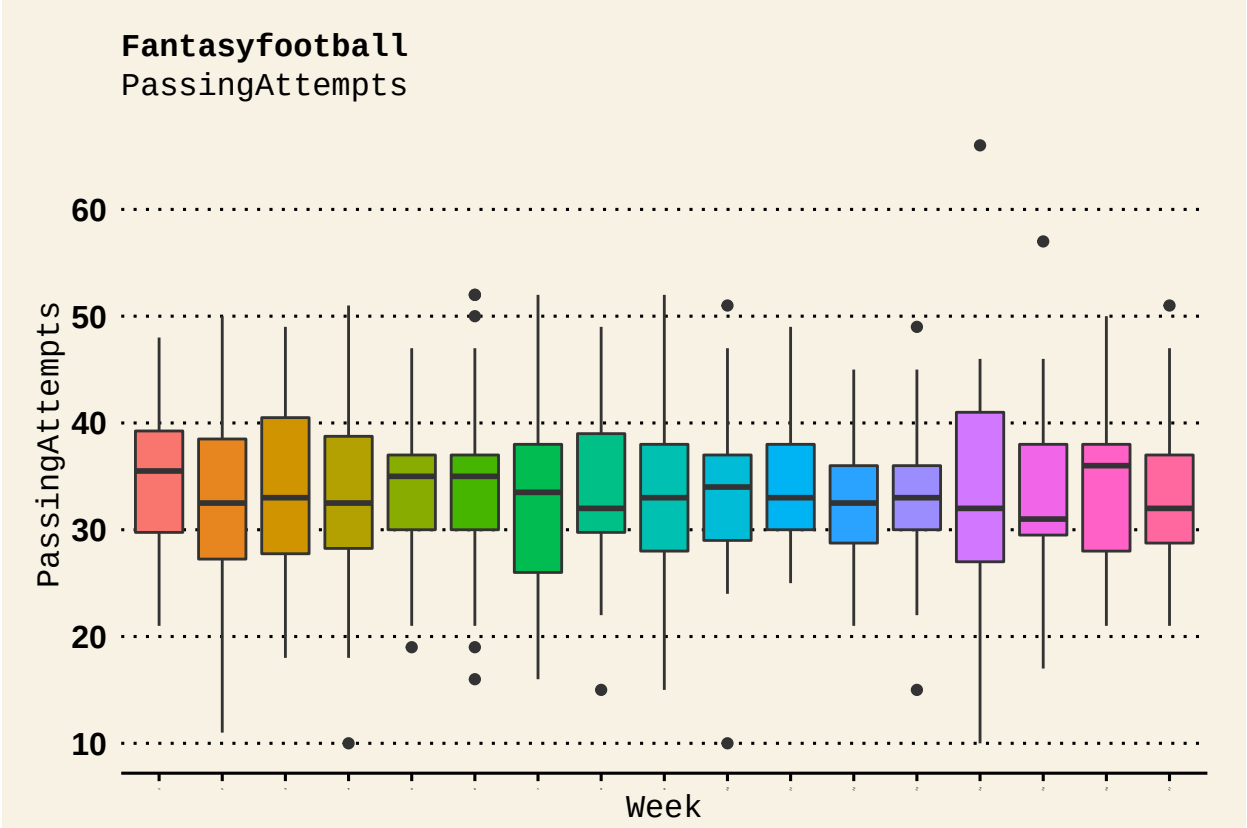
```
eda_base %>% ggplot(aes(y=FantasyPoints,x=Week,fill=Week,group=Week))+
                     geom_boxplot(show.legend = FALSE)+
                     xlab("Week")+ylab("FantasyPoints")+
                     labs(title="Fantasyfootball",
                     subtitle="Weekly fantasypoints",
                     aption="Source: Fantasyfootball")+
                     theme_wsj()+
                     theme(plot.title    = element_text(size = rel(0.5)),
                           plot.subtitle = element_text(size = rel(0.5)),
                           axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                           axis.title    = element_text(size = rel(0.5)),
                           legend.position  = "right",
                           legend.direction ="vertical",
                           legend.title = element_text(size = rel(0.5)))
```

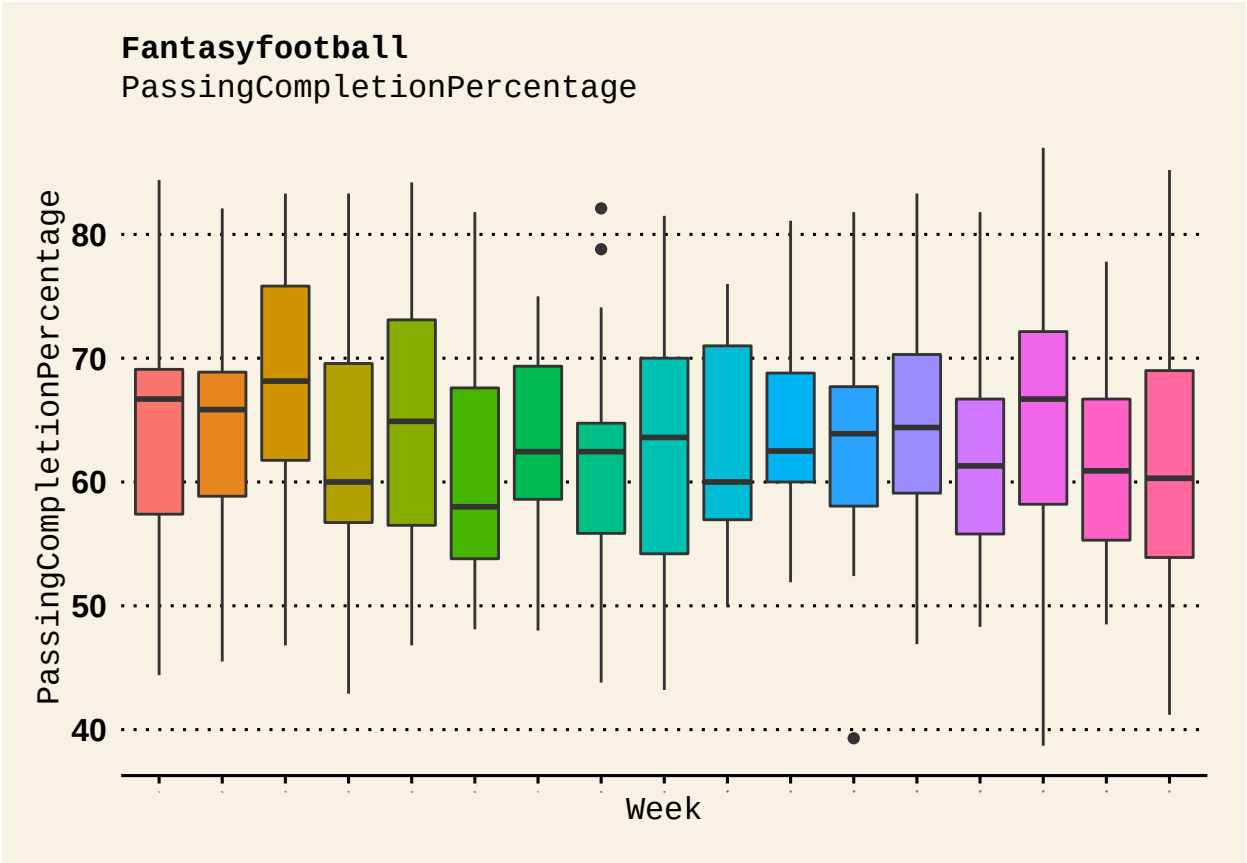


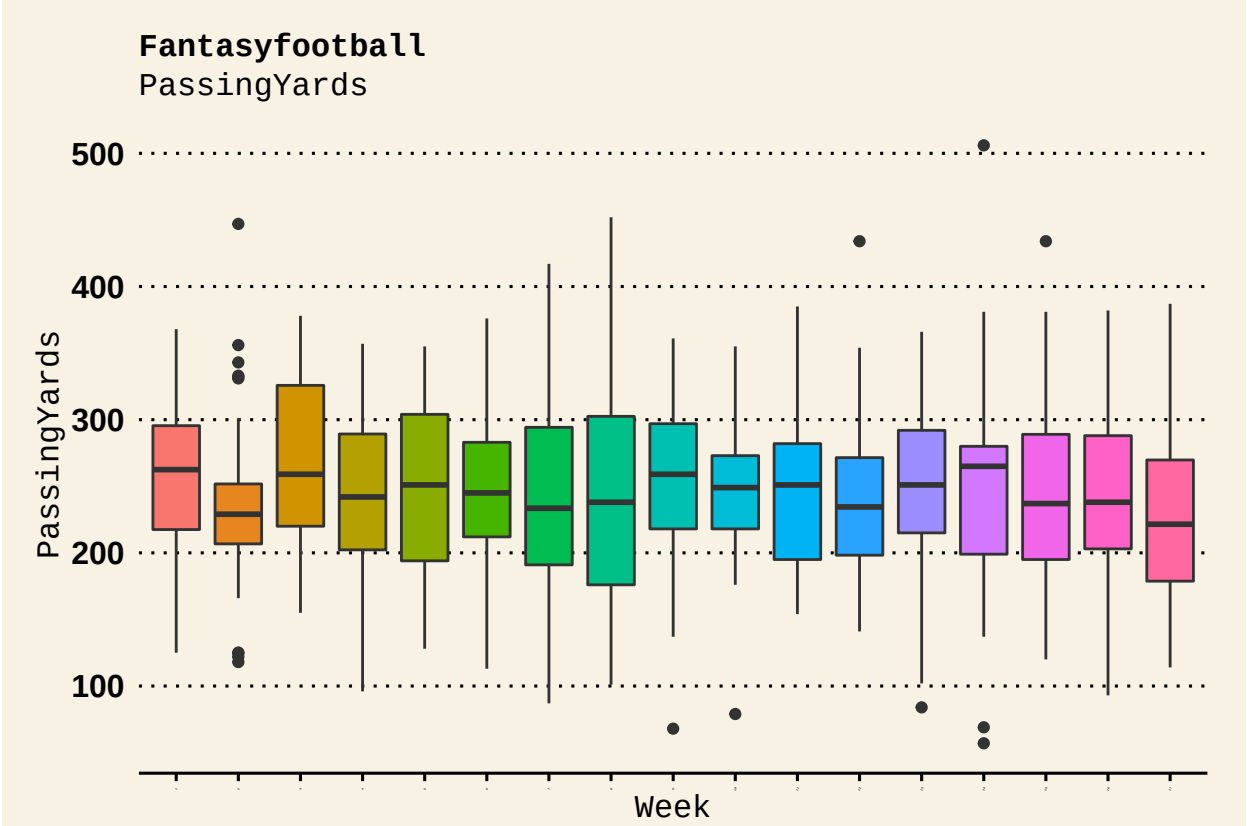

```
for (i in 2:15) {

ggplotp <- eda_base %>%
           ggplot(aes_string(y=names(eda_base[i]),x="Week",fill="Week",group="Week"))+
           geom_boxplot(show.legend = FALSE)+
           xlab("Week")+ylab(names(eda_base[i]))+
           labs(title="Fantasyfootball",
           subtitle=names(eda_base[i]),
           aption="Source: Fantasyfootball")+
           theme_wsj()+
           theme(plot.title    = element_text(size = rel(0.5)),
                 plot.subtitle = element_text(size = rel(0.5)),
                 axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                 axis.title    = element_text(size = rel(0.5)),
                 legend.position  = "right",
                 legend.direction ="vertical",
                 legend.title = element_text(size = rel(0.5)))


  print(ggplotp)
}
```

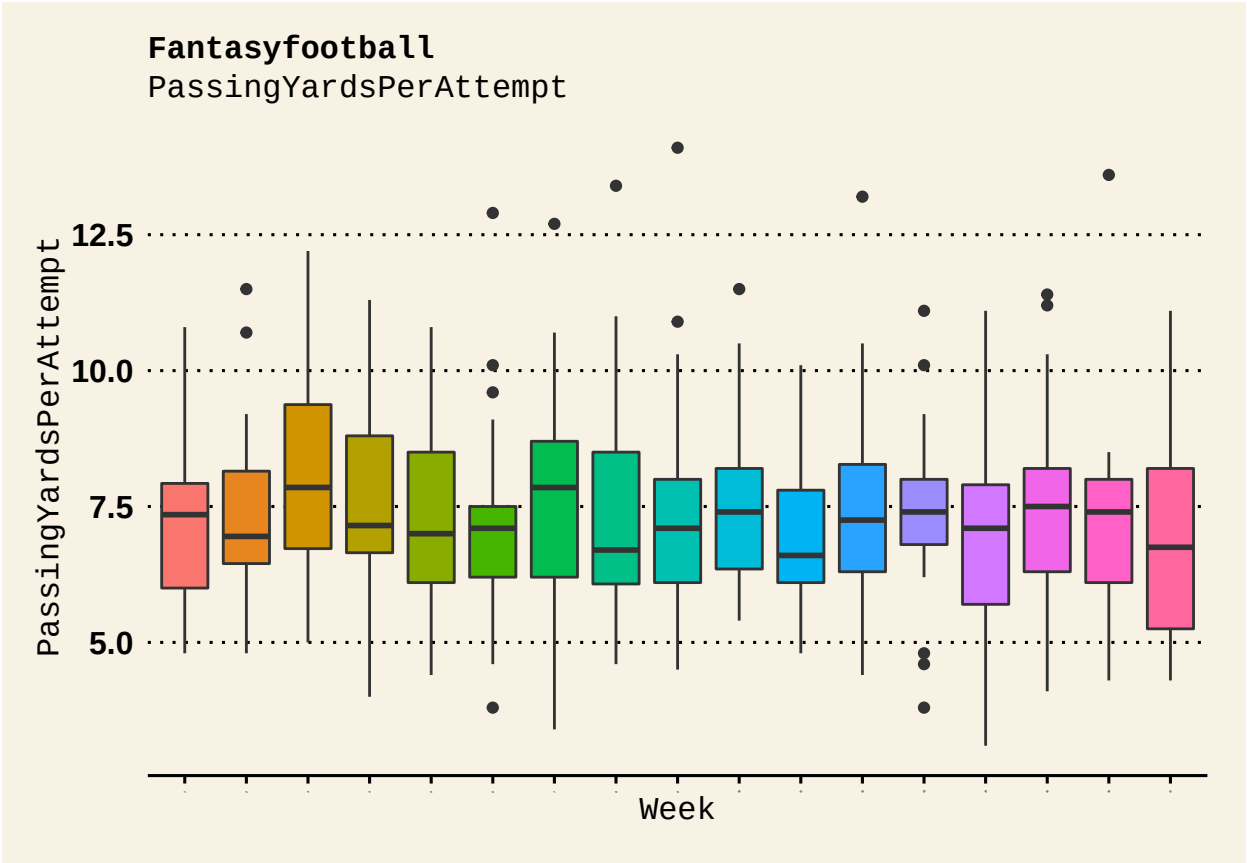

Fantasyfootball
FantasyPoints
FantasyPoints
30
20
10
Week

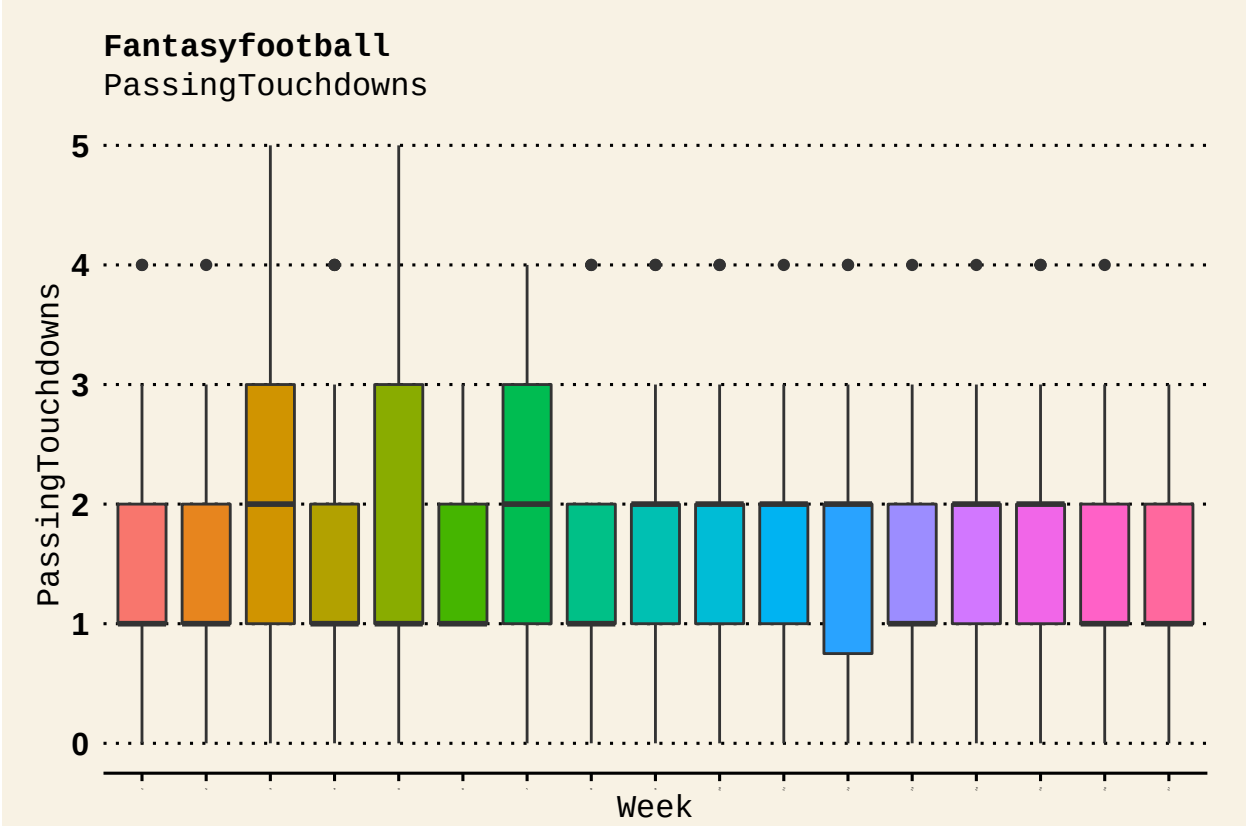

Fantasyfootball
PassingCompletions
PassingCompletions
40
30
20
10
Week

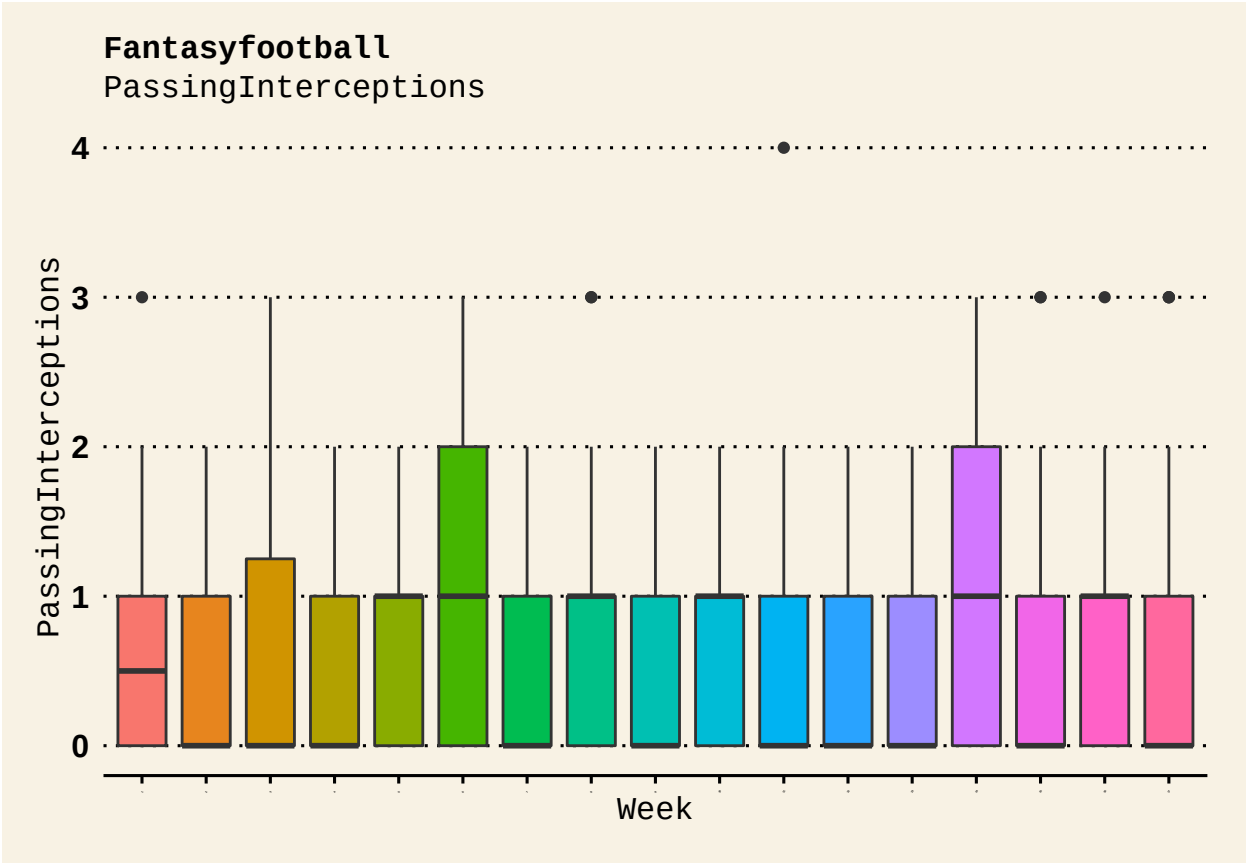

Fantasyfootball
PassingAttempts
PassingAttempts
60
50
40
30
20
10
Week

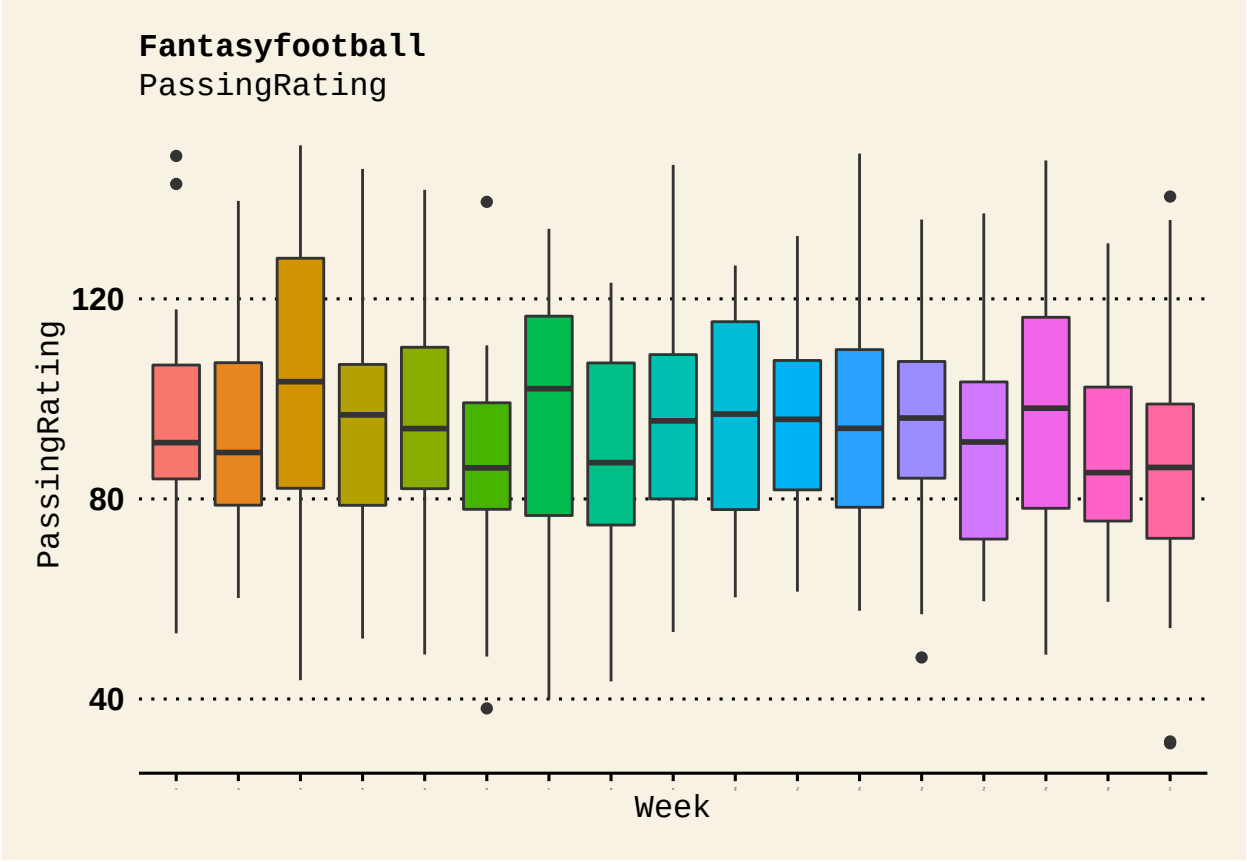

Fantasyfootball
PassingCompletionPercentage
PassingCompletionPercentage
80
70
60
50
40
Week

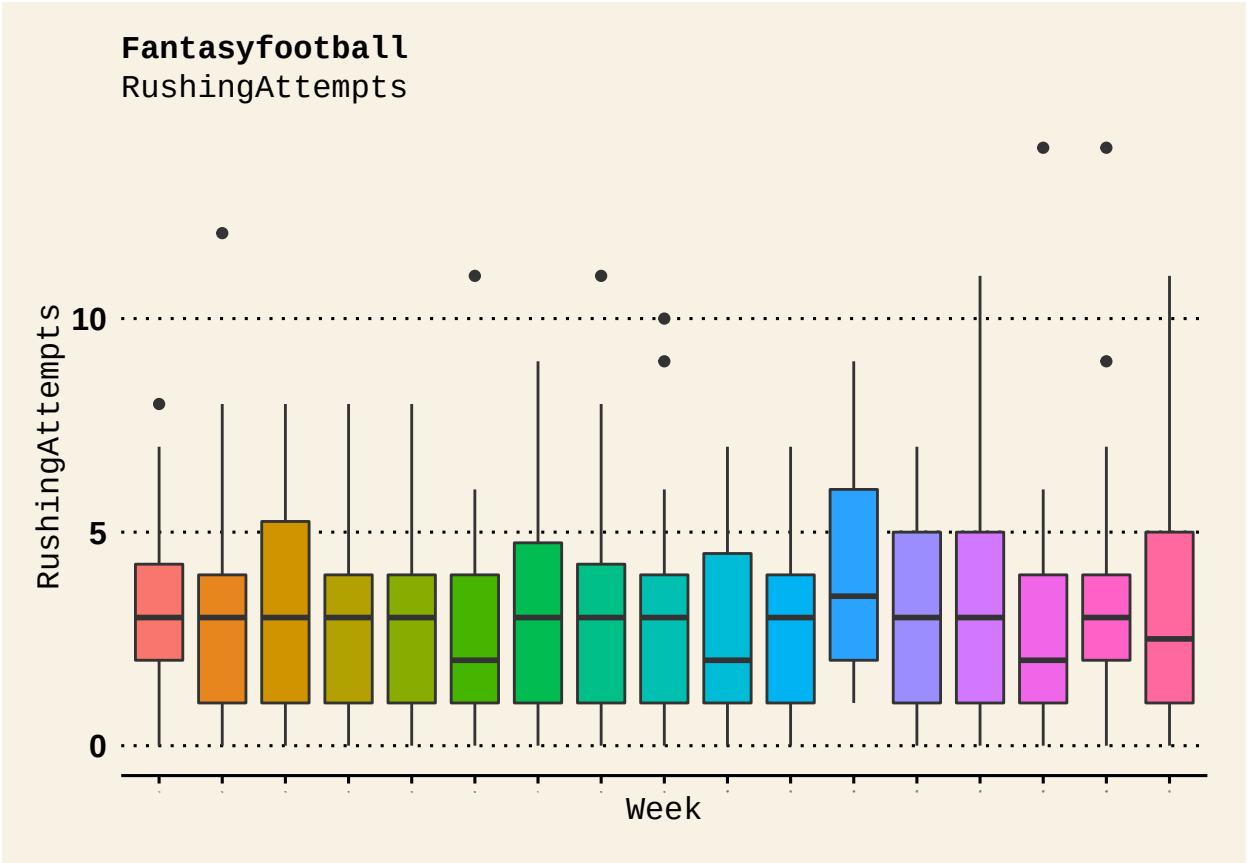

Fantasyfootball
PassingYards
500
400
300
200
100
PassingYards
Week

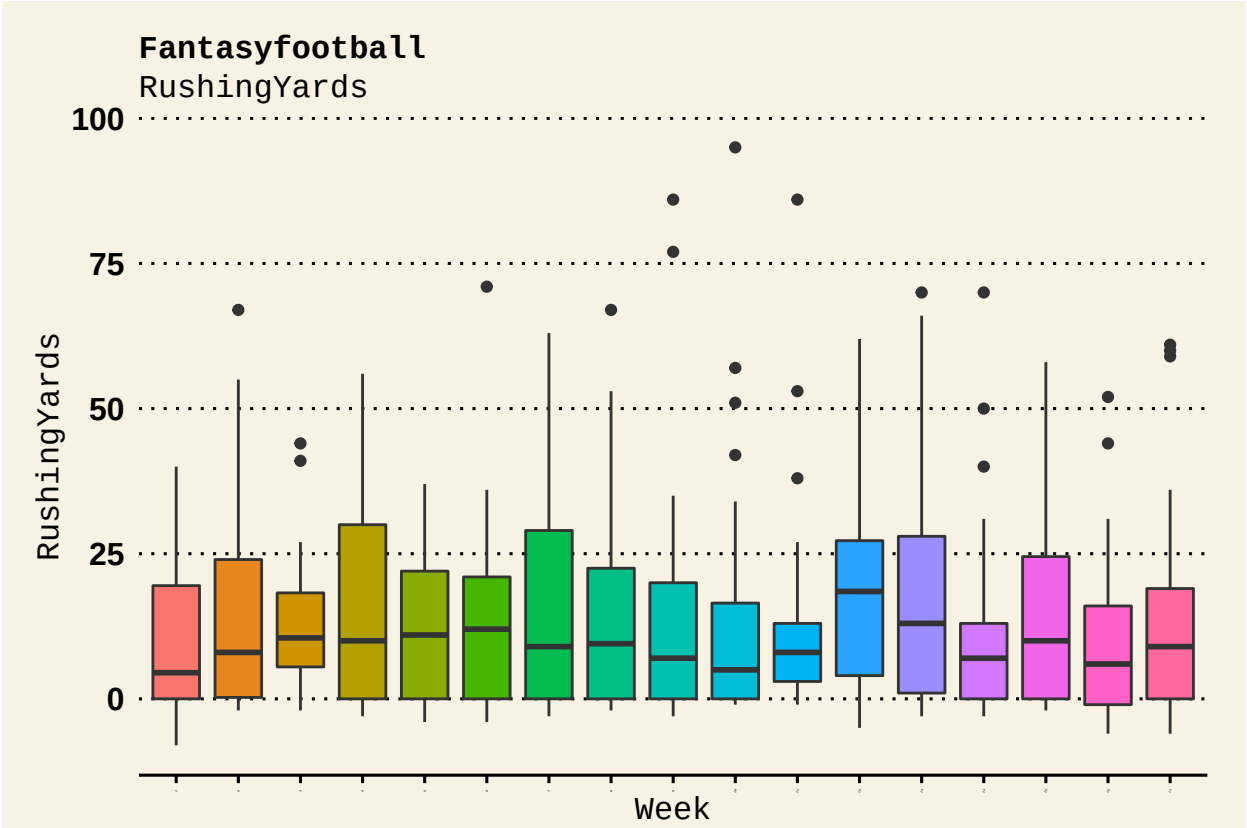

Fantasyfootball
PassingYardsPerAttempt
12.5
10.0
7.5
5.0
PassingYardsPerAttempt
Week

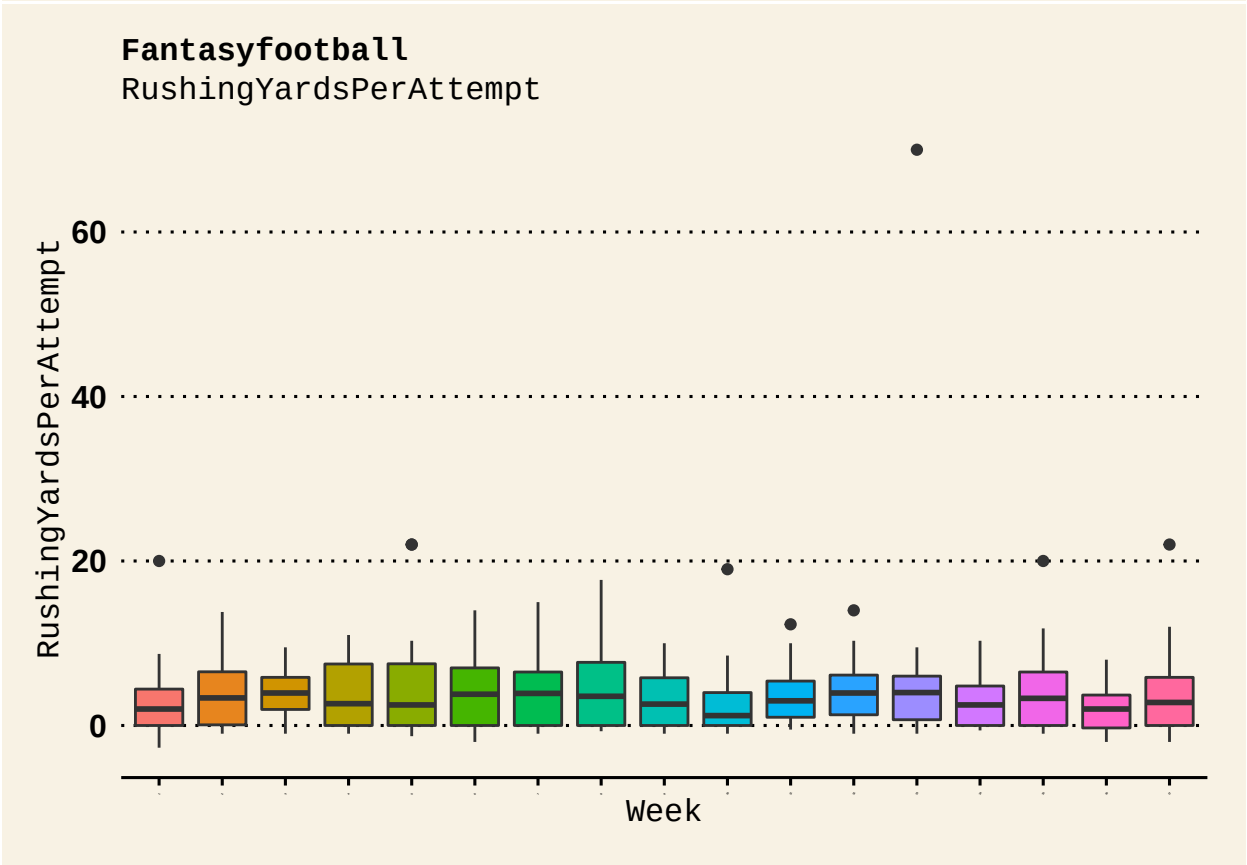

Fantasyfootball
PassingTouchdowns
PassingTouchdowns
5
4
3
2
1
0
Week

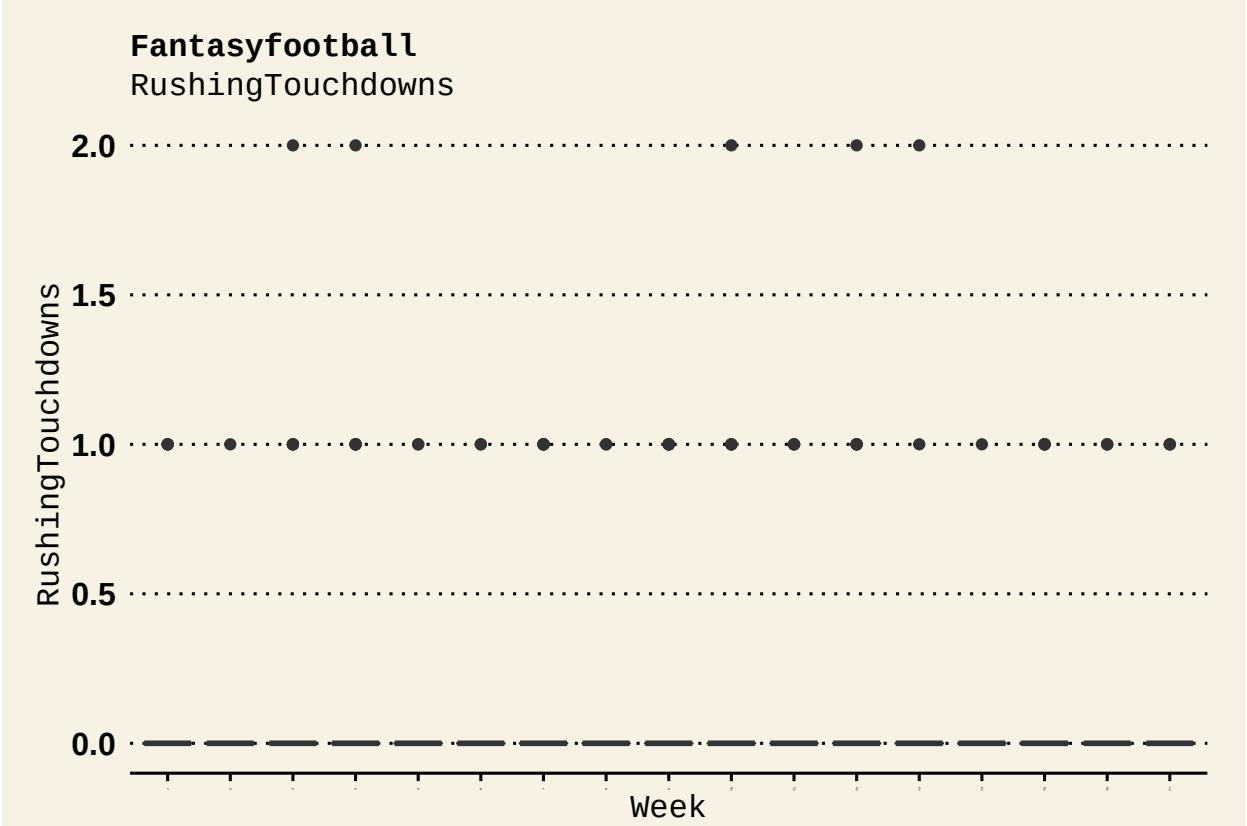

Fantasyfootball
PassingInterceptions
PassingInterceptions
4
3
2
1
0
Week

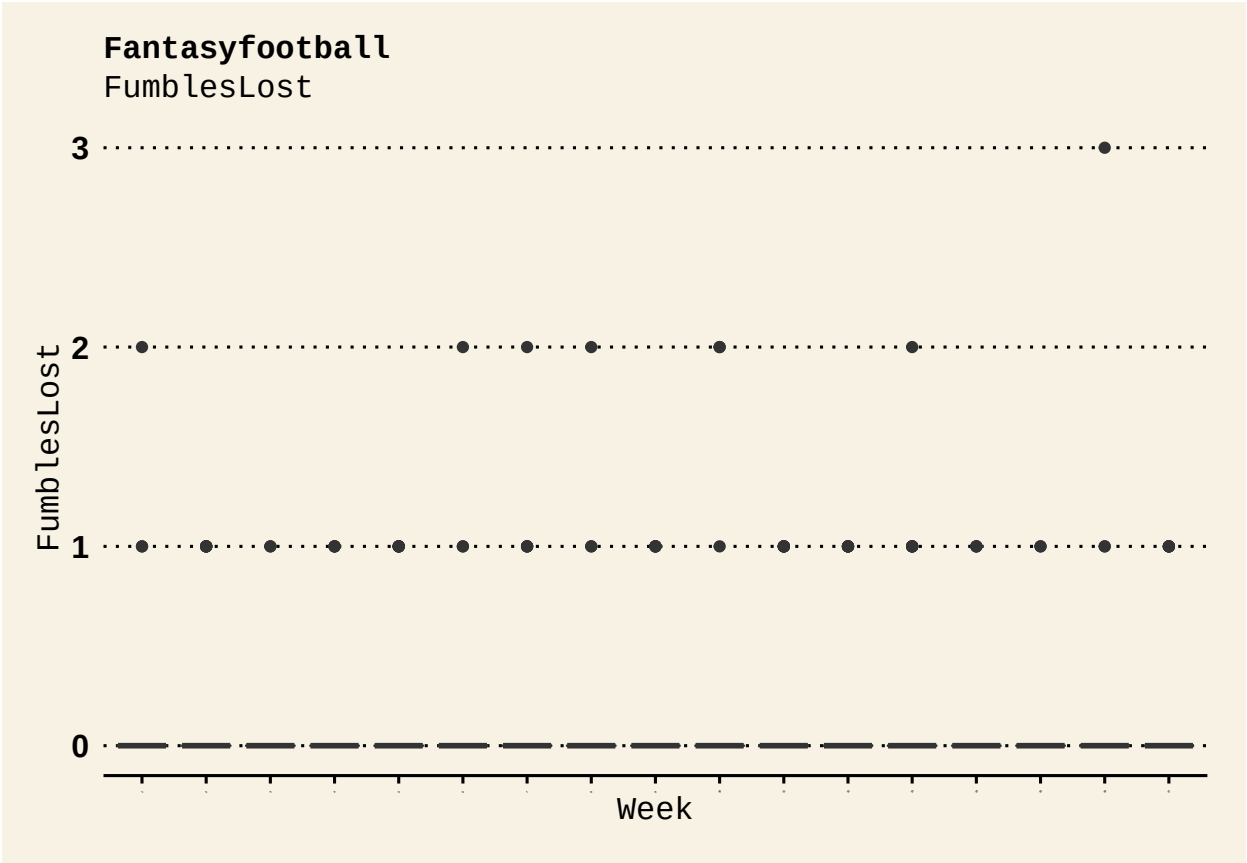

Fantasyfootball
PassingRating
PassingRating
120
80
40
Week


Fantasyfootball
RushingAttempts
RushingAttempts
10
5
0
Week


Fantasyfootball
RushingYards
100
75
50
25
0
RushingYards
Week

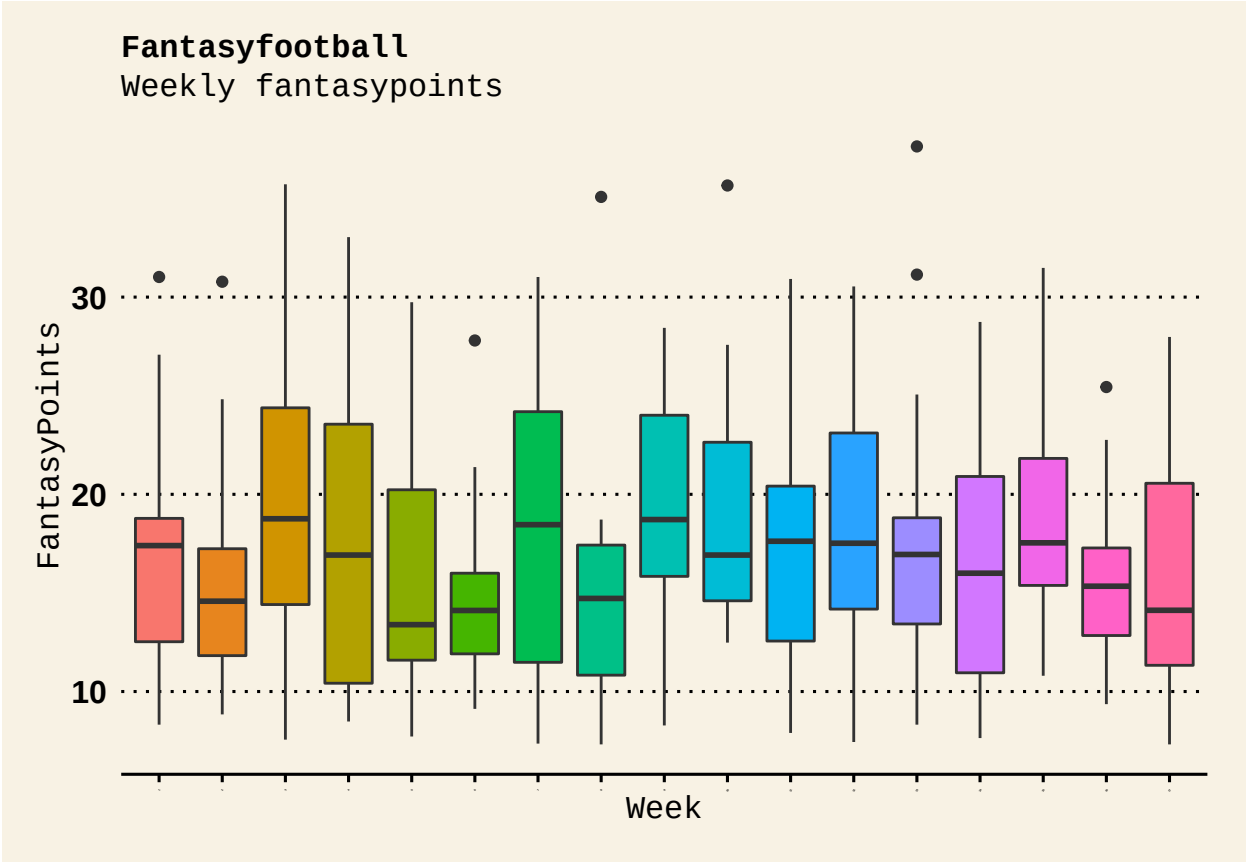

Fantasyfootball
RushingYardsPerAttempt
60
40
20
0
RushingYardsPerAttempt
Week


Fantasyfootball
RushingTouchdowns
2.0
1.5
1.0
0.5
0.0
RushingTouchdowns
Week


Fantasyfootball
FumblesLost
3
2
1
0
FumblesLost
Week

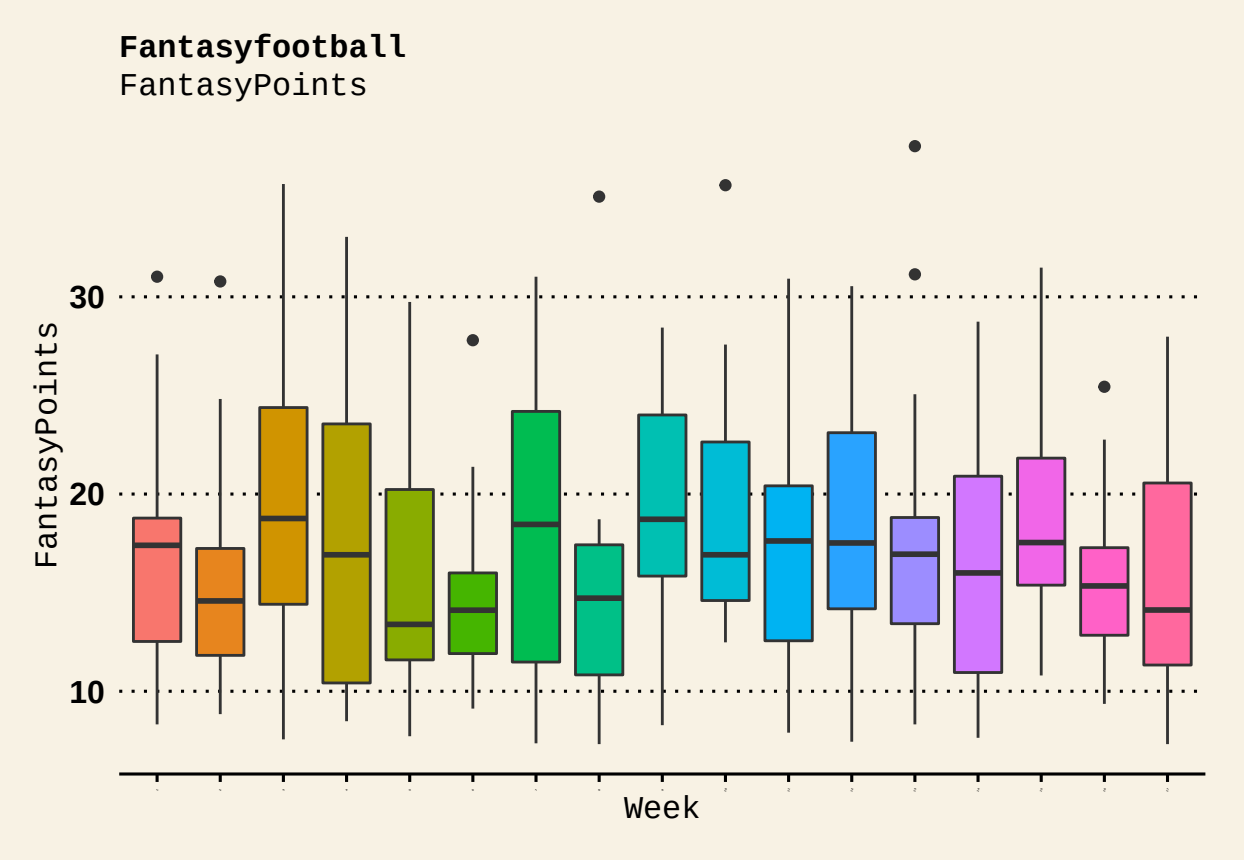
8.2.3 Boxplots Derived Feature set

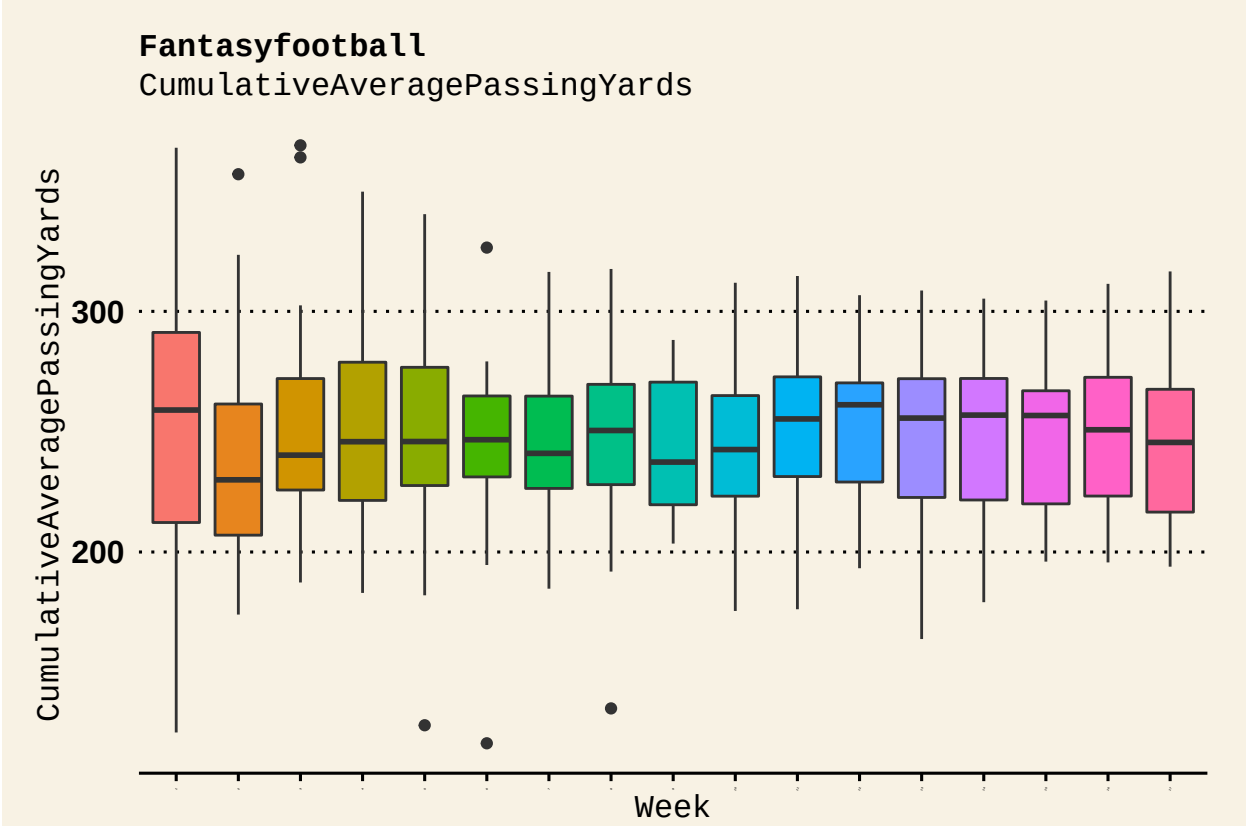
```
eda_derived %>% ggplot(aes(y=FantasyPoints,x=Week,fill=Week,group=Week))+
                      geom_boxplot(show.legend = FALSE)+
                      xlab("Week")+ylab("FantasyPoints")+
                      labs(title="Fantasyfootball",
                      subtitle="Weekly fantasypoints",
                      aption="Source: Fantasyfootball")+
                      theme_wsj()+
                      theme(plot.title    = element_text(size = rel(0.5)),
                            plot.subtitle = element_text(size = rel(0.5)),
                            axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                            axis.title    = element_text(size = rel(0.5)),
                            legend.position  = "right",
                            legend.direction ="vertical",
                            legend.title = element_text(size = rel(0.5)))
```

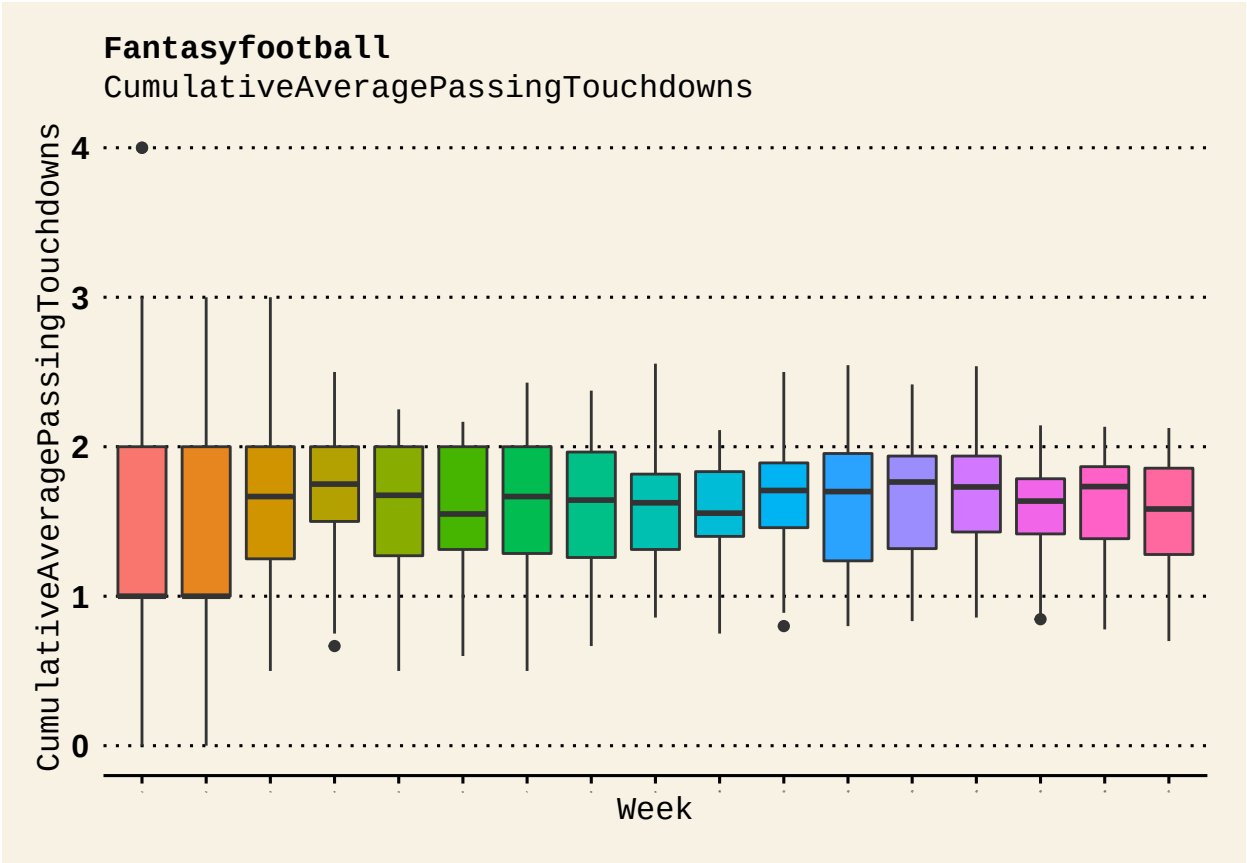


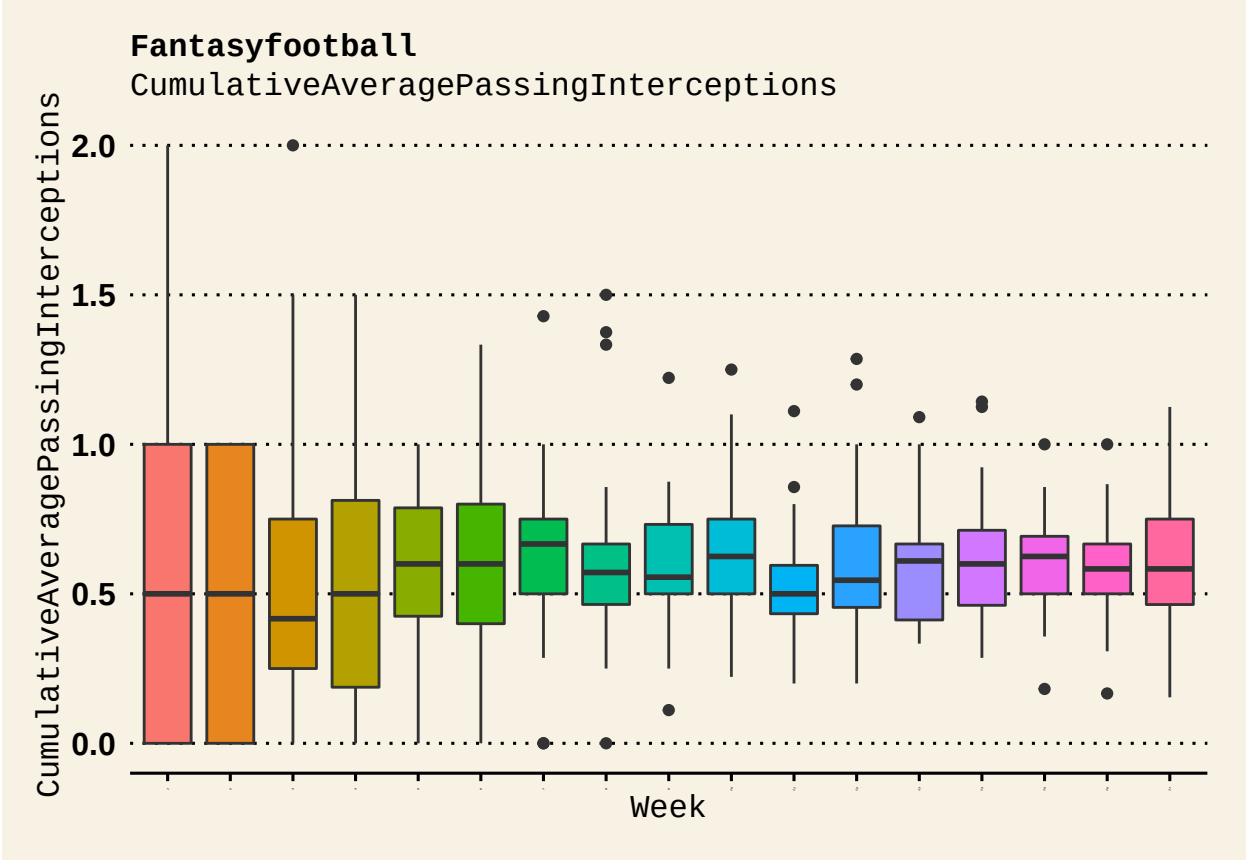

```
for (i in 2:20) {

ggplotp <- eda_derived %>%
           ggplot(aes_string(y=names(eda_derived[i]),x="Week",fill="Week",group="Week"))+
           geom_boxplot(show.legend = FALSE)+
           xlab("Week")+ylab(names(eda_derived[i]))+
           labs(title="Fantasyfootball",
           subtitle=names(eda_derived[i]),
           aption="Source: Fantasyfootball")+
           theme_wsj()+
```

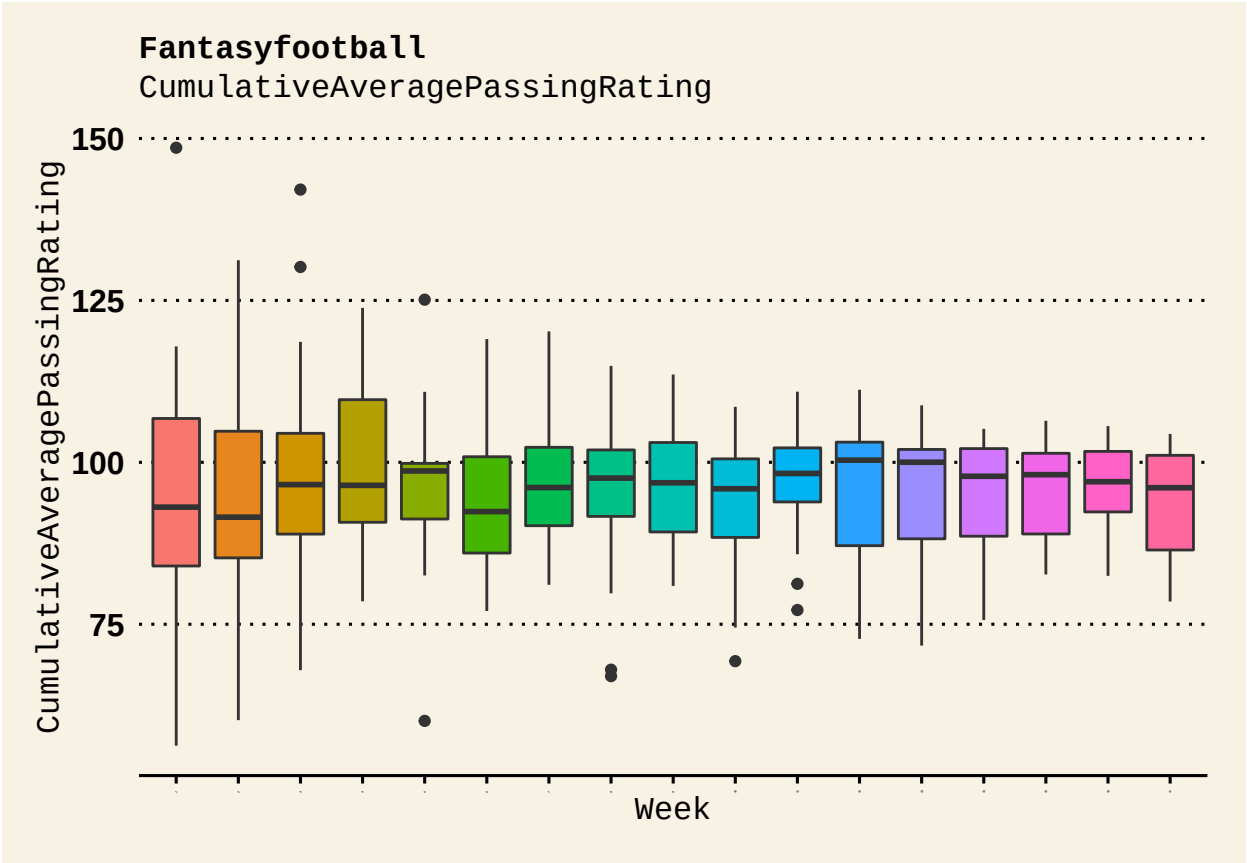
```
          theme(plot.title    = element_text(size = rel(0.5)),
                plot.subtitle = element_text(size = rel(0.5)),
                axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                axis.title    = element_text(size = rel(0.5)),
                legend.position  = "right",
                legend.direction ="vertical",
                legend.title = element_text(size = rel(0.5)))


  print(ggplotp)
}
```

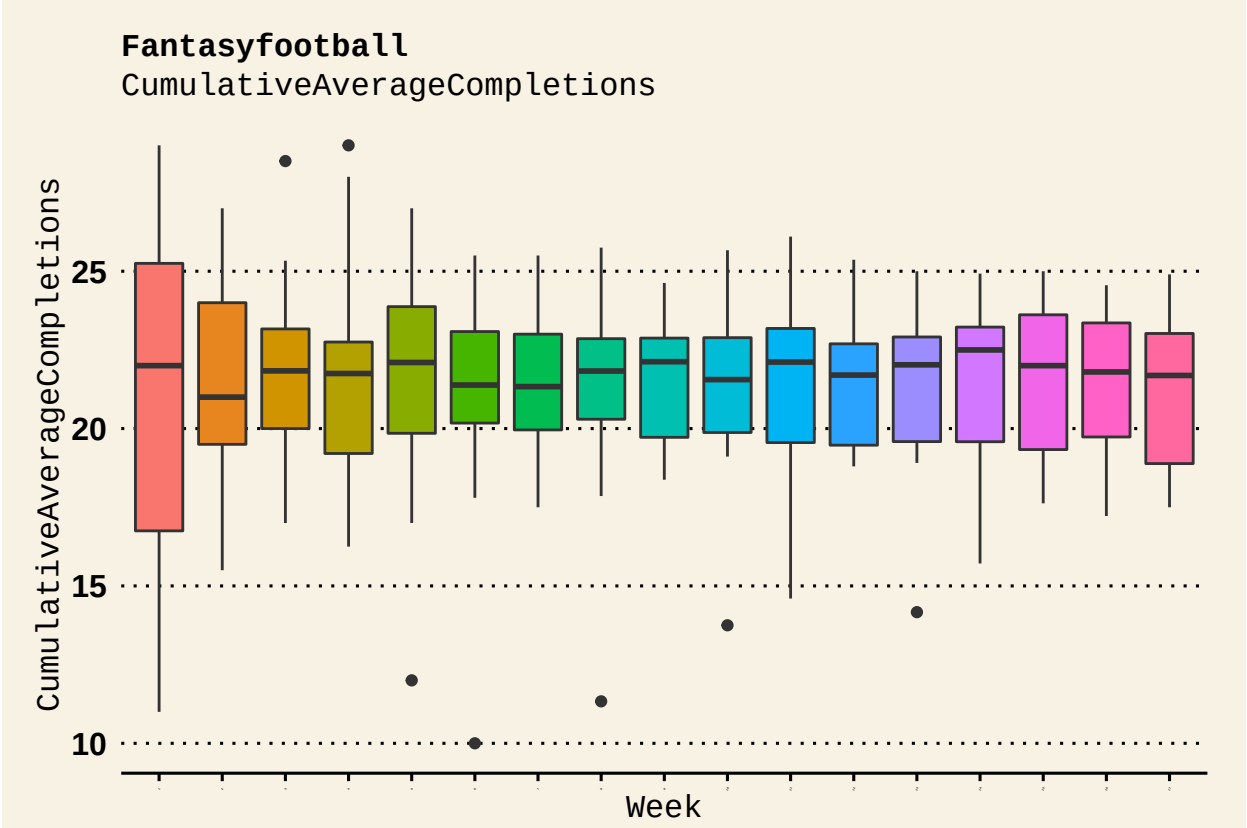


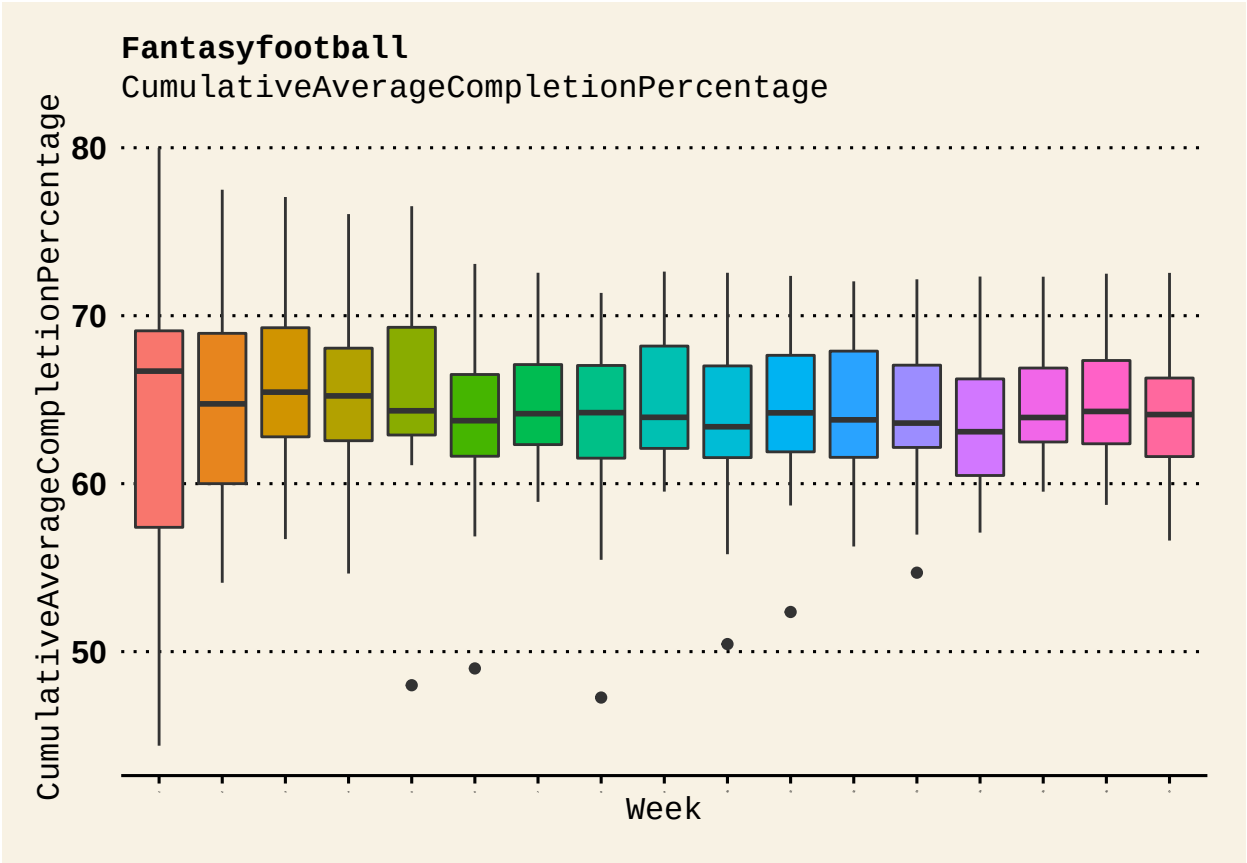

Fantasyfootball
CumulativeAveragePassingYards
CumulativeAveragePassingYards
300
200
Week

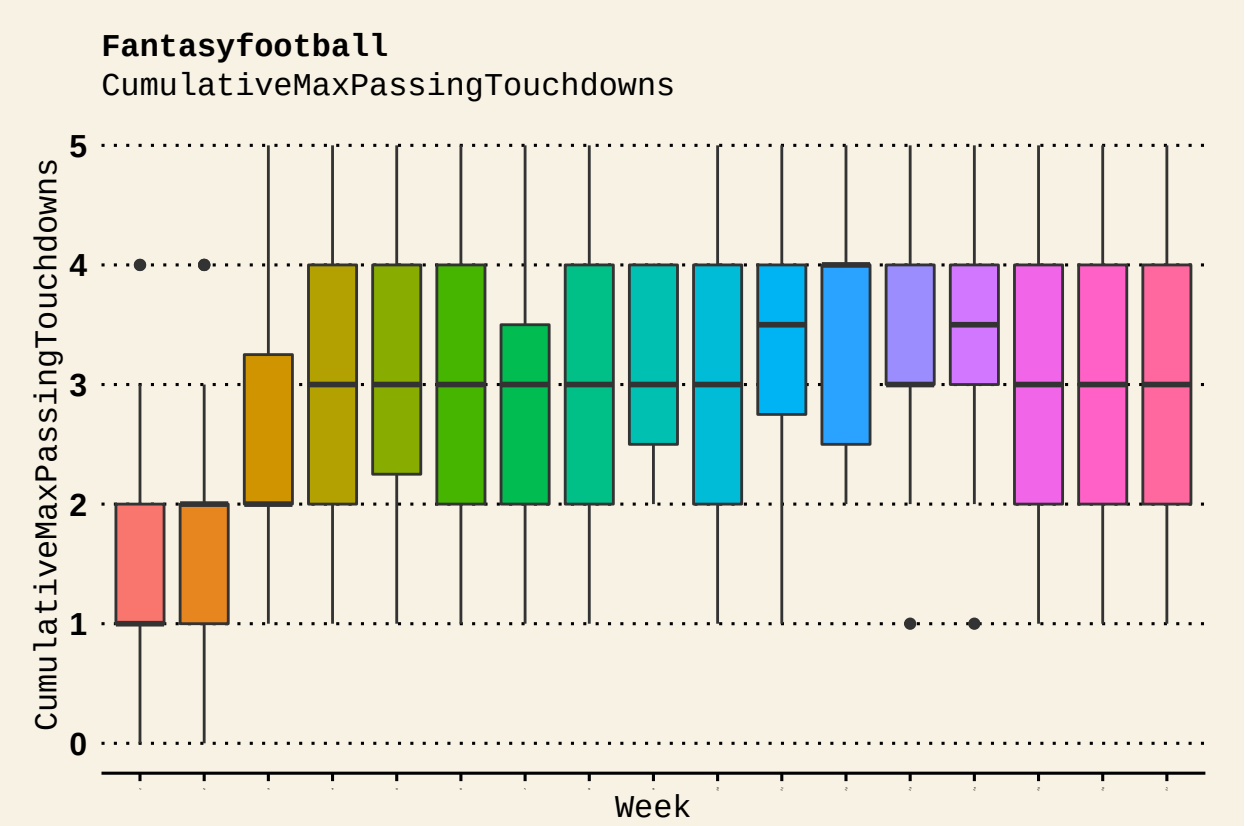

Fantasyfootball
CumulativeAveragePassingTouchdowns
CumulativeAveragePassingTouchdowns
4
3
2
1
0
Week

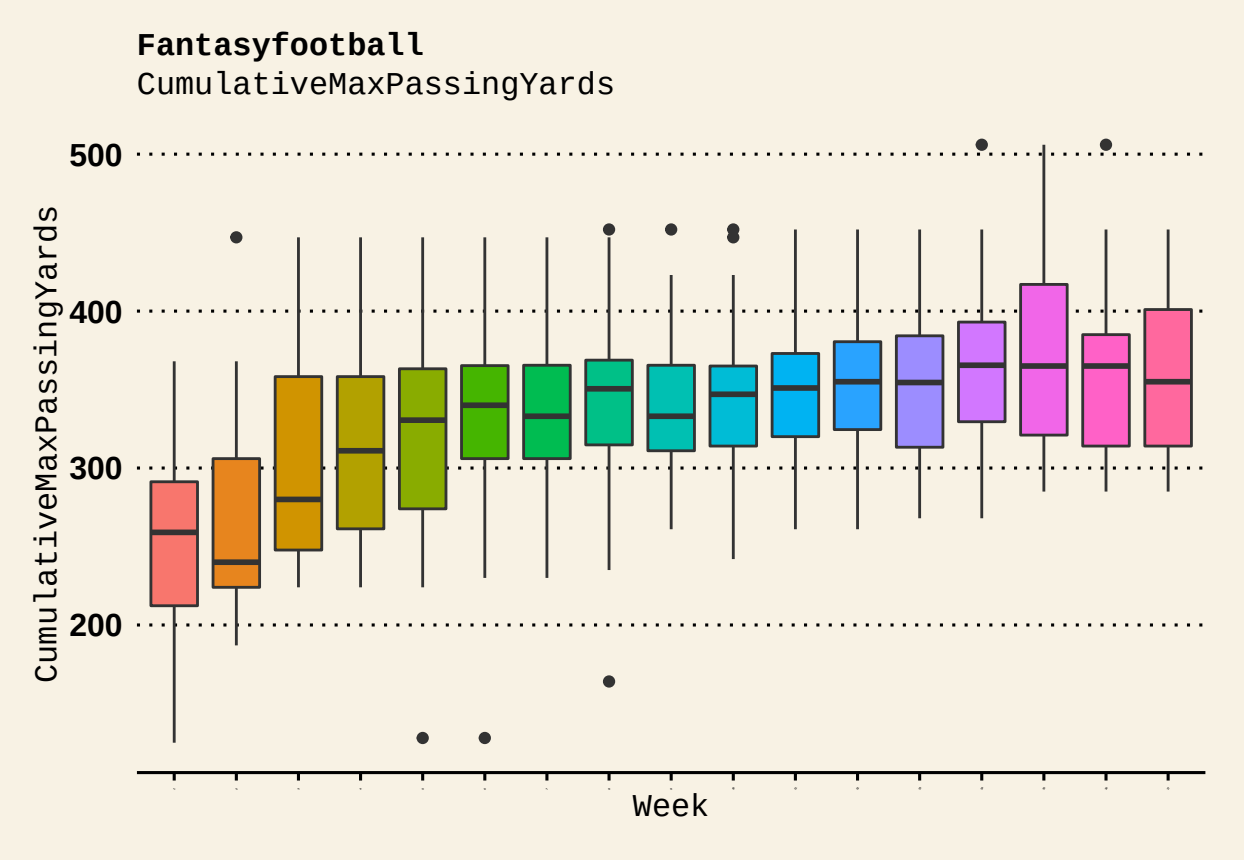

Fantasyfootball
CumulativeAveragePassingInterceptions
CumulativeAveragePassingInterceptions
2.0
1.5
1.0
0.5
0.0
Week

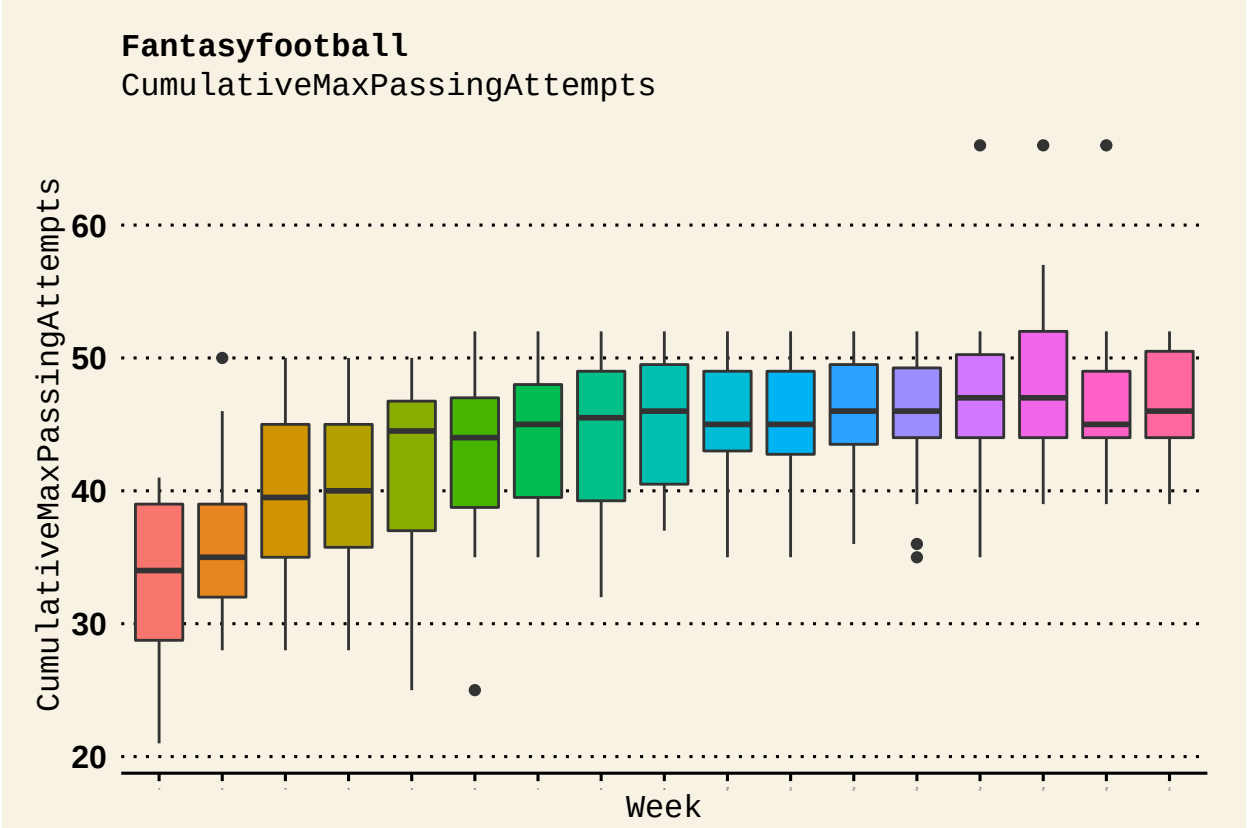

Fantasyfootball
CumulativeAveragePassingRating
CumulativeAveragePassingRating
150
125
100
75
Week

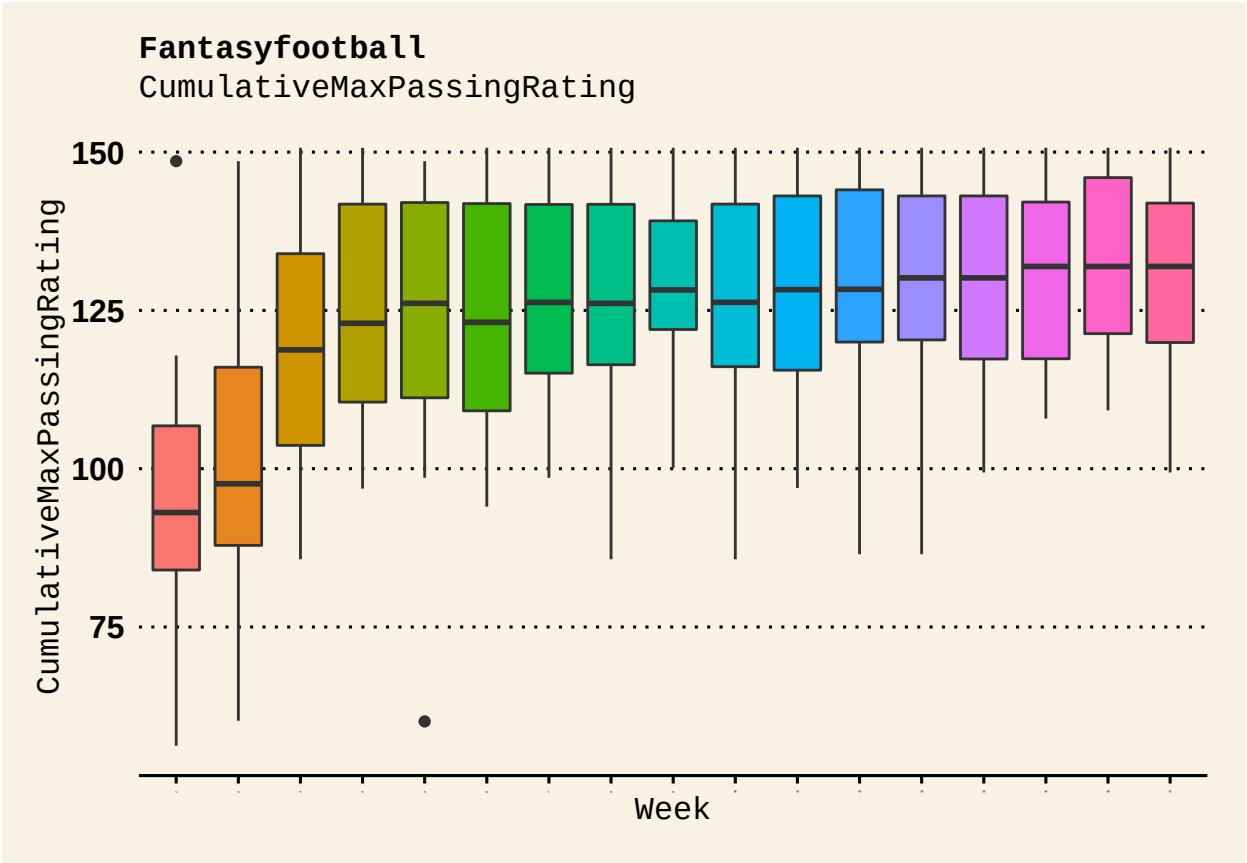

Fantasyfootball
CumulativeAverageCompletions
CumulativeAverageCompletions
25
20
15
10
Week

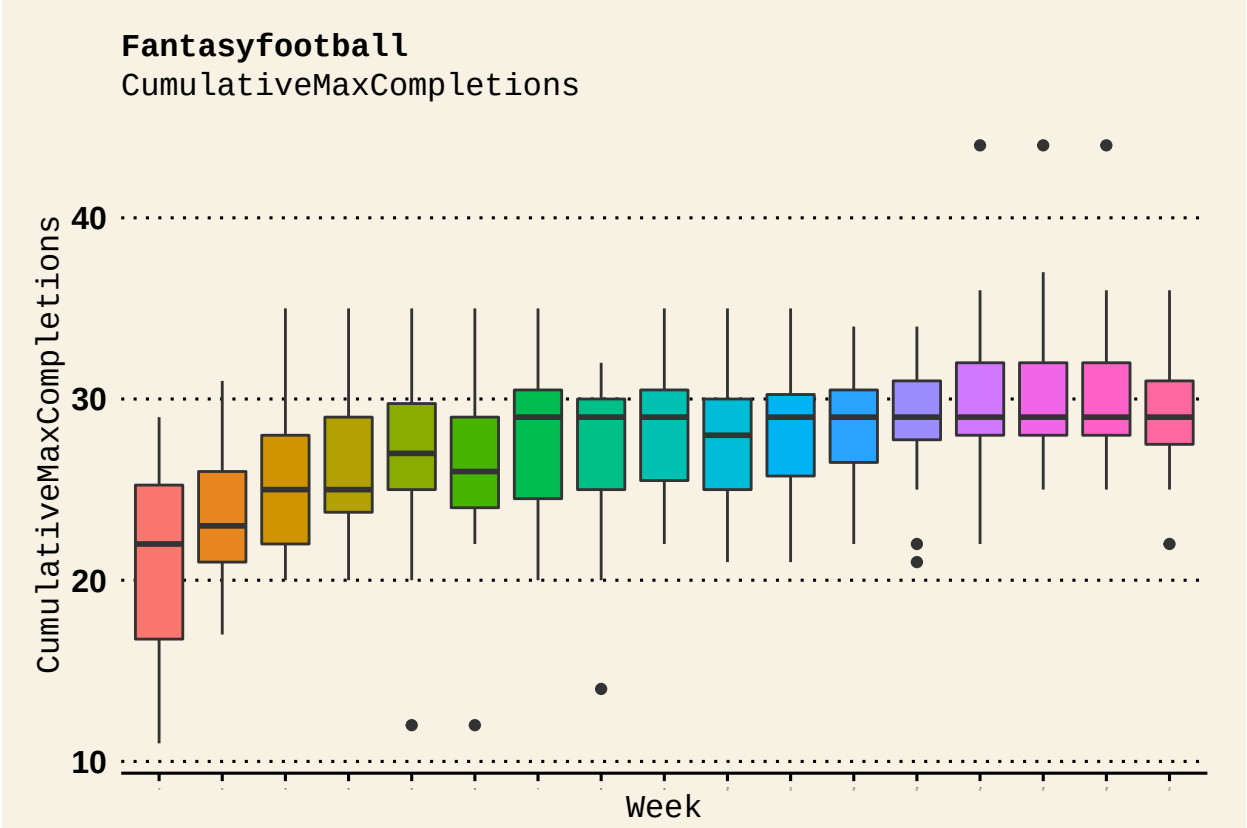

Fantasyfootball
CumulativeAverageCompletionPercentage
CumulativeAverageCompletionPercentage
80
70
60
50
Week

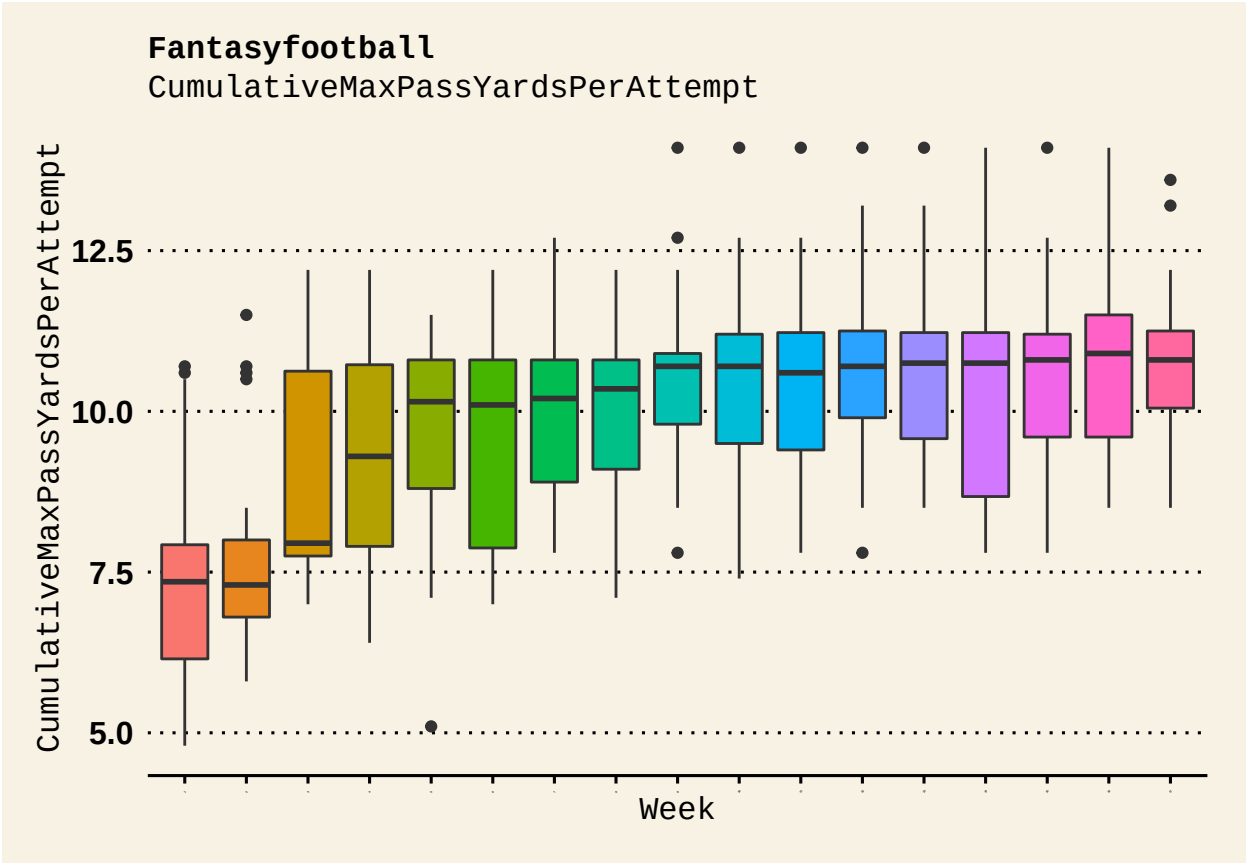

Fantasyfootball
CumulativeMaxPassingTouchdowns
CumulativeMaxPassingTouchdowns
0
1
2
3
4
5
Week

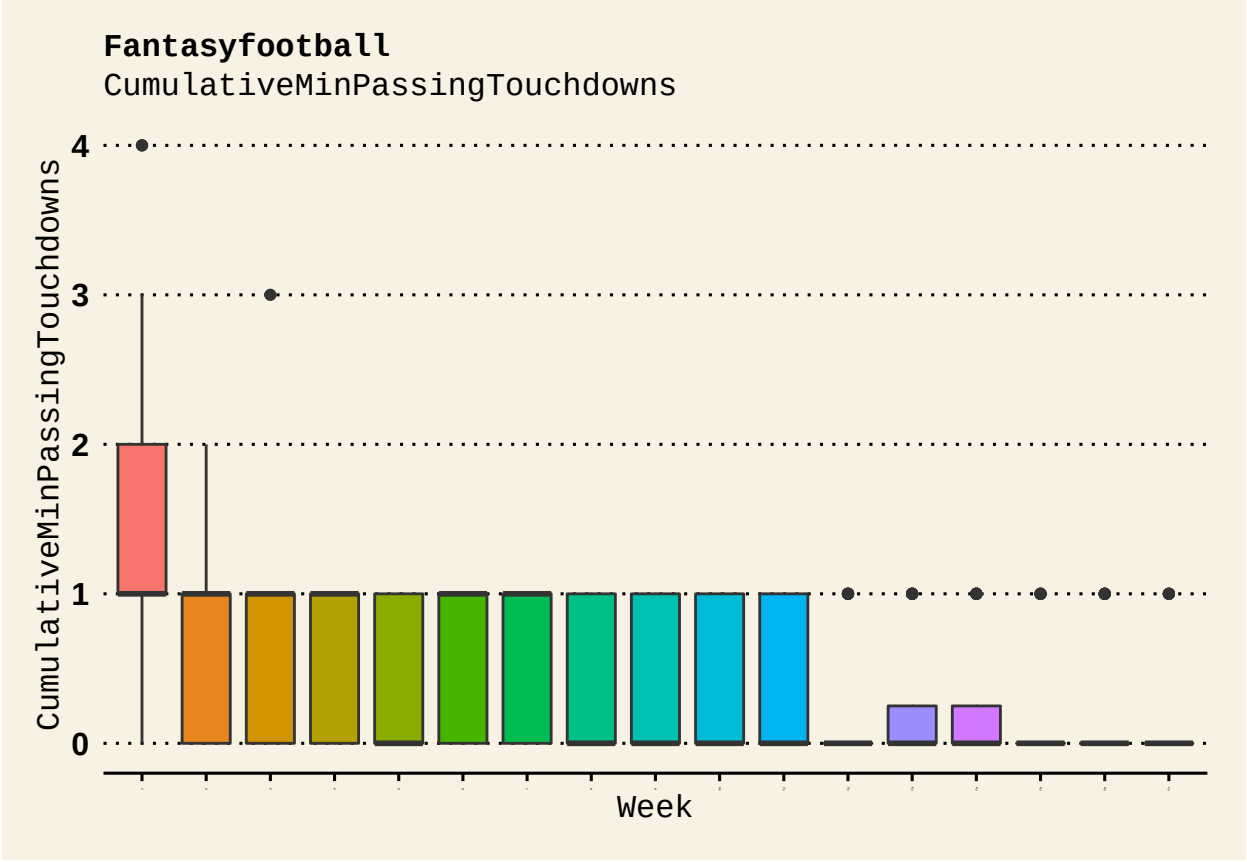

Fantasyfootball
CumulativeMaxPassingYards
CumulativeMaxPassingYards
200
300
400
500
Week

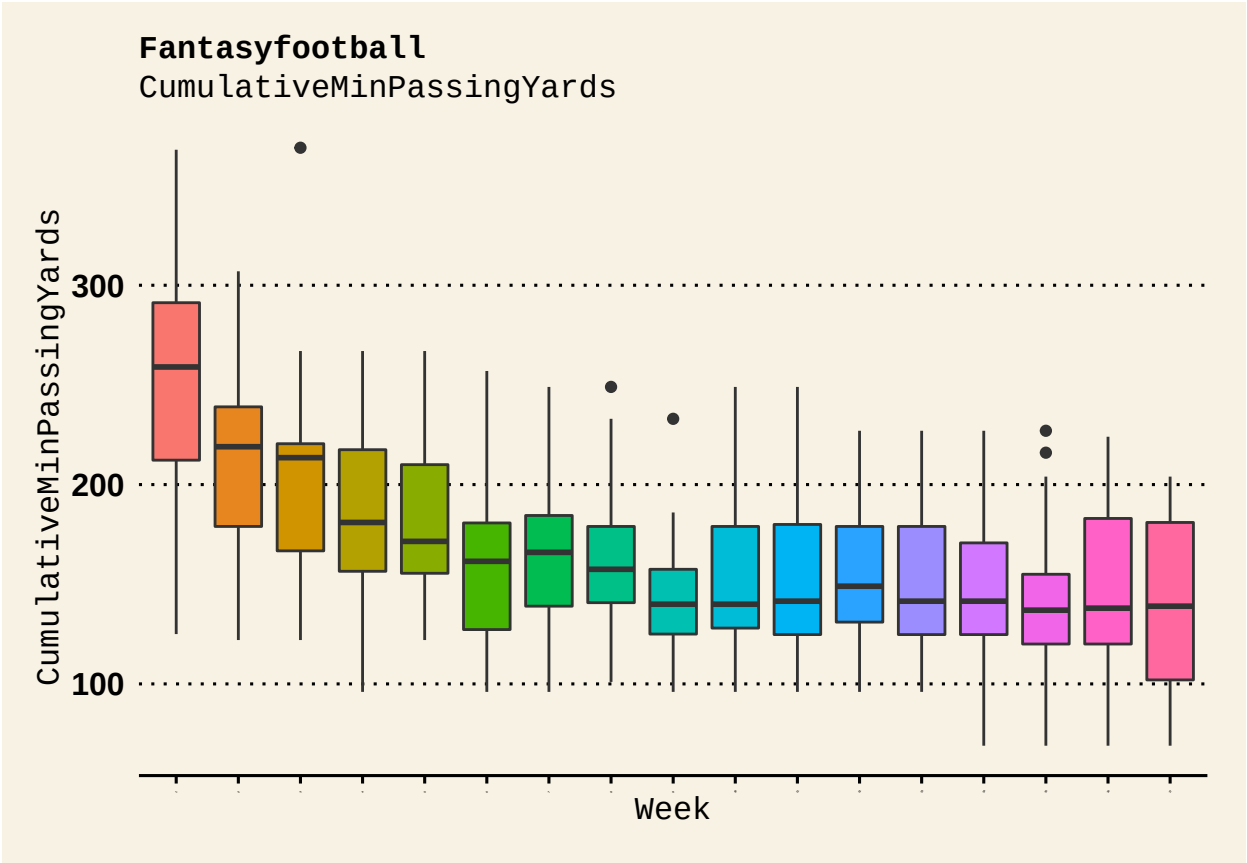

Fantasyfootball
CumulativeMaxPassingAttempts
CumulativeMaxPassingAttempts
60
50
40
30
20
Week

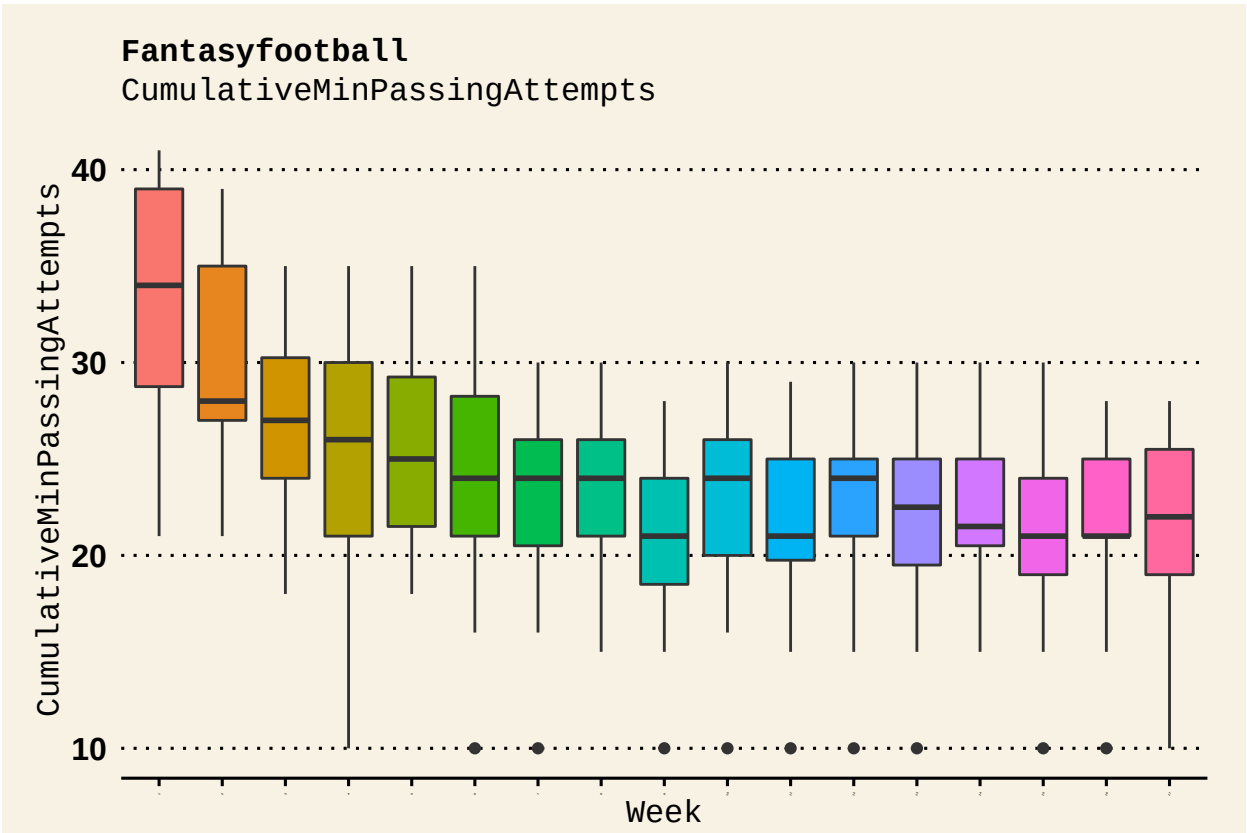

Fantasyfootball
CumulativeMaxPassingRating
CumulativeMaxPassingRating
150
125
100
75
Week

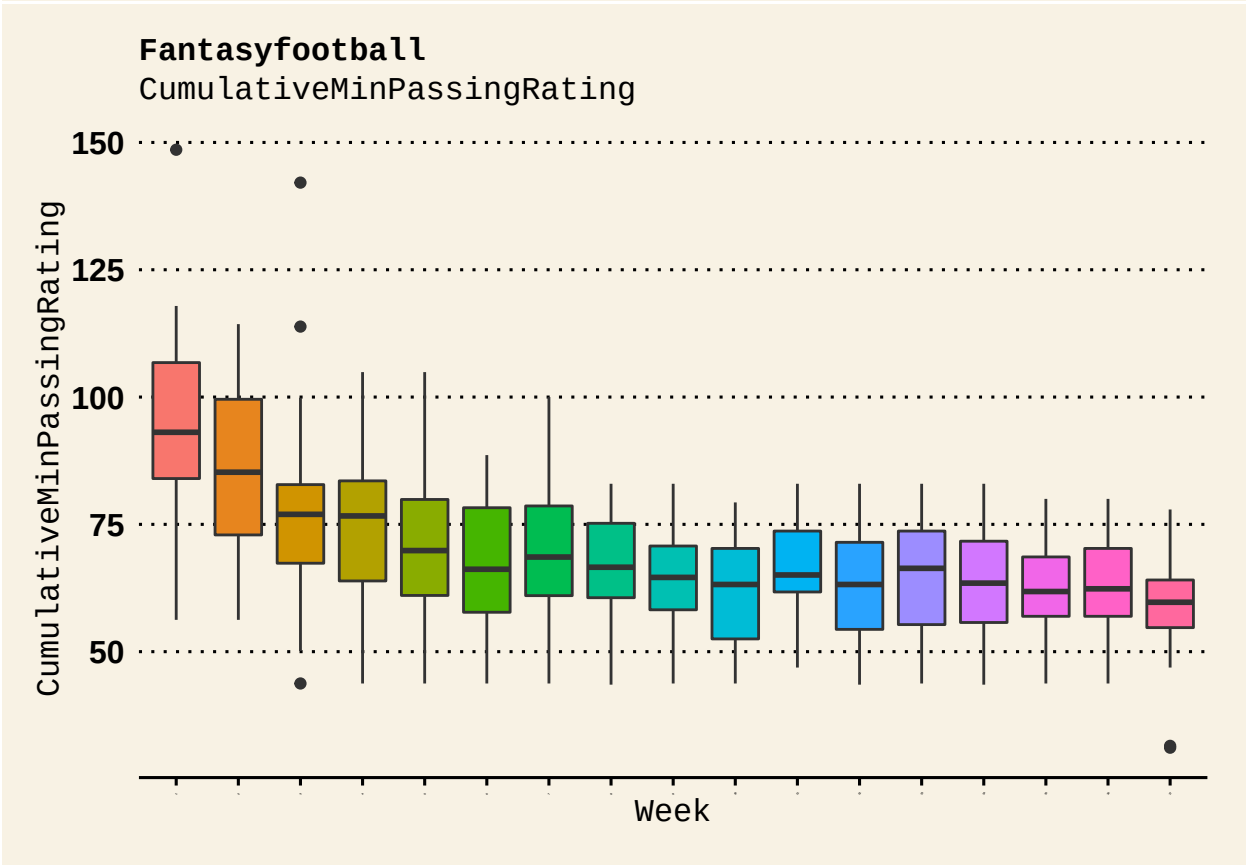

Fantasyfootball
CumulativeMaxCompletions
CumulativeMaxCompletions
40
30
20
10
Week

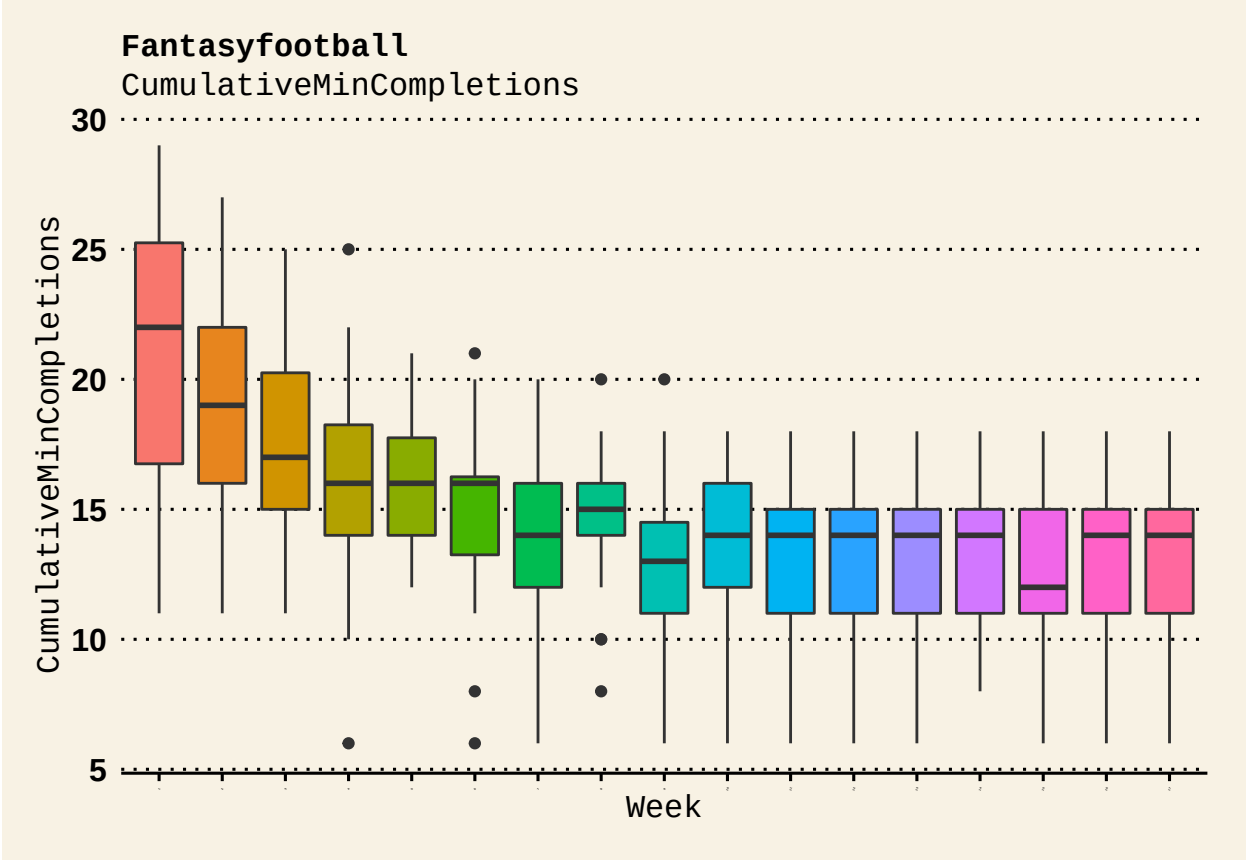

Fantasyfootball
CumulativeMaxPassYardsPerAttempt
CumulativeMaxPassYardsPerAttempt
12.5
10.0
7.5
5.0
Week

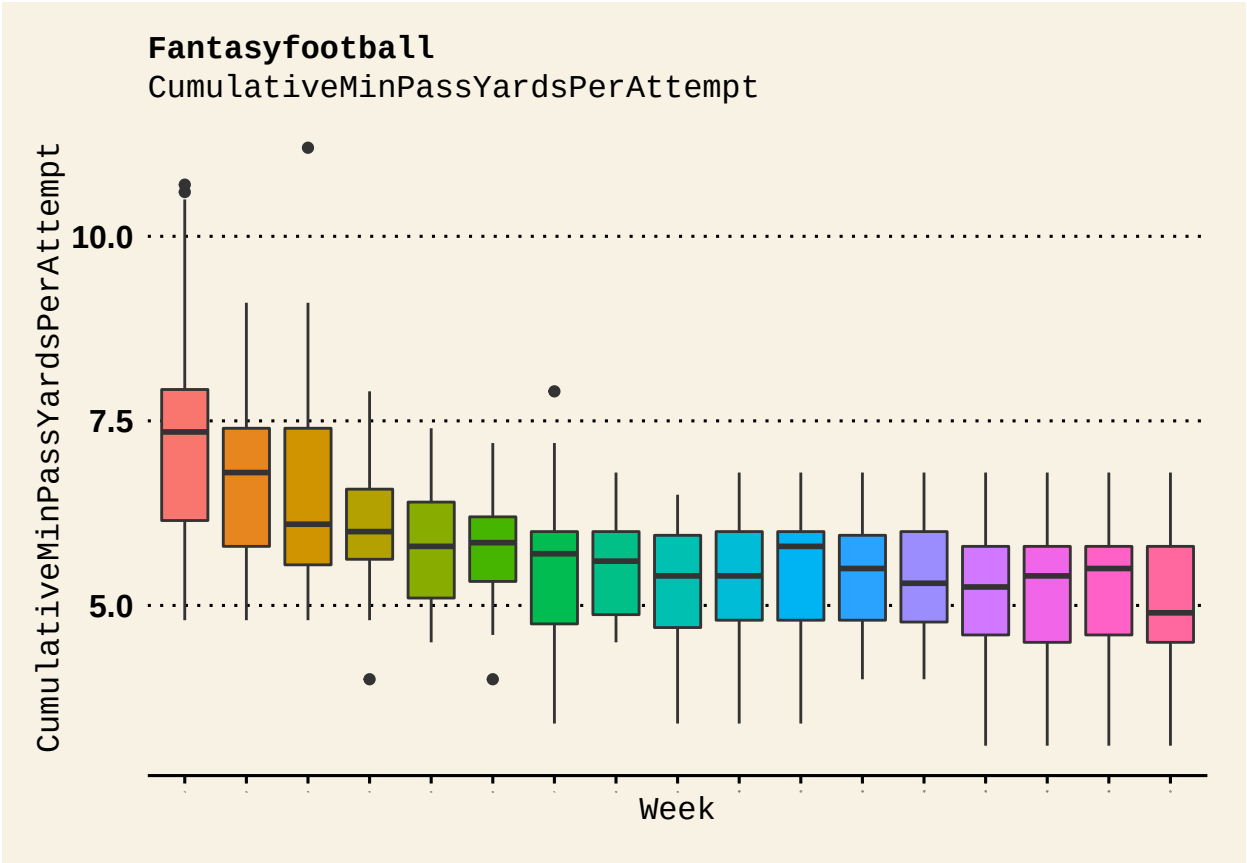

Fantasyfootball
CumulativeMinPassingTouchdowns
CumulativeMinPassingTouchdowns
4
3
2
1
0
Week


Fantasyfootball
CumulativeMinPassingYards
CumulativeMinPassingYards
300
200
100
Week


Fantasyfootball
CumulativeMinPassingAttempts
CumulativeMinPassingAttempts
40
30
20
10
Week

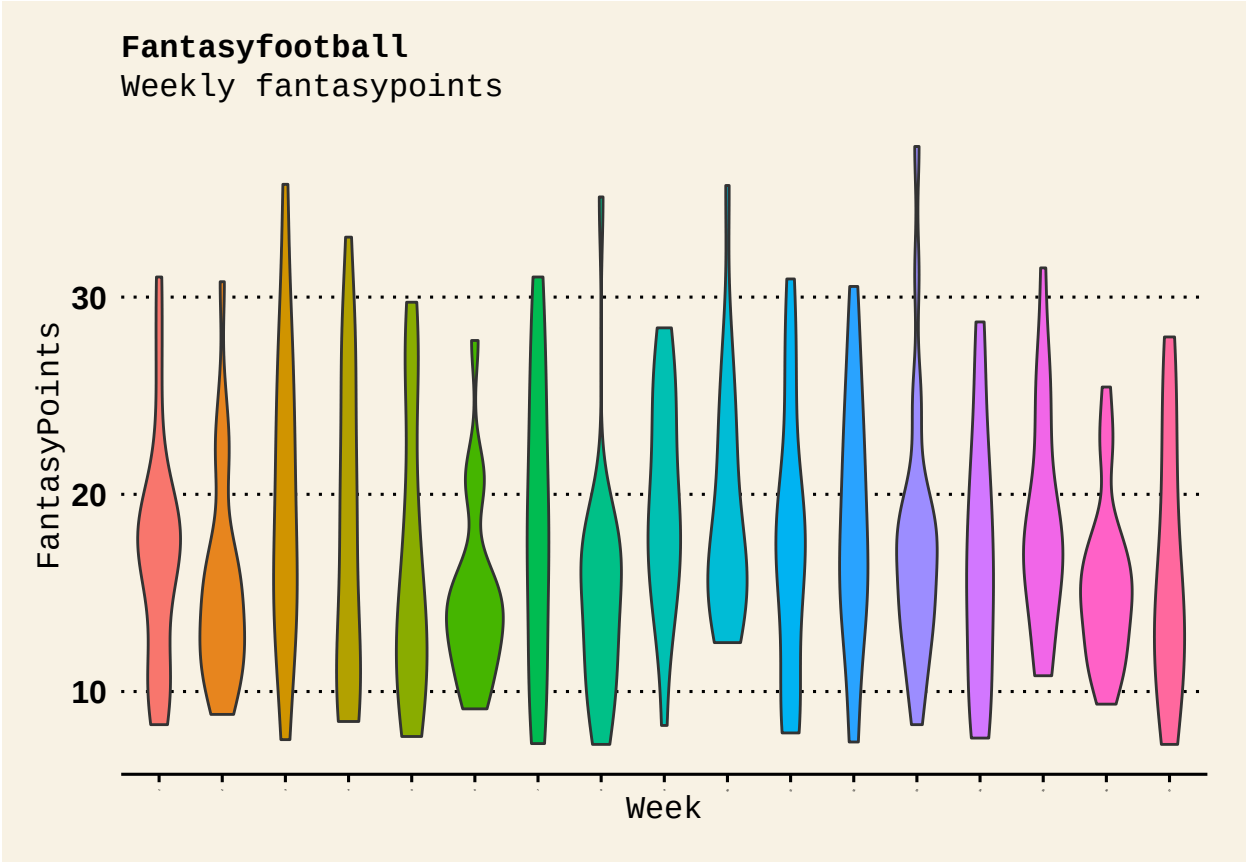

Fantasyfootball
CumulativeMinPassingRating
CumulativeMinPassingRating
150
125
100
75
50
Week


Fantasyfootball
CumulativeMinCompletions
30
25
20
15
10
5
CumulativeMinCompletions
Week


Fantasyfootball
CumulativeMinPassYardsPerAttempt
10.0
7.5
5.0
CumulativeMinPassYardsPerAttempt
Week

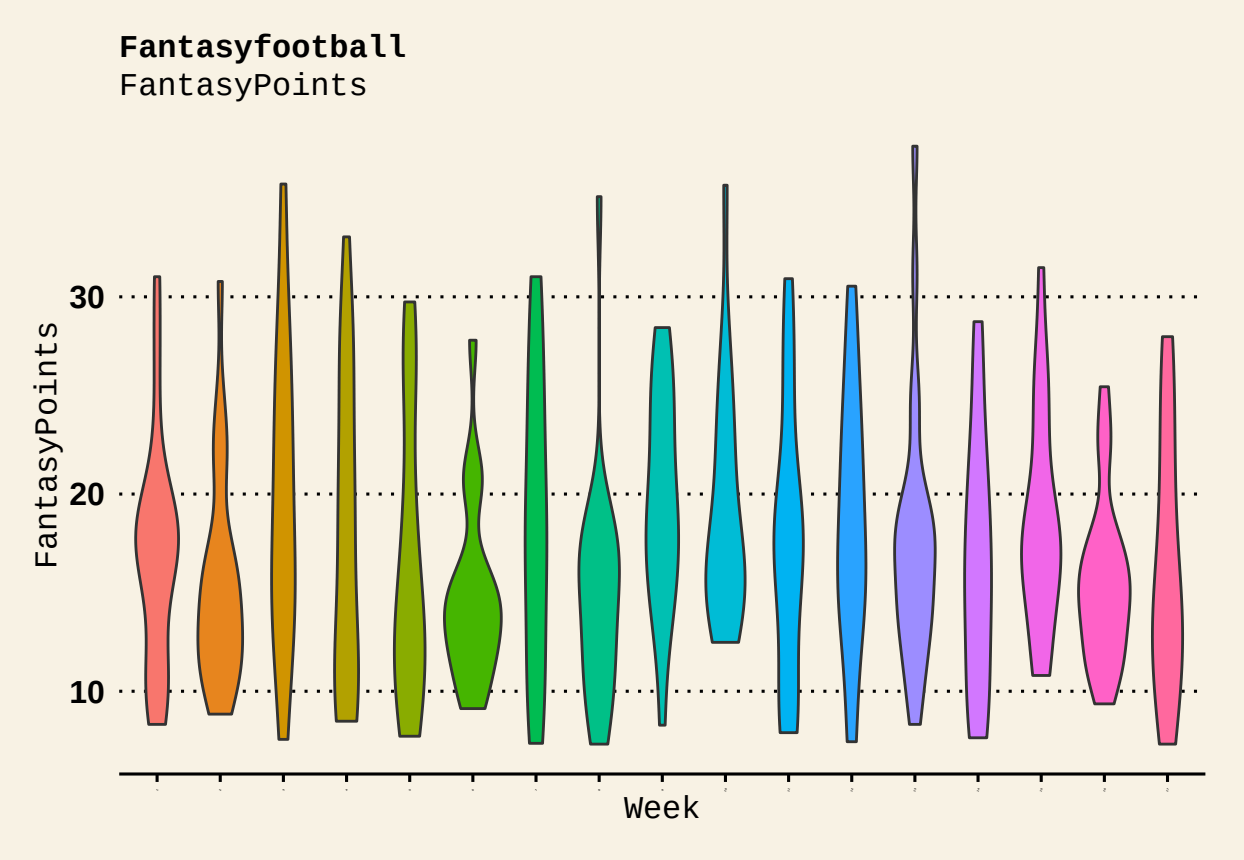
8.3 Violin plots Derived Feature set

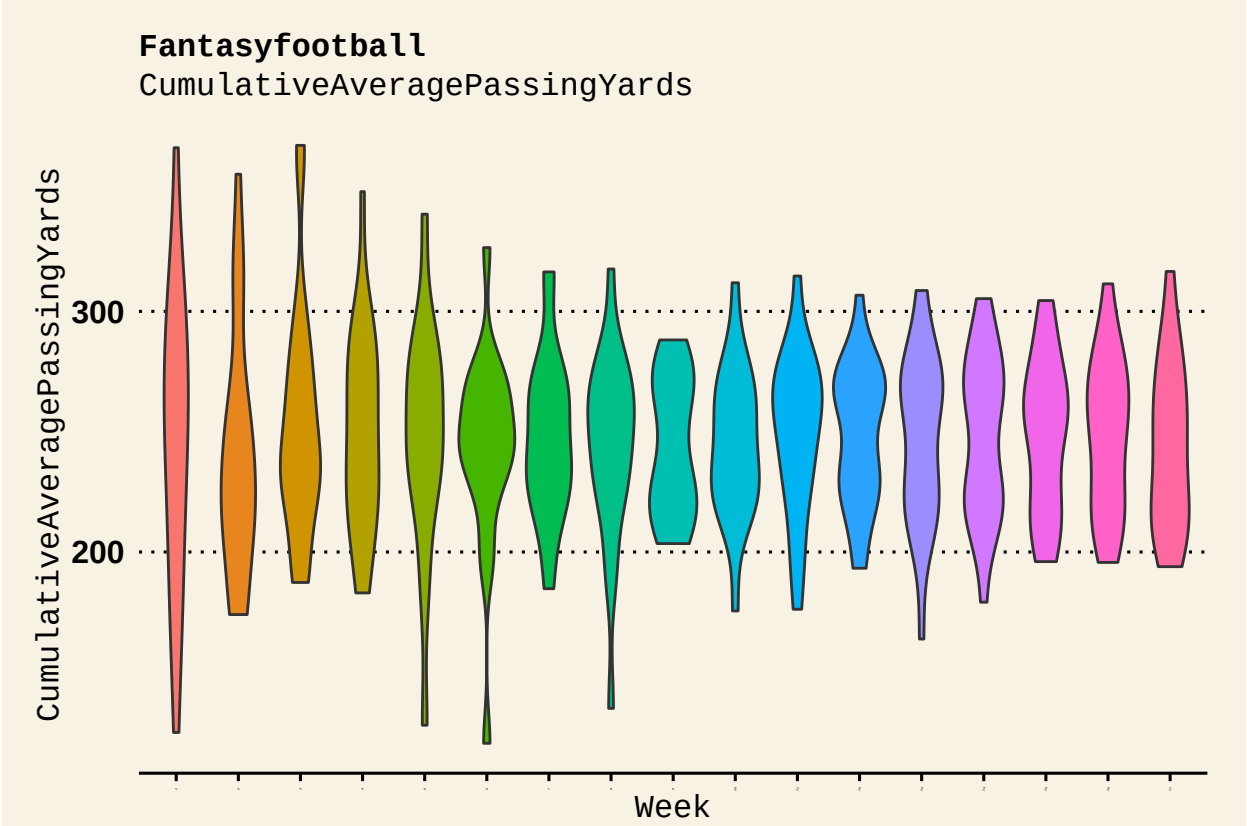
```
eda_derived %>% ggplot(aes(y=FantasyPoints,x=Week,fill=Week,group=Week))+
                      geom_violin(show.legend = FALSE)+
                      xlab("Week")+ylab("FantasyPoints")+
                      labs(title="Fantasyfootball",
                      subtitle="Weekly fantasypoints",
                      aption="Source: Fantasyfootball")+
                      theme_wsj()+
                      theme(plot.title    = element_text(size = rel(0.5)),
                            plot.subtitle = element_text(size = rel(0.5)),
                            axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                            axis.title    = element_text(size = rel(0.5)),
                            legend.position  = "right",
                            legend.direction ="vertical",
                            legend.title = element_text(size = rel(0.5)))
```

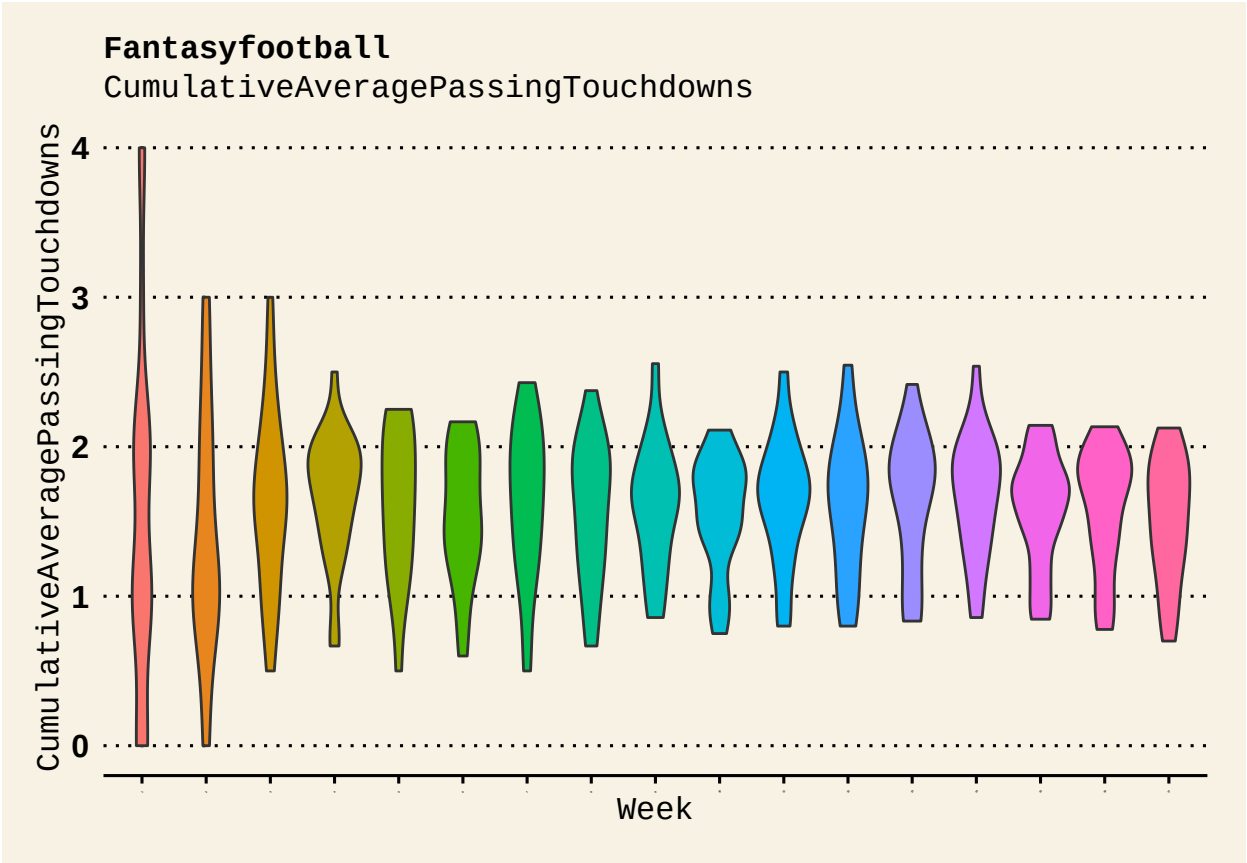


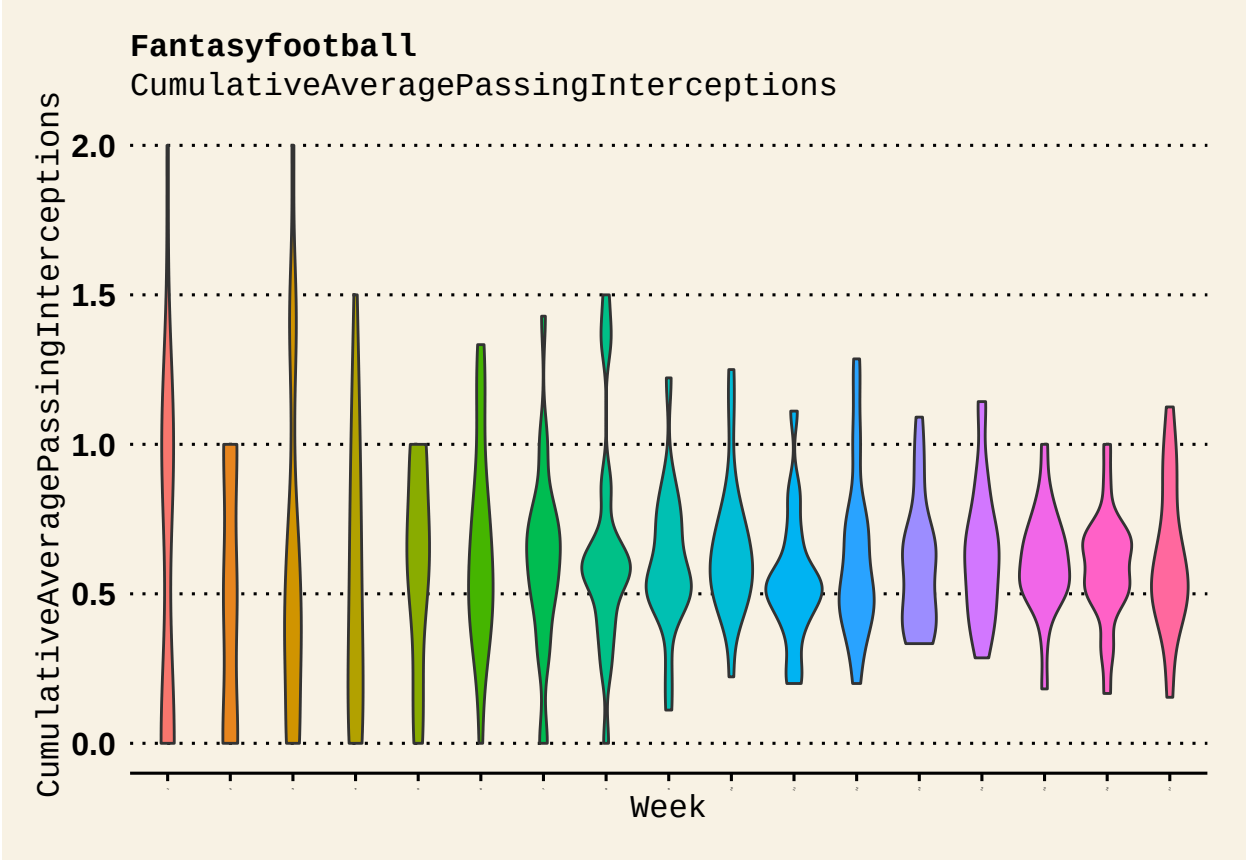

```
for (i in 2:20) {

ggplotp <- eda_derived %>%
           ggplot(aes_string(y=names(eda_derived[i]),x="Week",fill="Week",group="Week"))+
           geom_violin(show.legend = FALSE)+
           xlab("Week")+ylab(names(eda_derived[i]))+
           labs(title="Fantasyfootball",
           subtitle=names(eda_derived[i]),
           aption="Source: Fantasyfootball")+
           theme_wsj()+
```

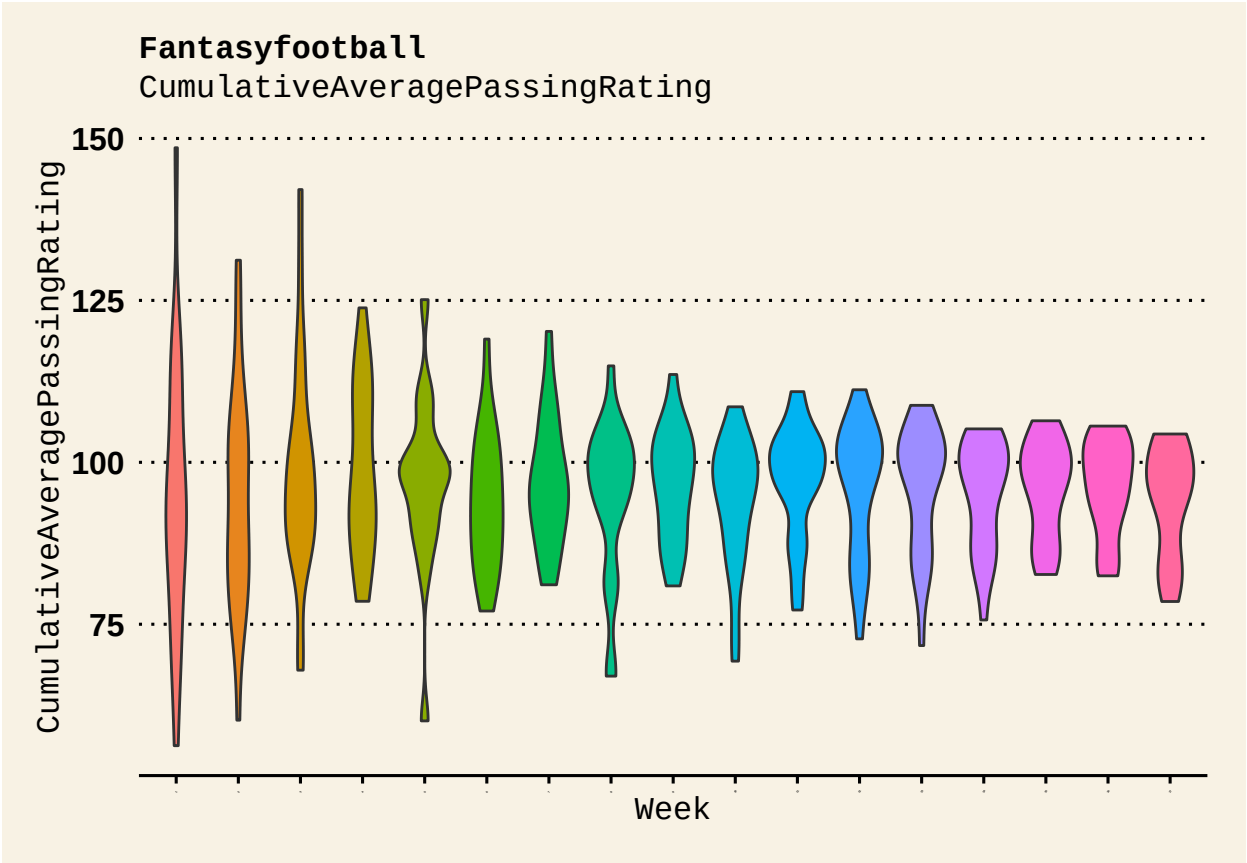
```
          theme(plot.title    = element_text(size = rel(0.5)),
                plot.subtitle = element_text(size = rel(0.5)),
                axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                axis.title    = element_text(size = rel(0.5)),
                legend.position  = "right",
                legend.direction ="vertical",
                legend.title = element_text(size = rel(0.5)))


  print(ggplotp)
}
```

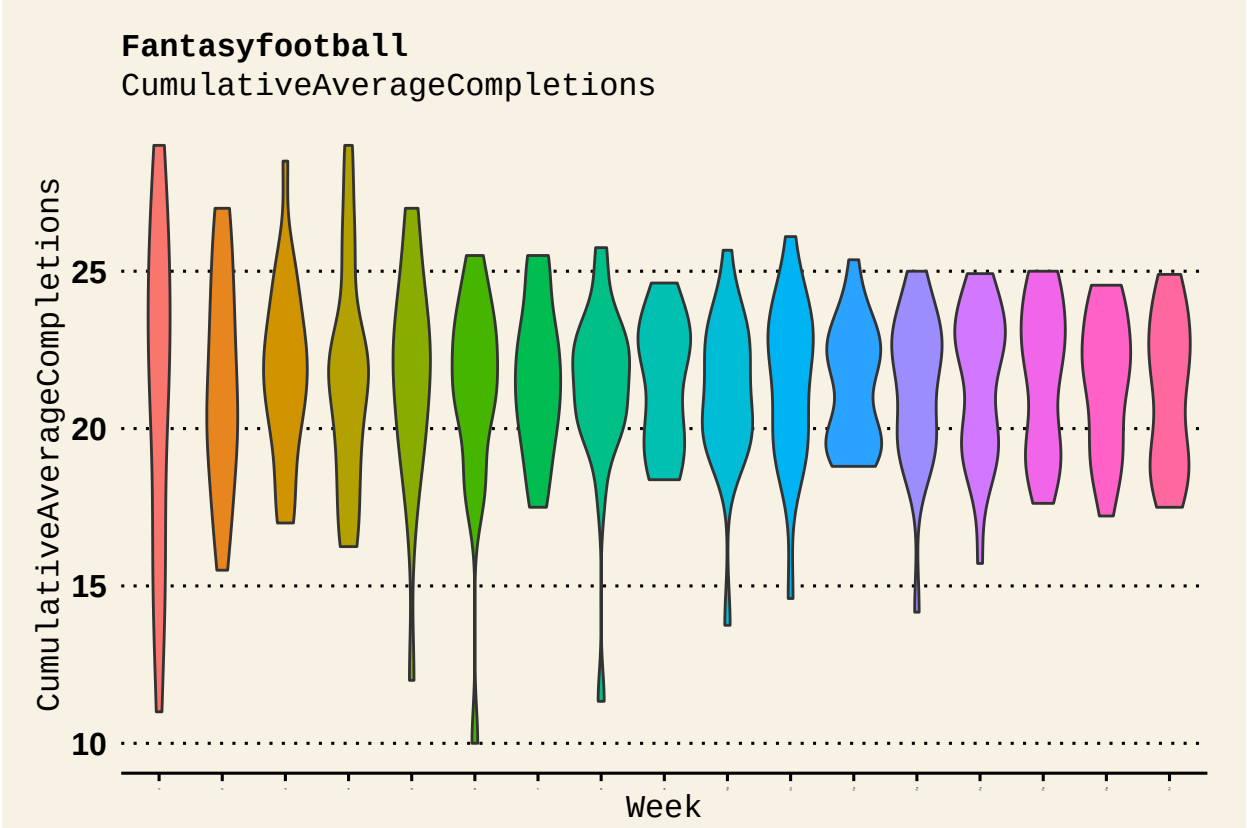


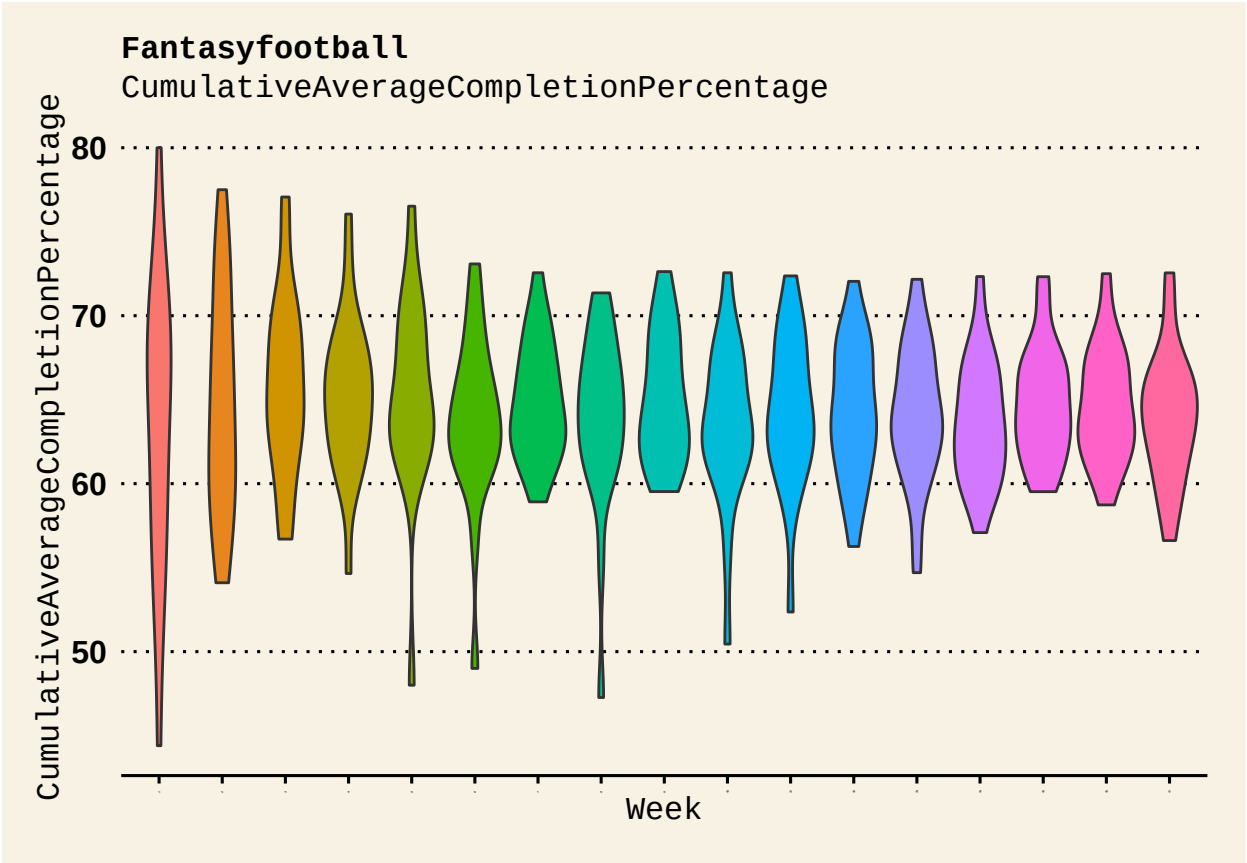

Fantasyfootball
CumulativeAveragePassingYards
CumulativeAveragePassingYards
300
200
Week

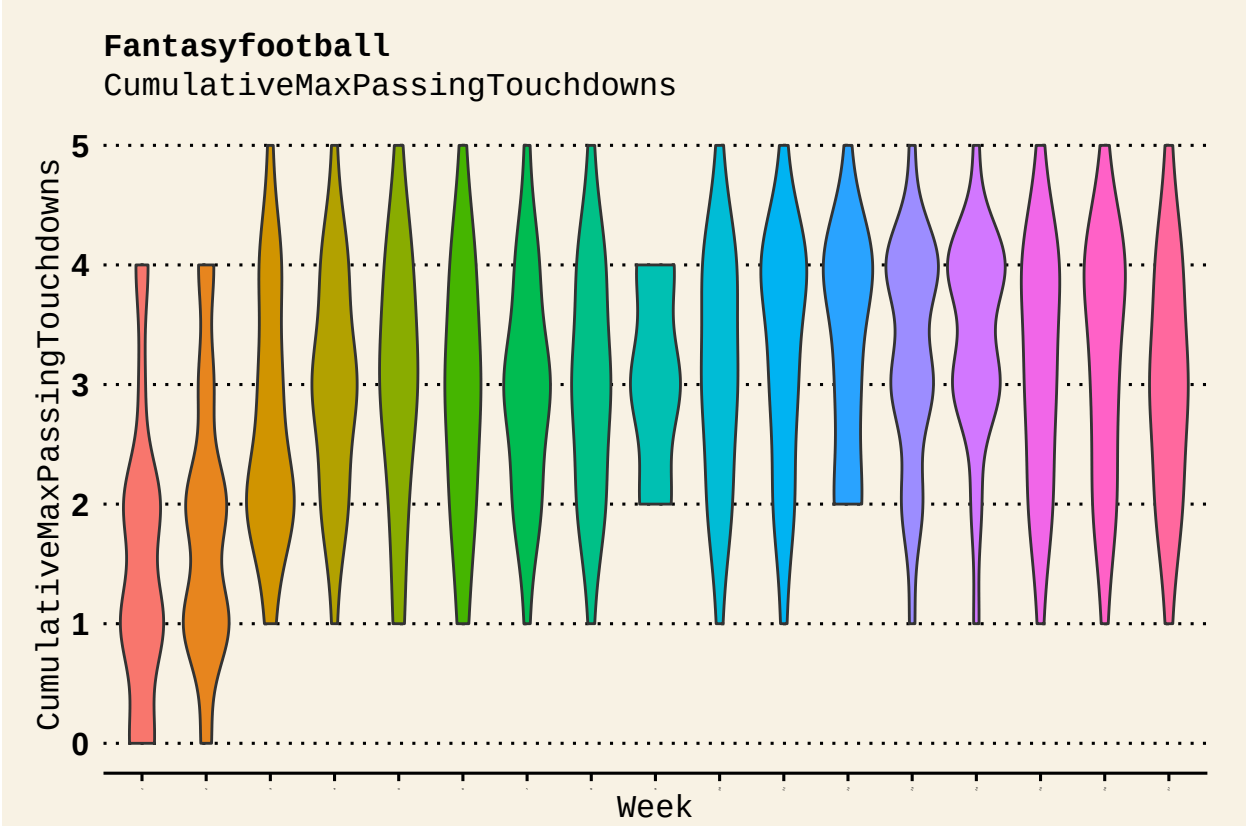

Fantasyfootball
CumulativeAveragePassingTouchdowns
CumulativeAveragePassingTouchdowns
4
3
2
1
0
Week

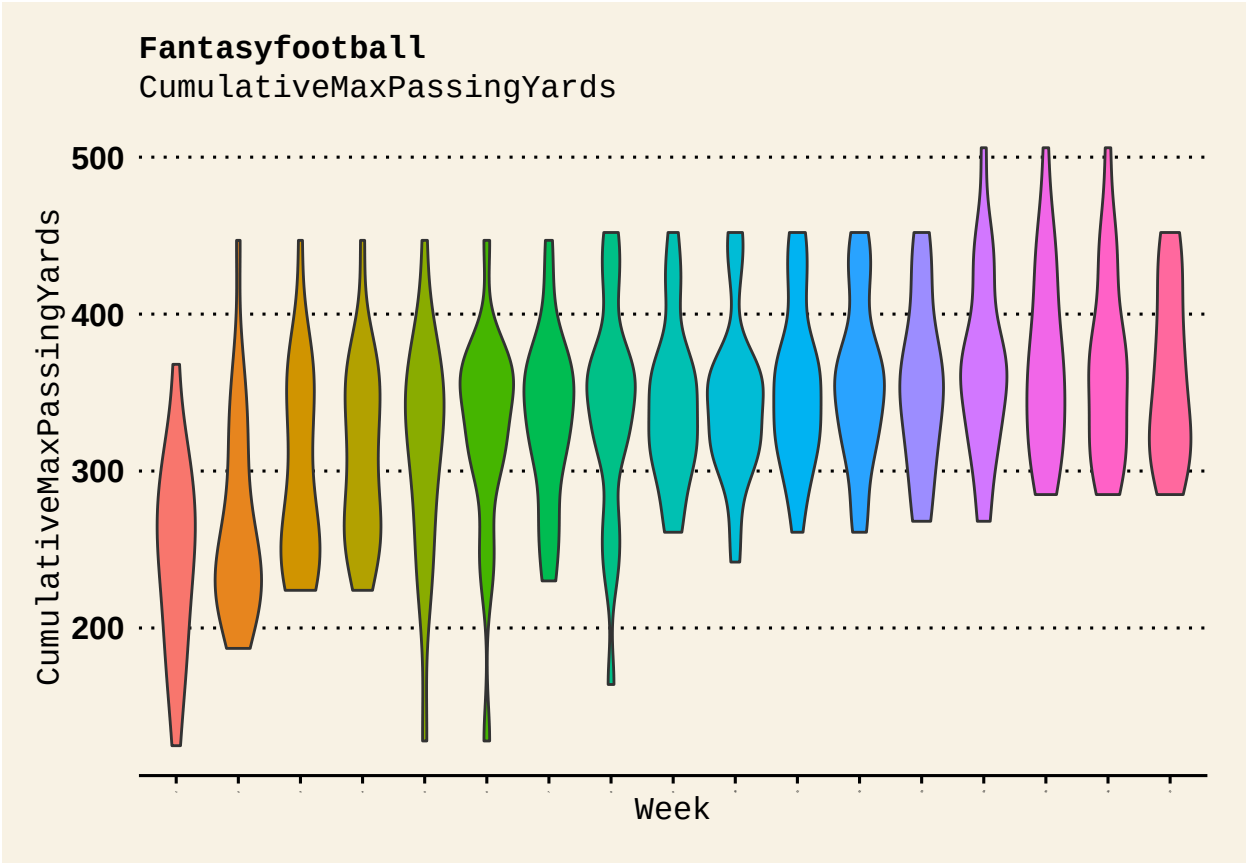

Fantasyfootball
CumulativeAveragePassingInterceptions
CumulativeAveragePassingInterceptions
2.0
1.5
1.0
0.5
0.0
Week

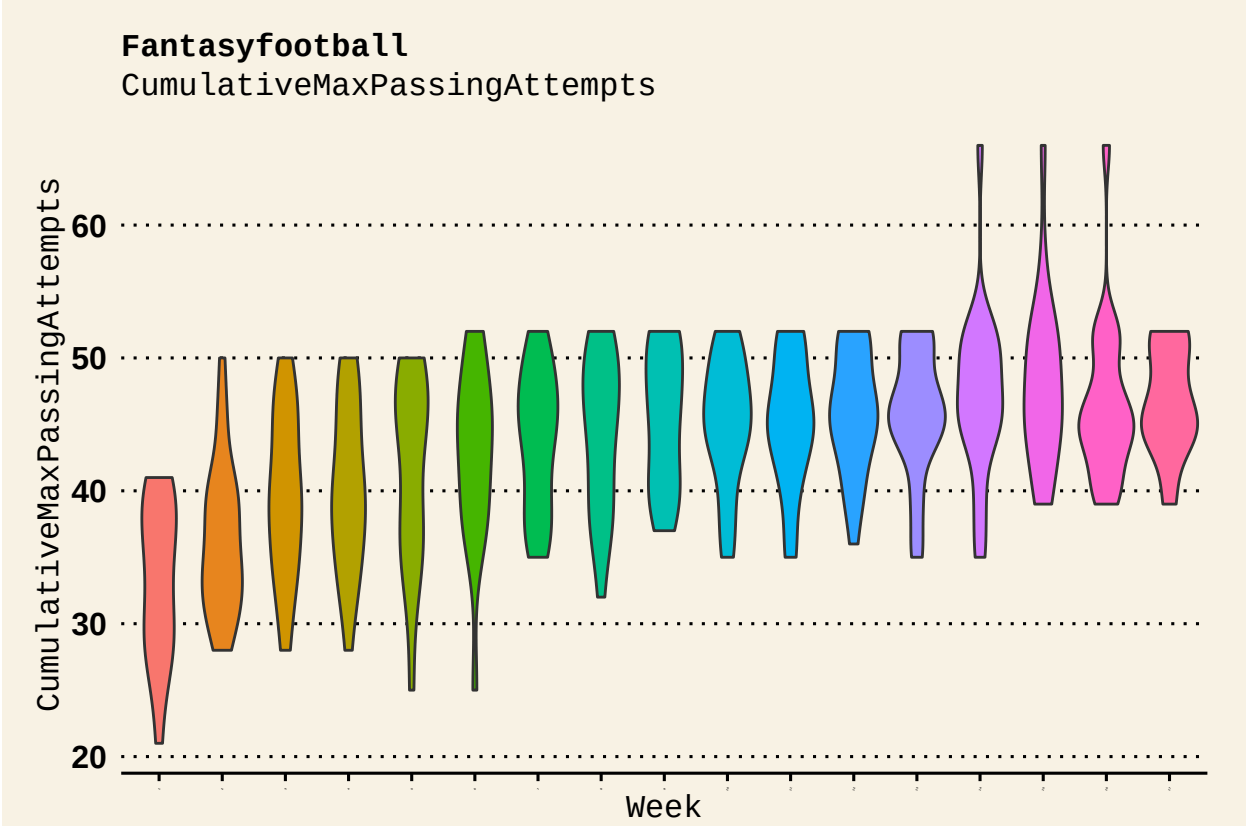

Fantasyfootball
CumulativeAveragePassingRating
CumulativeAveragePassingRating
150
125
100
75
Week

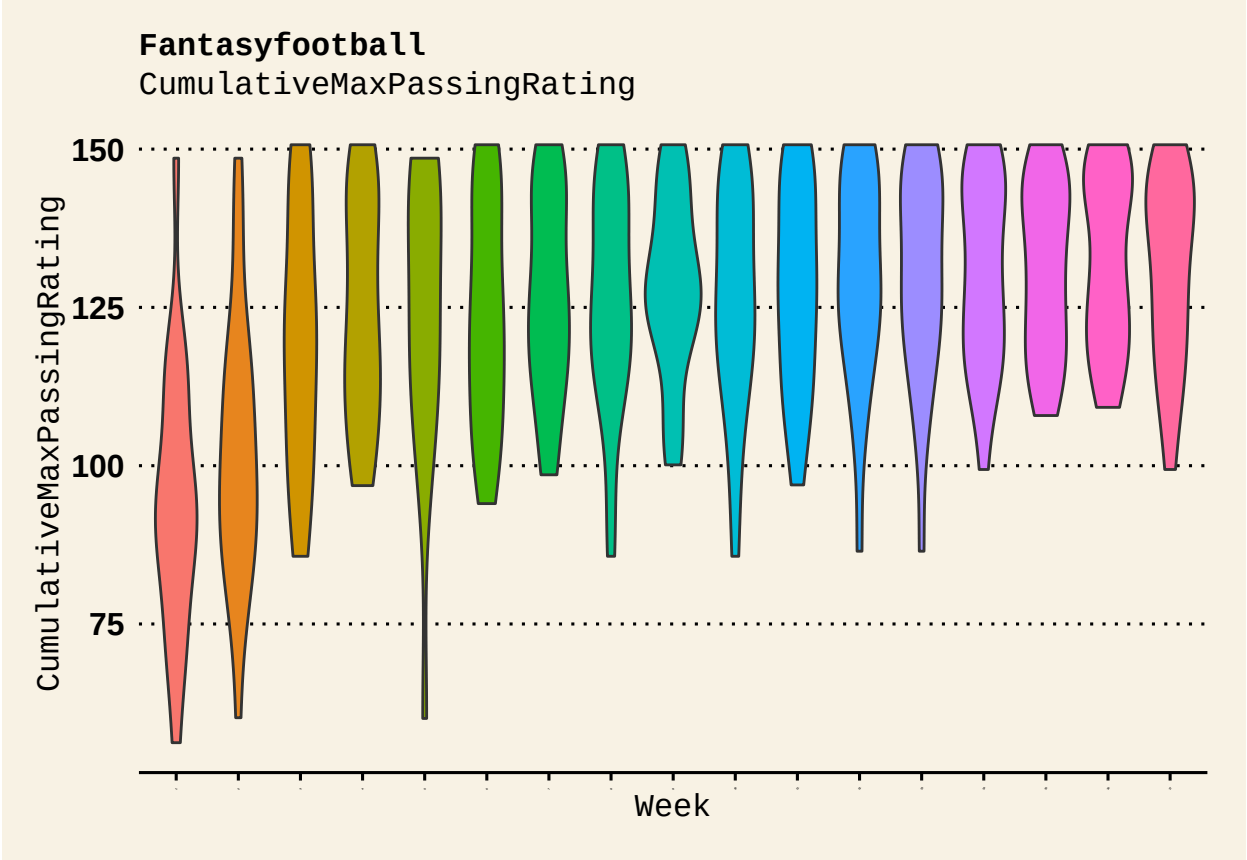

Fantasyfootball
CumulativeAverageCompletions
CumulativeAverageCompletions
25
20
15
10
Week

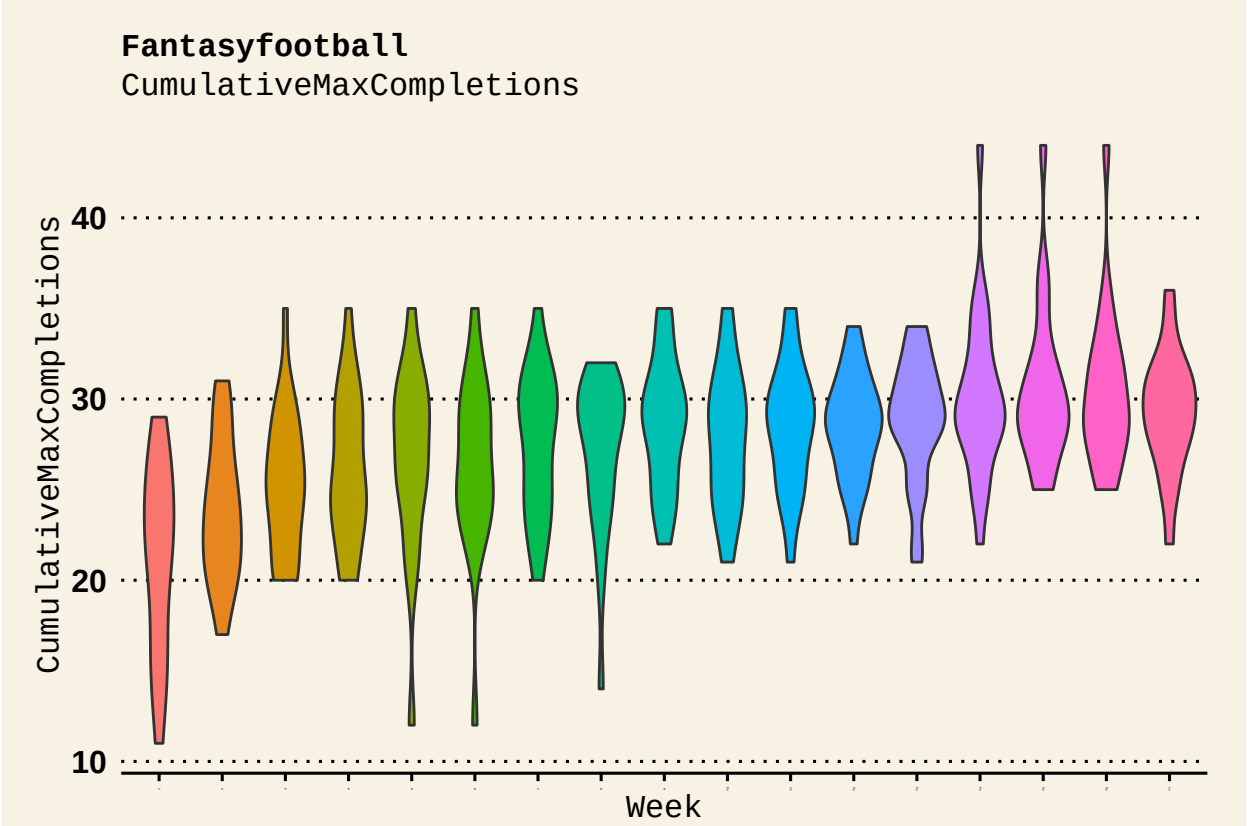

Fantasyfootball
CumulativeAverageCompletionPercentage
CumulativeAverageCompletionPercentage
80
70
60
50
Week

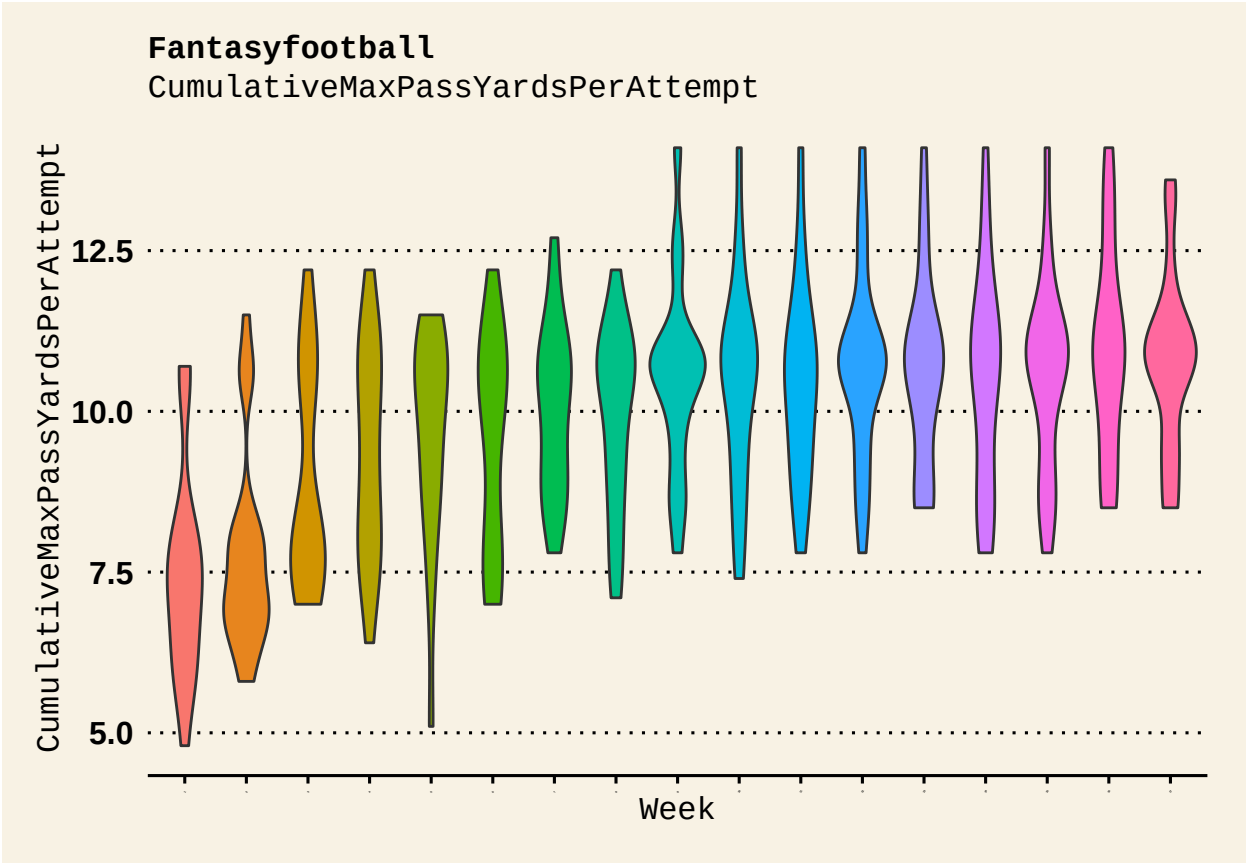

Fantasyfootball
CumulativeMaxPassingTouchdowns
CumulativeMaxPassingTouchdowns
5
4
3
2
1
0
Week

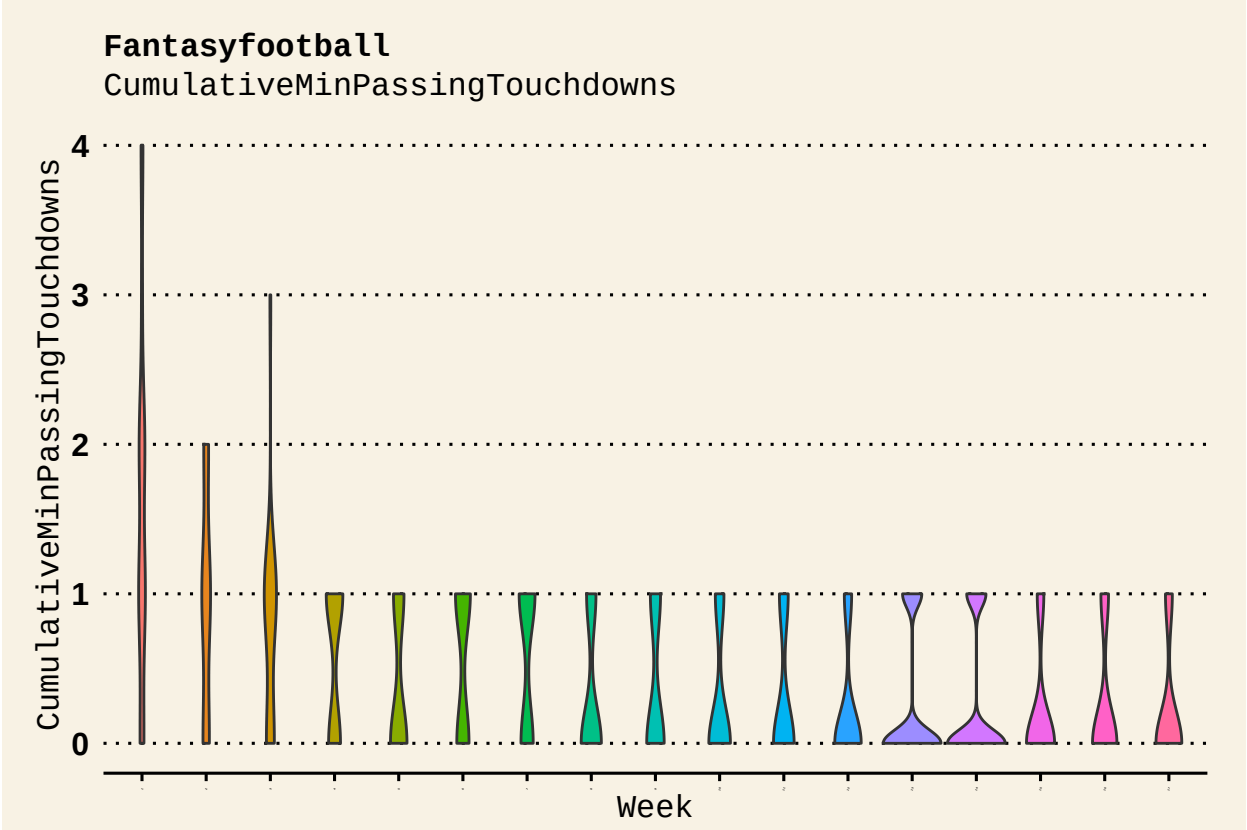

Fantasyfootball
CumulativeMaxPassingYards
CumulativeMaxPassingYards
500
400
300
200
Week

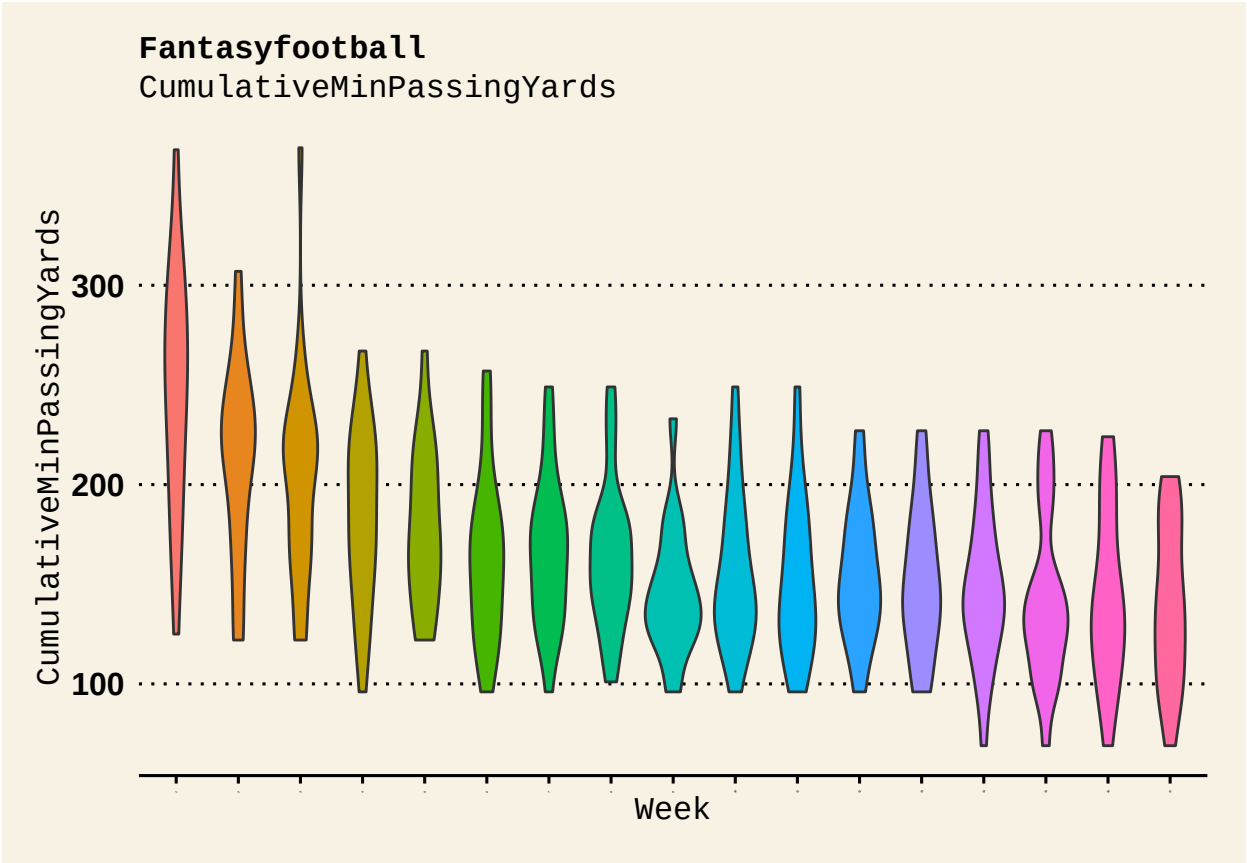

Fantasyfootball
CumulativeMaxPassingAttempts
CumulativeMaxPassingAttempts
60
50
40
30
20
Week

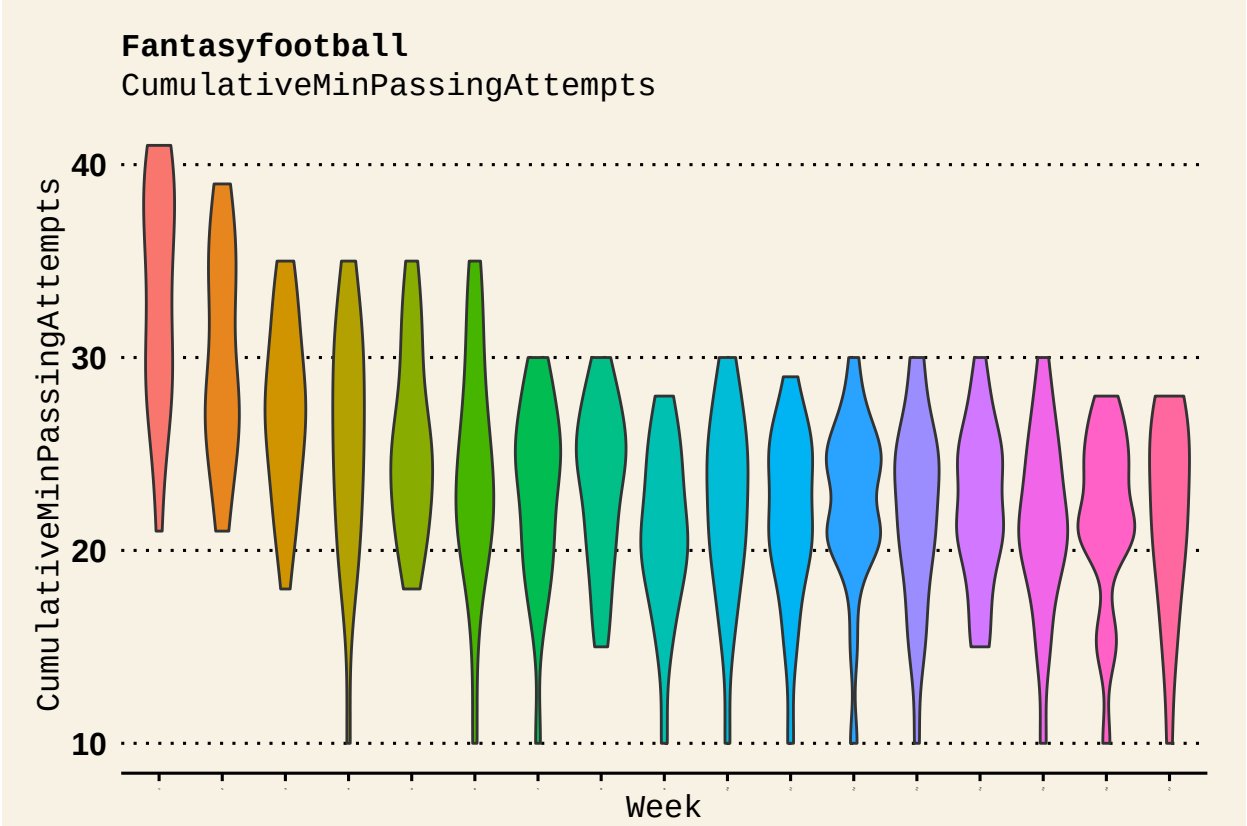

Fantasyfootball
CumulativeMaxPassingRating
CumulativeMaxPassingRating
150
125
100
75
Week

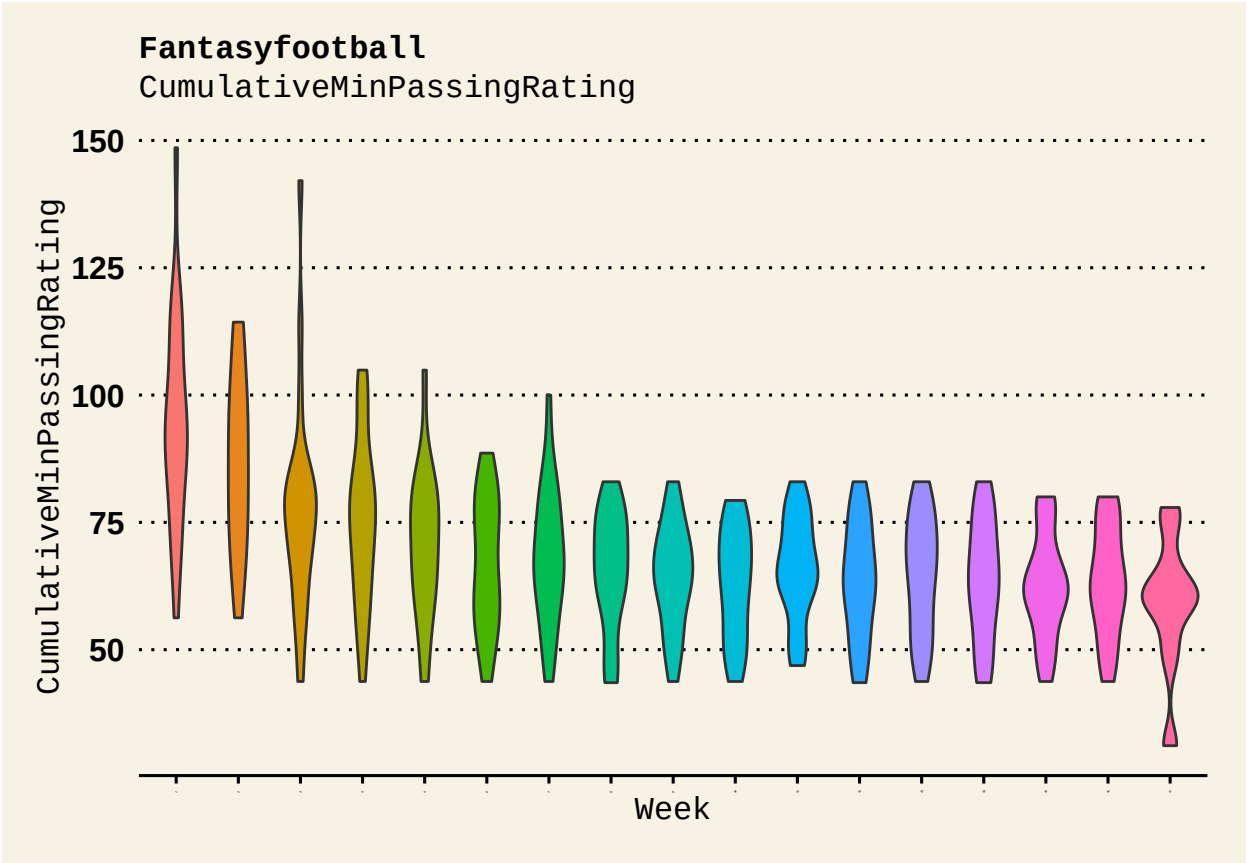

Fantasyfootball
CumulativeMaxCompletions
CumulativeMaxCompletions
40
30
20
10
Week

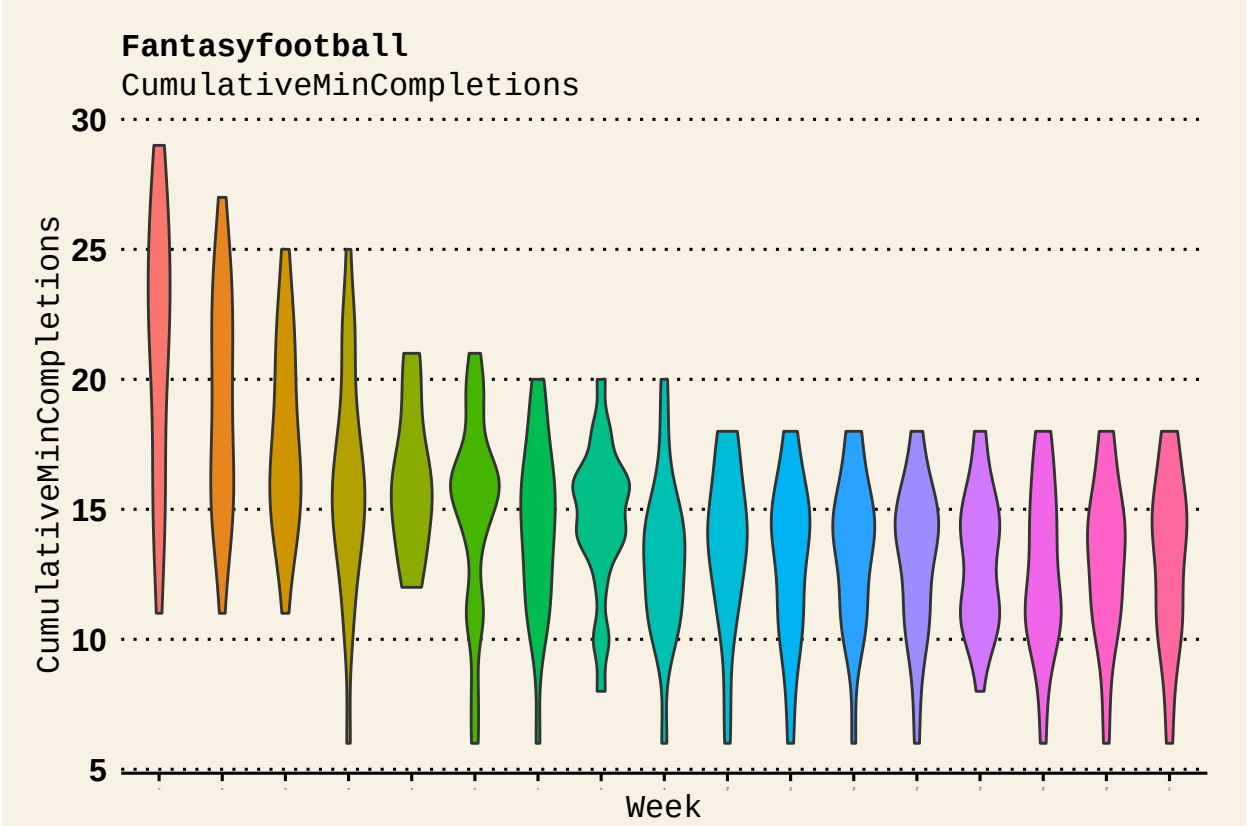

Fantasyfootball
CumulativeMaxPassYardsPerAttempt
CumulativeMaxPassYardsPerAttempt
12.5
10.0
7.5
5.0
Week

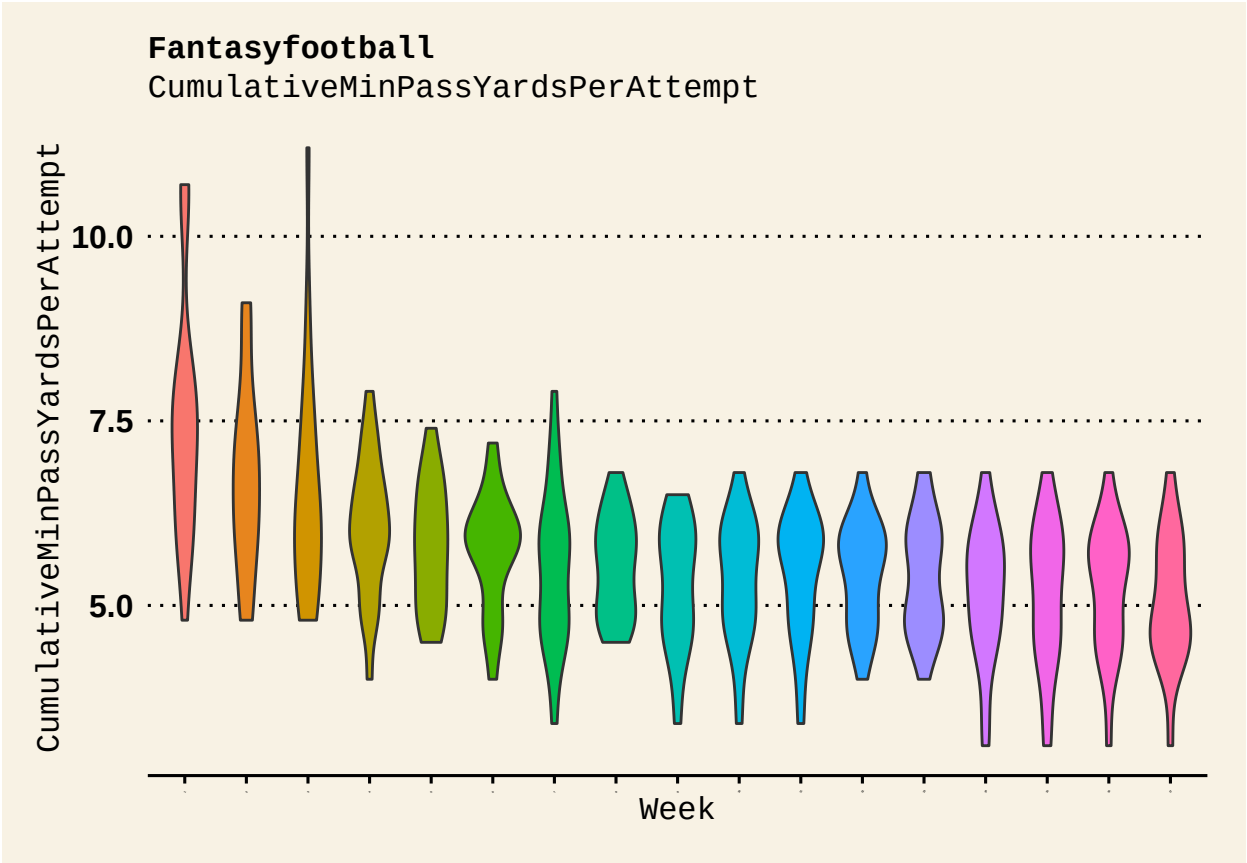

Fantasyfootball
CumulativeMinPassingTouchdowns
CumulativeMinPassingTouchdowns
4
3
2
1
0
Week


Fantasyfootball
CumulativeMinPassingYards
CumulativeMinPassingYards
300
200
100
Week


Fantasyfootball
CumulativeMinPassingAttempts
CumulativeMinPassingAttempts
40
30
20
10
Week


Fantasyfootball
CumulativeMinPassingRating
CumulativeMinPassingRating
150
125
100
75
50
Week


Fantasyfootball
CumulativeMinCompletions
30
25
20
15
10
5
CumulativeMinCompletions
Week

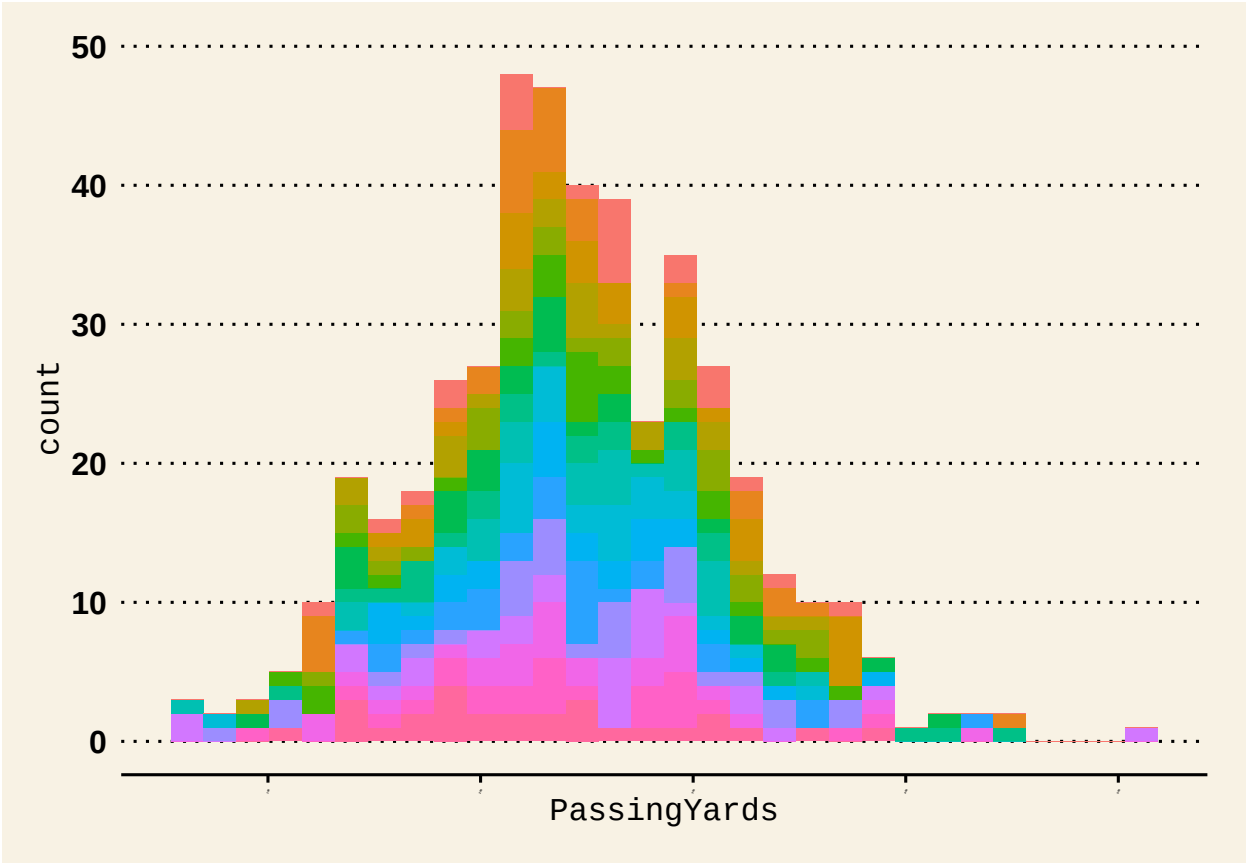

Fantasyfootball
CumulativeMinPassYardsPerAttempt
10.0
7.5
5.0
CumulativeMinPassYardsPerAttempt
Week

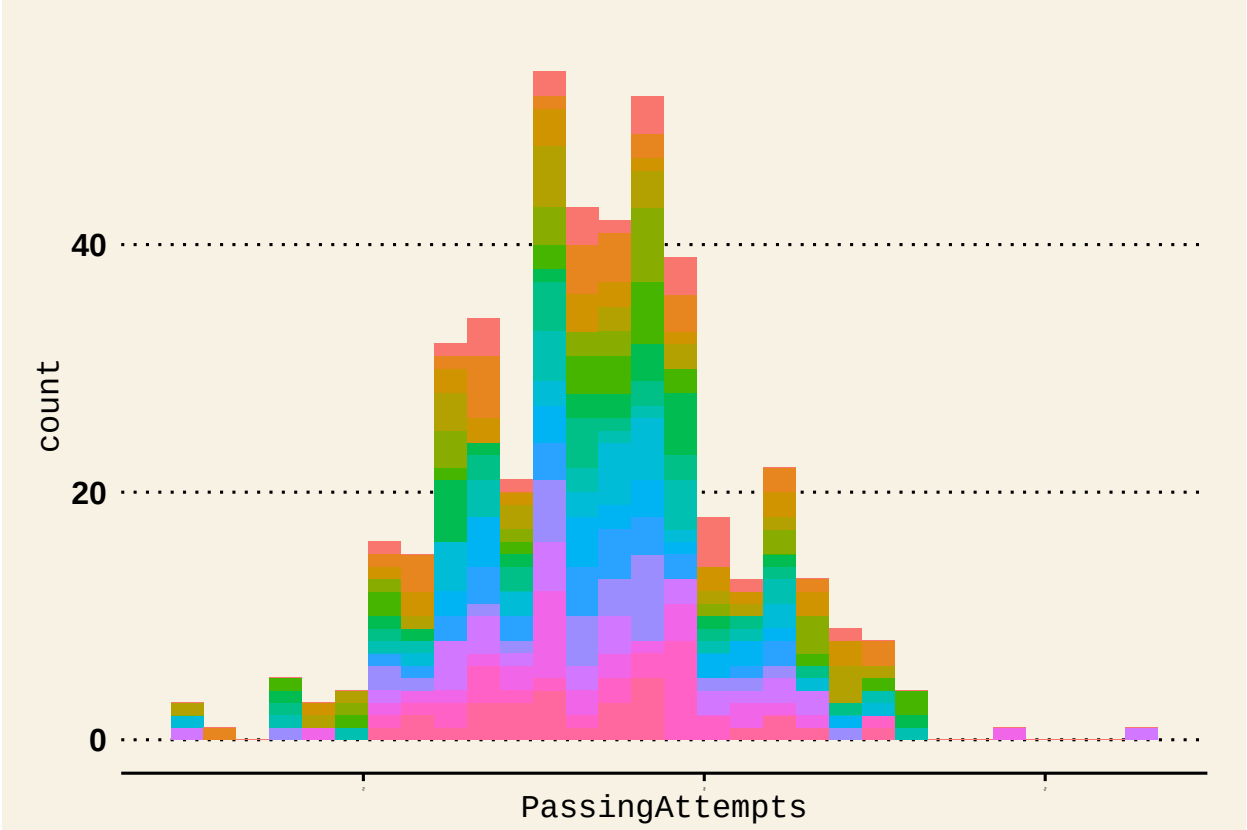
Check for skewed predictors

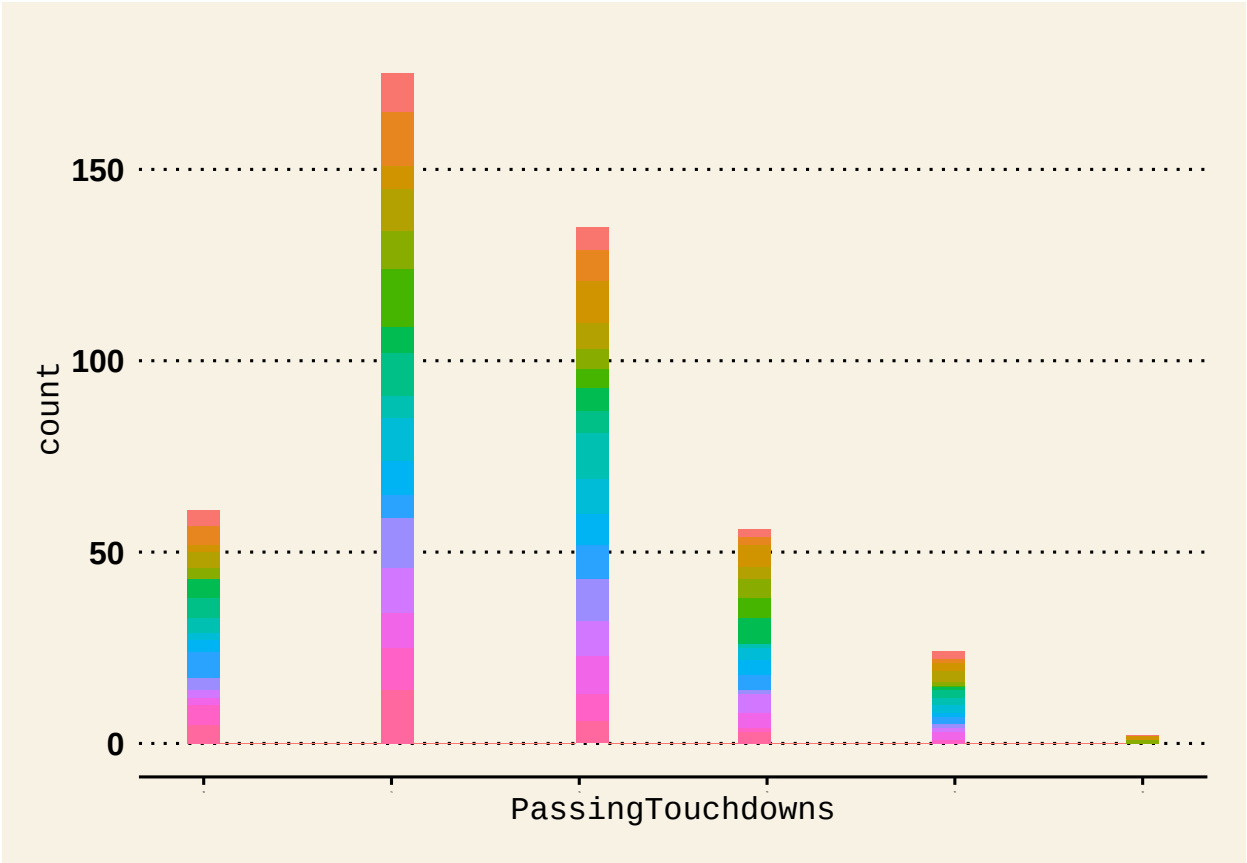
8.4 : Histograms - Normality by Week

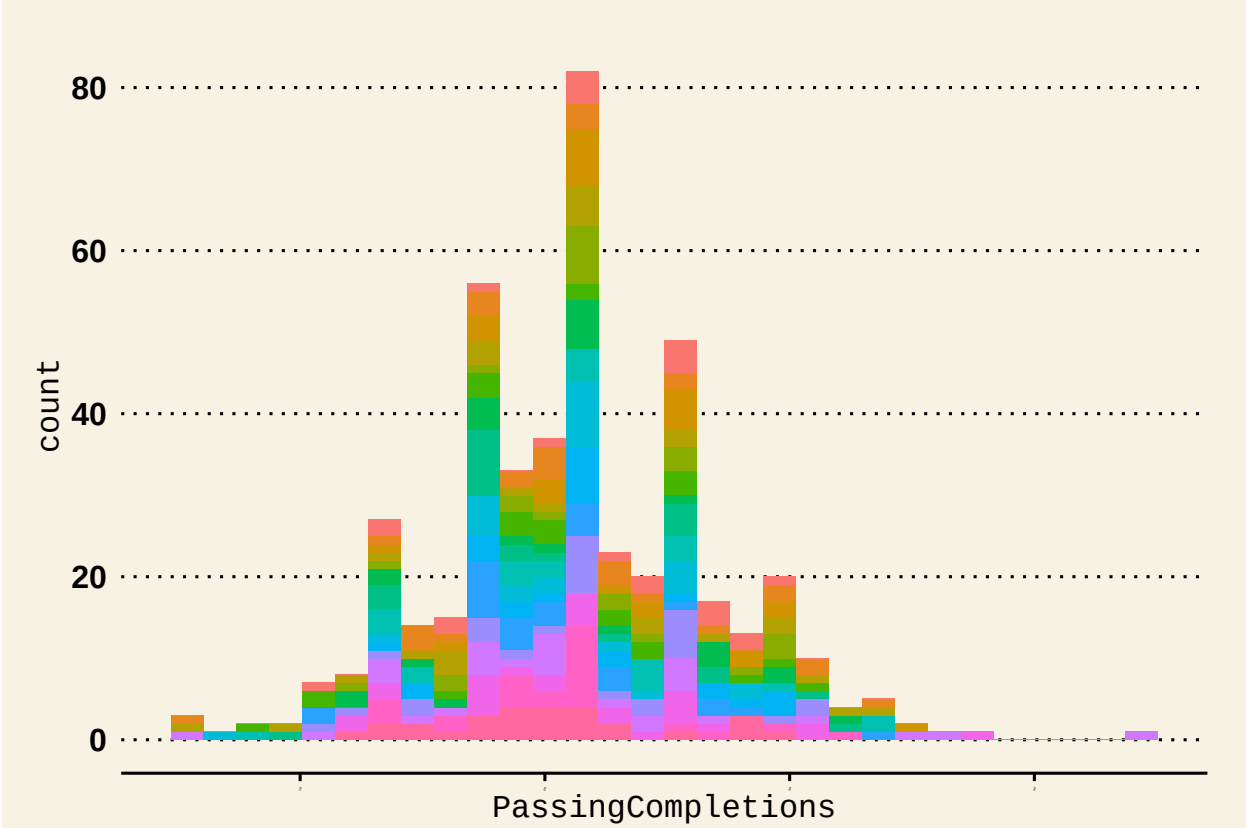
8.4.1 : Base feature Set

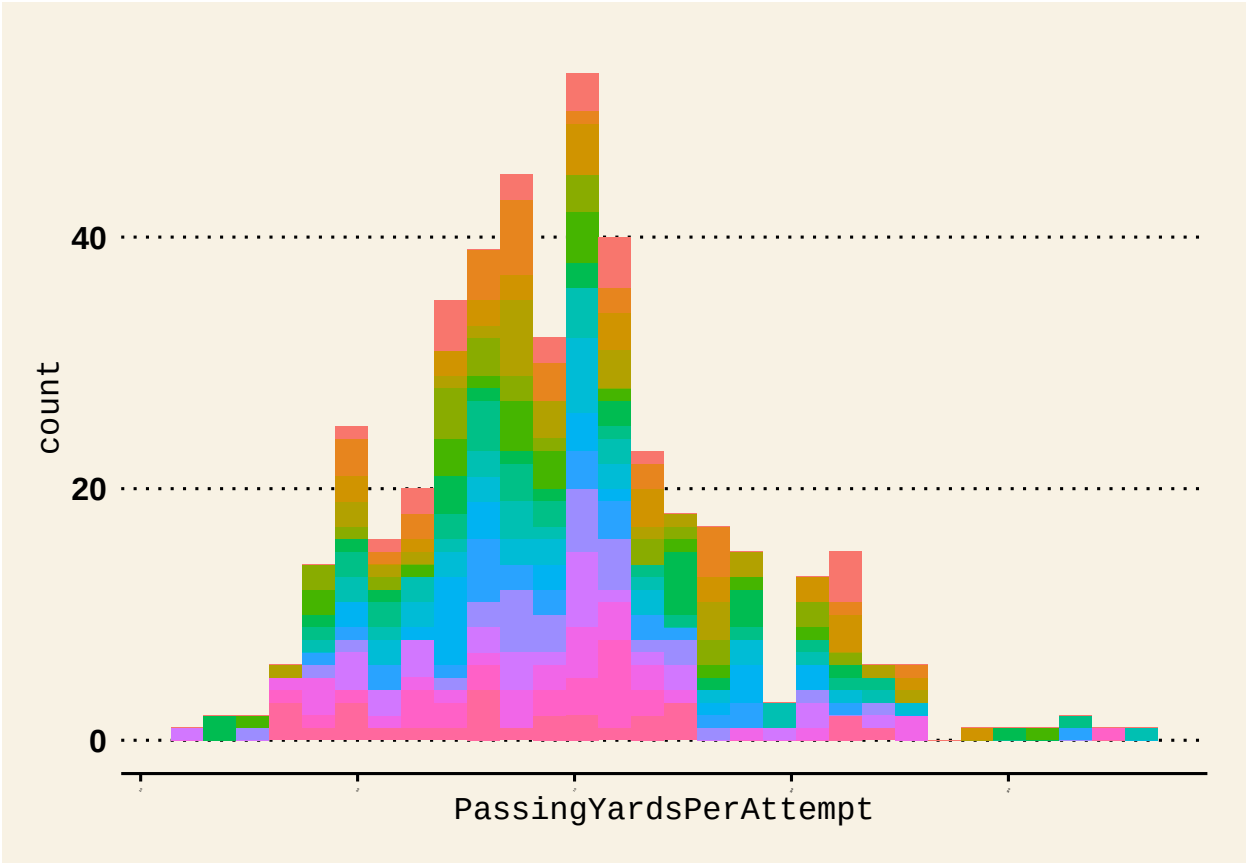
```
features_to_keep = c('PassingYards', 'PassingAttempts', 'PassingTouchdowns', 'PassingCompletions', 'Pas

for(f in features_to_keep){
  hist = eda_base %>% ggplot(aes_string(x=f,fill="Week"))+
                      geom_histogram(bins=30,show.legend = FALSE)+
                      theme_wsj()+
                      theme(plot.title    = element_text(size = rel(0.5)),
                            plot.subtitle = element_text(size = rel(0.5)),
                            axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                            axis.title    = element_text(size = rel(0.5)),
                            legend.position  = "right",
                            legend.direction ="vertical",
                            legend.title = element_text(size = rel(0.5)))
  print(hist)
}
```




40
20
0
count
PassingAttempts

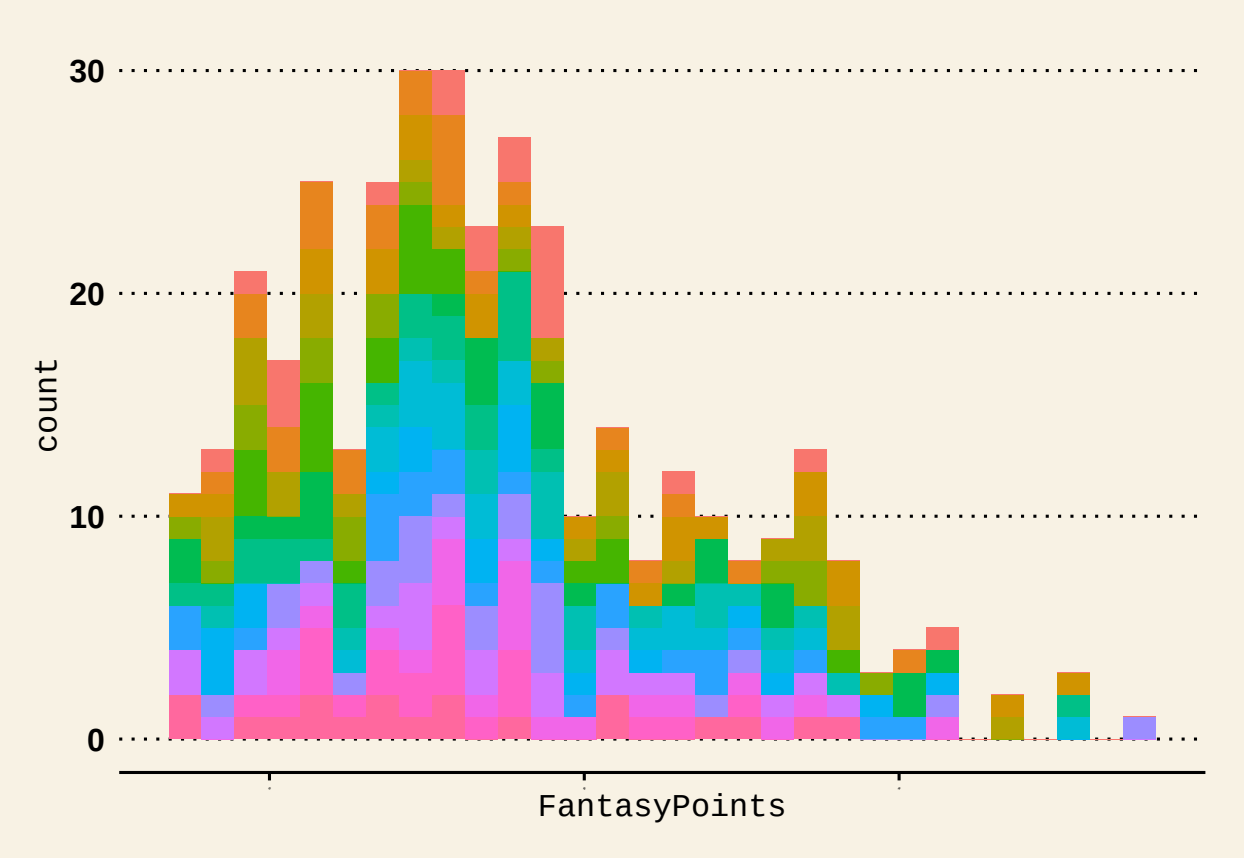

150
100
50
0
count
PassingTouchdowns

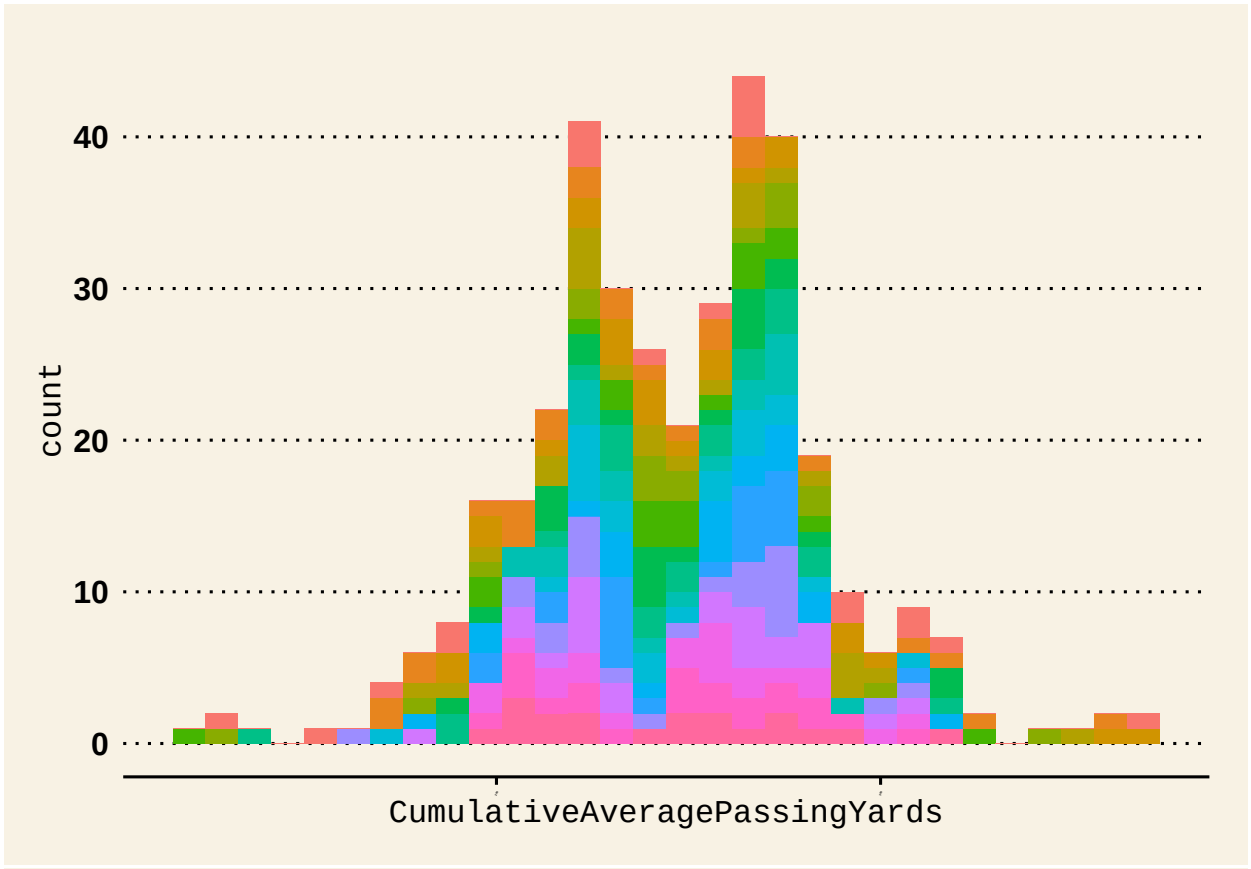

80
60
40
20
0
count
PassingCompletions

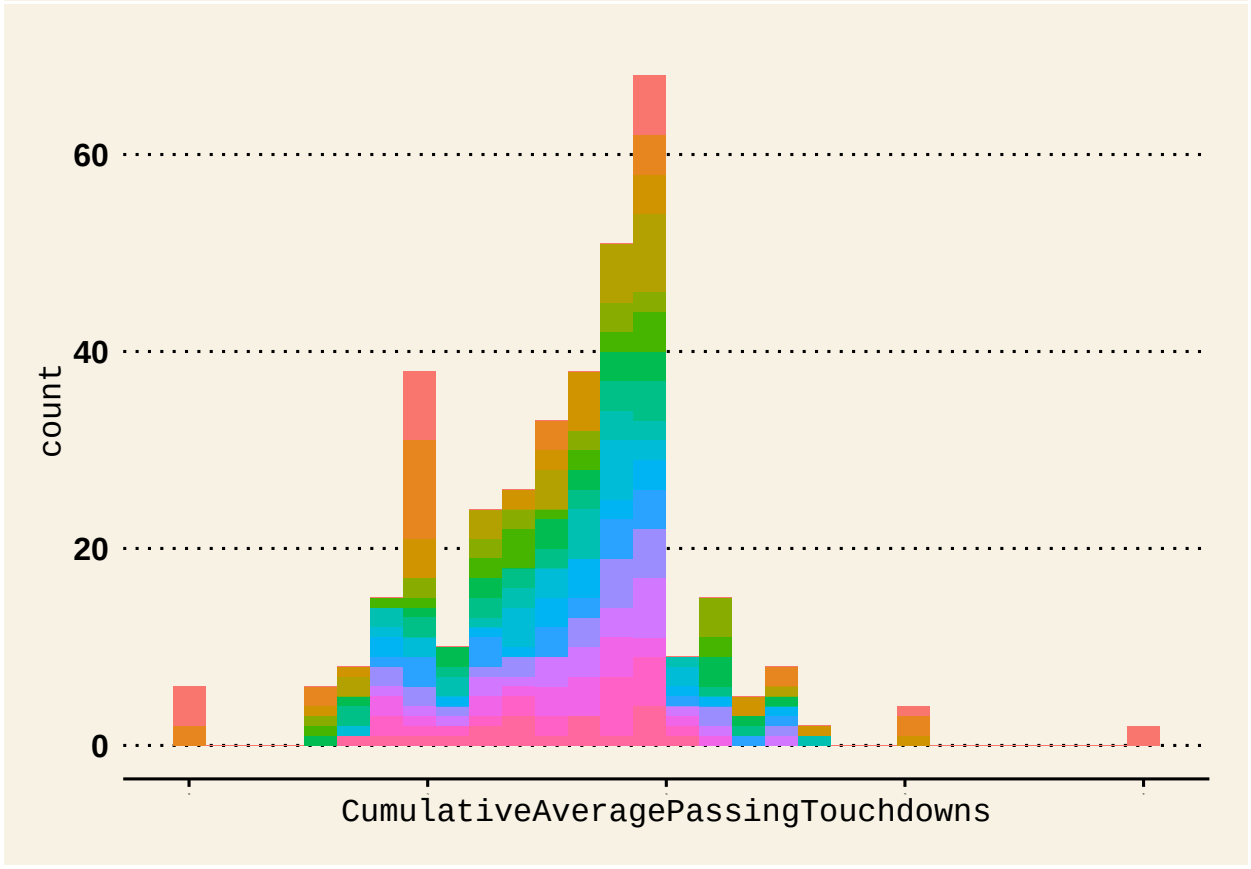

40
20
0
count
PassingYardsPerAttempt

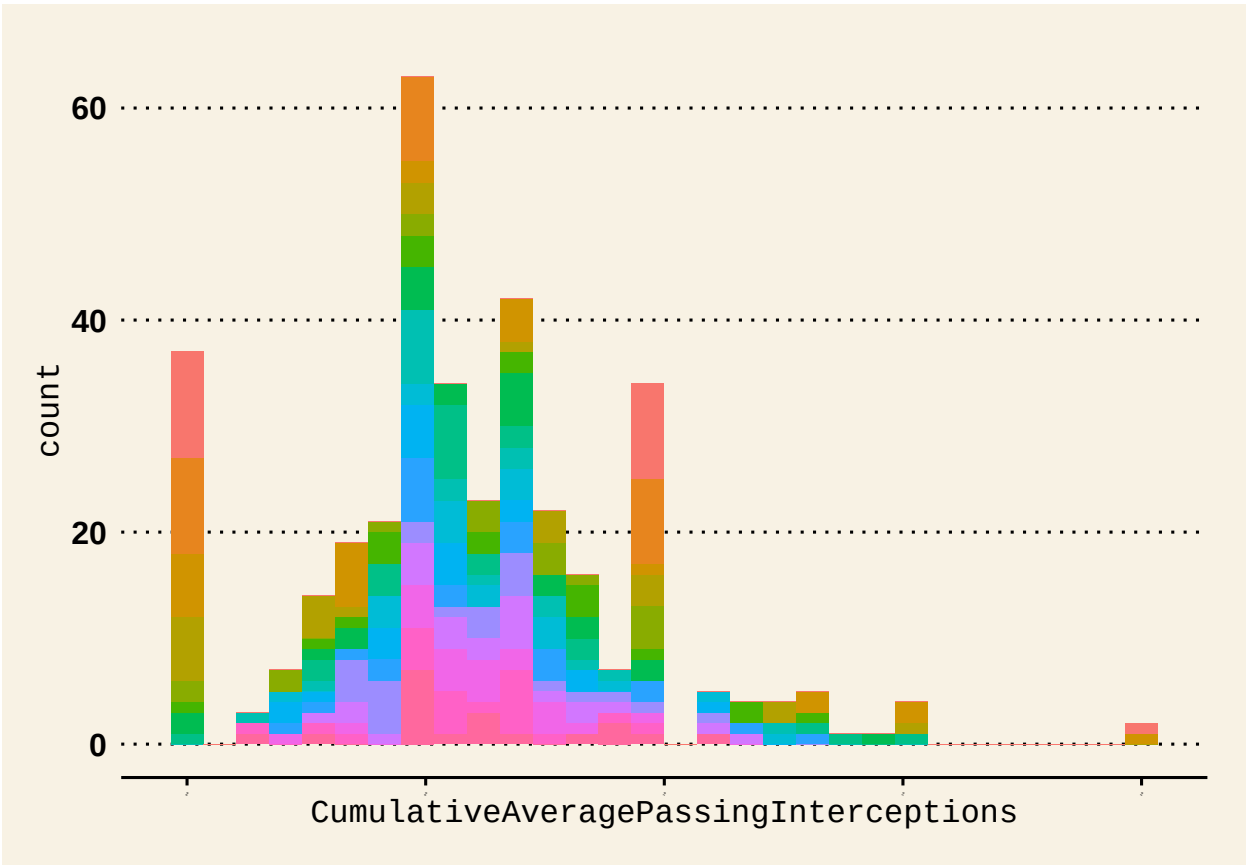
8.4.2 : Dervived feature Set

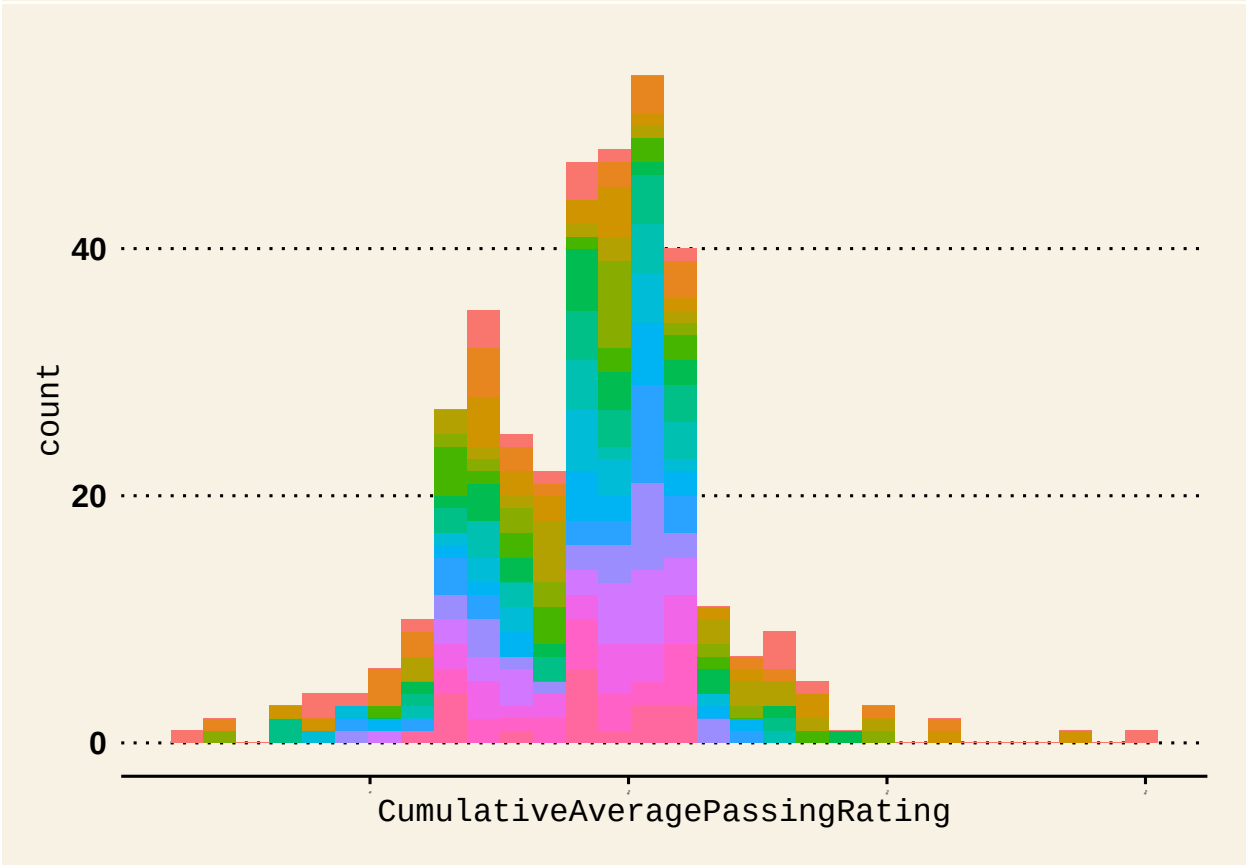
```
features_to_keep = names(eda_derived[-1])

for(f in features_to_keep){
  hist = eda_derived %>% ggplot(aes_string(x=f,fill="Week"))+
                       geom_histogram(bins=30,show.legend = FALSE)+
                       theme_wsj()+
                       theme(plot.title    = element_text(size = rel(0.5)),
                             plot.subtitle = element_text(size = rel(0.5)),
                             axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                             axis.title    = element_text(size = rel(0.5)),
                             legend.position  = "right",
                             legend.direction ="vertical",
                             legend.title = element_text(size = rel(0.5)))
  print(hist)
}
```

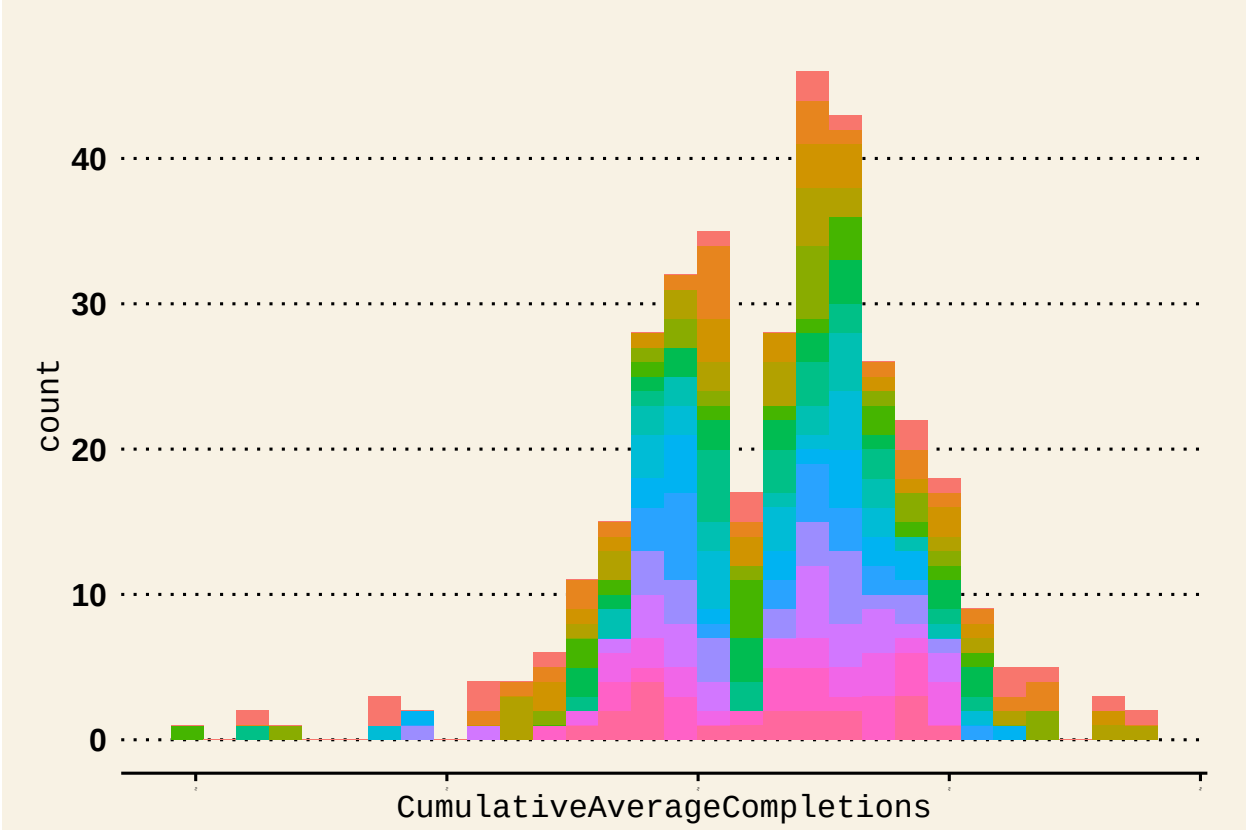


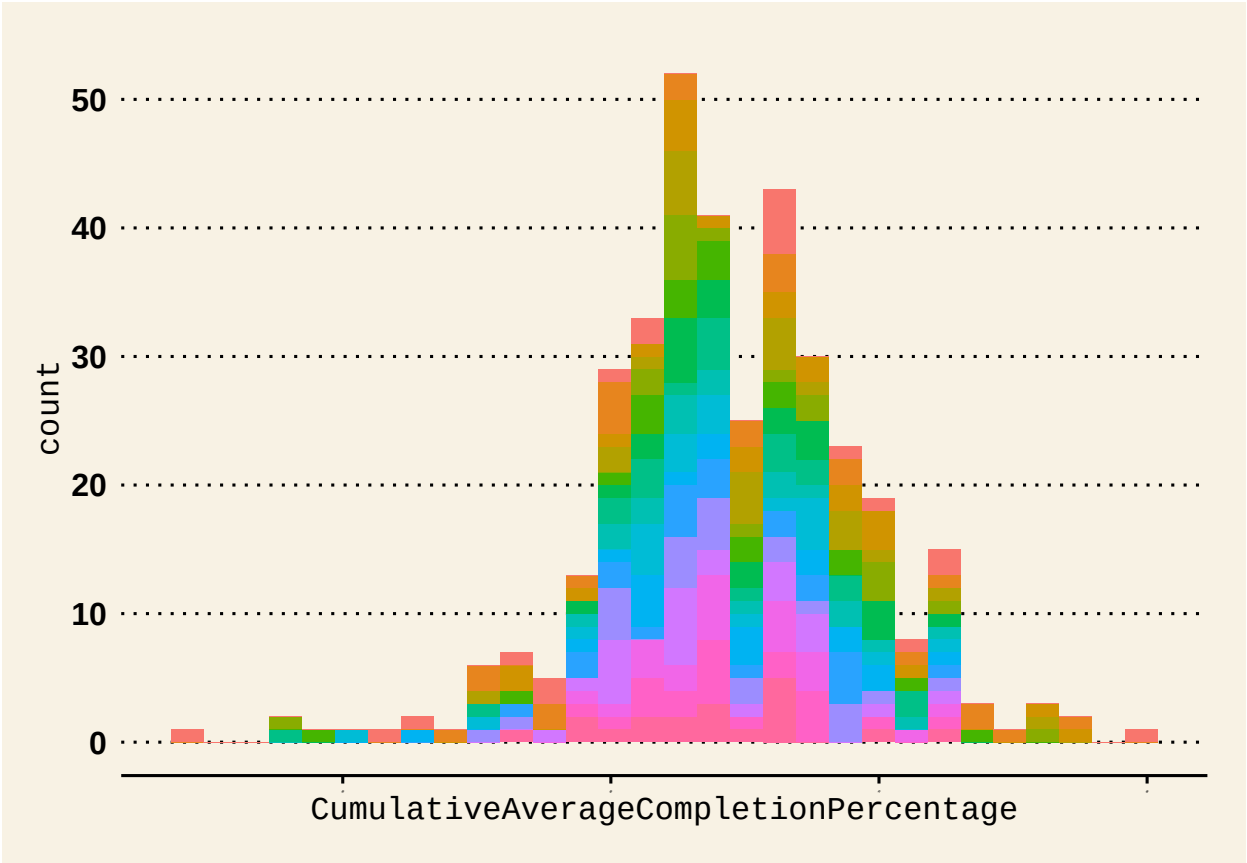

40
30
20
10
0
count
CumulativeAveragePassingYards

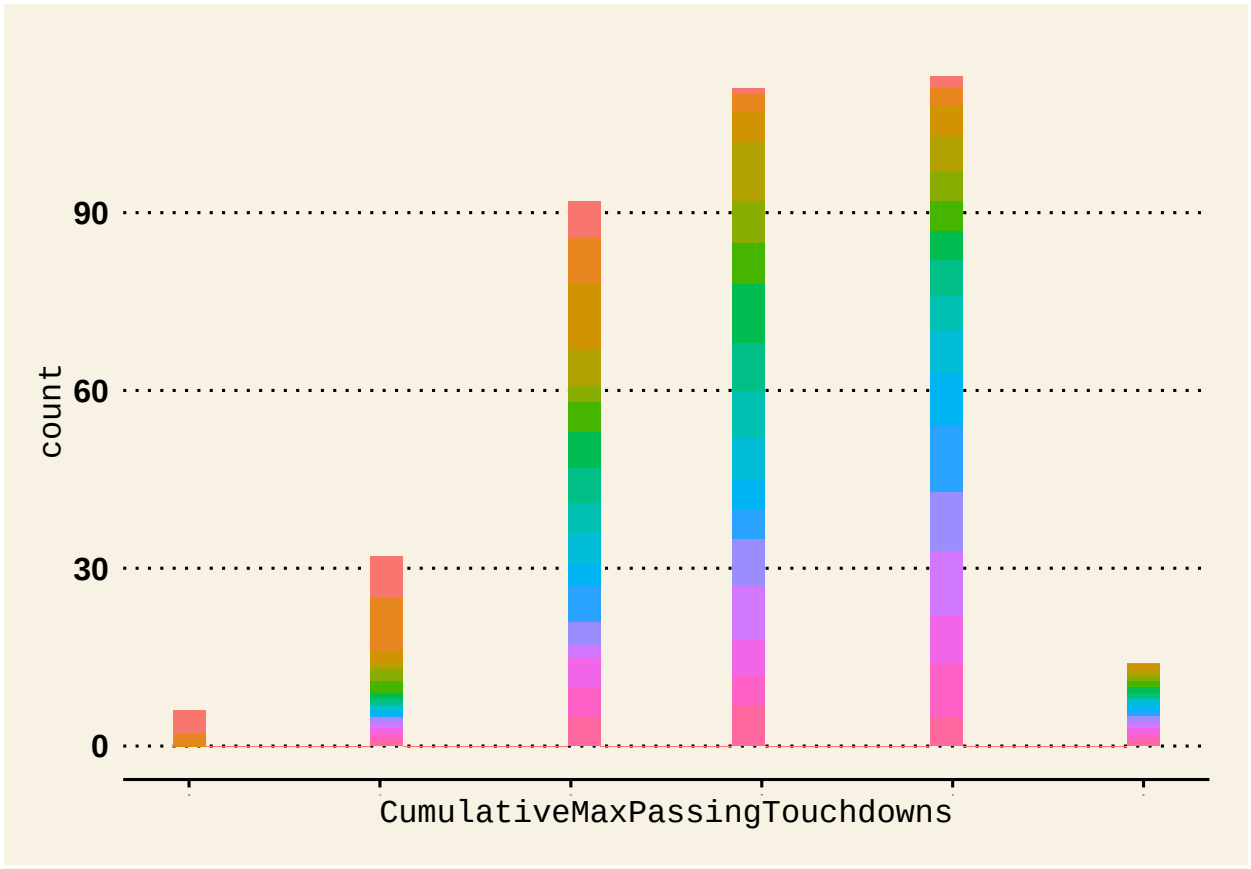

60
40
20
0
count
CumulativeAveragePassingTouchdowns

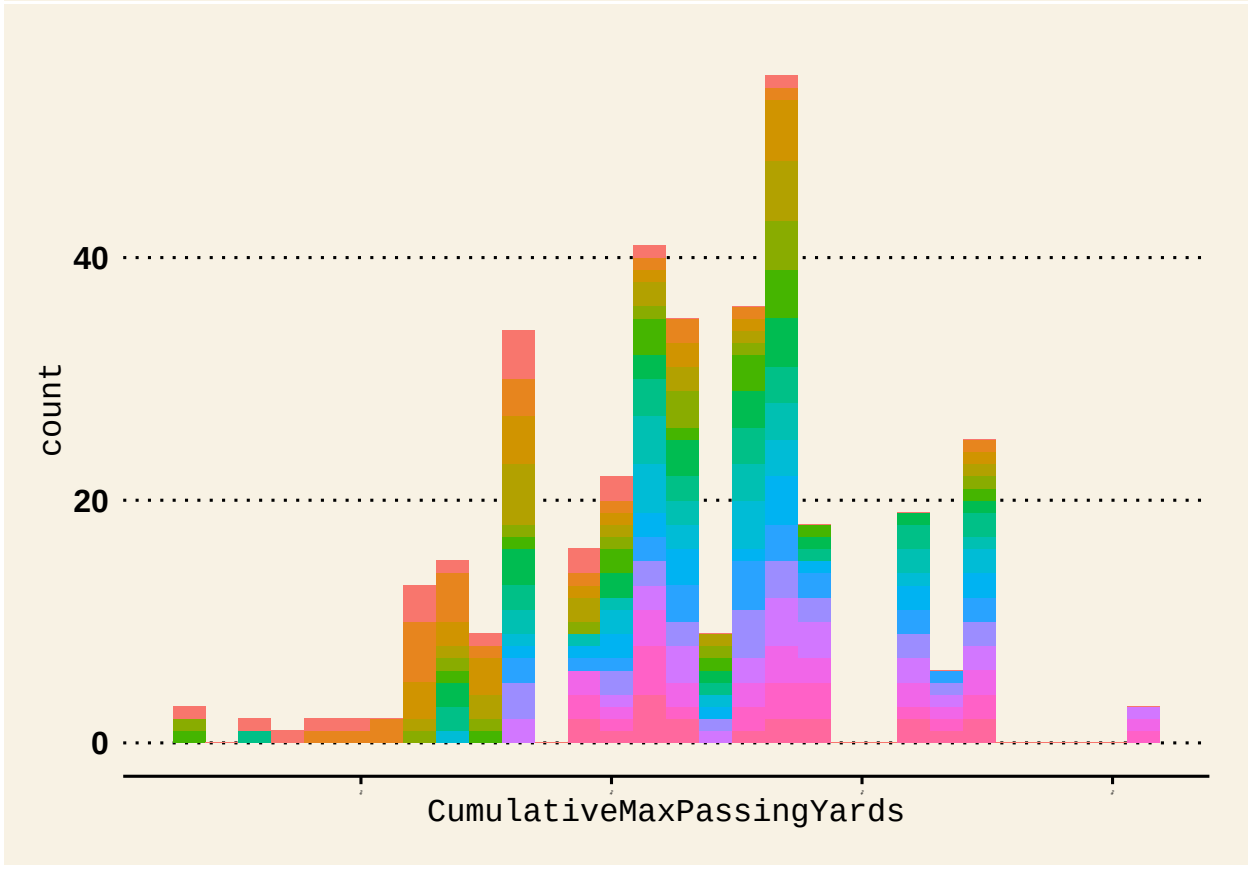

60
40
20
0
count
CumulativeAveragePassingInterceptions

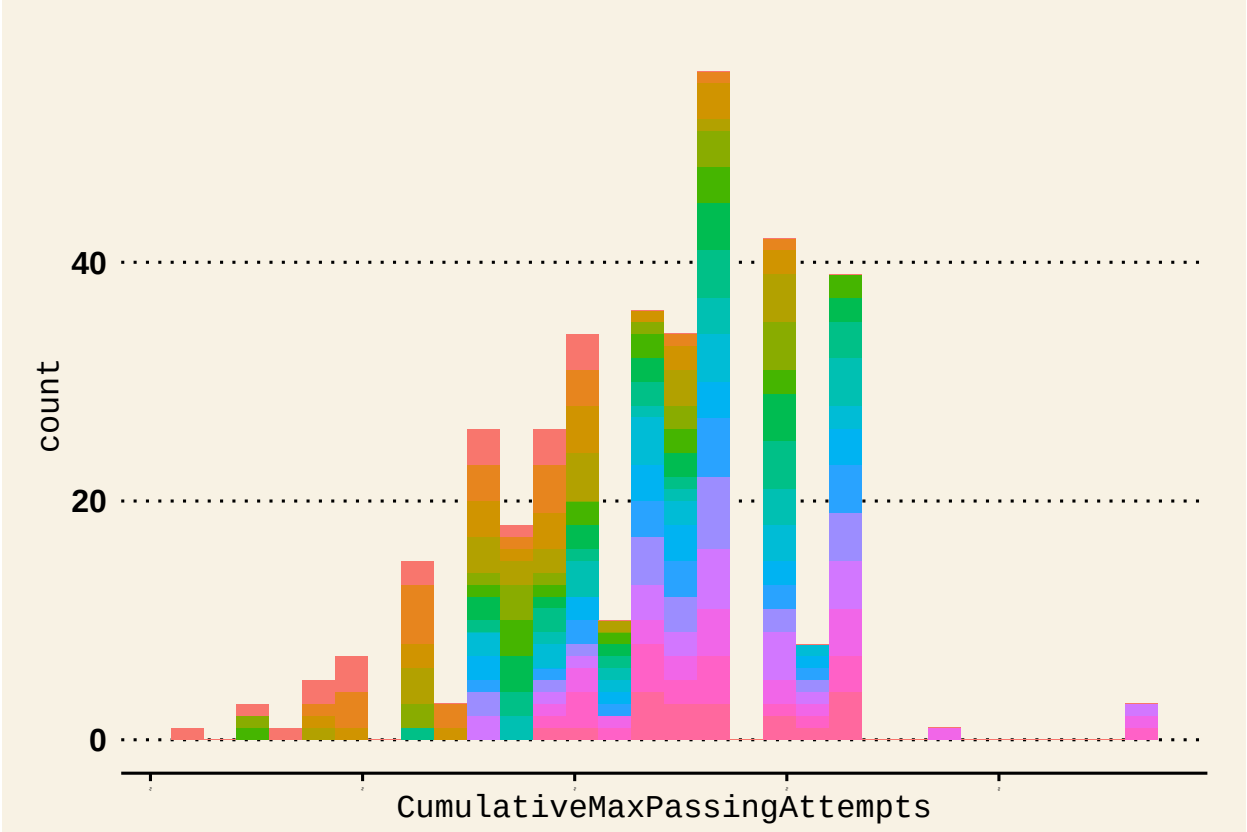

40
20
0
count
CumulativeAveragePassingRating

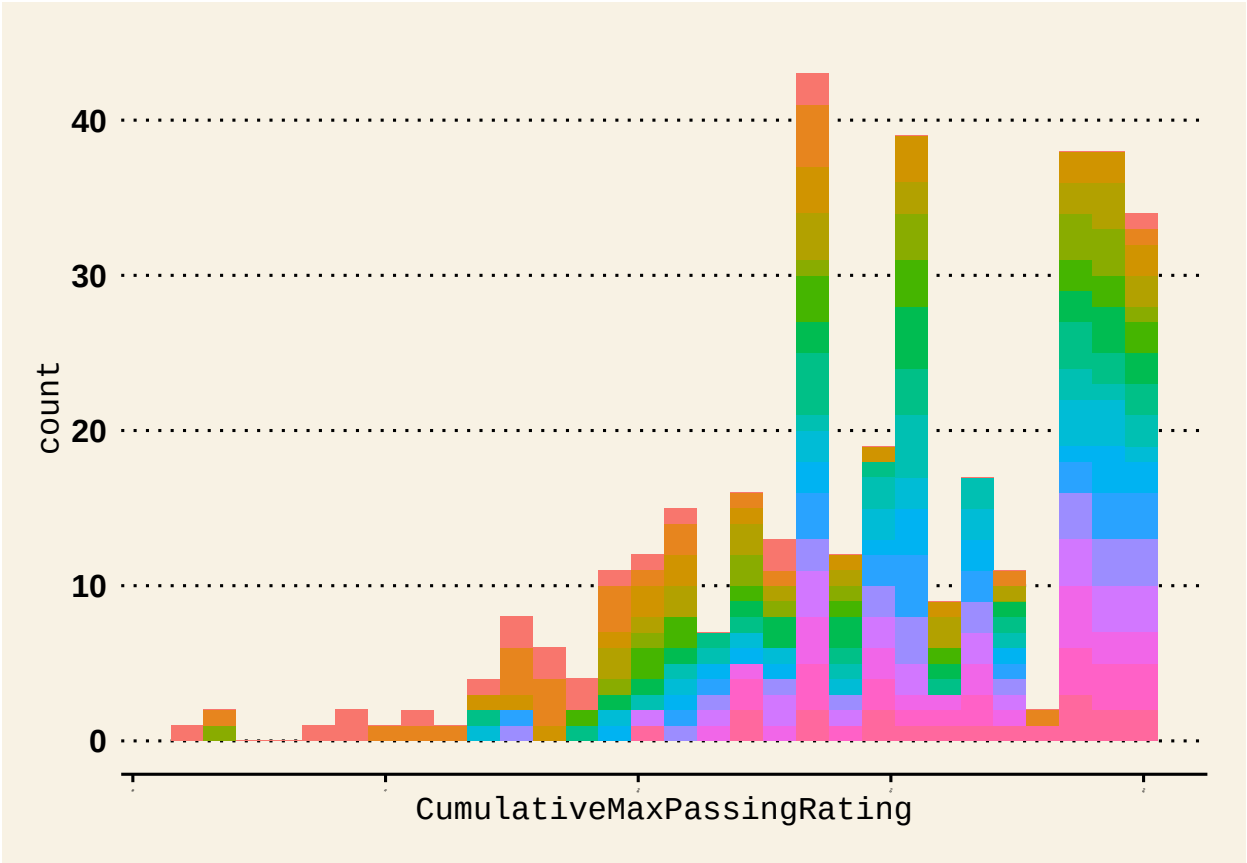

40
30
20
10
0
count
CumulativeAverageCompletions

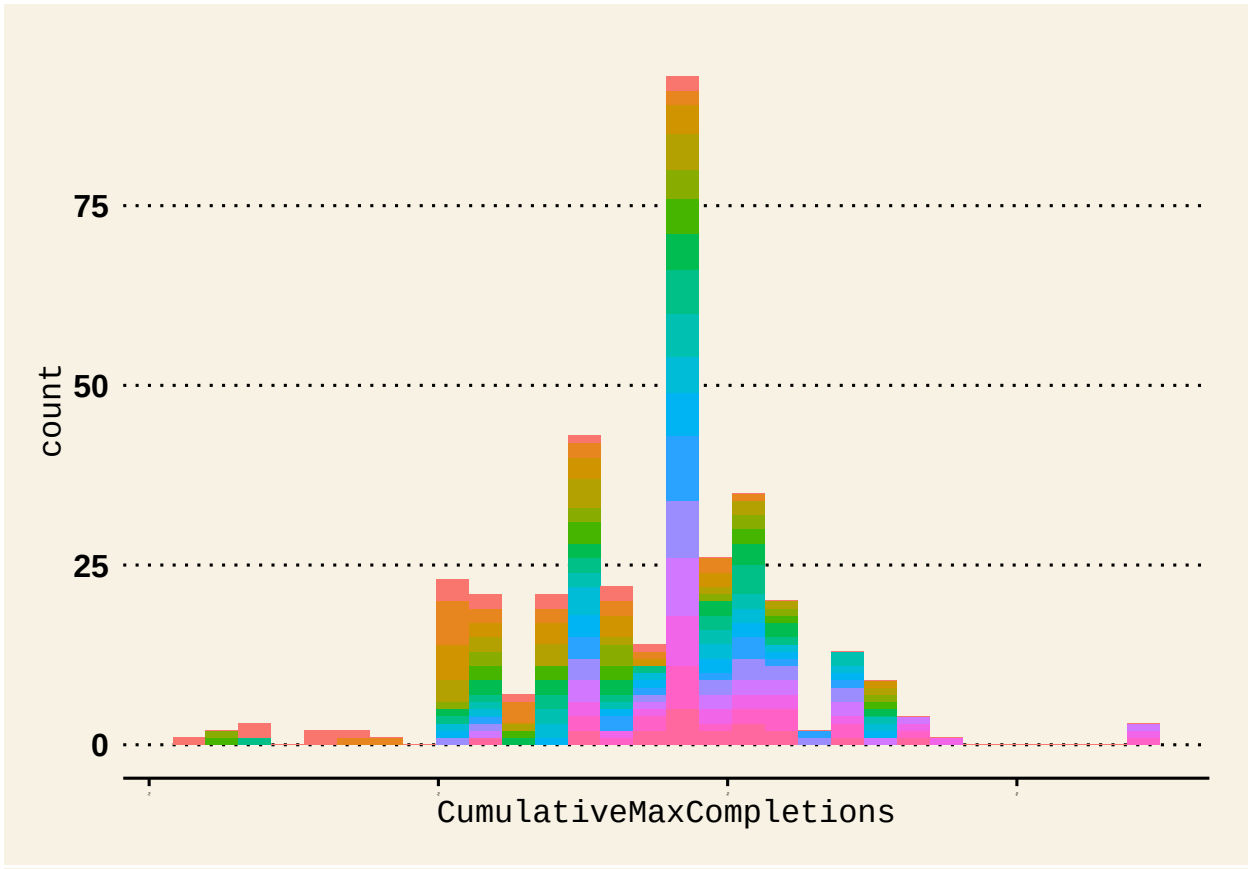

50
40
30
20
10
0
count
CumulativeAverageCompletionPercentage

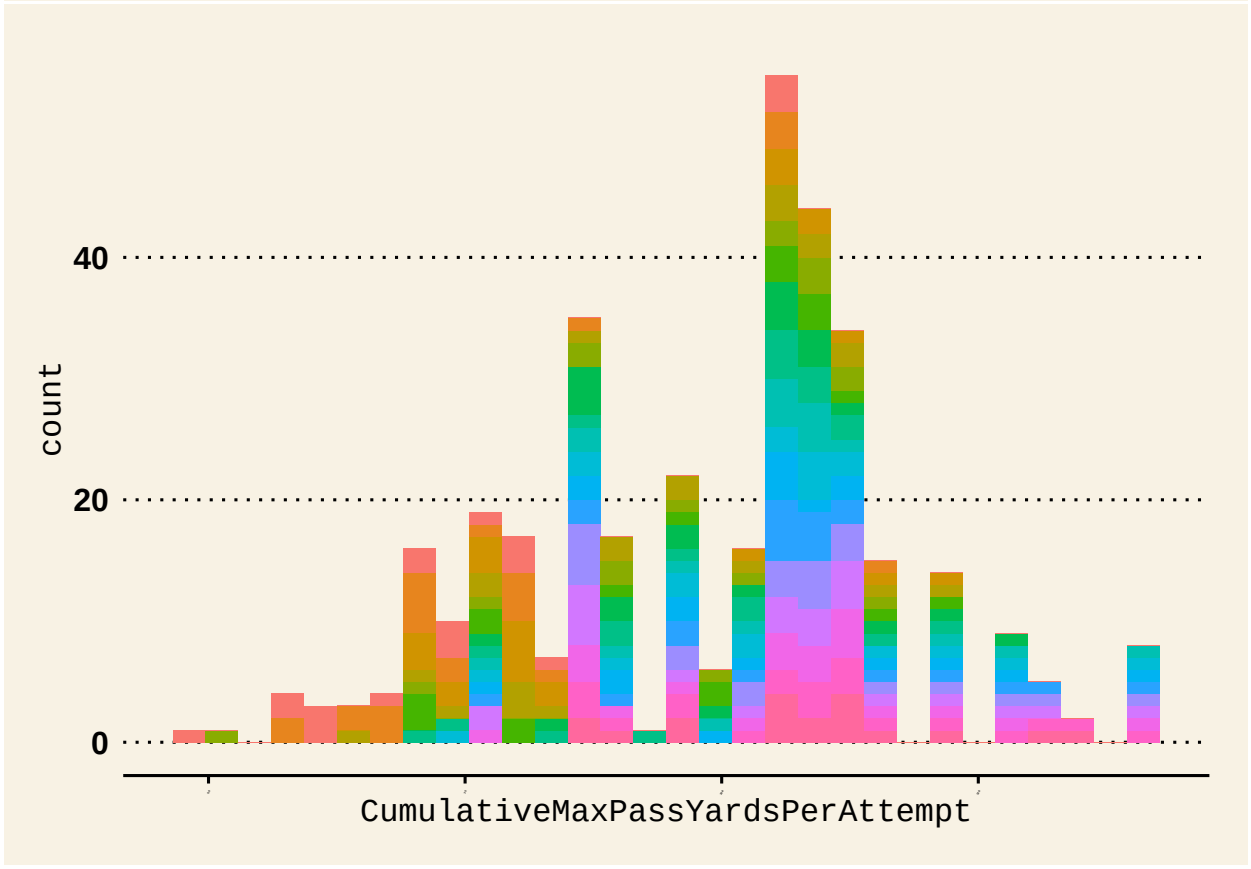

90
60
30
0
count
CumulativeMaxPassingTouchdowns

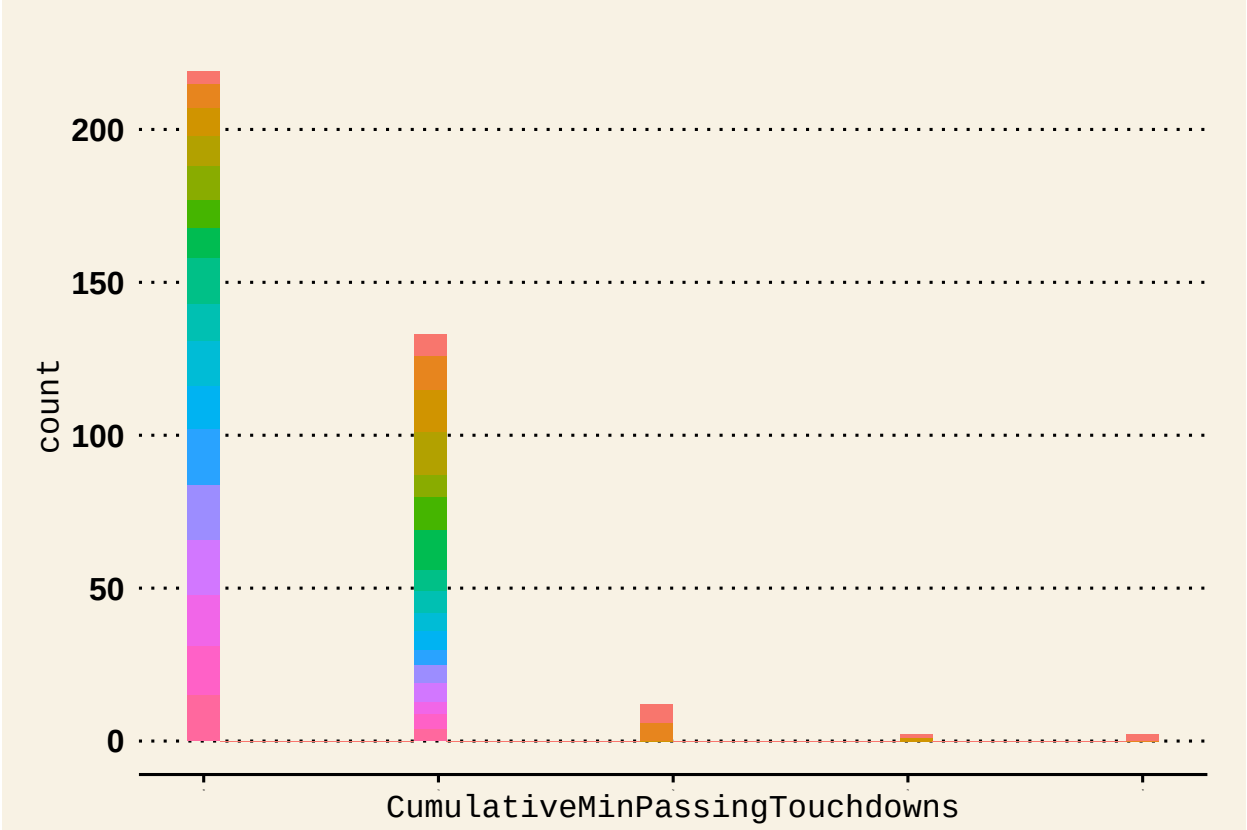

40
20
0
count
CumulativeMaxPassingYards

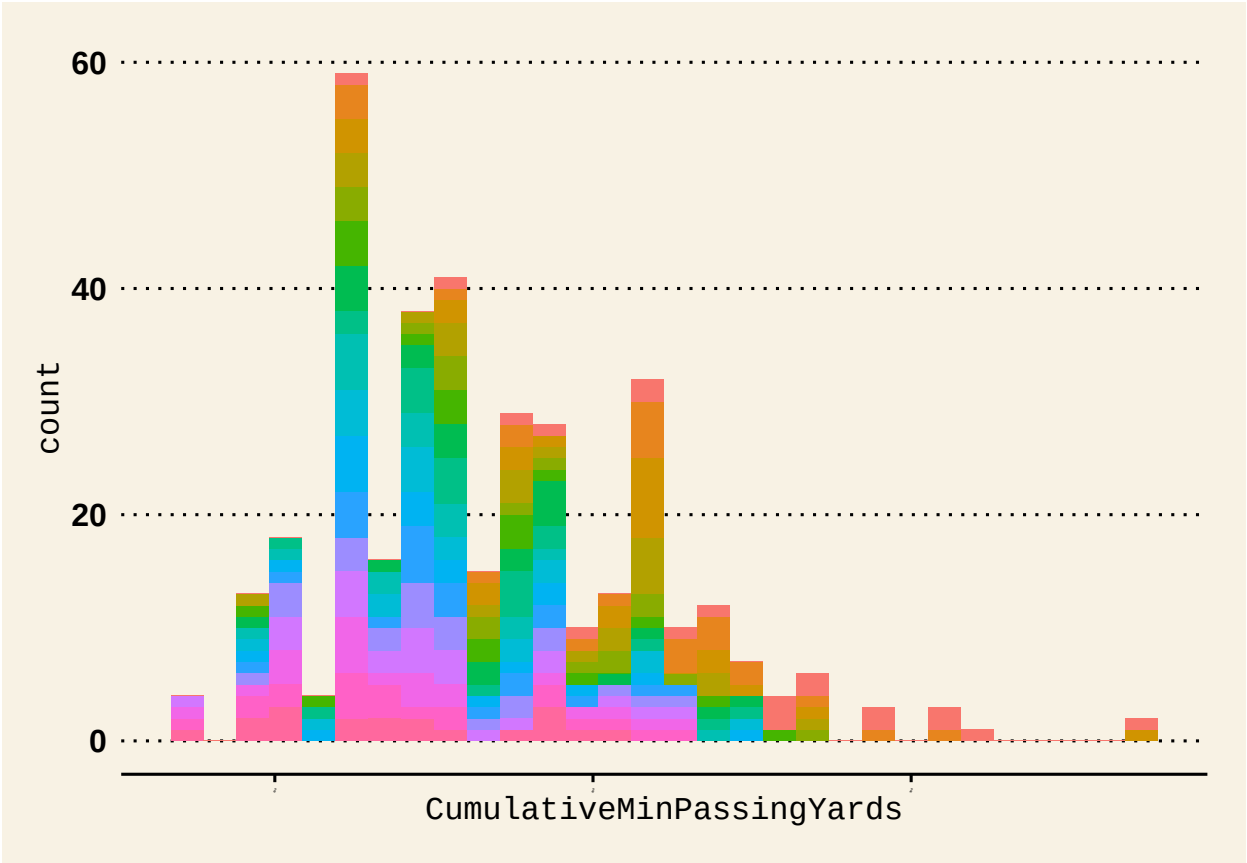

40
20
0
count
CumulativeMaxPassingAttempts

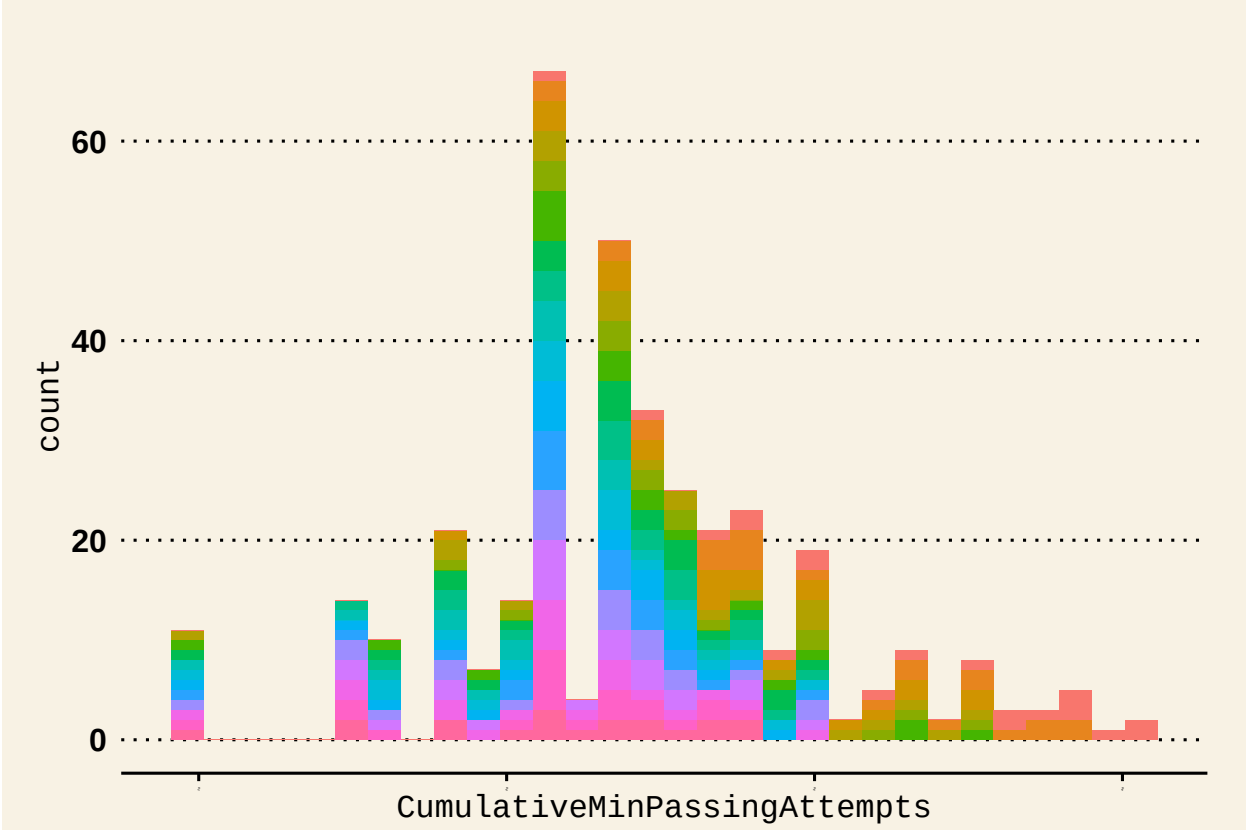

40
30
20
10
0
count
CumulativeMaxPassingRating

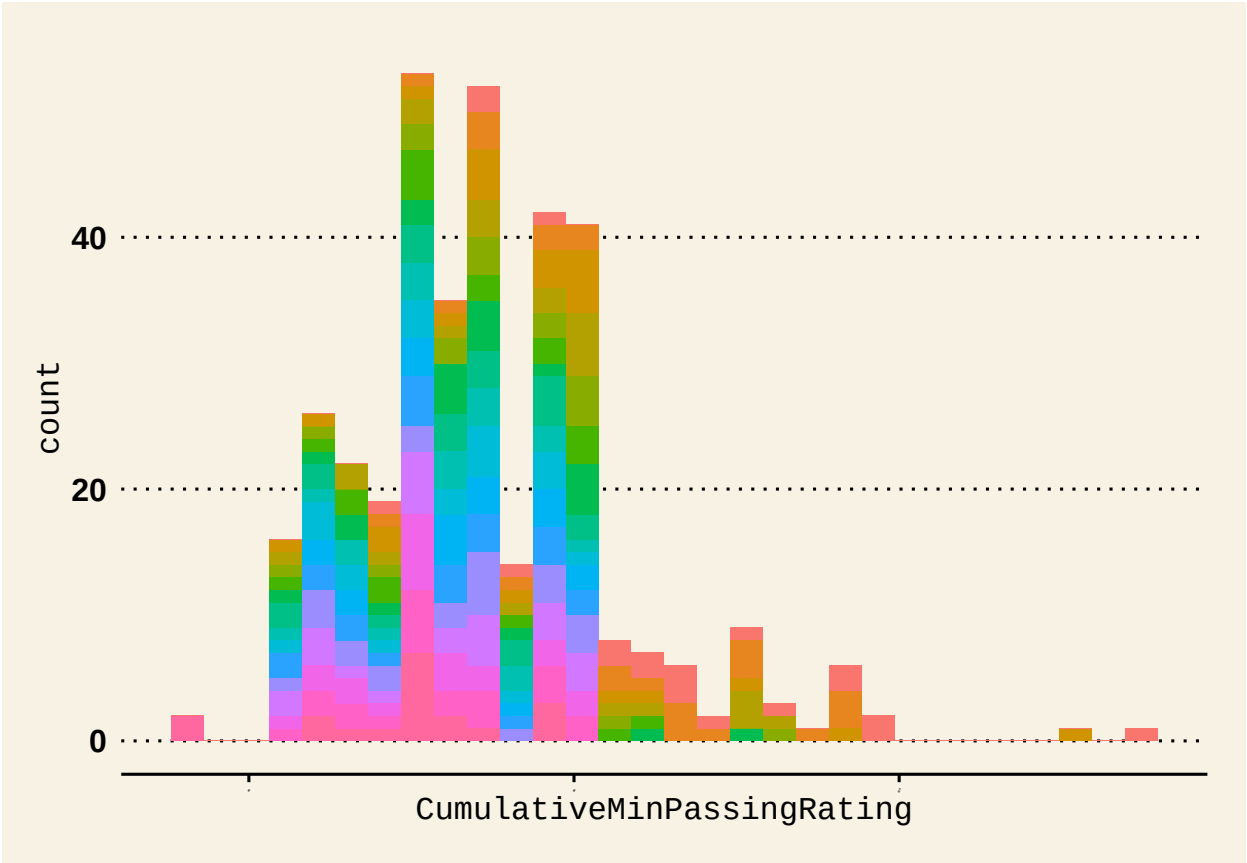

75
50
25
0
count
CumulativeMaxCompletions

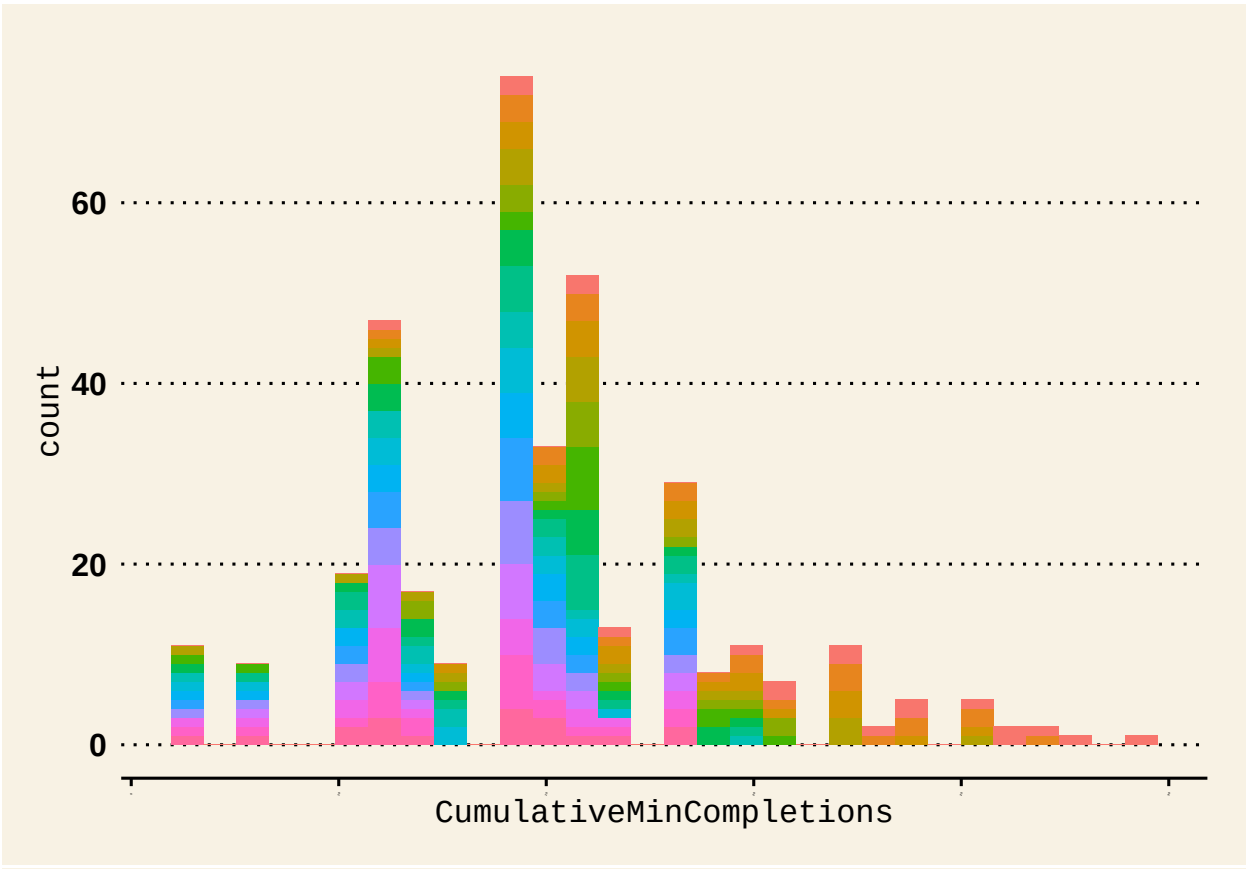

40
20
0
count
CumulativeMaxPassYardsPerAttempt

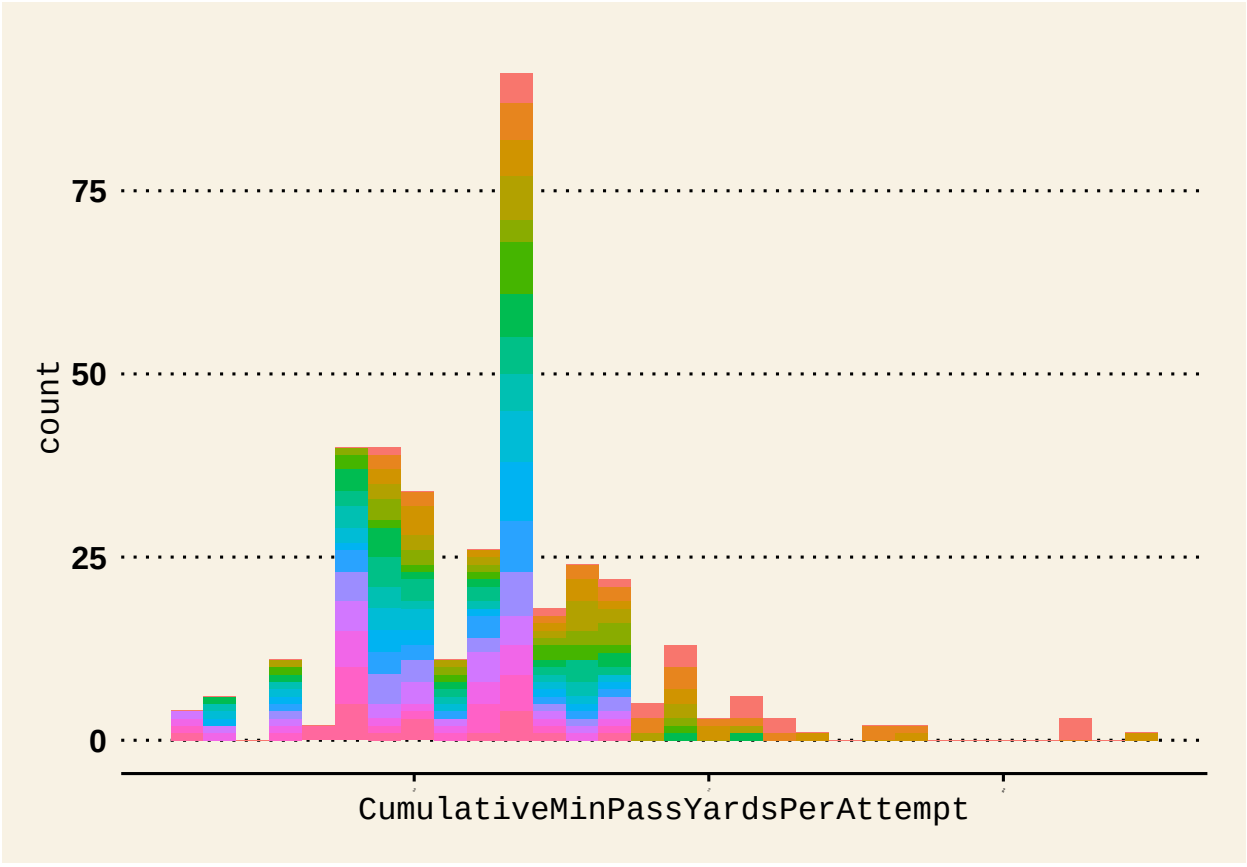

200
150
100
50
0
count
CumulativeMinPassingTouchdowns


60
40
20
0
count
CumulativeMinPassingYards


60
40
20
0
count
CumulativeMinPassingAttempts

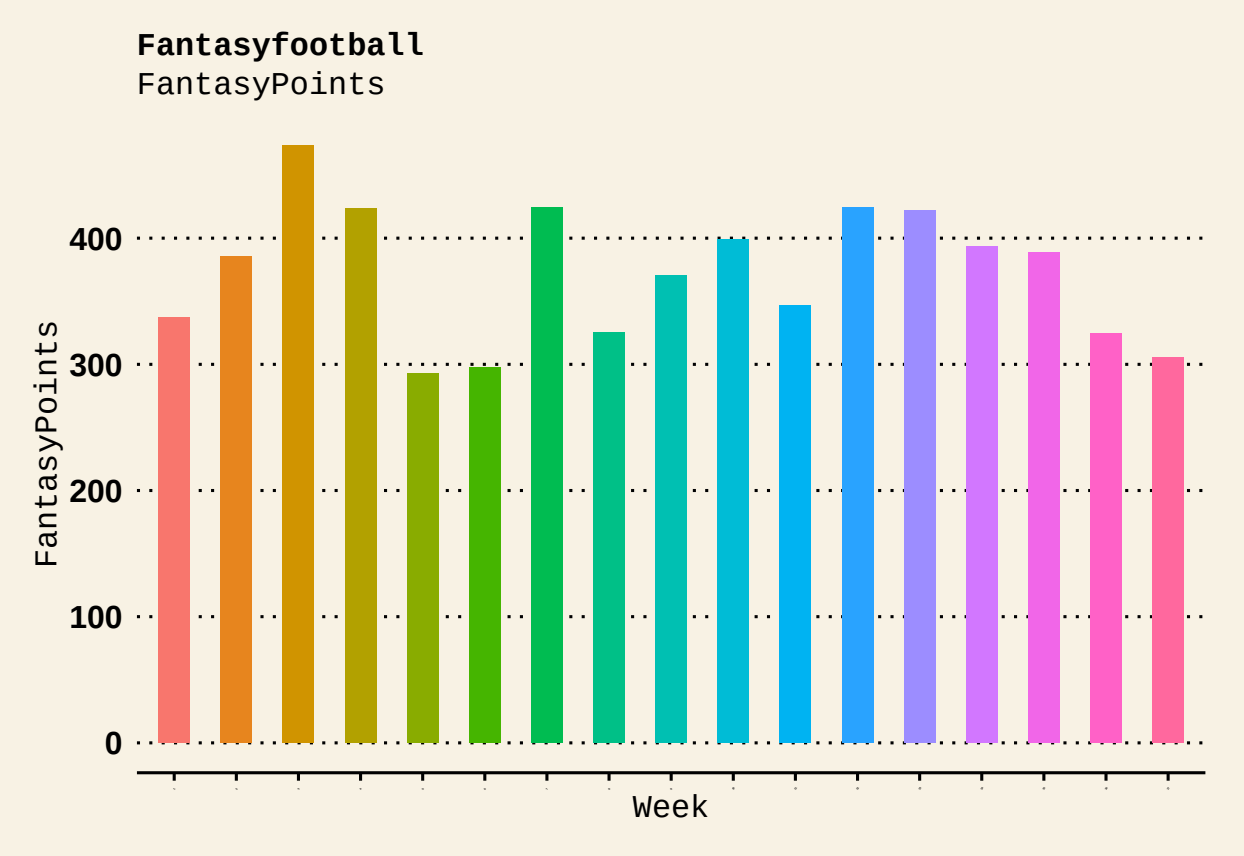

40
20
0
count
CumulativeMinPassingRating

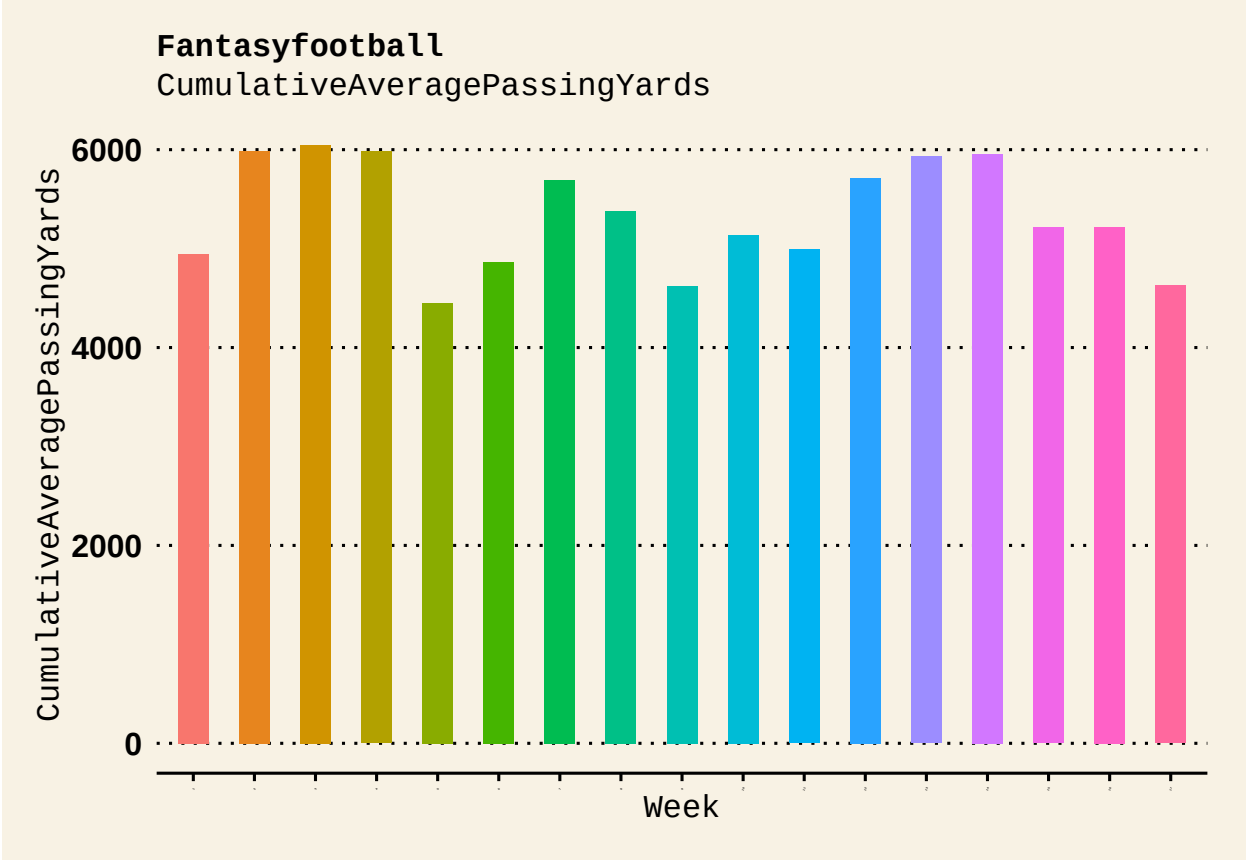

60
40
20
0
count
CumulativeMinCompletions

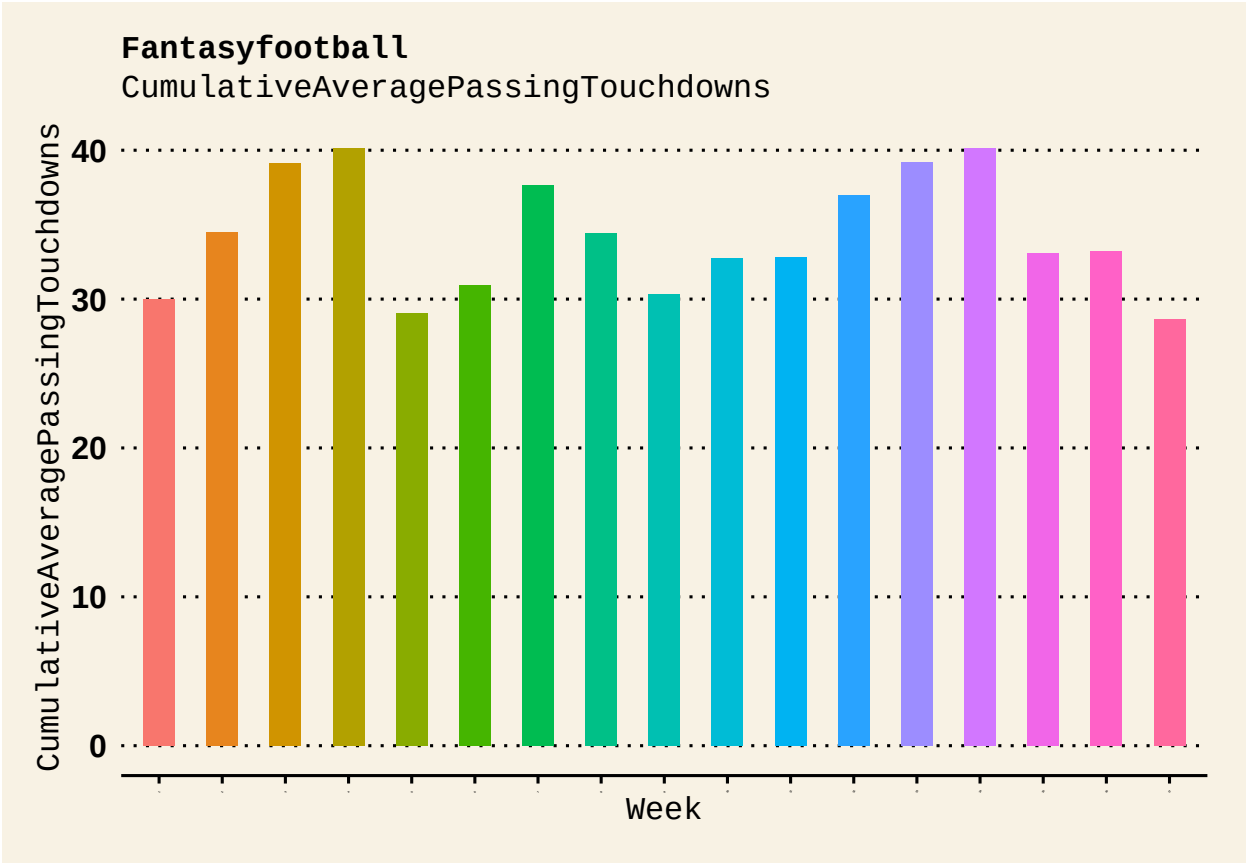

75
50
25
0
count
CumulativeMinPassYardsPerAttempt

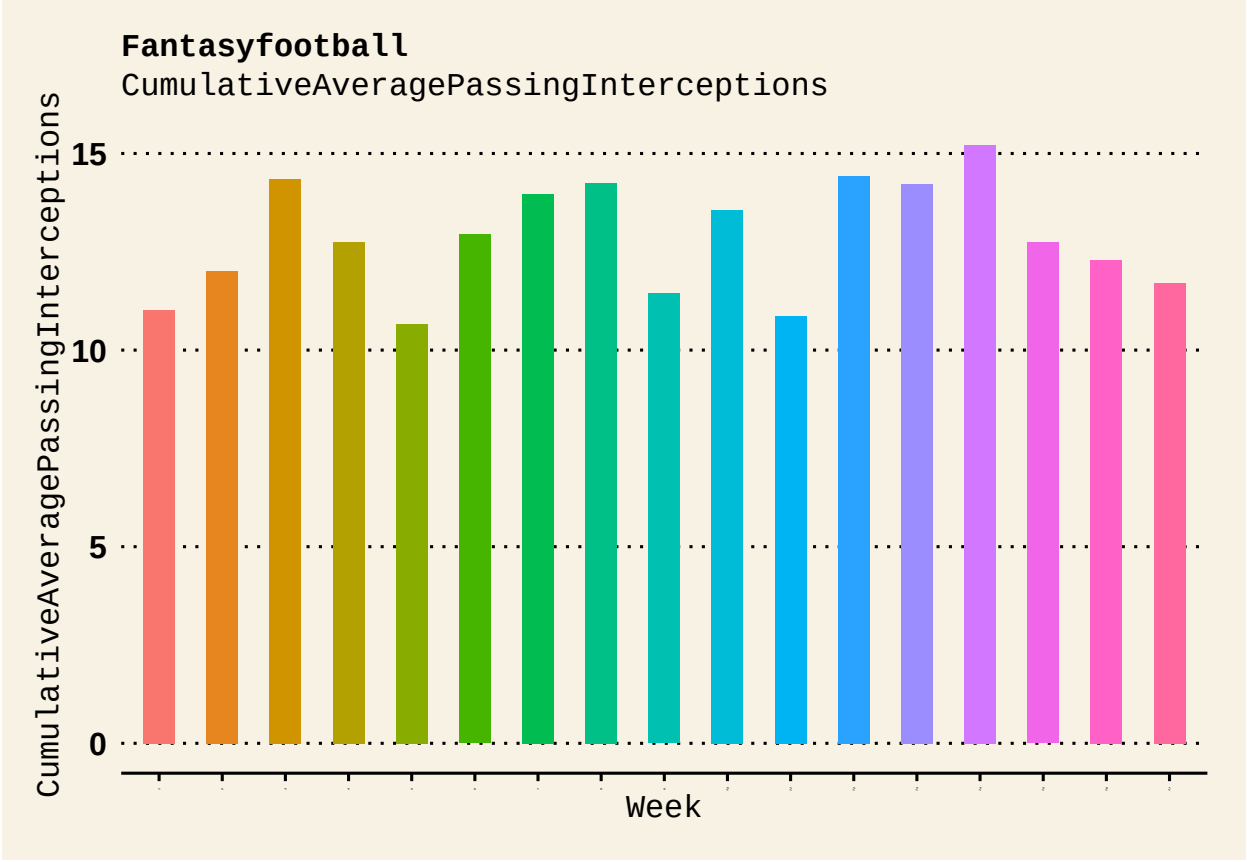
8.5 Bar plots Derived Feature set

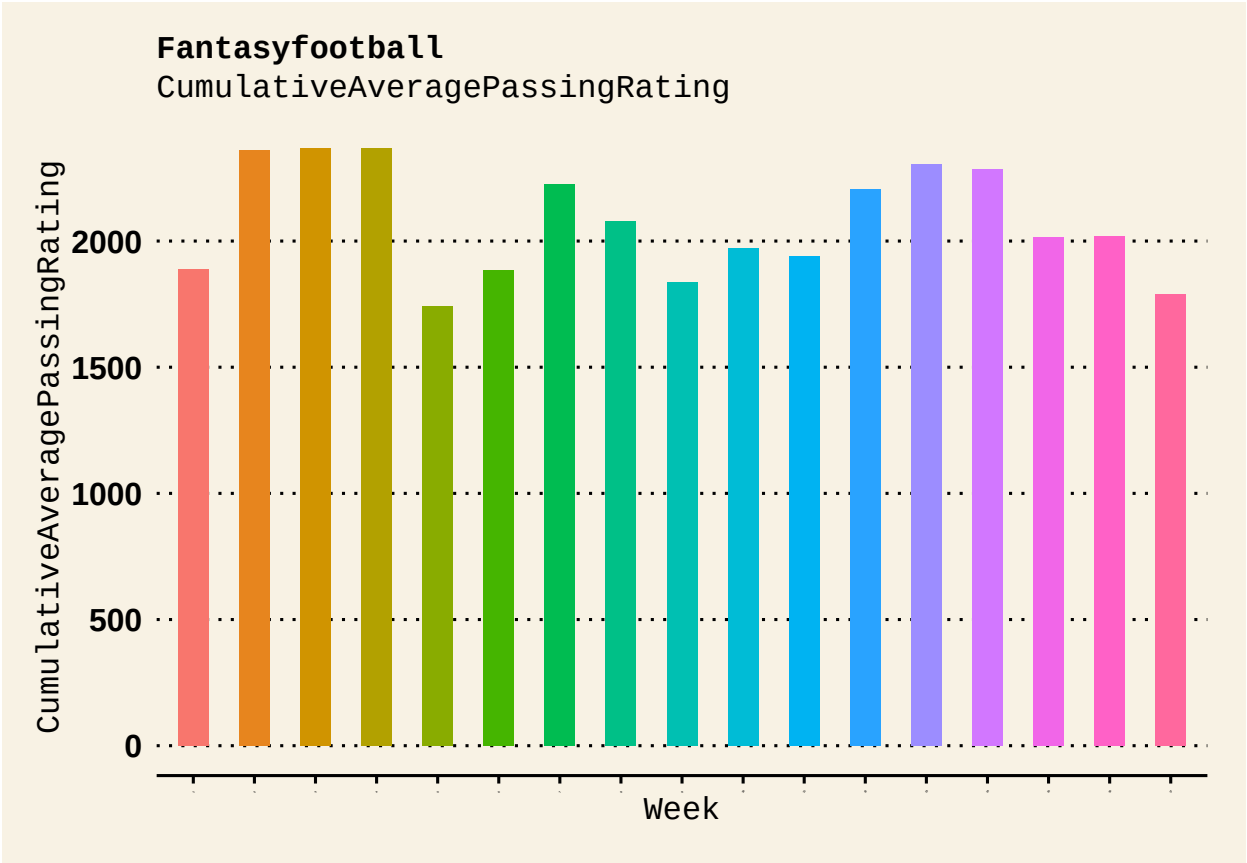
```
for(p in 2:20){
    bar_plot  <- eda_derived %>%
                 ggplot(aes_string(x="Week",
                                   y=names(eda_derived[p]),
                                   fill="Week",group="Week"))+
                 ggtitle(names(eda_derived[p]))+
                 geom_bar(stat="identity", width=.5, show.legend = FALSE)+
                 xlab("Week")+
                 ylab(names(eda_derived[p]))+
                 labs(title="Fantasyfootball",
                      subtitle=names(eda_derived[p]),
                      aption="Source: Fantasyfootball")+
                  theme_wsj()+
                  theme(plot.title    = element_text(size = rel(0.5)),
                        plot.subtitle = element_text(size = rel(0.5)),
                        axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                        axis.title    = element_text(size = rel(0.5)),
                        legend.position  = "right",
                        legend.direction ="vertical",
                        legend.title = element_text(size = rel(0.5)))
           print(bar_plot)
}
```

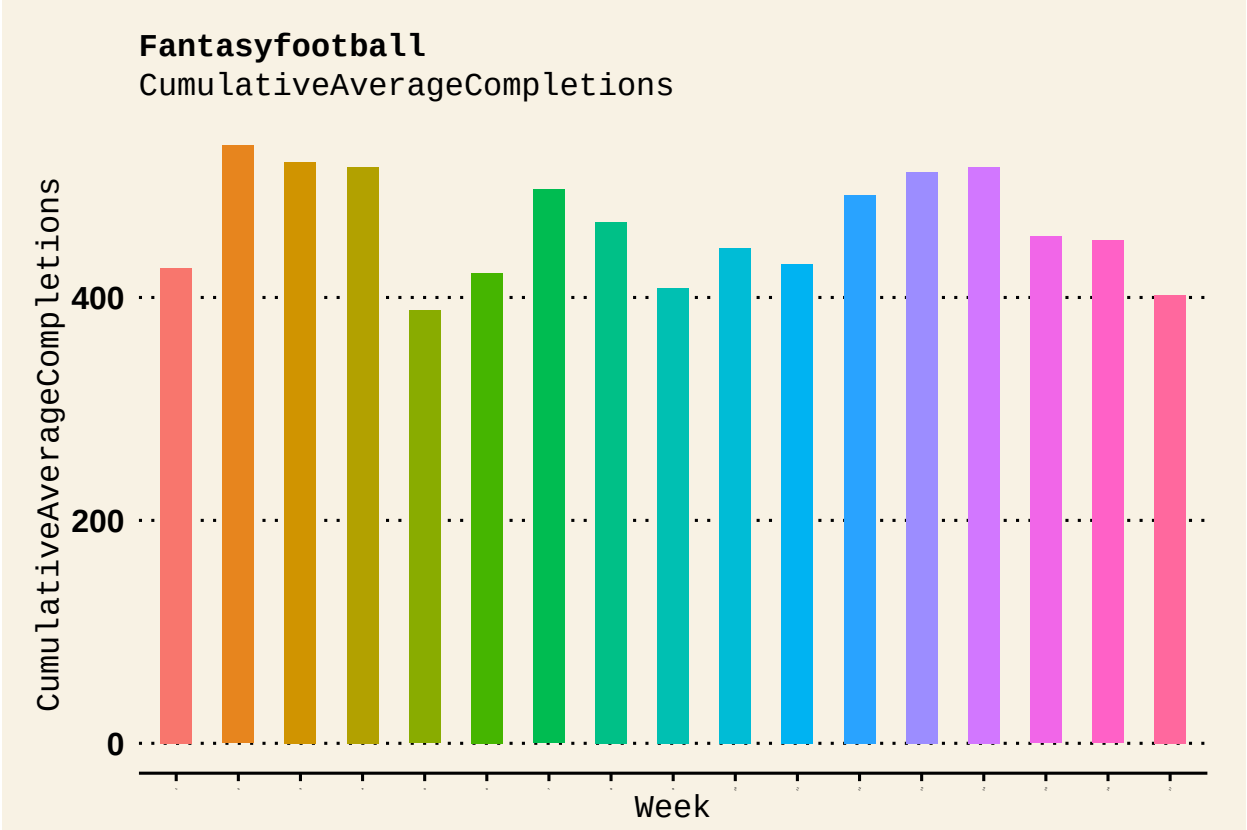


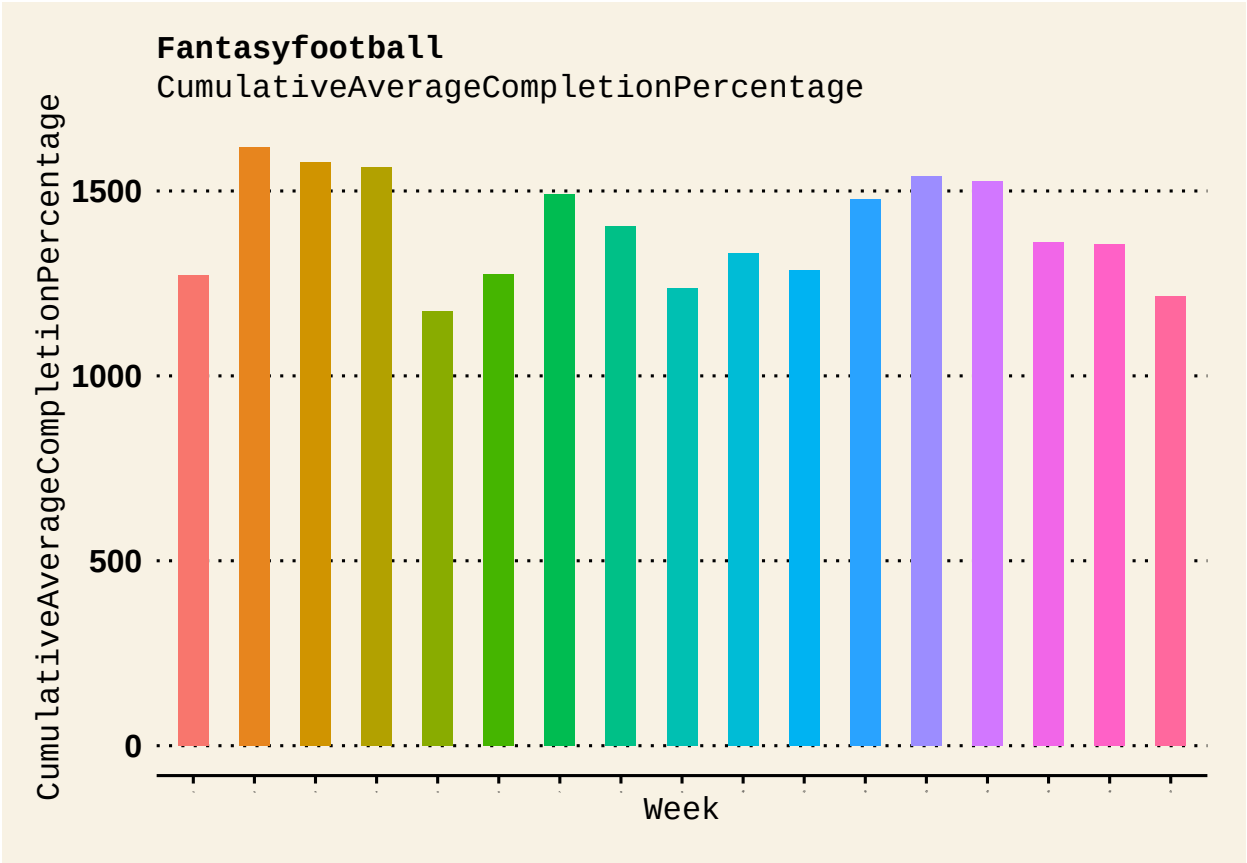

Fantasyfootball
CumulativeAveragePassingYards
CumulativeAveragePassingYards
6000
4000
2000
0
Week

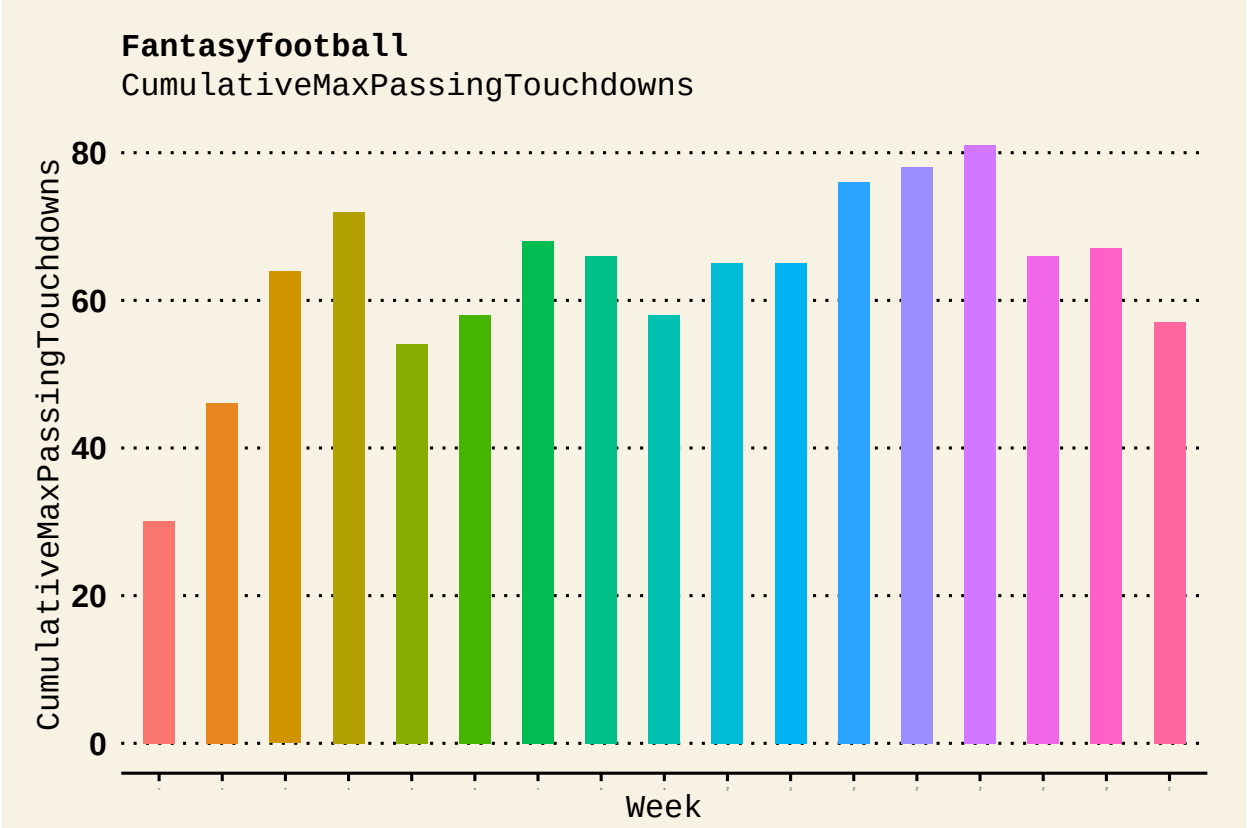

Fantasyfootball
CumulativeAveragePassingTouchdowns
CumulativeAveragePassingTouchdowns
40
30
20
10
0
Week

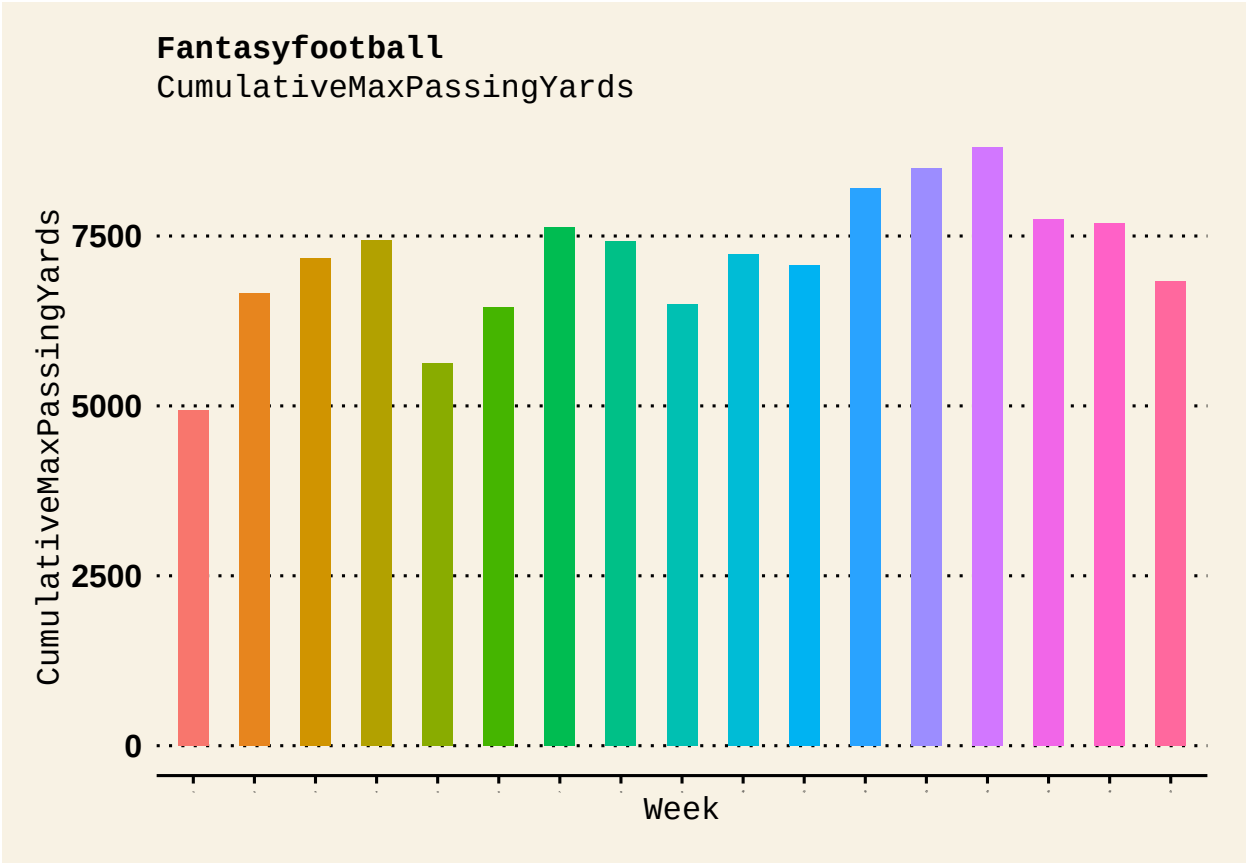

Fantasyfootball
CumulativeAveragePassingInterceptions
CumulativeAveragePassingInterceptions
15
10
5
0
Week

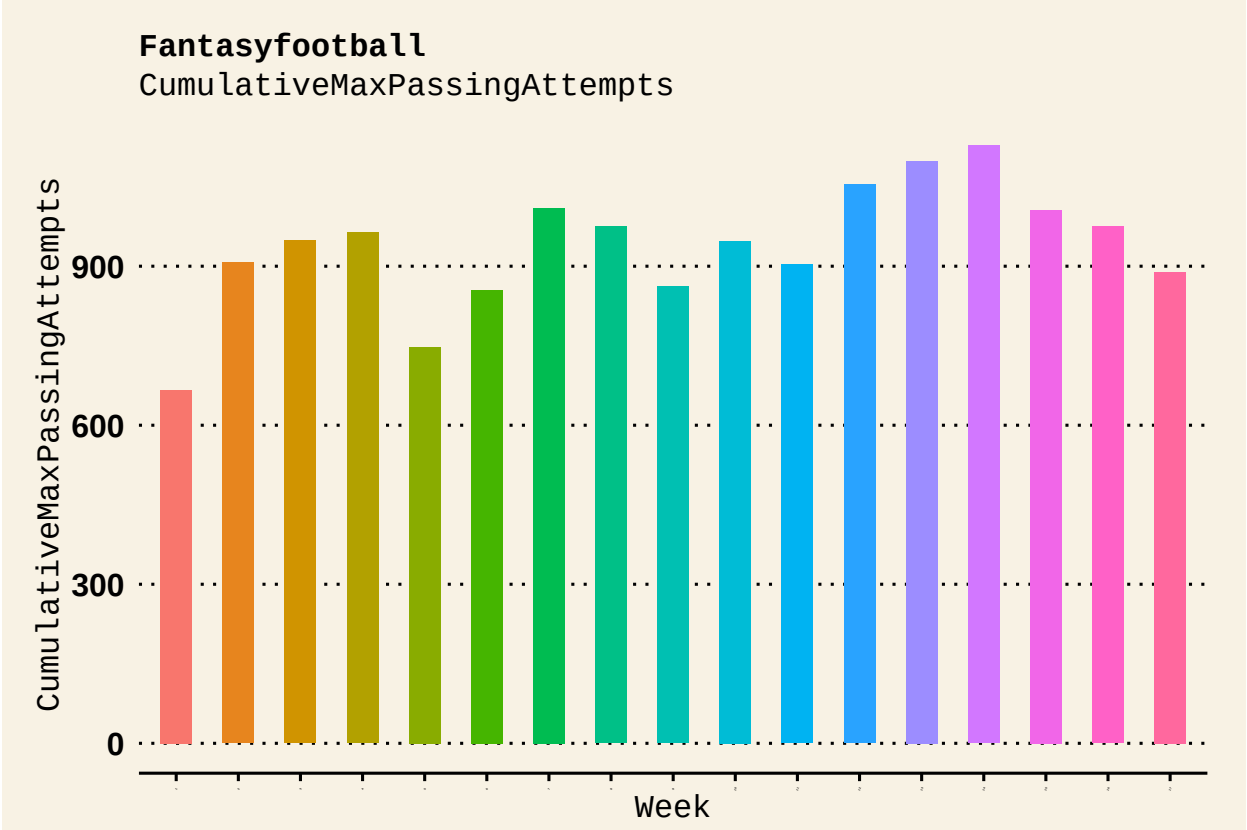

Fantasyfootball
CumulativeAveragePassingRating
CumulativeAveragePassingRating
2000
1500
1000
500
0
Week

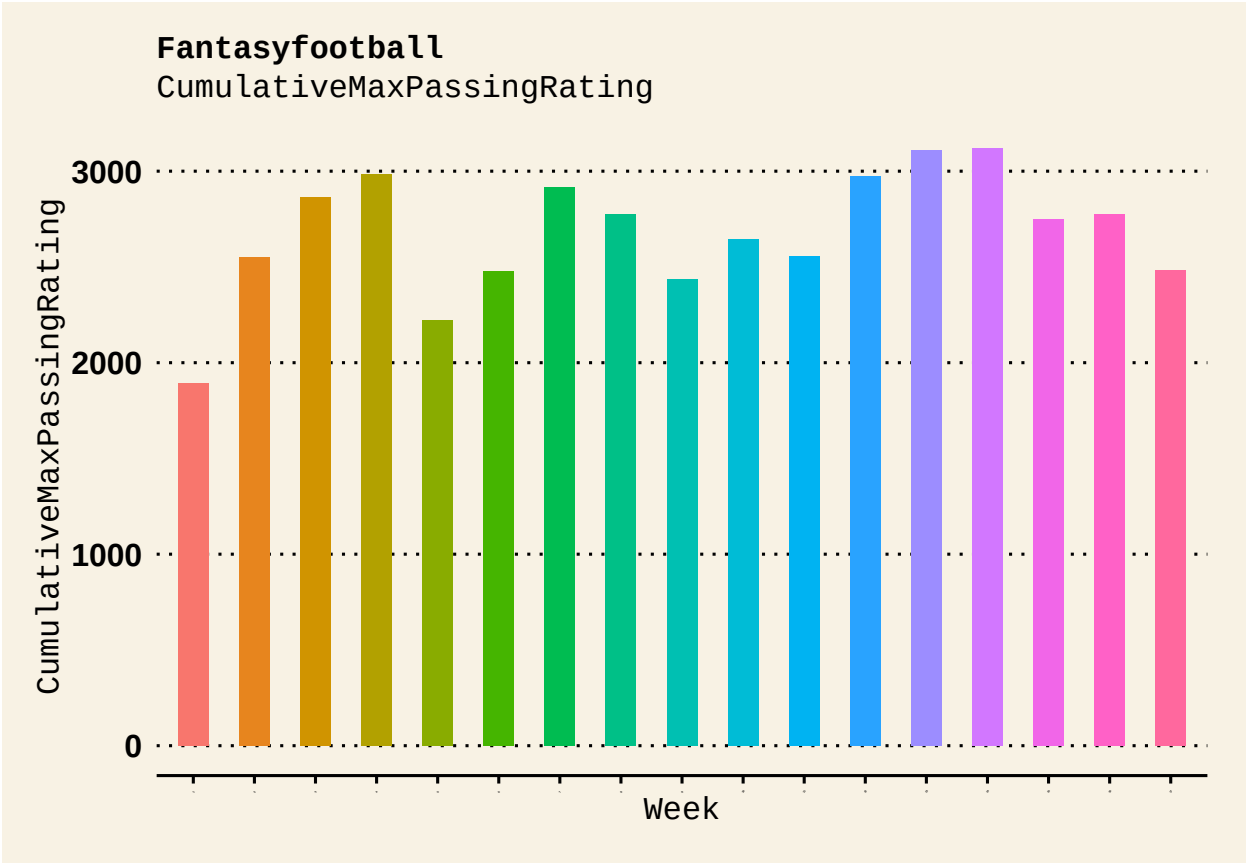

Fantasyfootball
CumulativeAverageCompletions
CumulativeAverageCompletions
400
200
0
Week

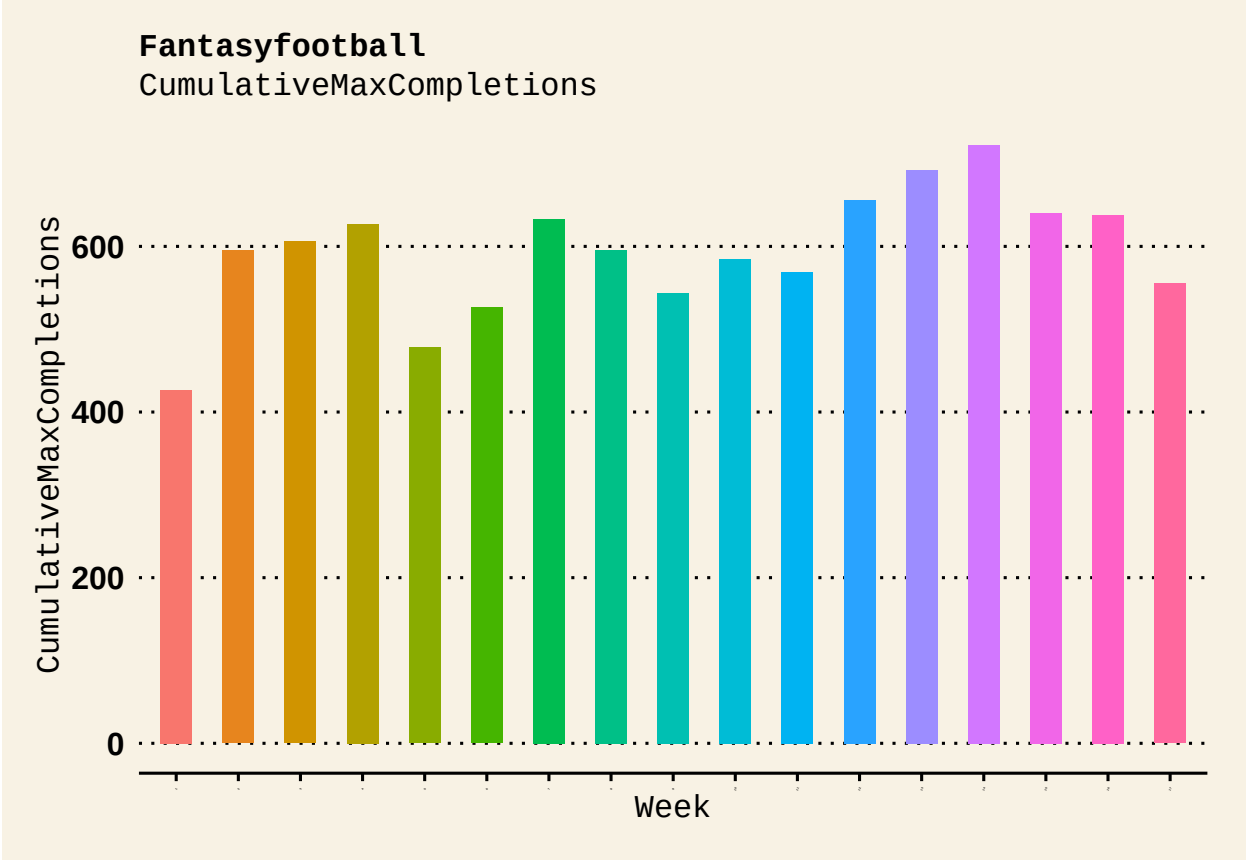

Fantasyfootball
CumulativeAverageCompletionPercentage
CumulativeAverageCompletionPercentage
1500
1000
500
0
Week

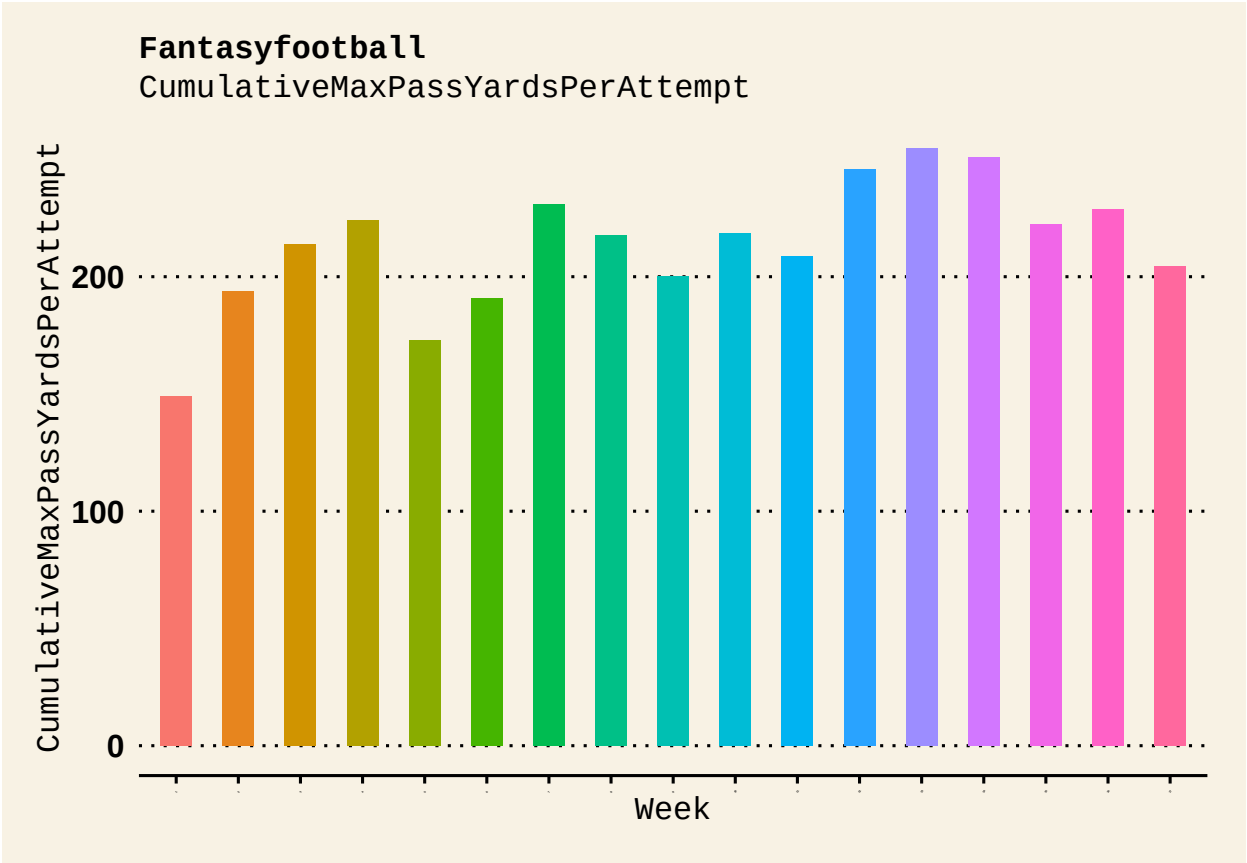

Fantasyfootball
CumulativeMaxPassingTouchdowns
CumulativeMaxPassingTouchdowns
80
60
40
20
0
Week

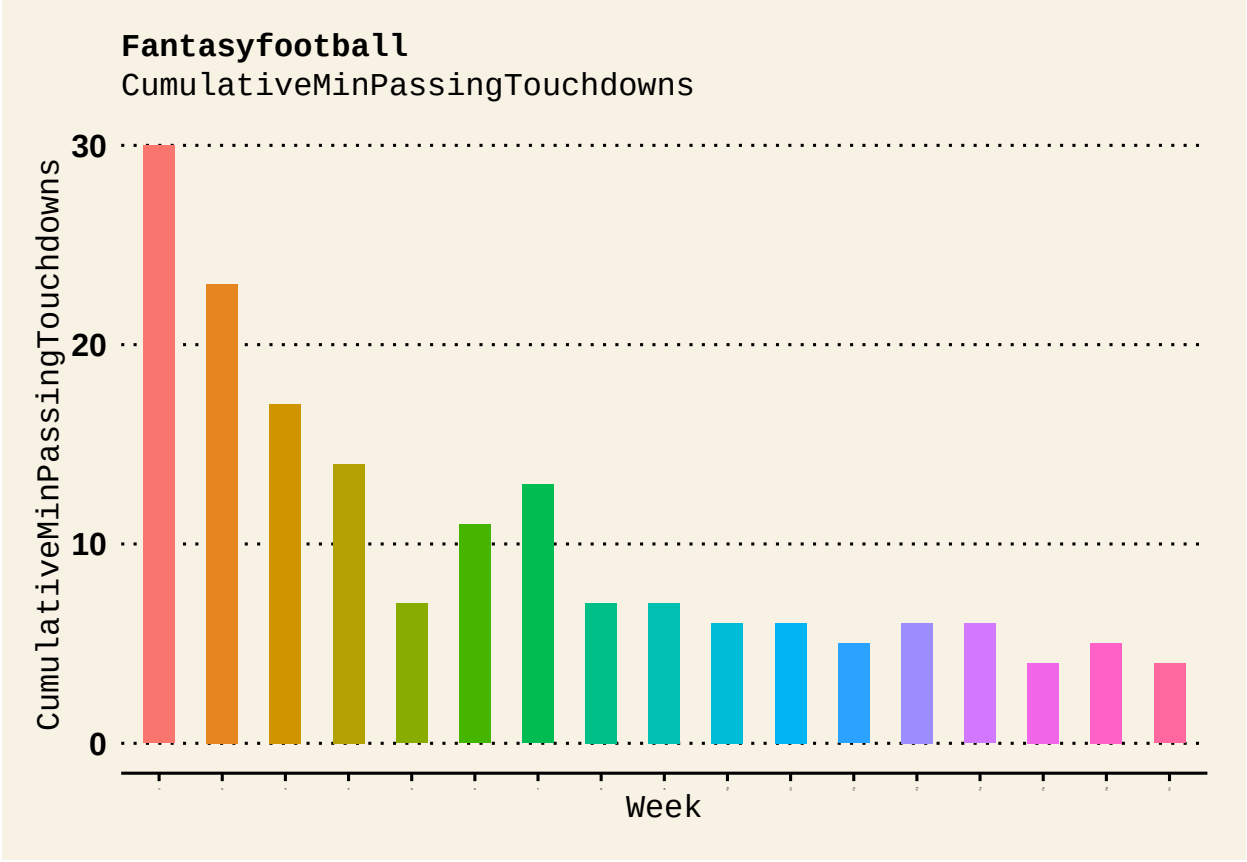

Fantasyfootball
CumulativeMaxPassingYards
CumulativeMaxPassingYards
7500
5000
2500
0
Week

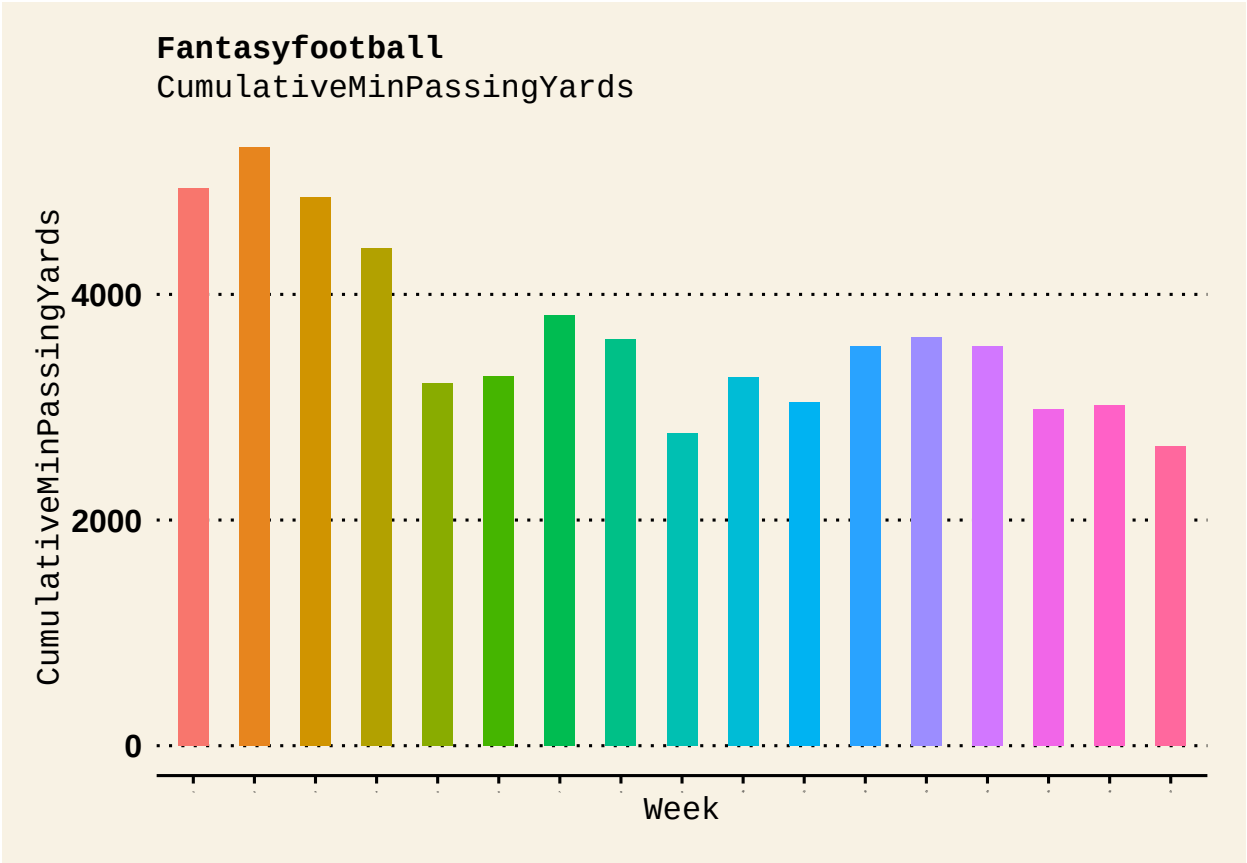

Fantasyfootball
CumulativeMaxPassingAttempts
CumulativeMaxPassingAttempts
900
600
300
0
Week

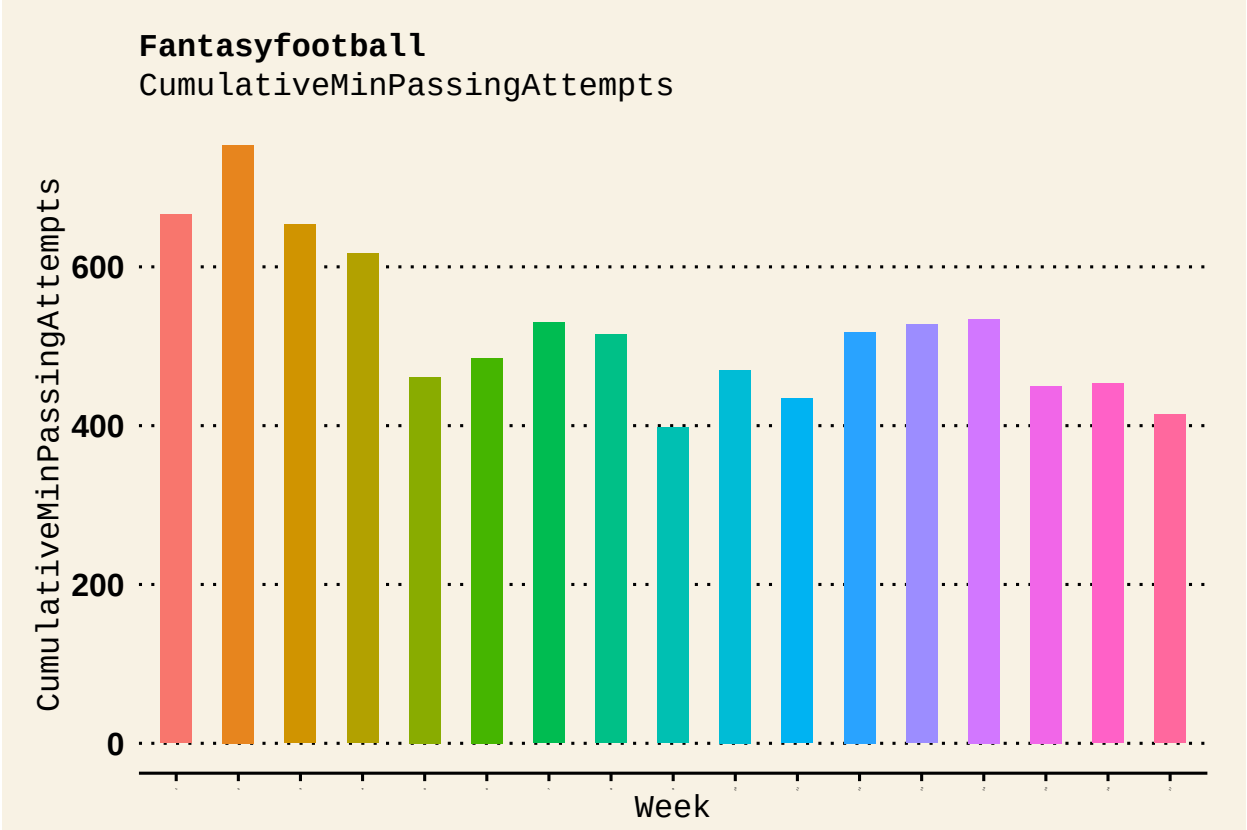

Fantasyfootball
CumulativeMaxPassingRating
CumulativeMaxPassingRating
3000
2000
1000
0
Week

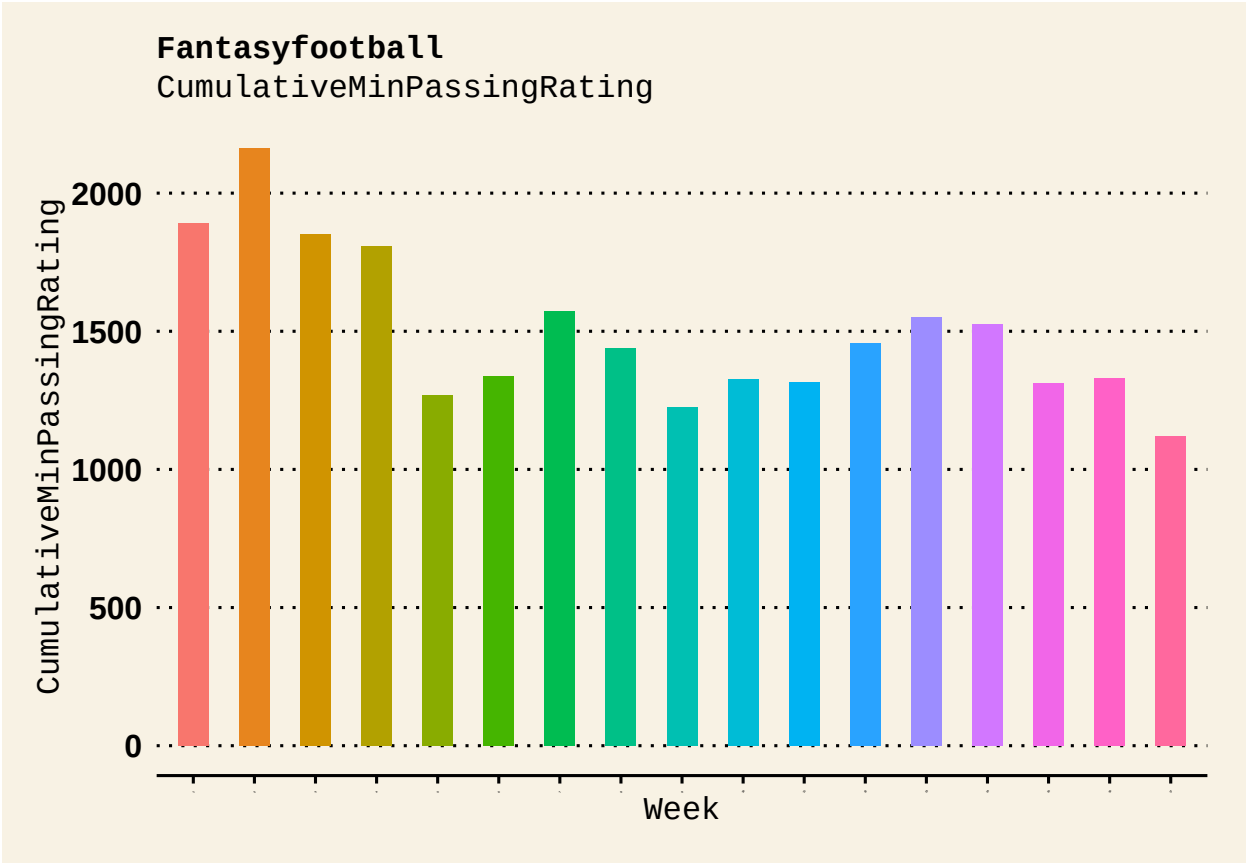

Fantasyfootball
CumulativeMaxCompletions
CumulativeMaxCompletions
600
400
200
0
Week

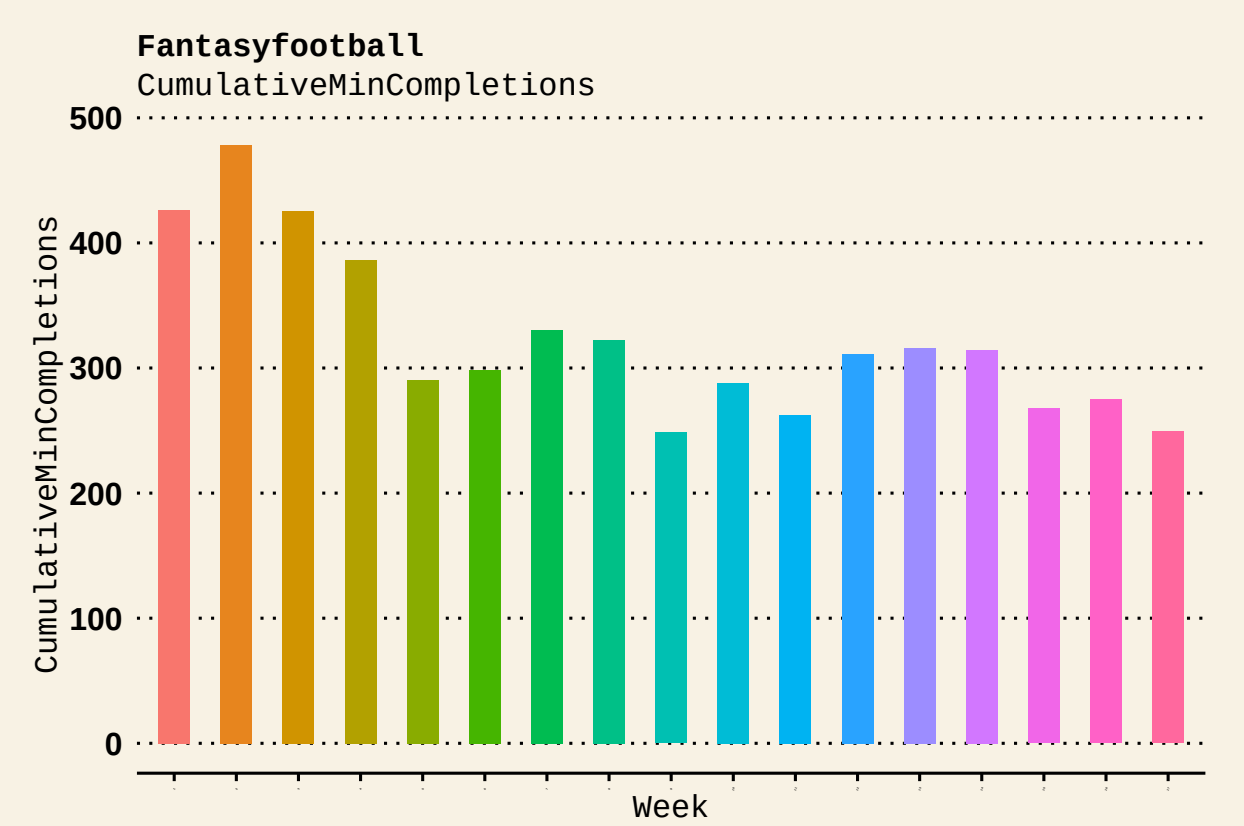

Fantasyfootball
CumulativeMaxPassYardsPerAttempt
CumulativeMaxPassYardsPerAttempt
200
100
0
Week

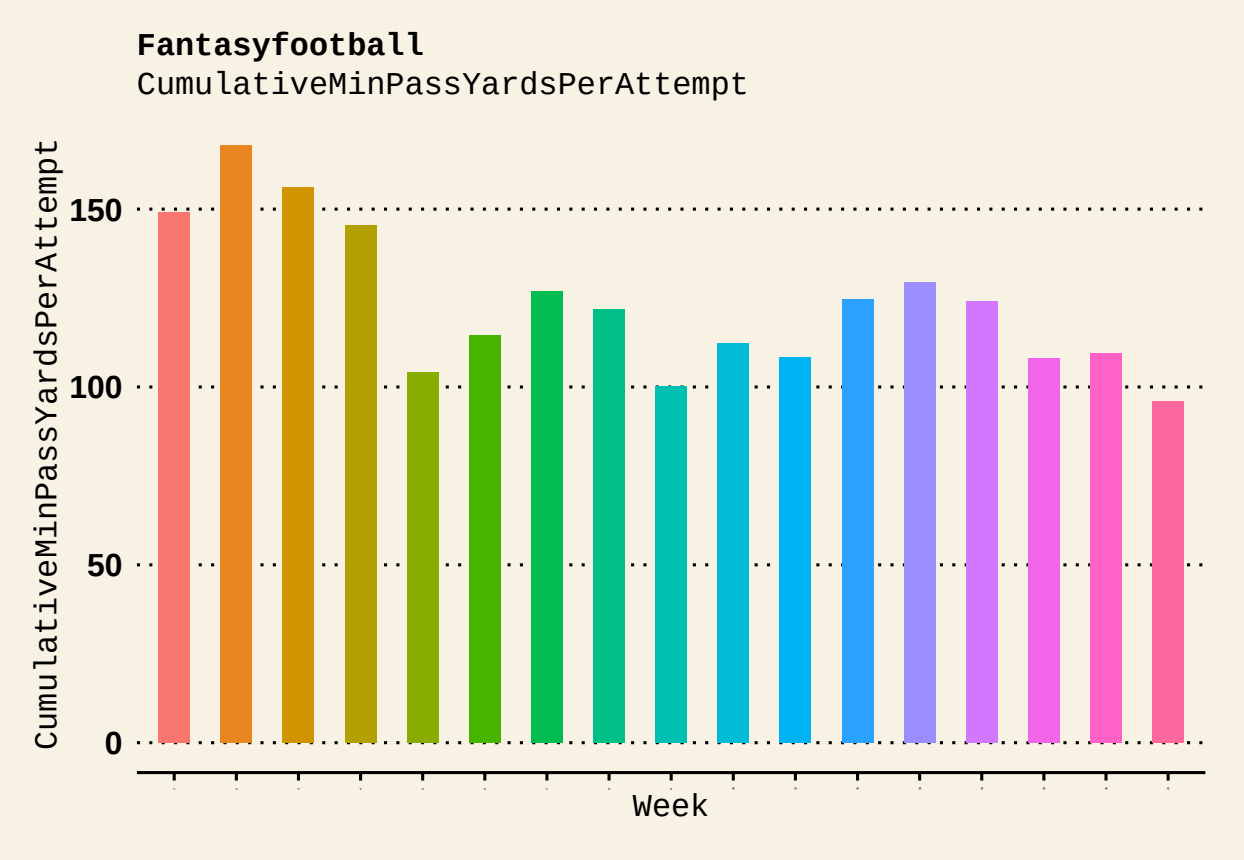

Fantasyfootball
CumulativeMinPassingTouchdowns
CumulativeMinPassingTouchdowns
30
20
10
0
Week


Fantasyfootball
CumulativeMinPassingYards
CumulativeMinPassingYards
4000
2000
0
Week


Fantasyfootball
CumulativeMinPassingAttempts
CumulativeMinPassingAttempts
600
400
200
0
Week


Fantasyfootball
CumulativeMinPassingRating
CumulativeMinPassingRating
2000
1500
1000
500
0
Week


Fantasyfootball
CumulativeMinCompletions
CumulativeMinCompletions
500
400
300
200
100
0
Week

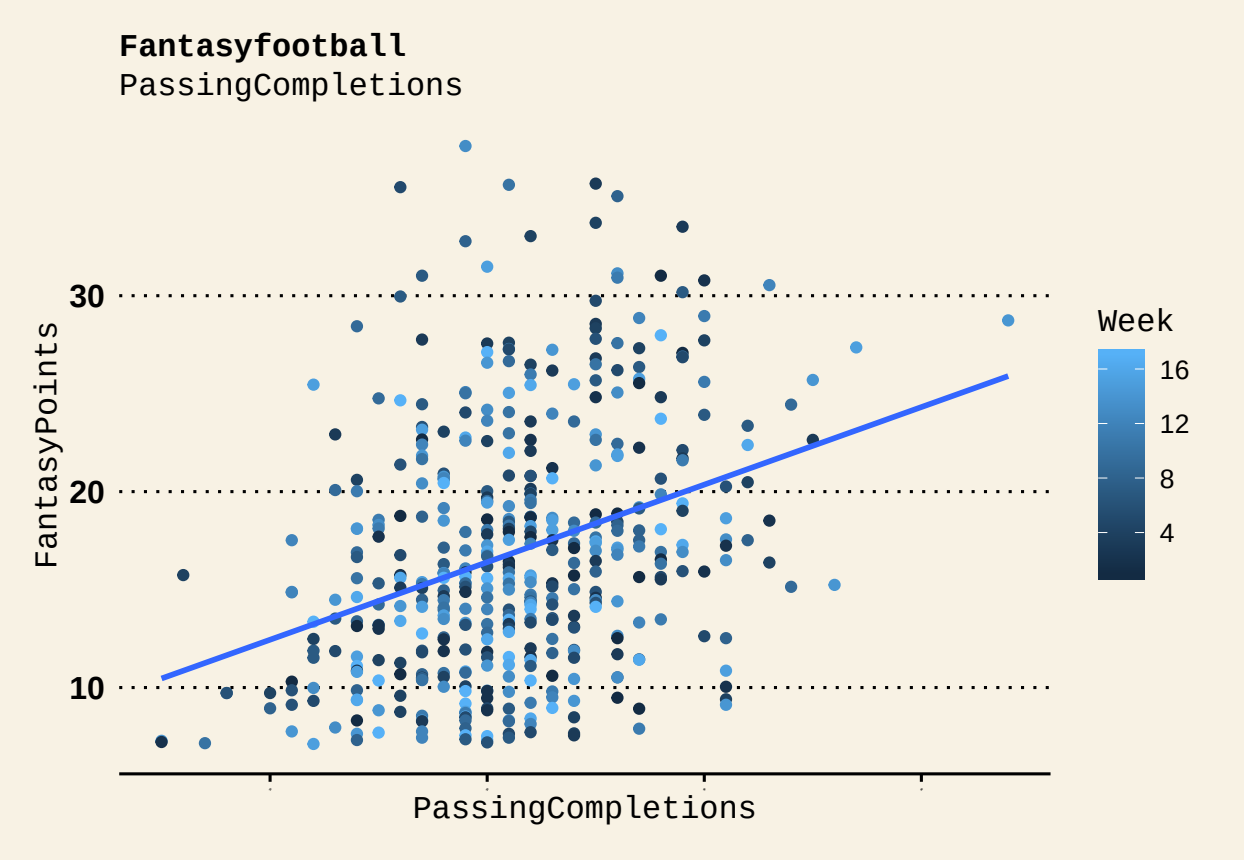

Fantasyfootball
CumulativeMinPassYardsPerAttempt
CumulativeMinPassYardsPerAttempt
150
100
50
0
Week

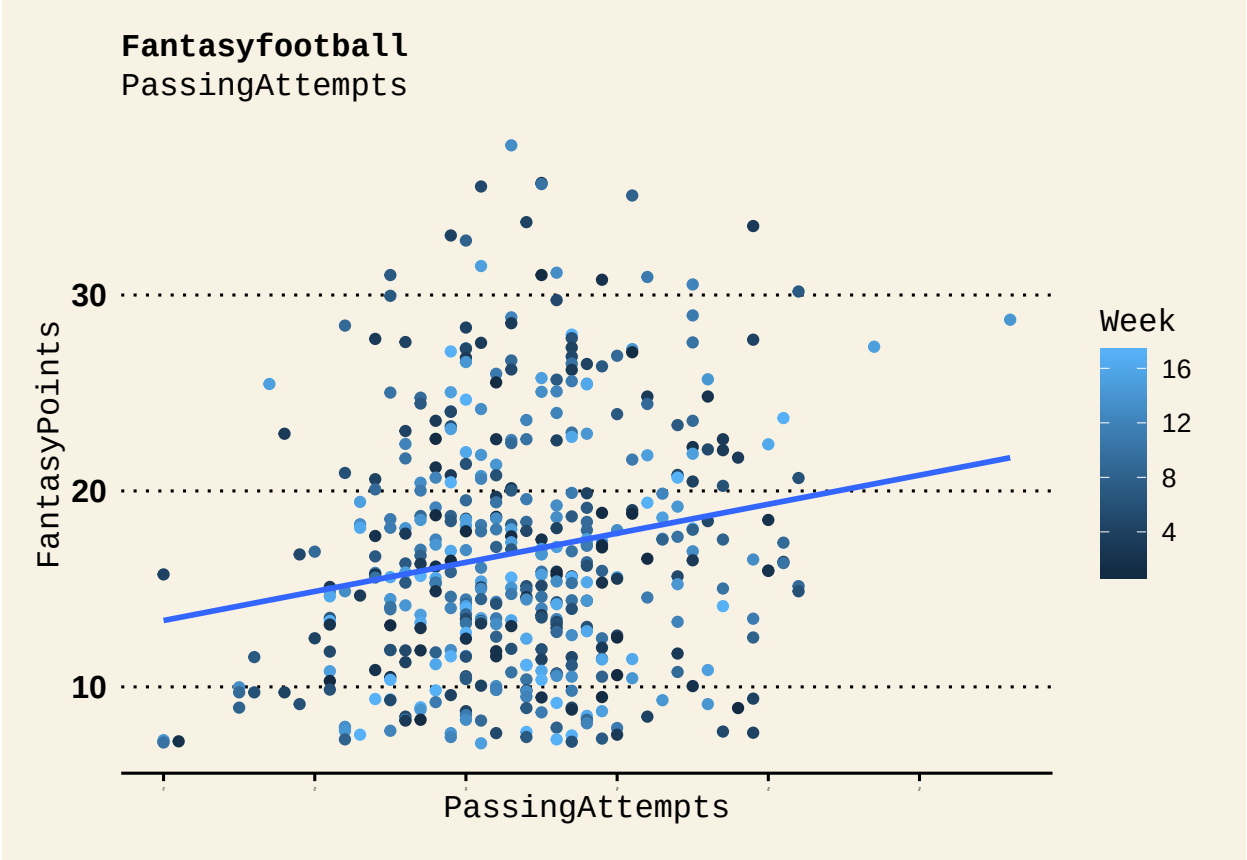
9 : Scatterplots

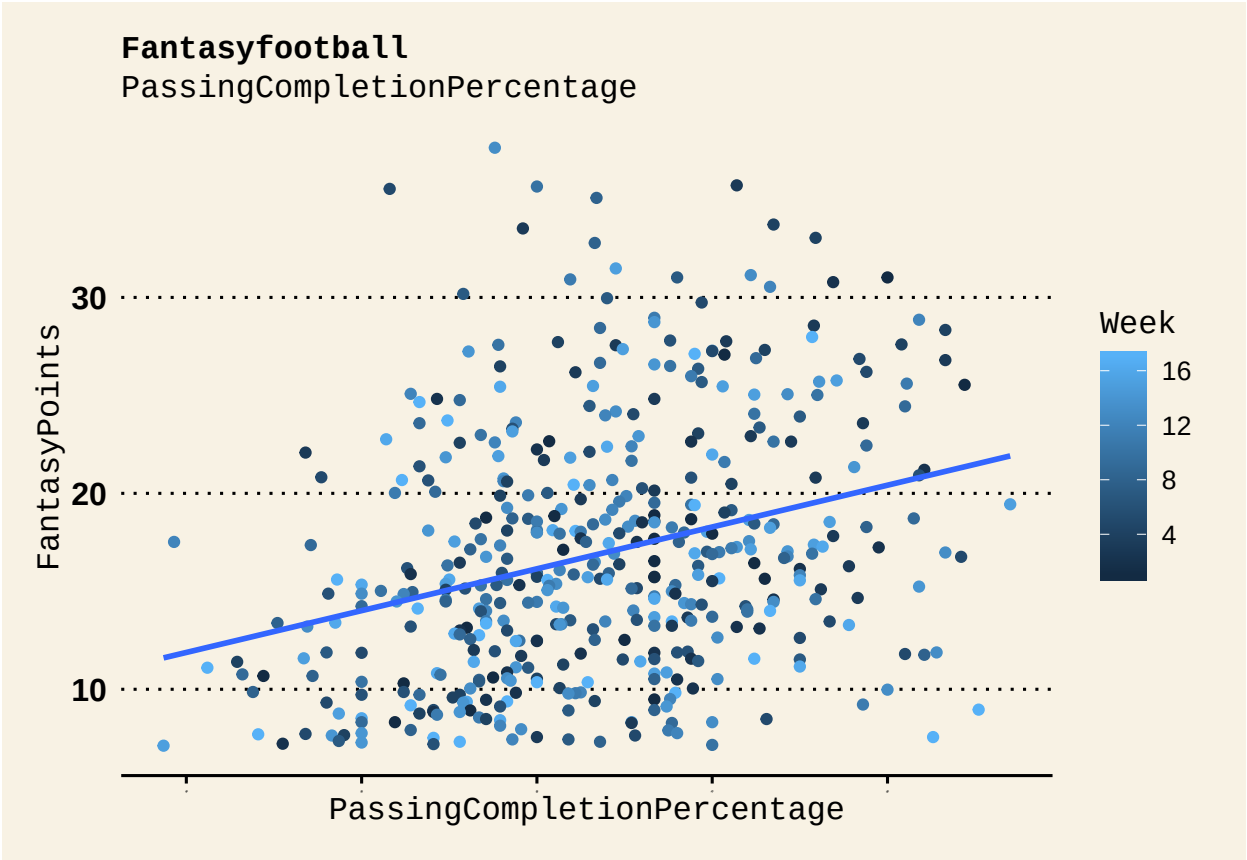
We are trying to capture what the NEXT value for fantasy points is likely to be - these are all going t
current week since the fantasy score is a linear combination of the predictors for any given week.
We need to shift the data before running these charts.

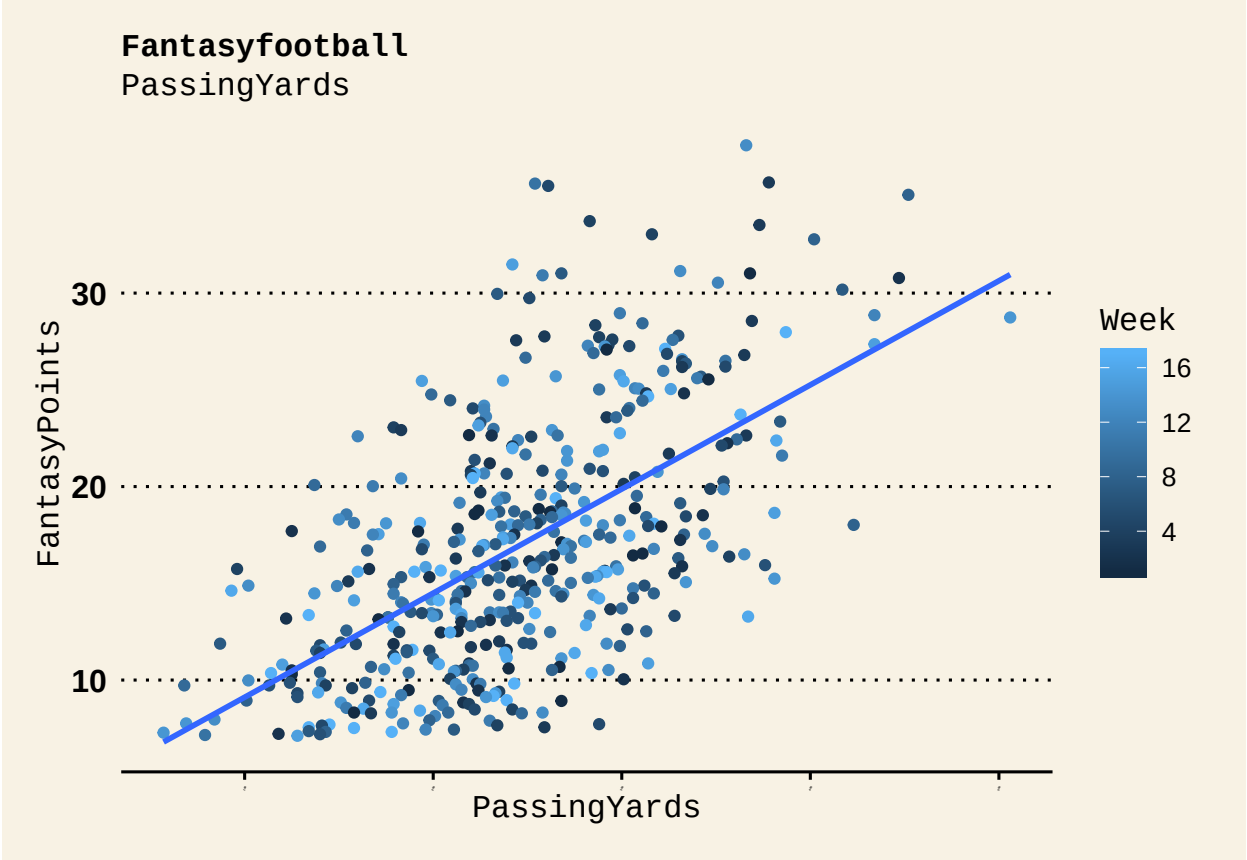
9.1 : Scatterplots for base features

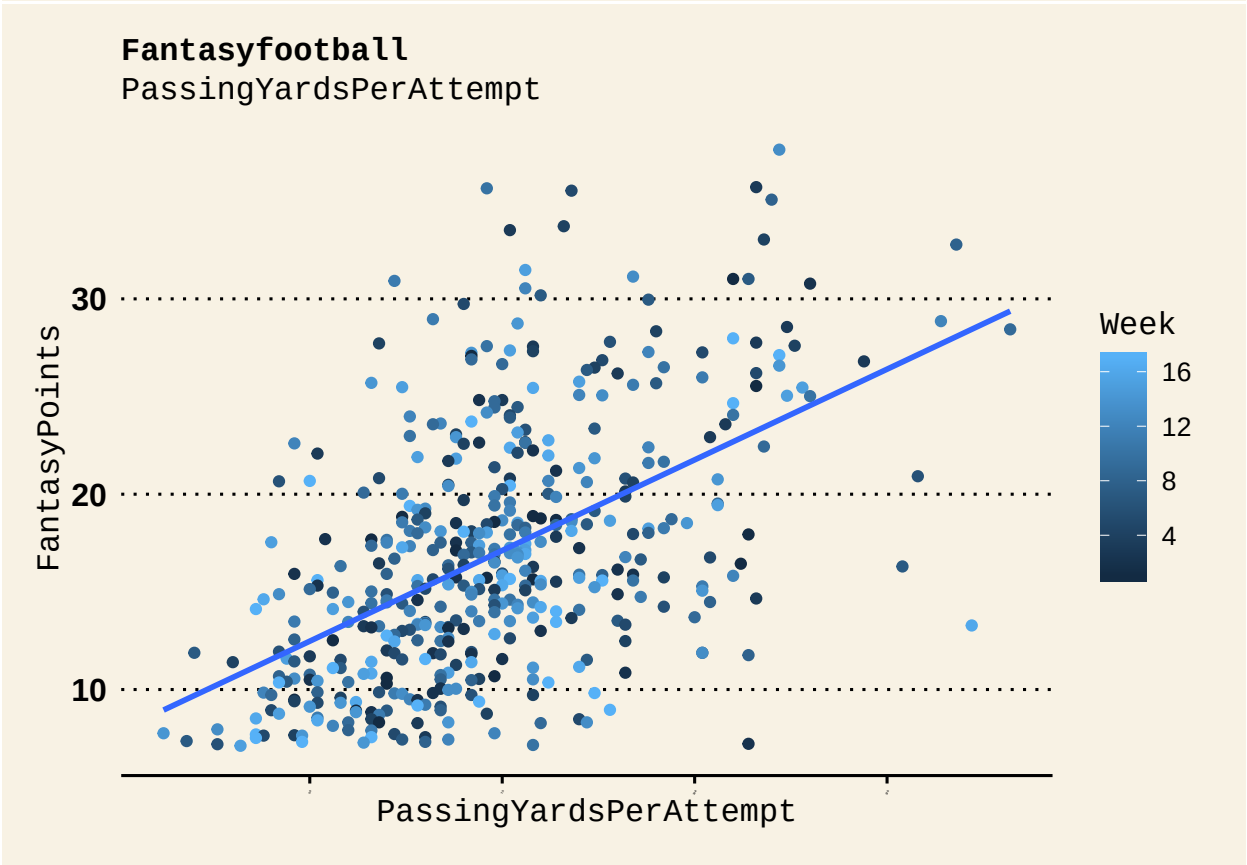
```
for (i in 3:15) {
  base_scatter <- eda_base %>%
                  ggplot(aes_string(y="FantasyPoints",x=names(eda_base[i]),color="as.numeric(Week)")) +
                  geom_point()+geom_smooth(method="lm",se=F)+
                  labs(title="Fantasyfootball",
                       subtitle=names(eda_base[i]),
                       aption="Source: Fantasyfootball")+
                  labs(color="Week")+
                  theme_wsj()+
                  theme(plot.title    = element_text(size = rel(0.5)),
                        plot.subtitle = element_text(size = rel(0.5)),
                        axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                        axis.title    = element_text(size = rel(0.5)),
                        legend.position  = "right",
                        legend.direction ="vertical",
                        legend.title = element_text(size = rel(0.5))
                       )
    print(base_scatter)
  }
```

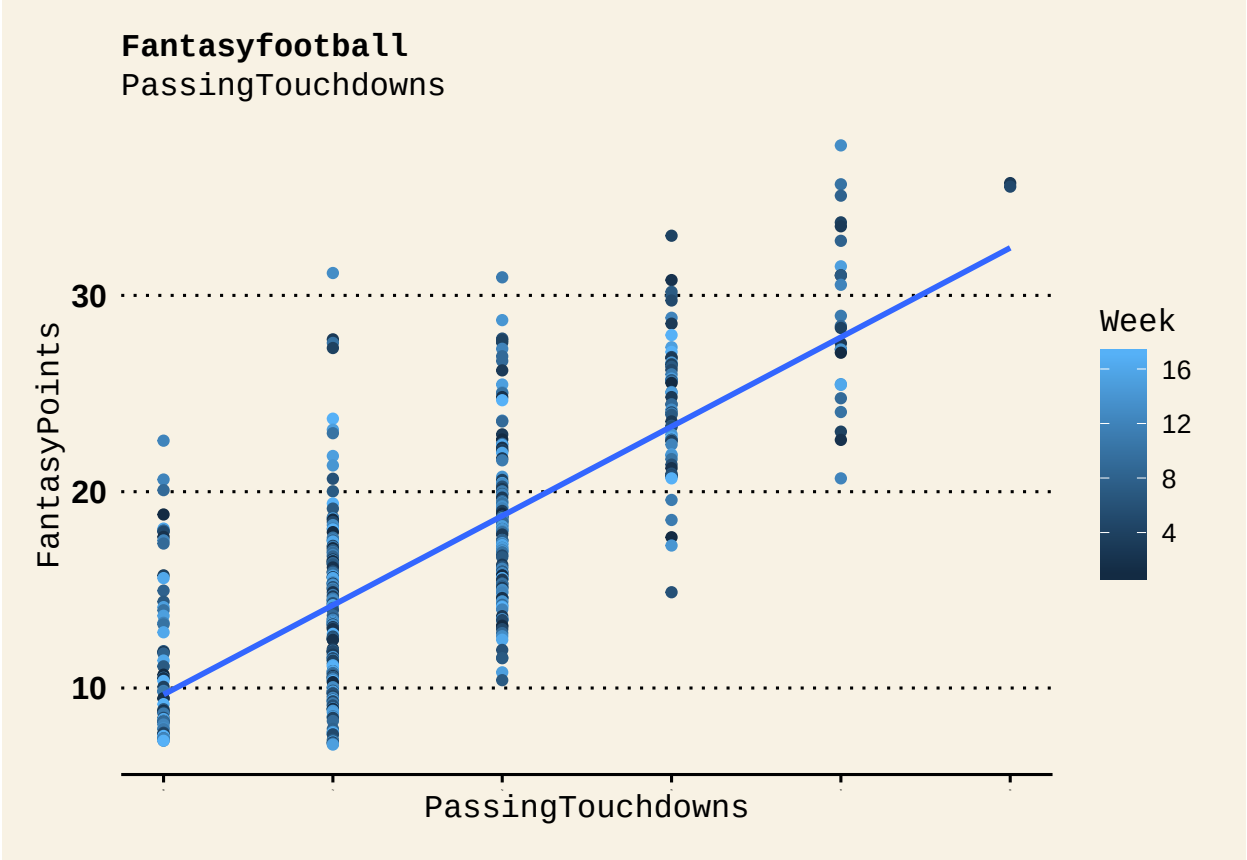


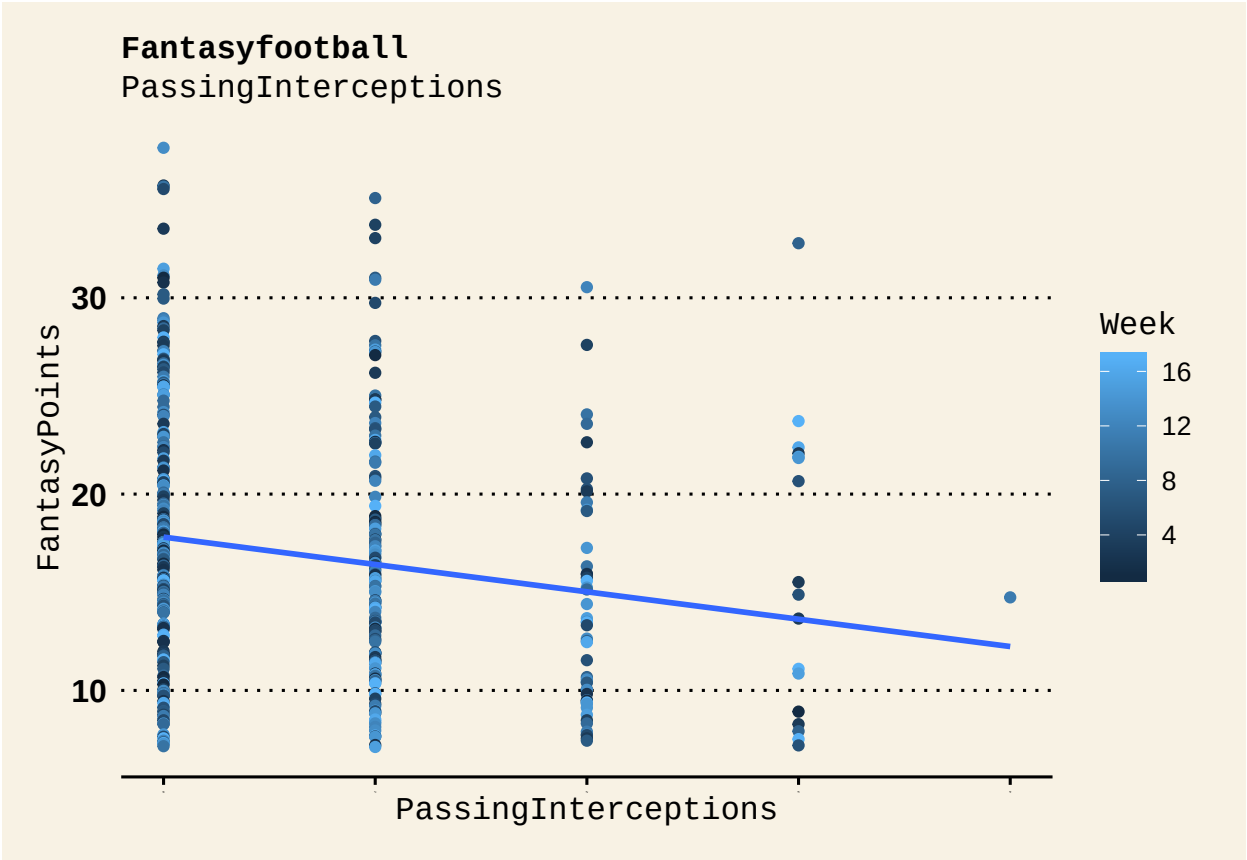

Fantasyfootball
PassingAttempts
FantasyPoints
30
20
10
PassingAttempts
Week
16
12
8
4

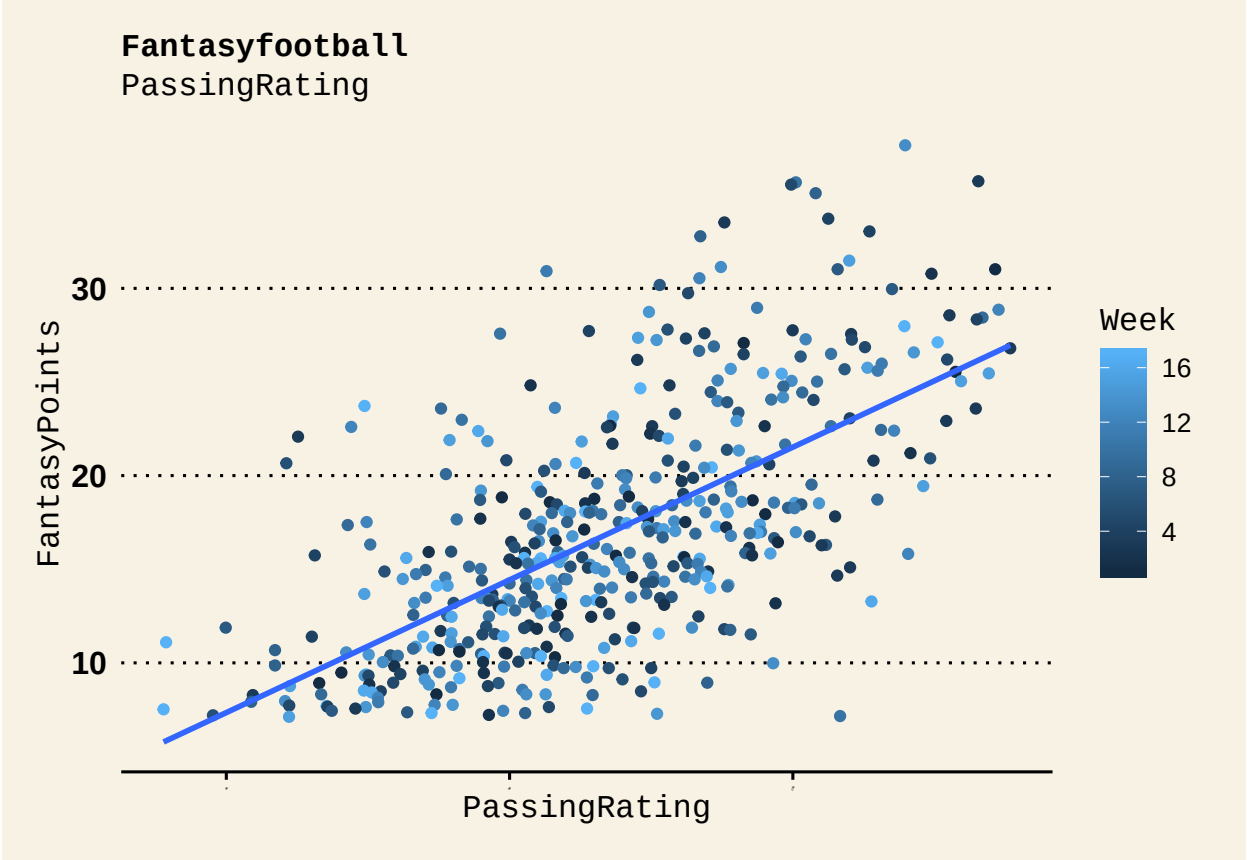

Fantasyfootball
PassingCompletionPercentage
FantasyPoints
30
20
10
PassingCompletionPercentage
Week
16
12
8
4

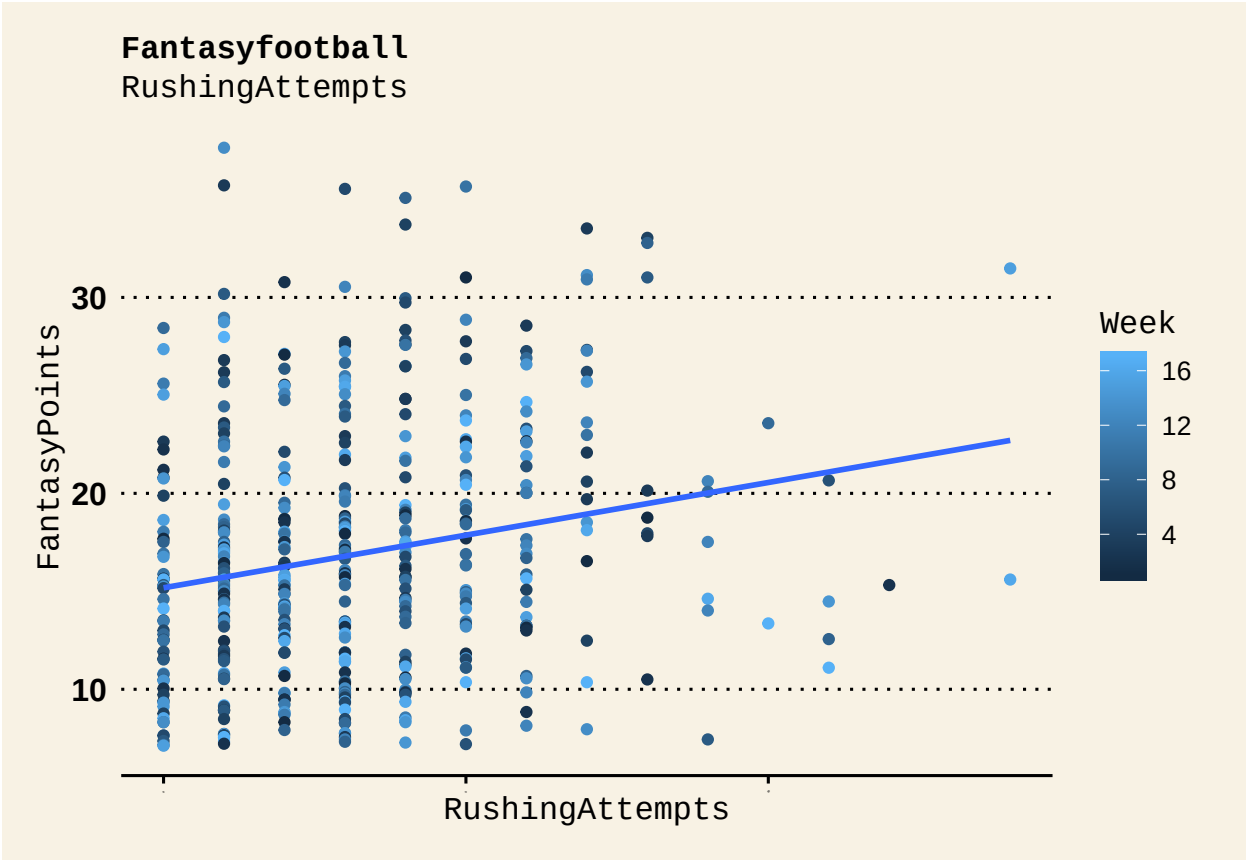

Fantasyfootball
PassingYards
FantasyPoints
30
20
10
PassingYards
Week
16
12
8
4

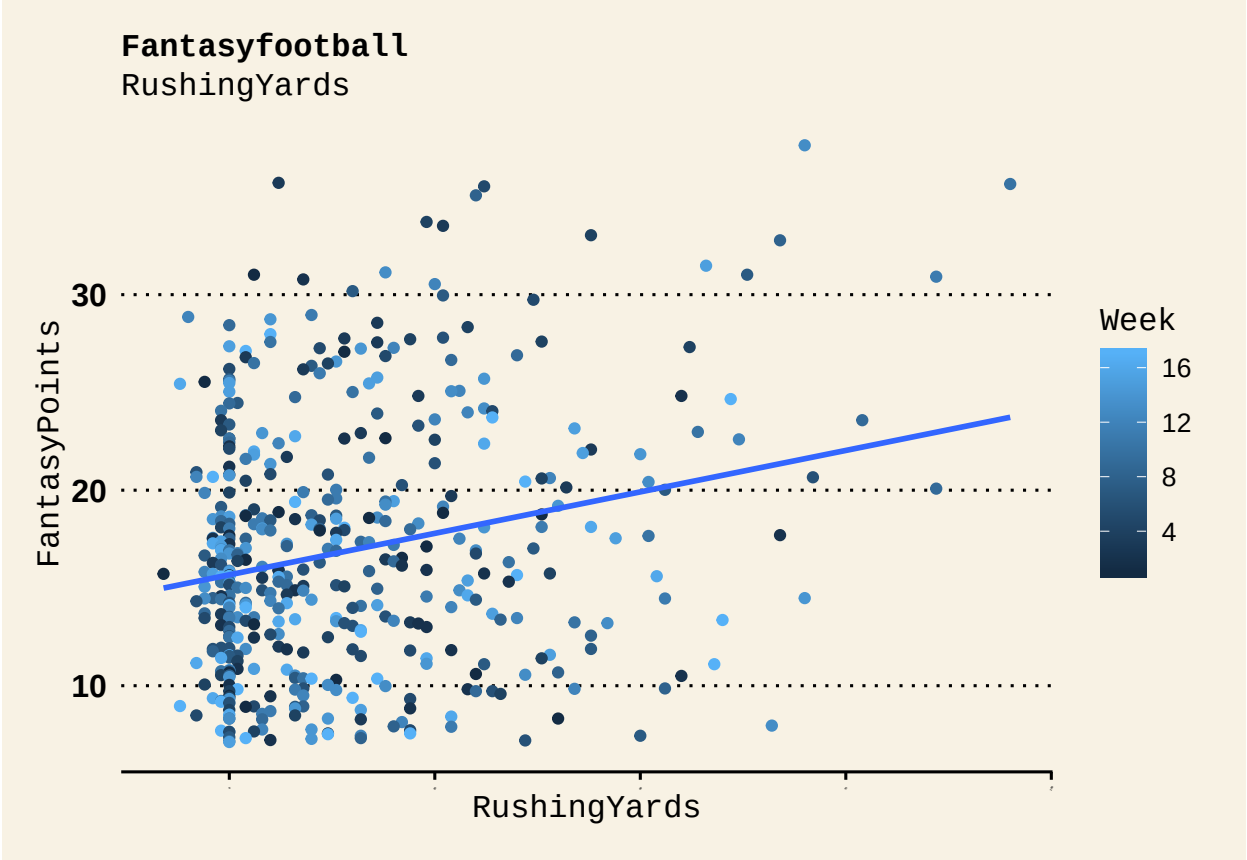

Fantasyfootball
PassingYardsPerAttempt
FantasyPoints
30
20
10
PassingYardsPerAttempt
Week
16
12
8
4

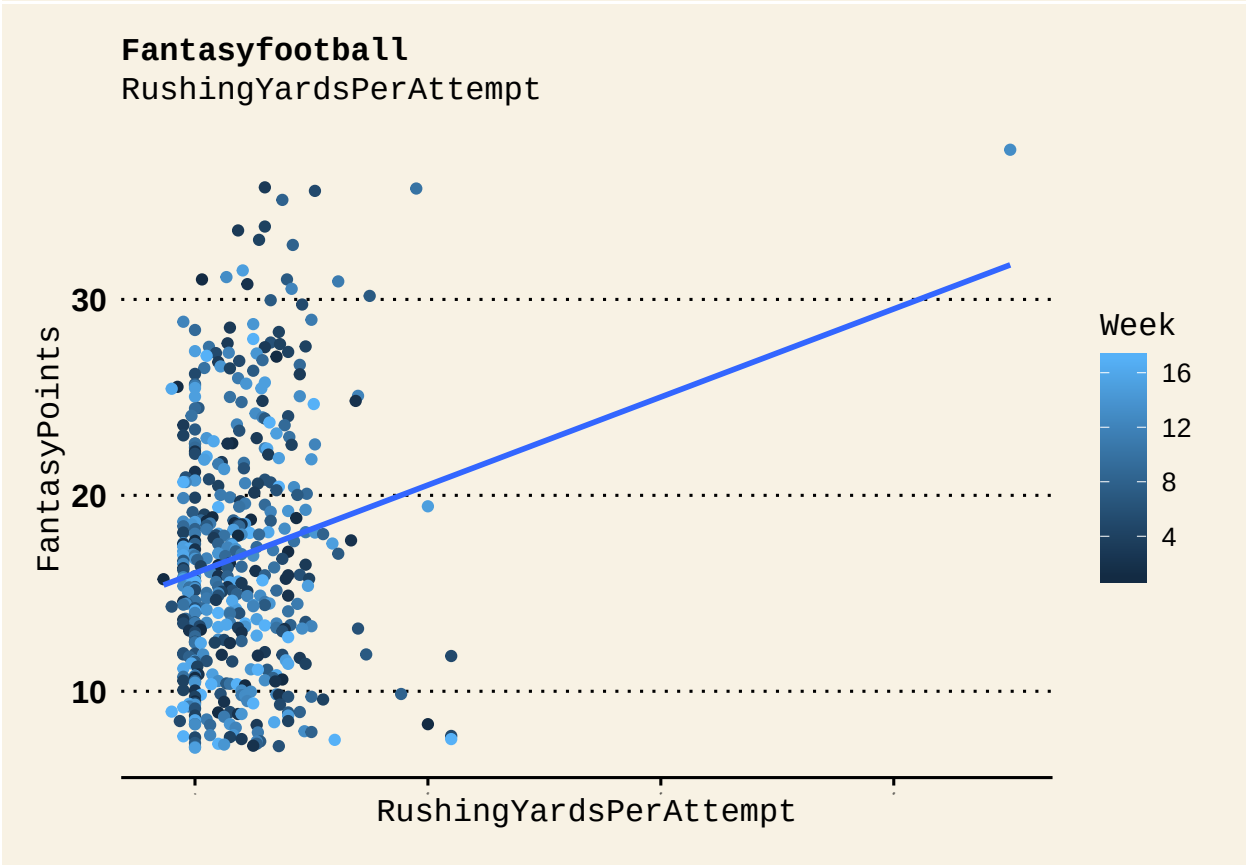

Fantasyfootball
PassingTouchdowns
FantasyPoints
30
20
10
PassingTouchdowns
Week
16
12
8
4

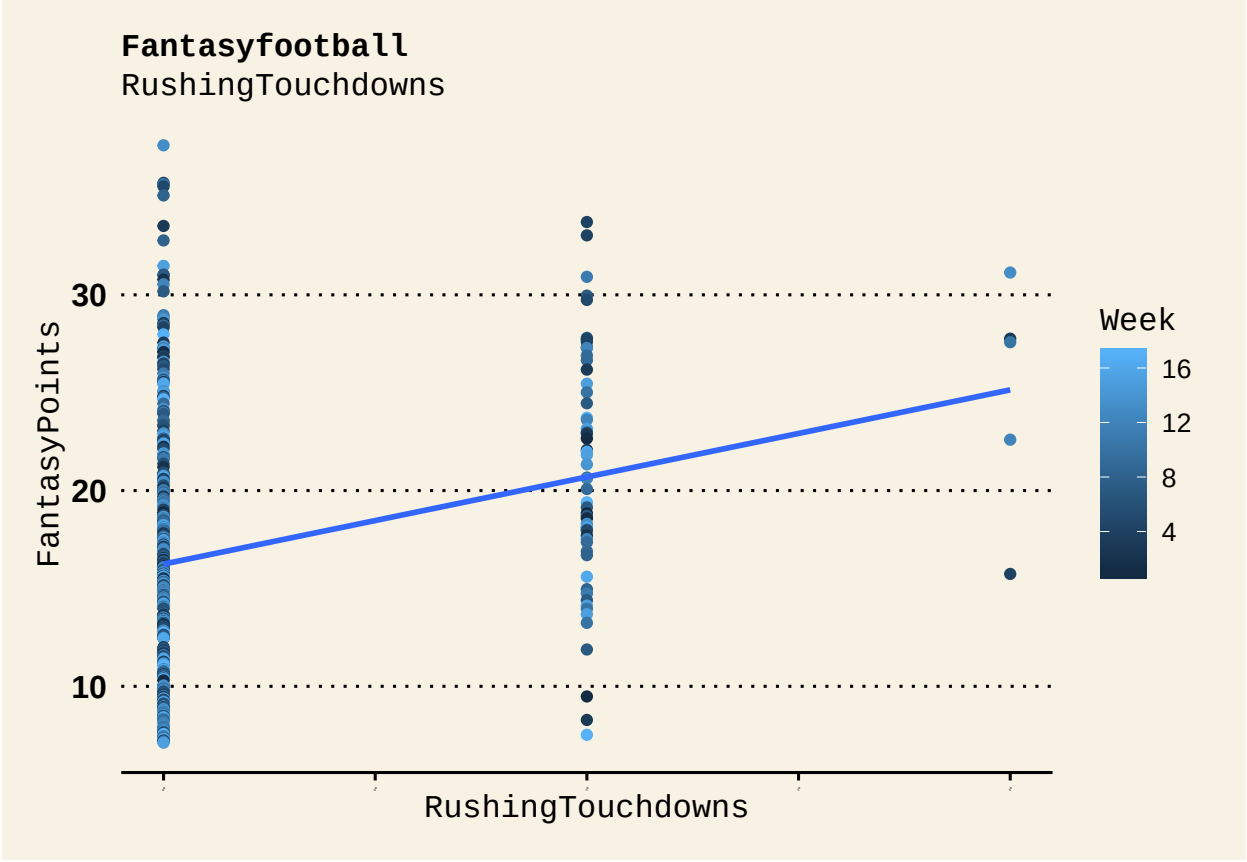

Fantasyfootball
PassingInterceptions
FantasyPoints
30
20
10
PassingInterceptions
Week
16
12
8
4

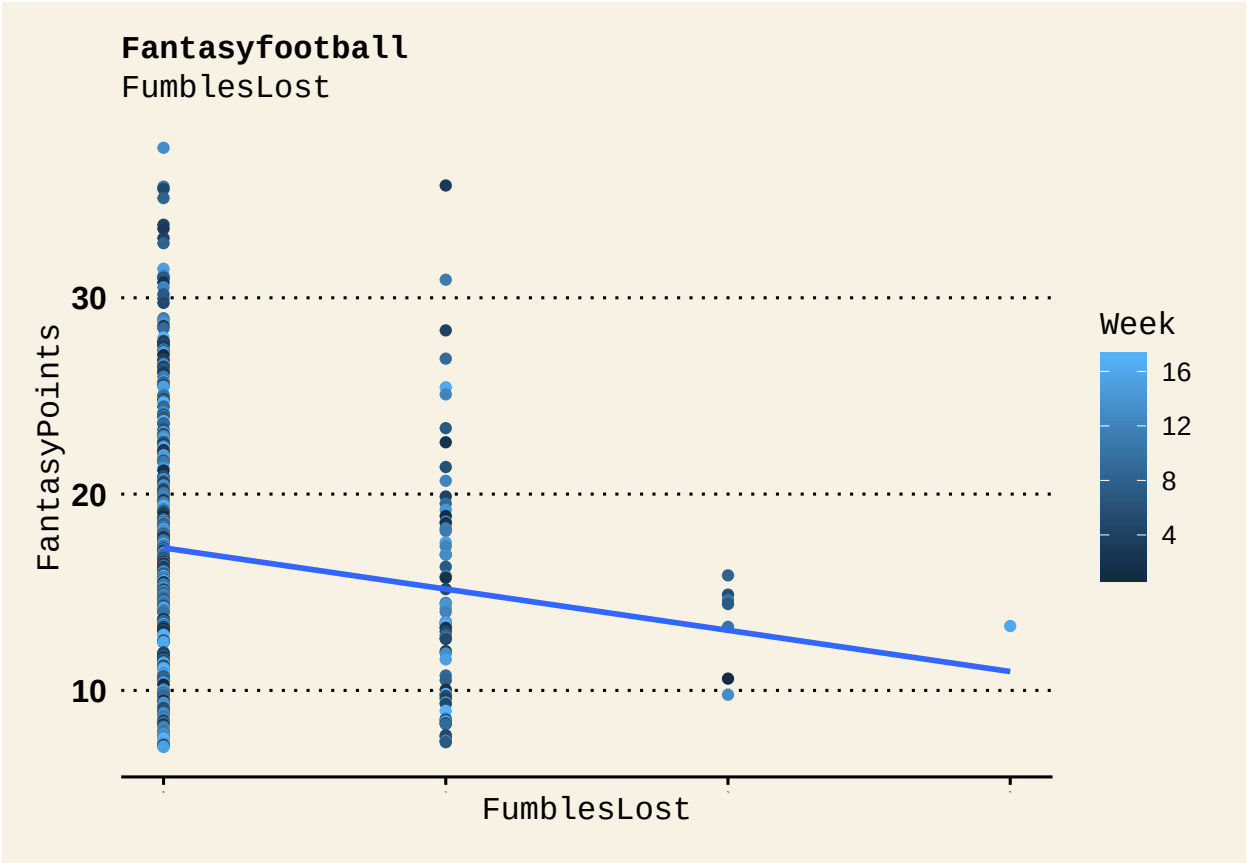

Fantasyfootball
PassingRating
FantasyPoints
30
20
10
PassingRating
Week
16
12
8
4


Fantasyfootball
RushingAttempts
FantasyPoints
30
20
10
RushingAttempts
Week
16
12
8
4


Fantasyfootball
RushingYards
FantasyPoints
30
20
10
RushingYards
Week
16
12
8
4

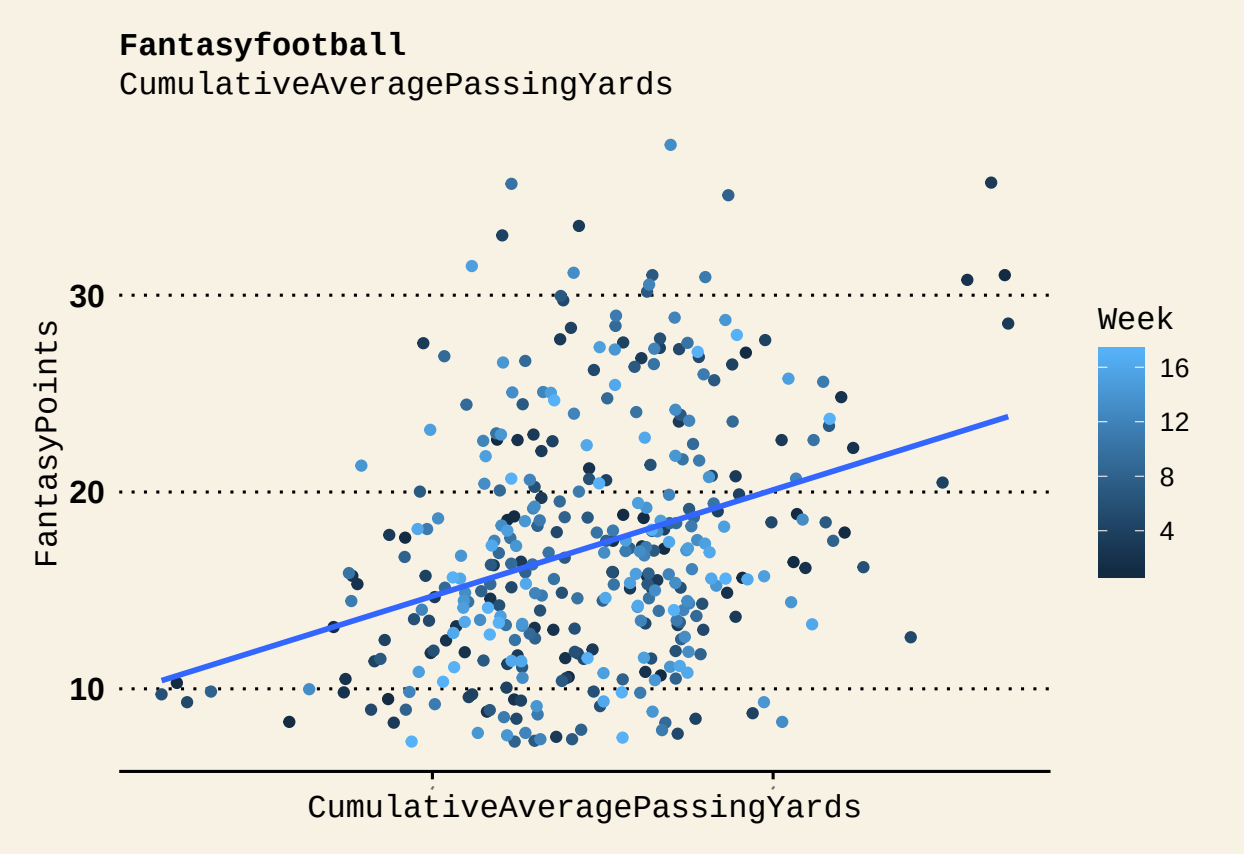

Fantasyfootball
RushingYardsPerAttempt
FantasyPoints
30
20
10
RushingYardsPerAttempt
Week
16
12
8
4

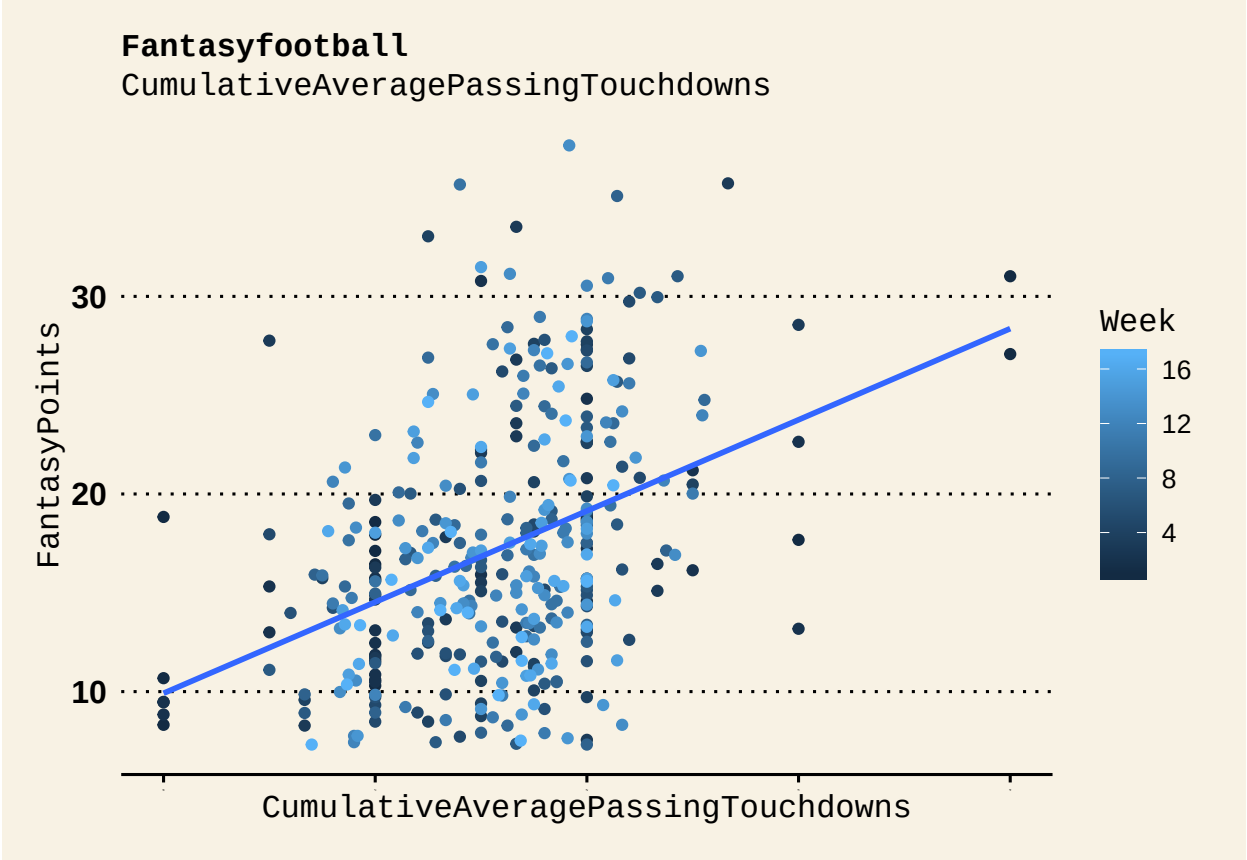

Fantasyfootball
RushingTouchdowns
FantasyPoints
30
20
10
RushingTouchdowns
Week
16
12
8
4

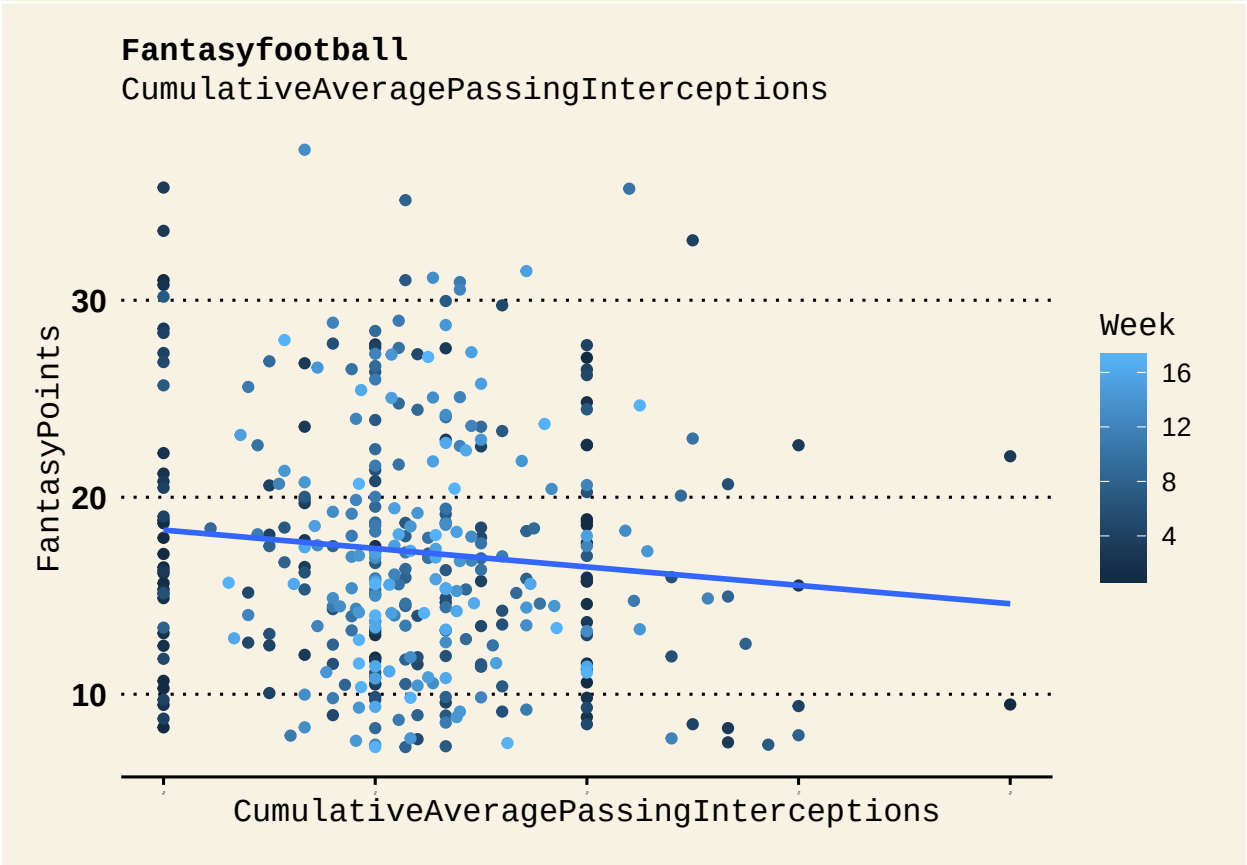

Fantasyfootball
FumblesLost
FantasyPoints
30
20
10
FumblesLost
Week
16
12
8
4

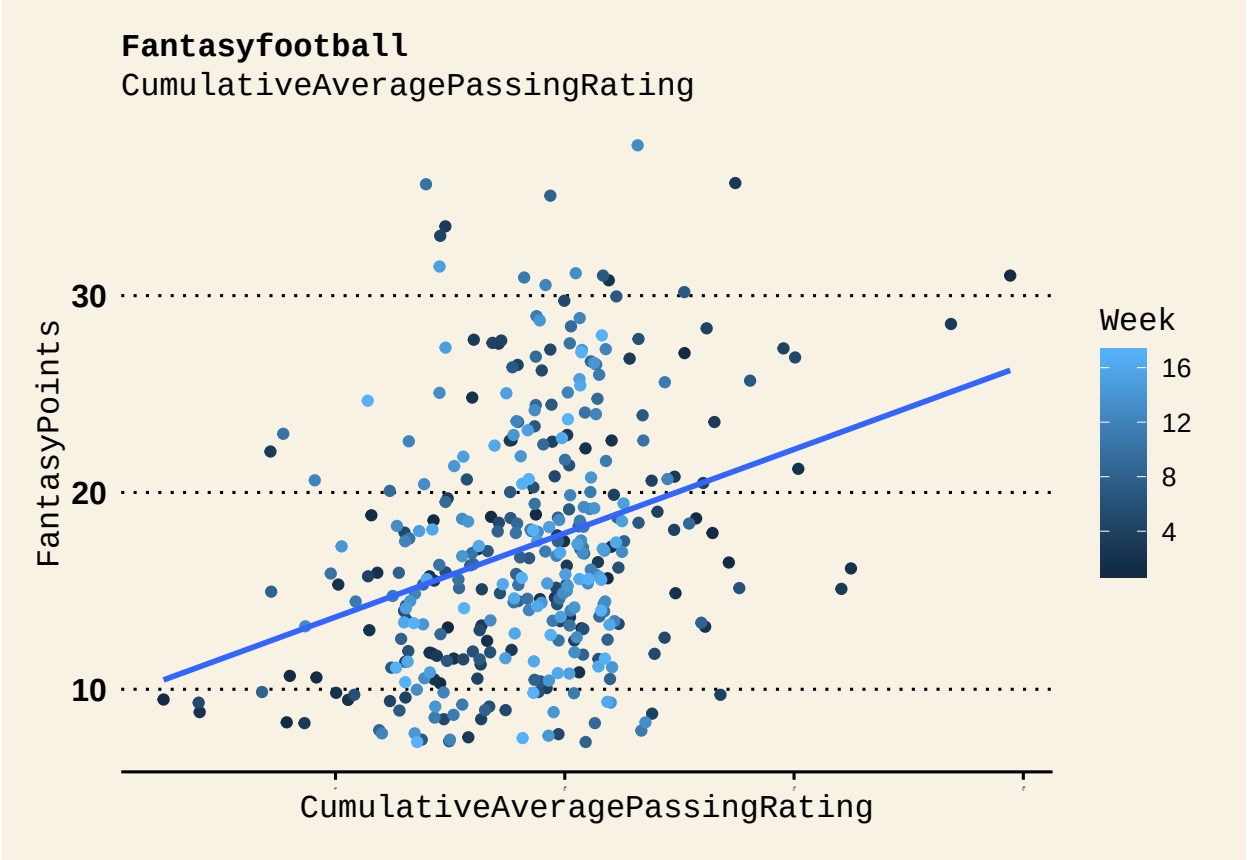
```
## 9.2 : Scatterplots for Derived features
```

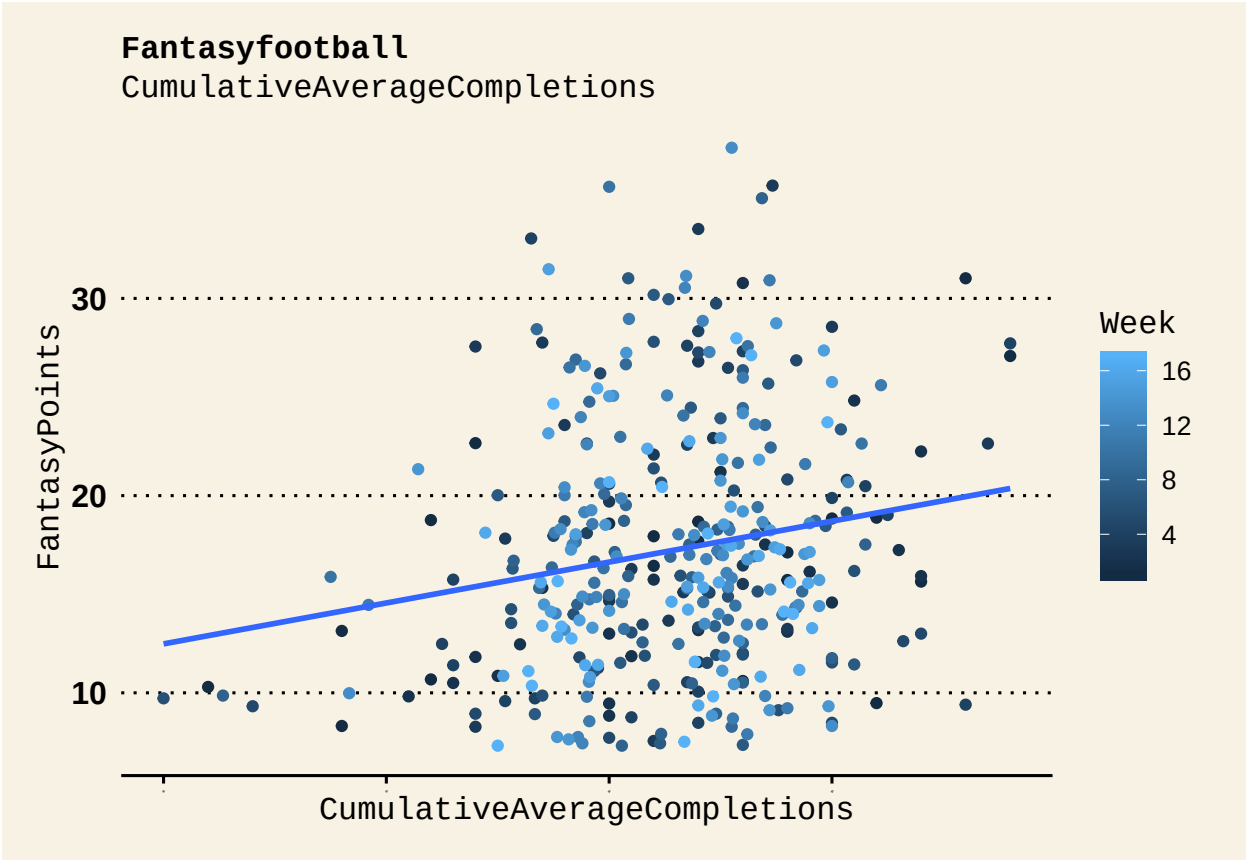
```
for (i in 3:20) {
  derived_scatter <- eda_derived %>%
                     ggplot(aes_string(y="FantasyPoints",x=names(eda_derived[i]),color="as.numeric(Week)"))+
                     geom_point()+
                     geom_smooth(method="lm",se=F)+
                     xlab(names(eda_derived[i]))+
                     ylab("FantasyPoints")+
                     labs(title="Fantasyfootball",
                          subtitle=names(eda_derived[i]),
                          aption="Source: Fantasyfootball")+
                     labs(color="Week")+
                     theme_wsj()+
                     theme(plot.title    = element_text(size = rel(0.5)),
                           plot.subtitle = element_text(size = rel(0.5)),
                           axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                           axis.title    = element_text(size = rel(0.5)),
                           legend.position  = "right",
                           legend.direction ="vertical",
                           legend.title = element_text(size = rel(0.5))
                          )
    print(derived_scatter)
}
```

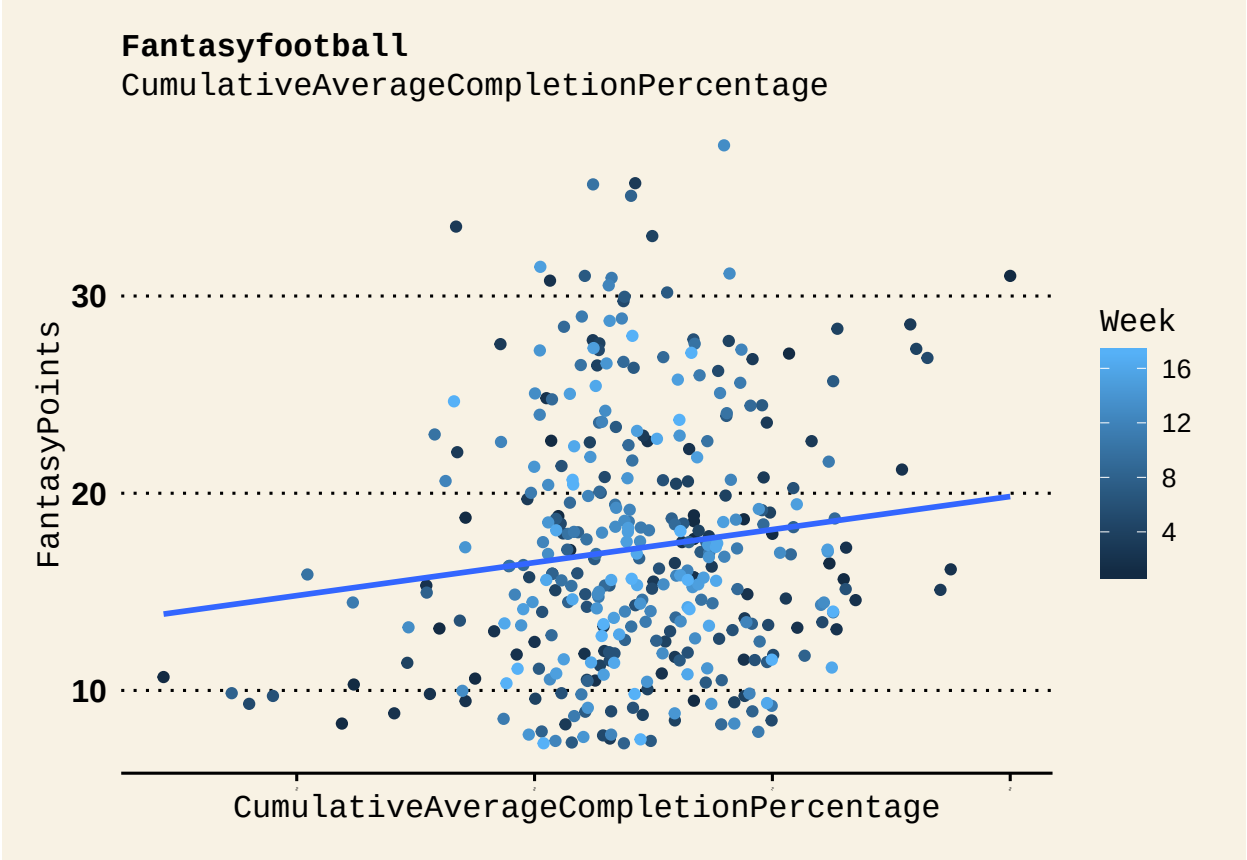


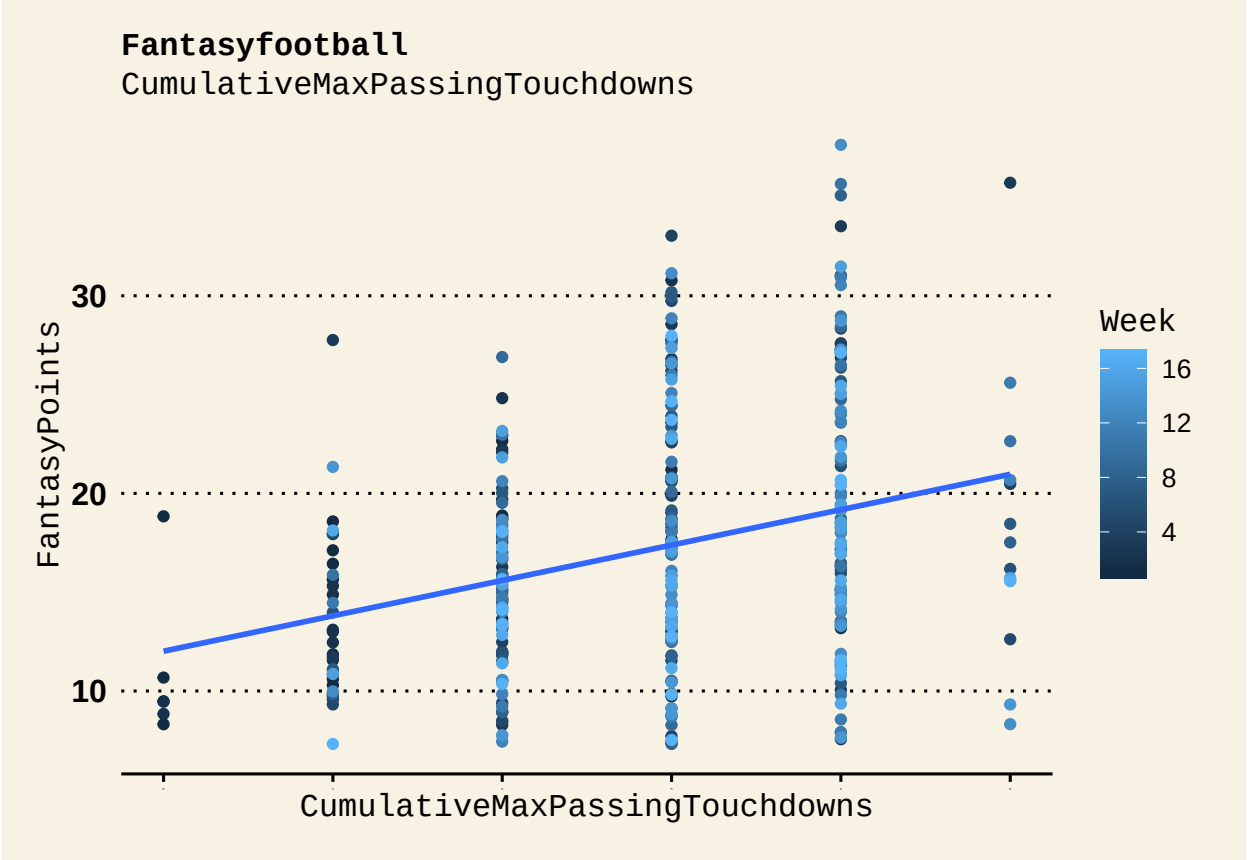

Fantasyfootball
CumulativeAveragePassingTouchdowns
FantasyPoints
30
20
10
CumulativeAveragePassingTouchdowns
Week
16
12
8
4

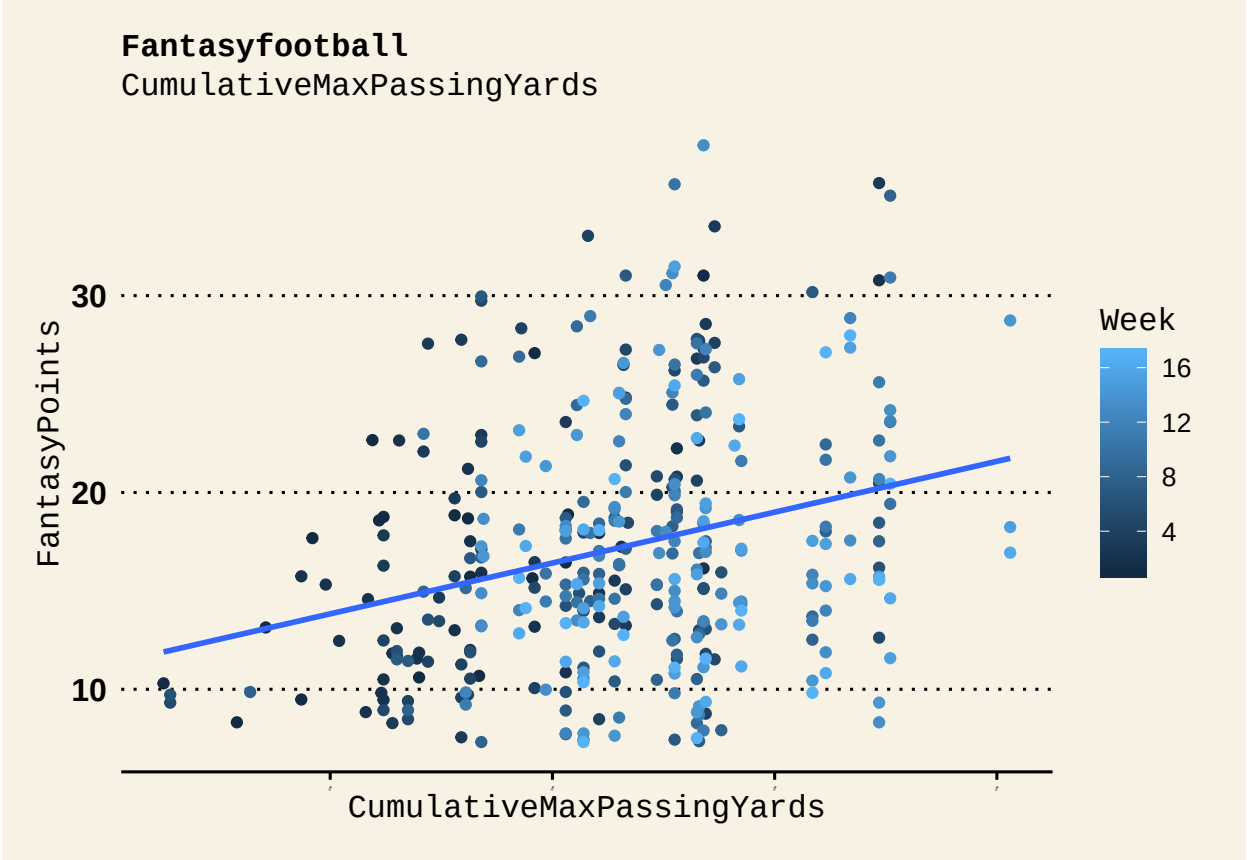

Fantasyfootball
CumulativeAveragePassingInterceptions
FantasyPoints
30
20
10
CumulativeAveragePassingInterceptions
Week
16
12
8
4

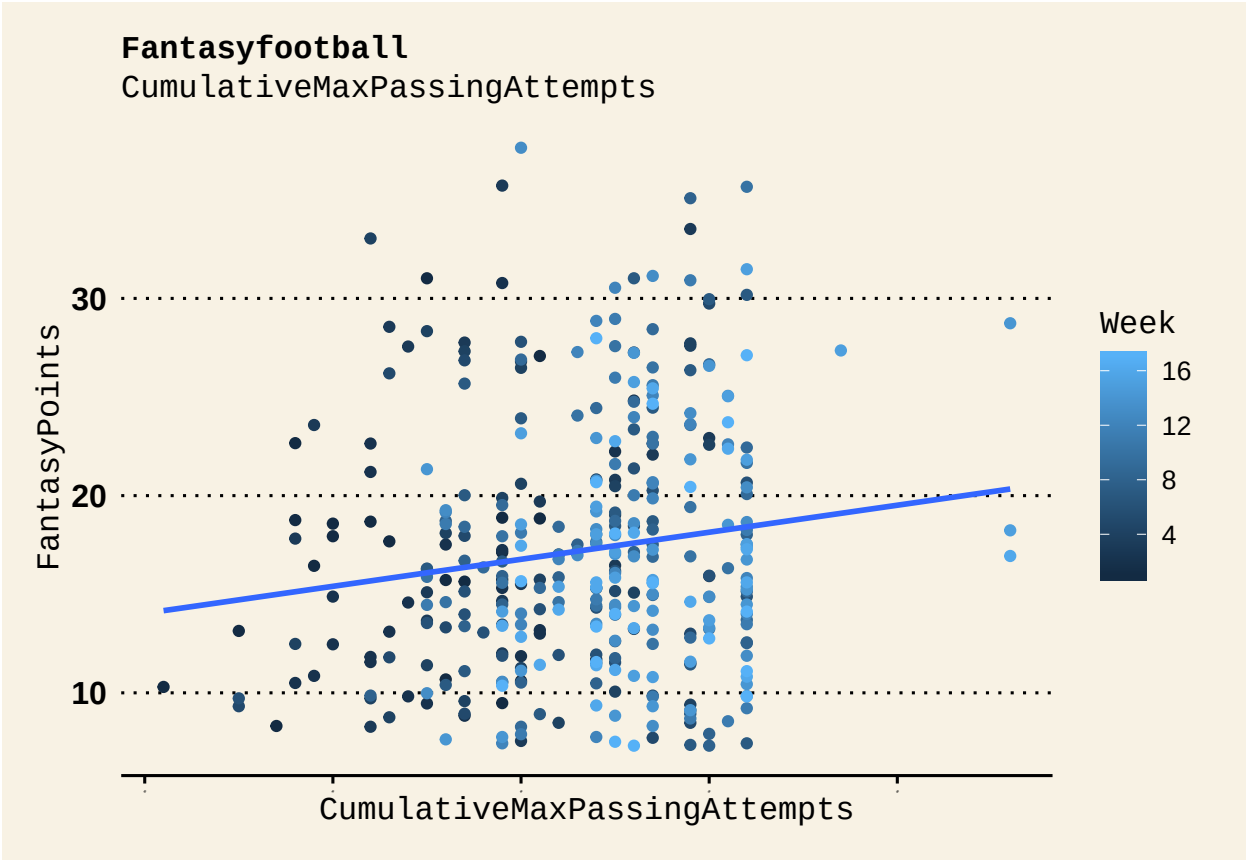

Fantasyfootball
CumulativeAveragePassingRating
FantasyPoints
30
20
10
CumulativeAveragePassingRating
Week
16
12
8
4

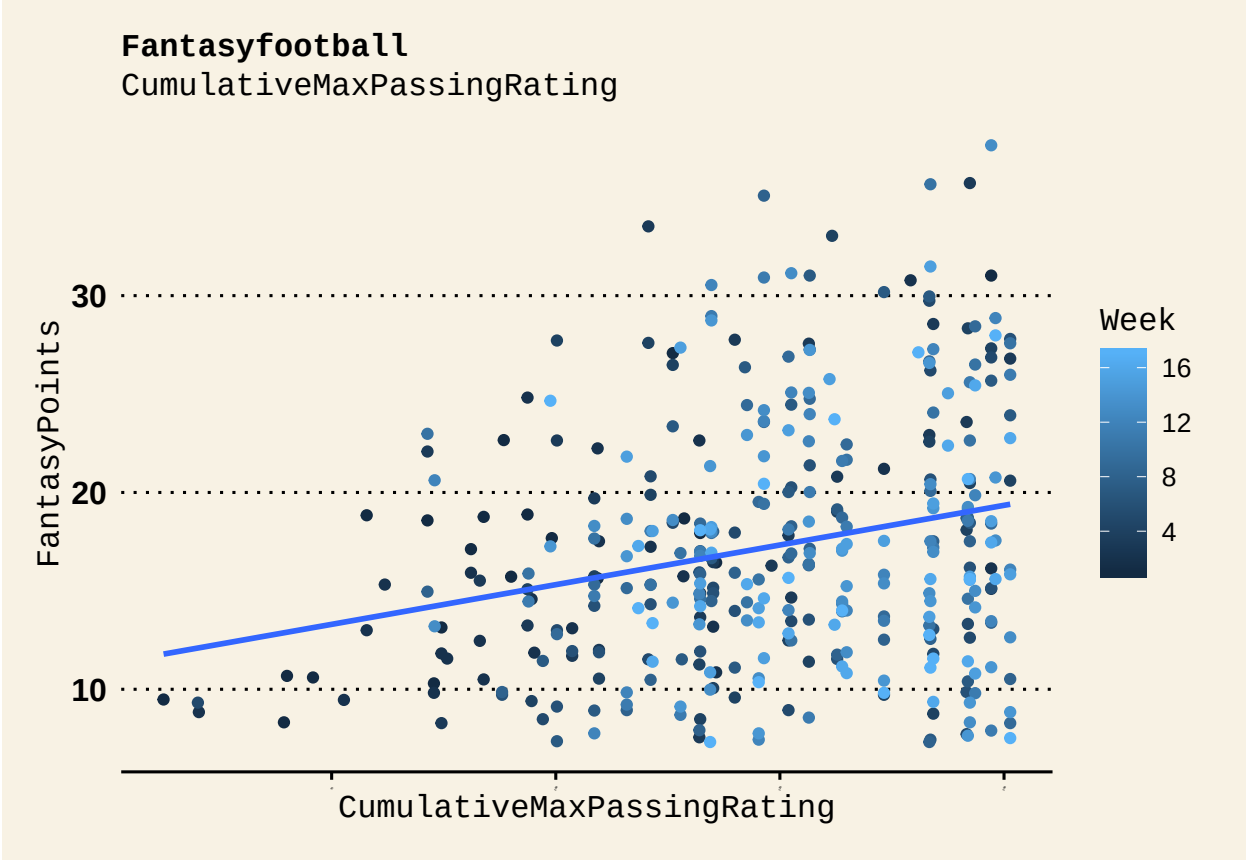

Fantasyfootball
CumulativeAverageCompletions
FantasyPoints
30
20
10
CumulativeAverageCompletions
Week
16
12
8
4

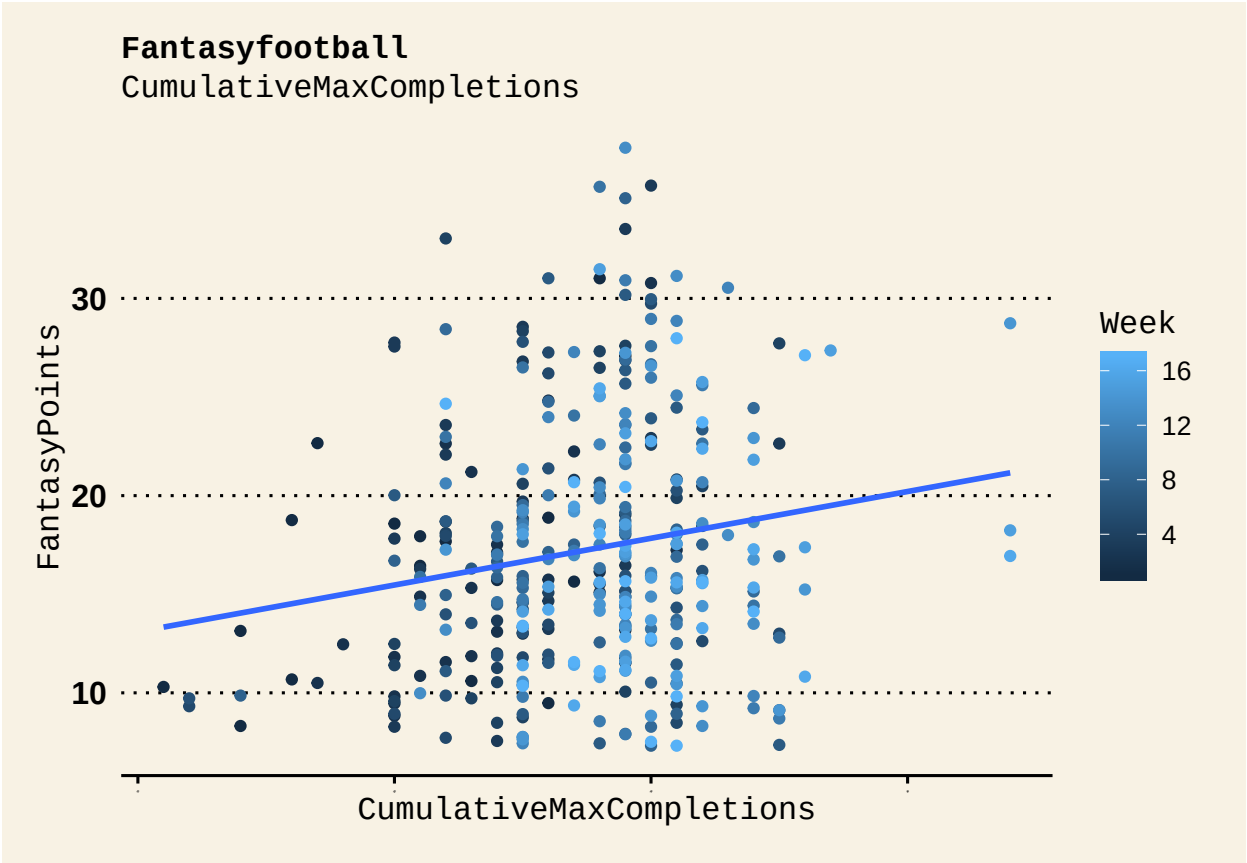

Fantasyfootball
CumulativeAverageCompletionPercentage
FantasyPoints
30
20
10
CumulativeAverageCompletionPercentage
Week
16
12
8
4

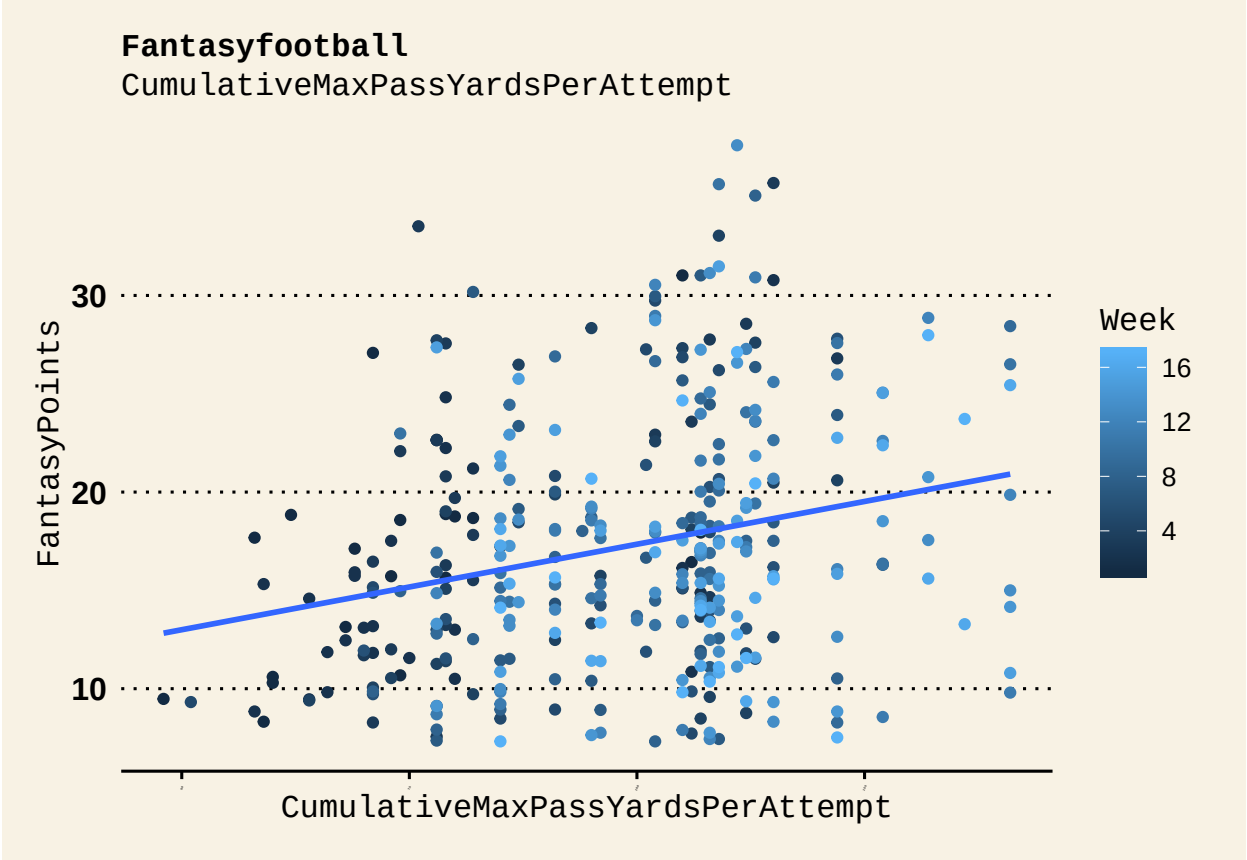

Fantasyfootball
CumulativeMaxPassingTouchdowns
FantasyPoints
30
20
10
CumulativeMaxPassingTouchdowns
Week
16
12
8
4

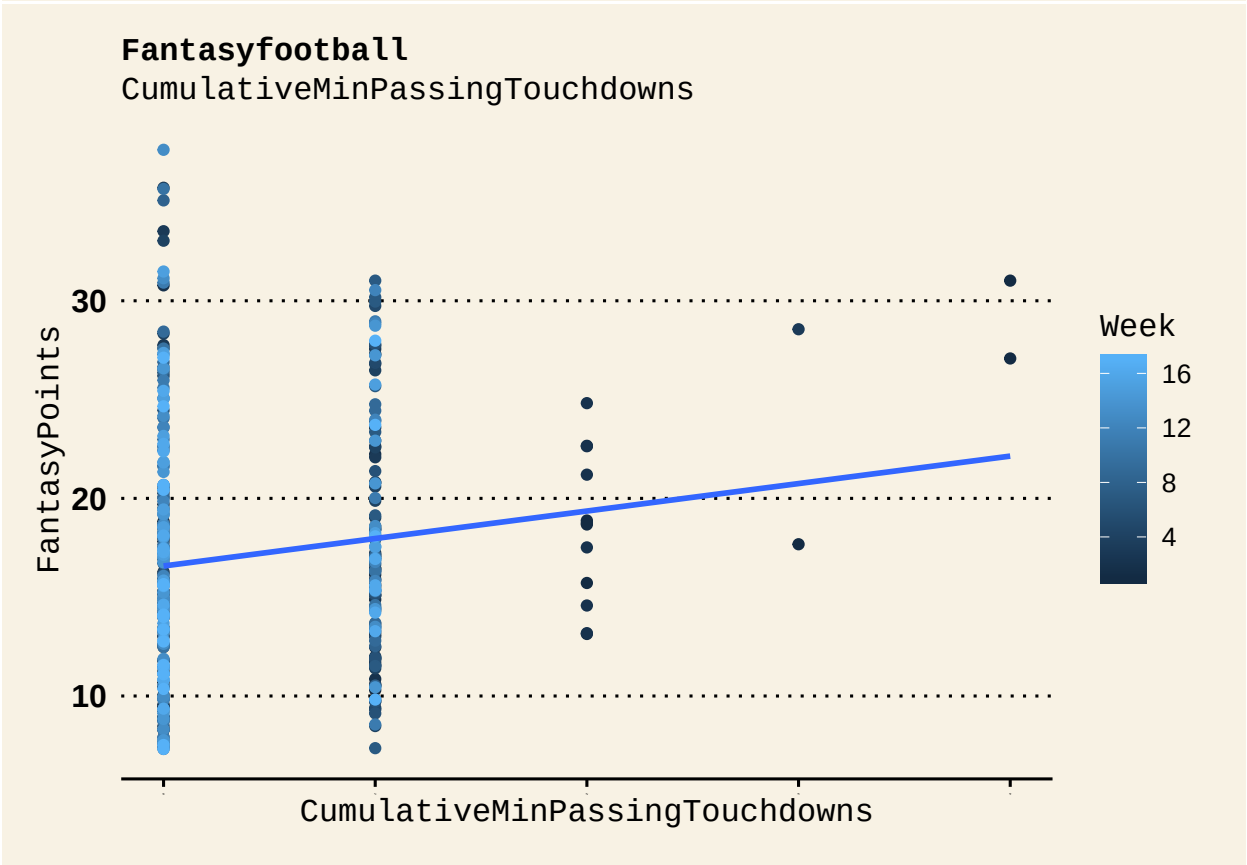

Fantasyfootball
CumulativeMaxPassingYards
FantasyPoints
30
20
10
CumulativeMaxPassingYards
Week
16
12
8
4

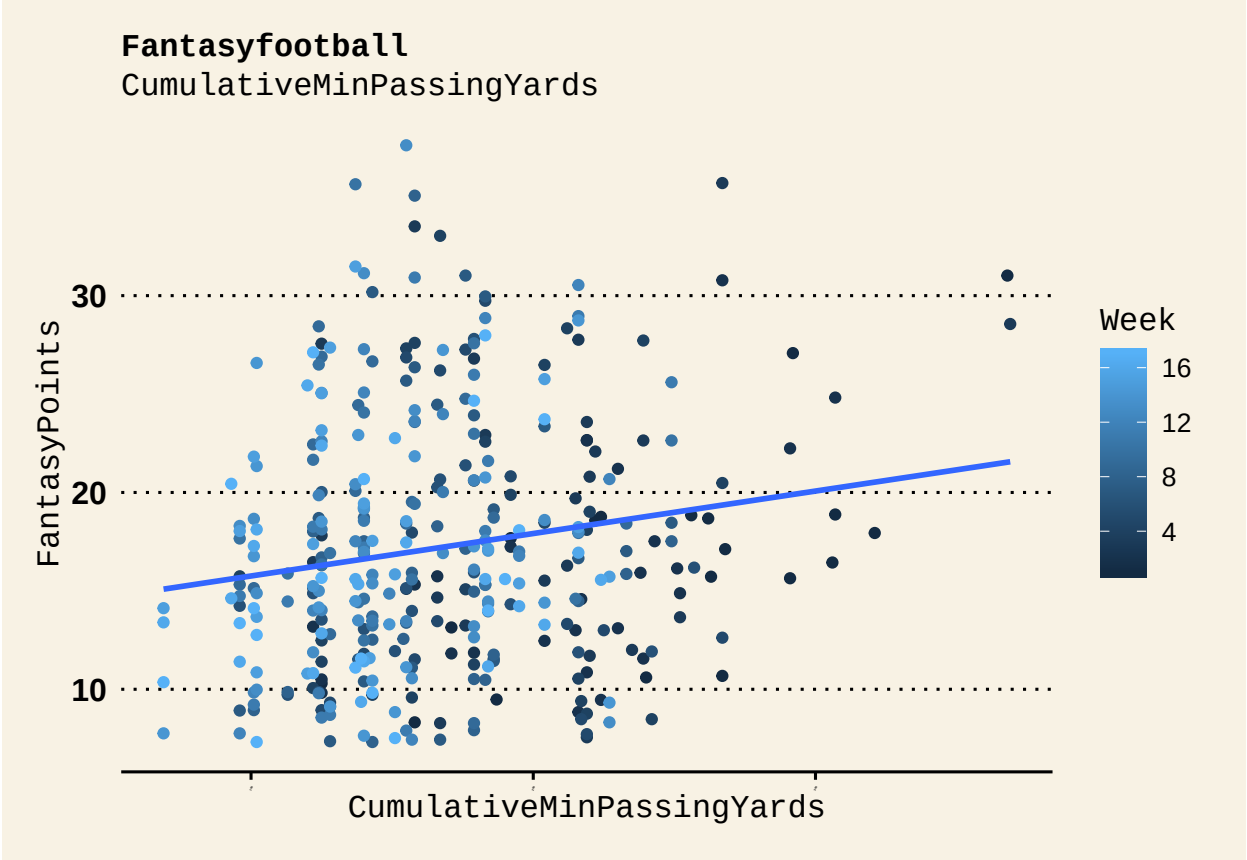

Fantasyfootball
CumulativeMaxPassingAttempts
FantasyPoints
30
20
10
CumulativeMaxPassingAttempts
Week
16
12
8
4

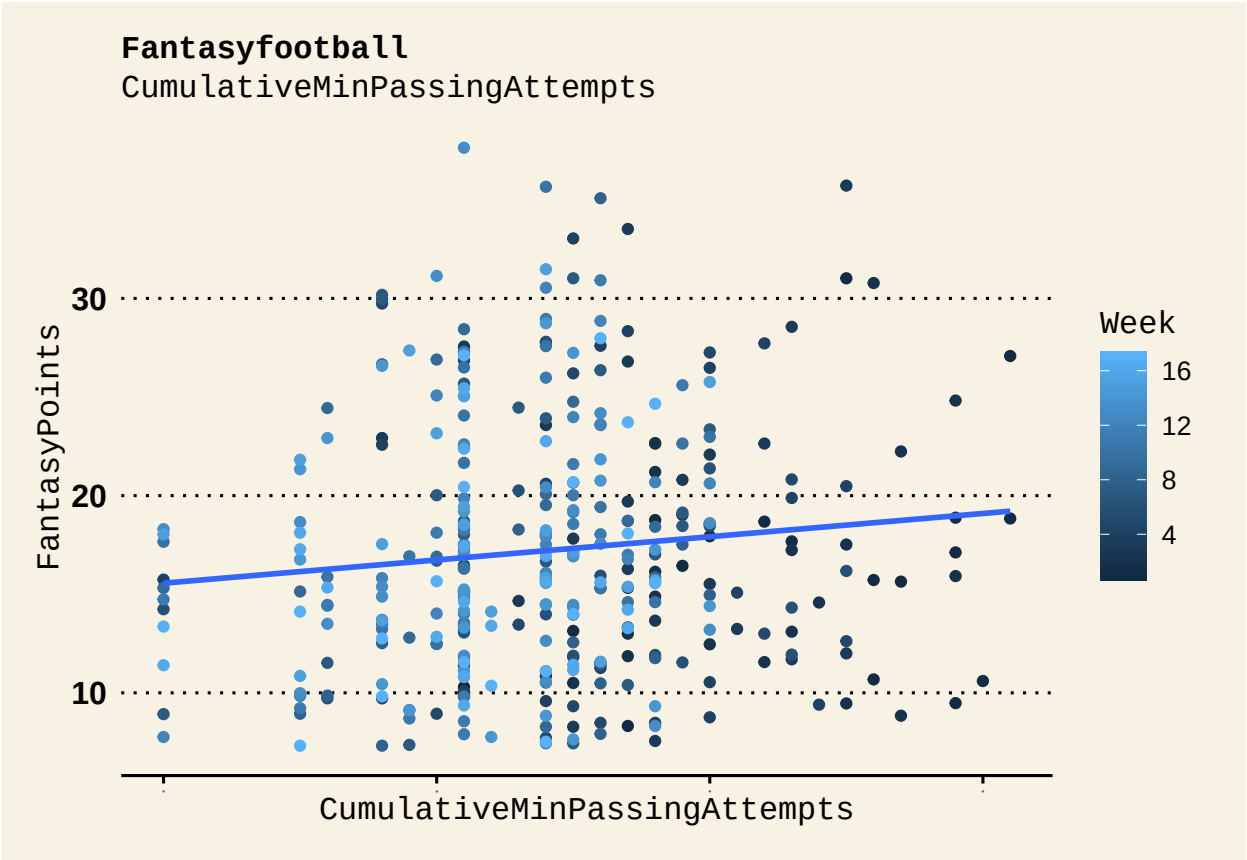

Fantasyfootball
CumulativeMaxPassingRating
FantasyPoints
30
20
10
CumulativeMaxPassingRating
Week
16
12
8
4

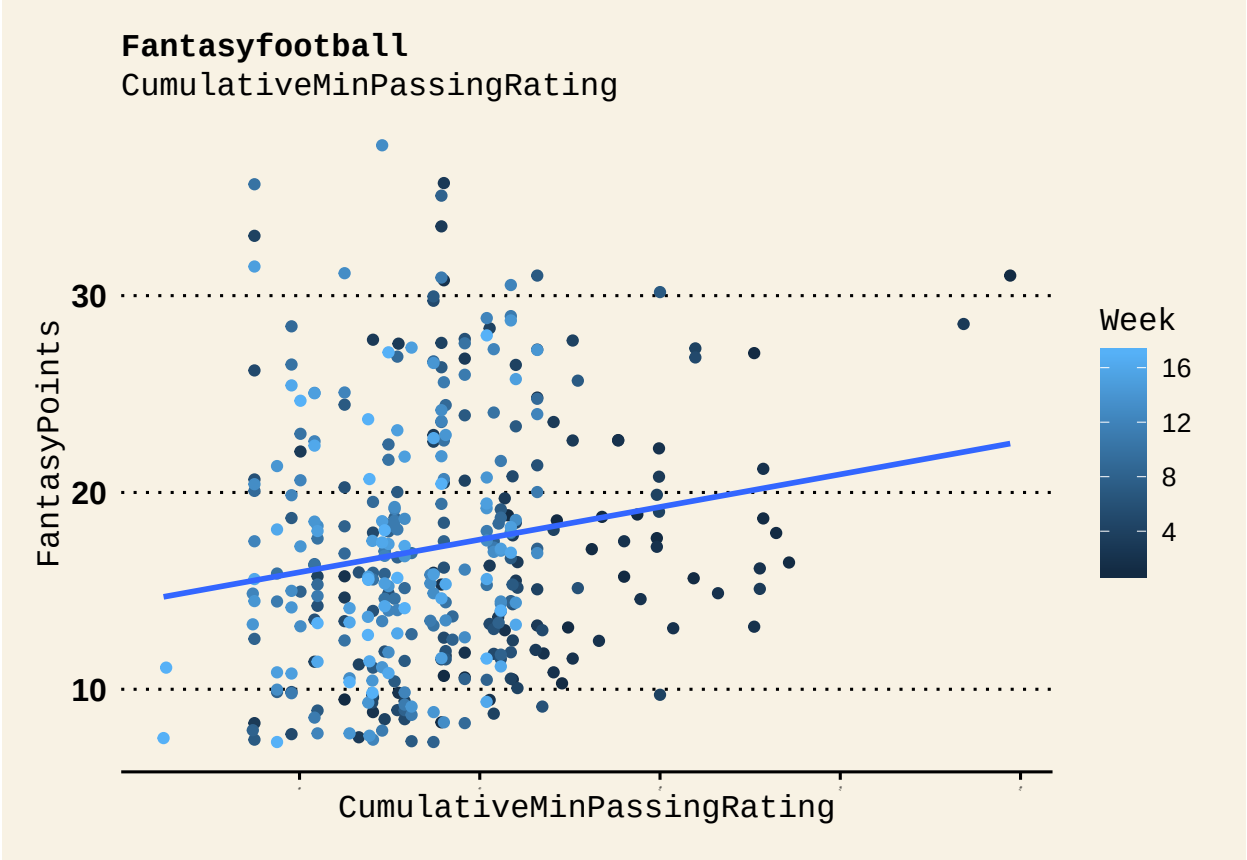

Fantasyfootball
CumulativeMaxCompletions
FantasyPoints
30
20
10
CumulativeMaxCompletions
Week
16
12
8
4

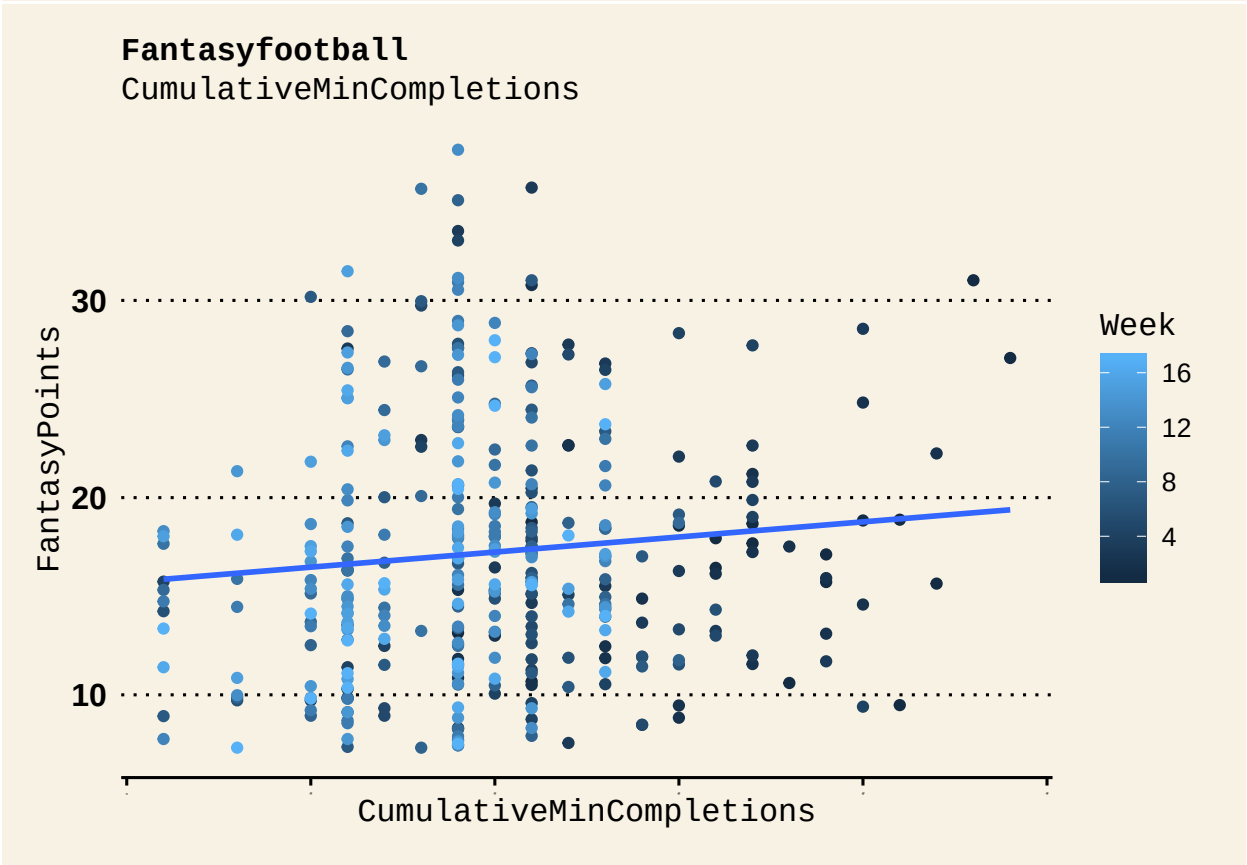

Fantasyfootball
CumulativeMaxPassYardsPerAttempt
FantasyPoints
30
20
10
CumulativeMaxPassYardsPerAttempt
Week
16
12
8
4

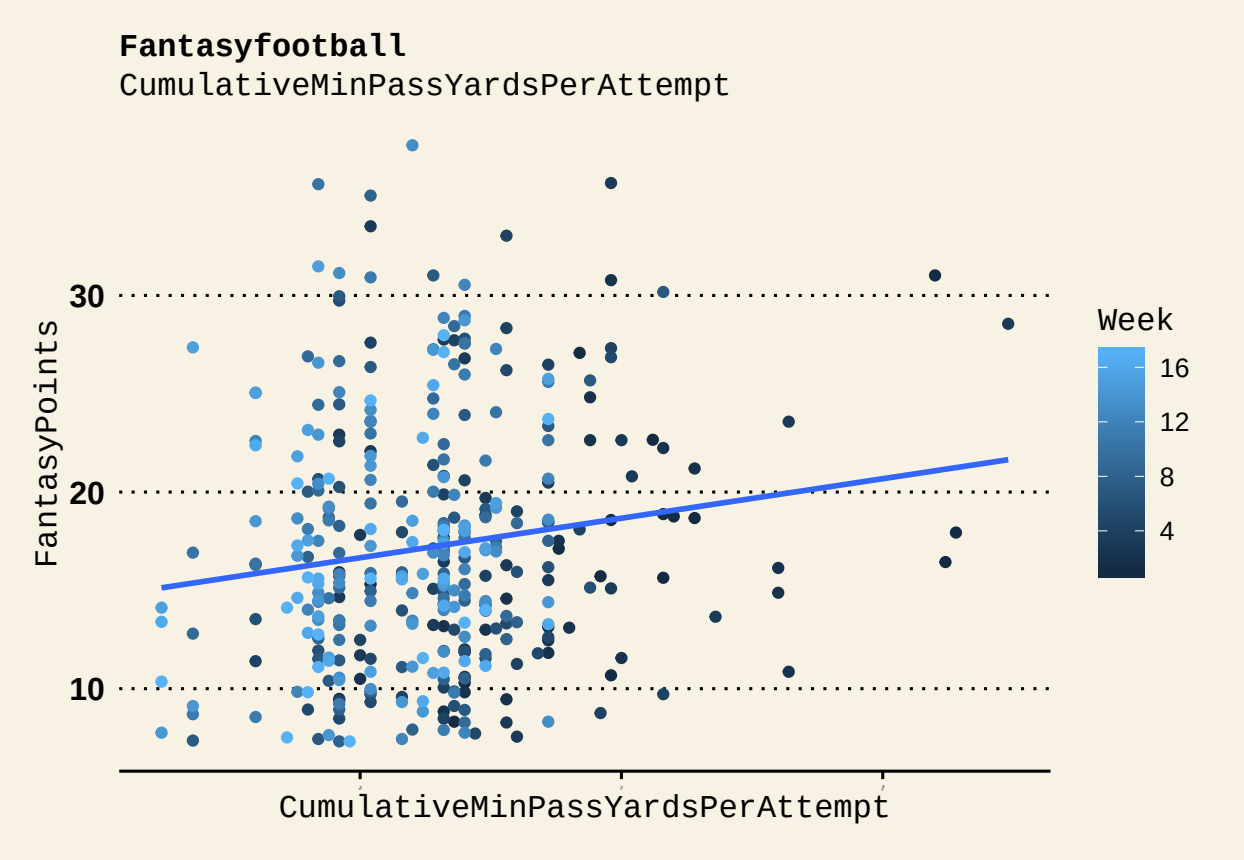

Fantasyfootball
CumulativeMinPassingTouchdowns
FantasyPoints
30
20
10
CumulativeMinPassingTouchdowns
Week
16
12
8
4


Fantasyfootball
CumulativeMinPassingYards
FantasyPoints
30
20
10
CumulativeMinPassingYards
Week
16
12
8
4


Fantasyfootball
CumulativeMinPassingAttempts
FantasyPoints
30
20
10
CumulativeMinPassingAttempts
Week
16
12
8
4


Fantasyfootball
CumulativeMinPassingRating
FantasyPoints
30
20
10
CumulativeMinPassingRating
Week
16
12
8
4


Fantasyfootball
CumulativeMinCompletions
FantasyPoints
30
20
10
CumulativeMinCompletions
Week
16
12
8
4

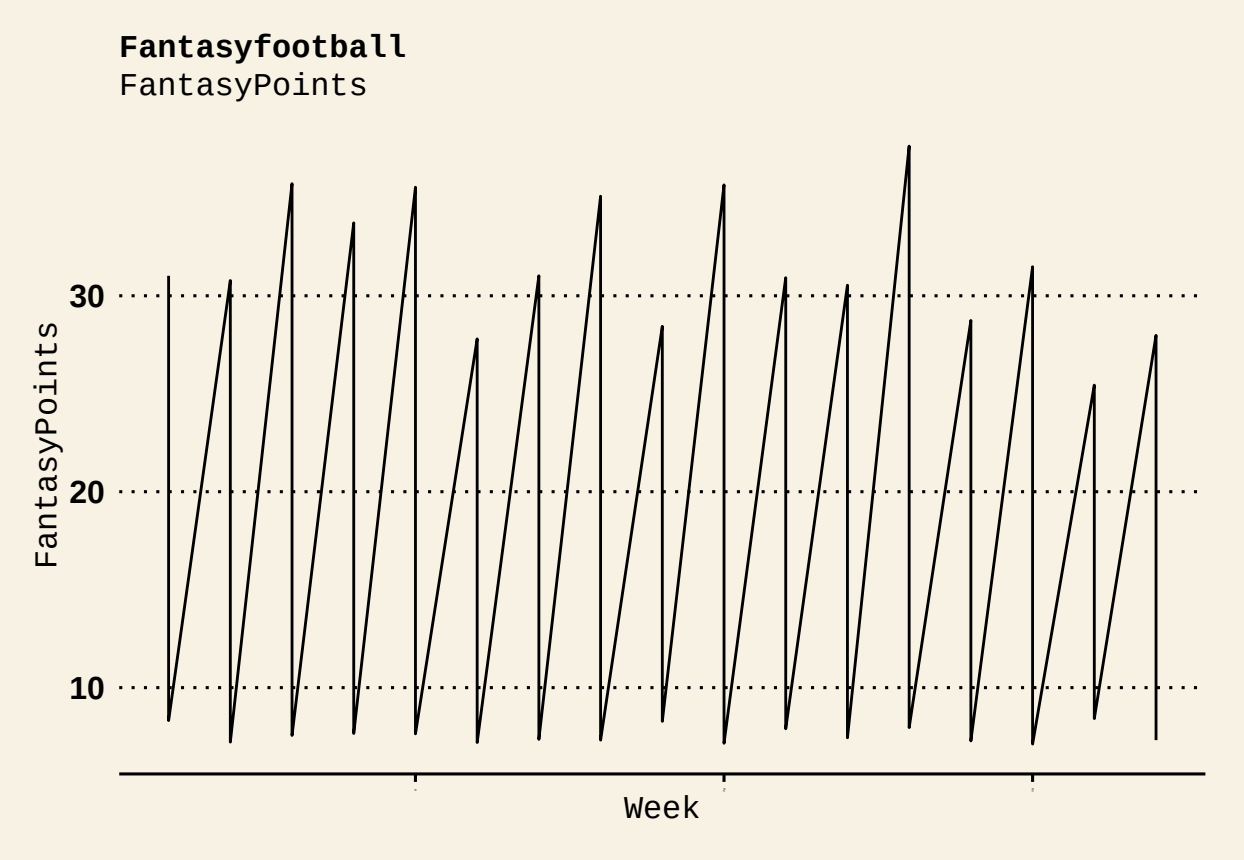


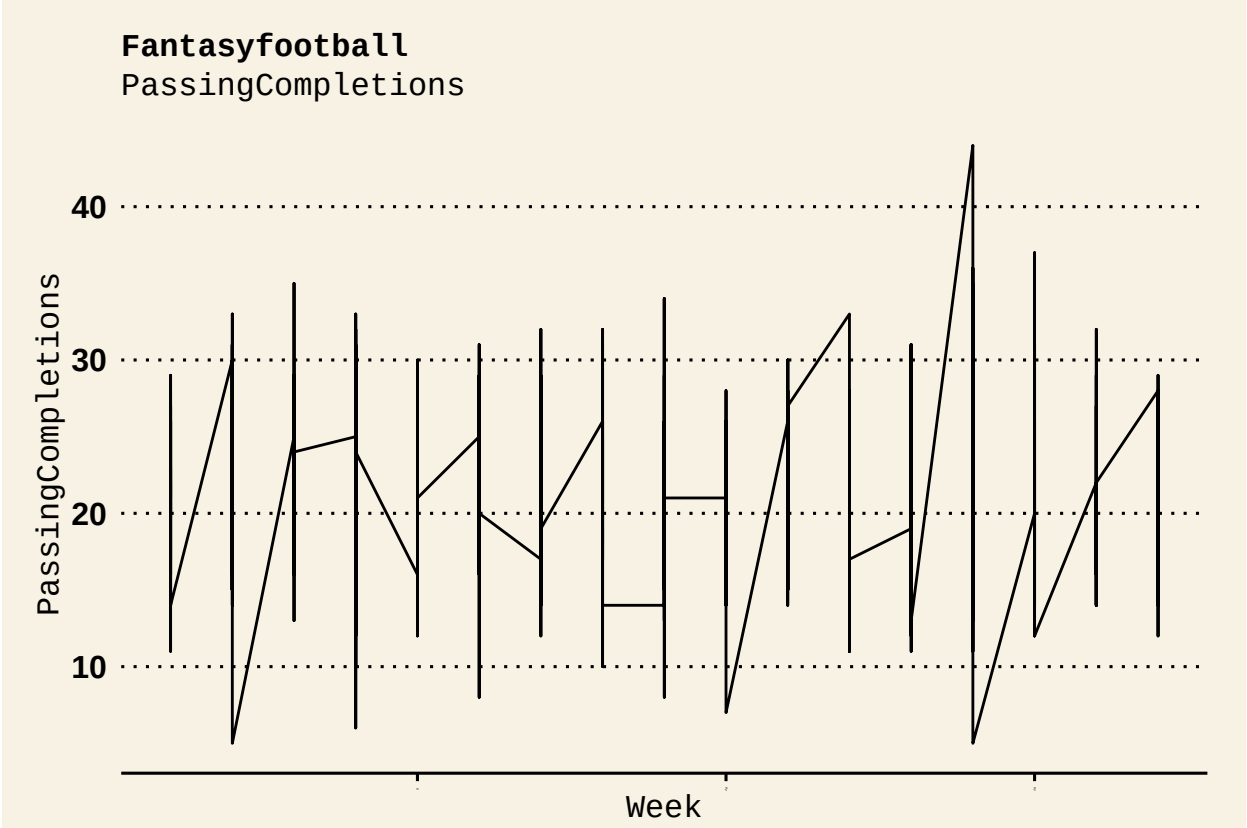
10 : Line plots

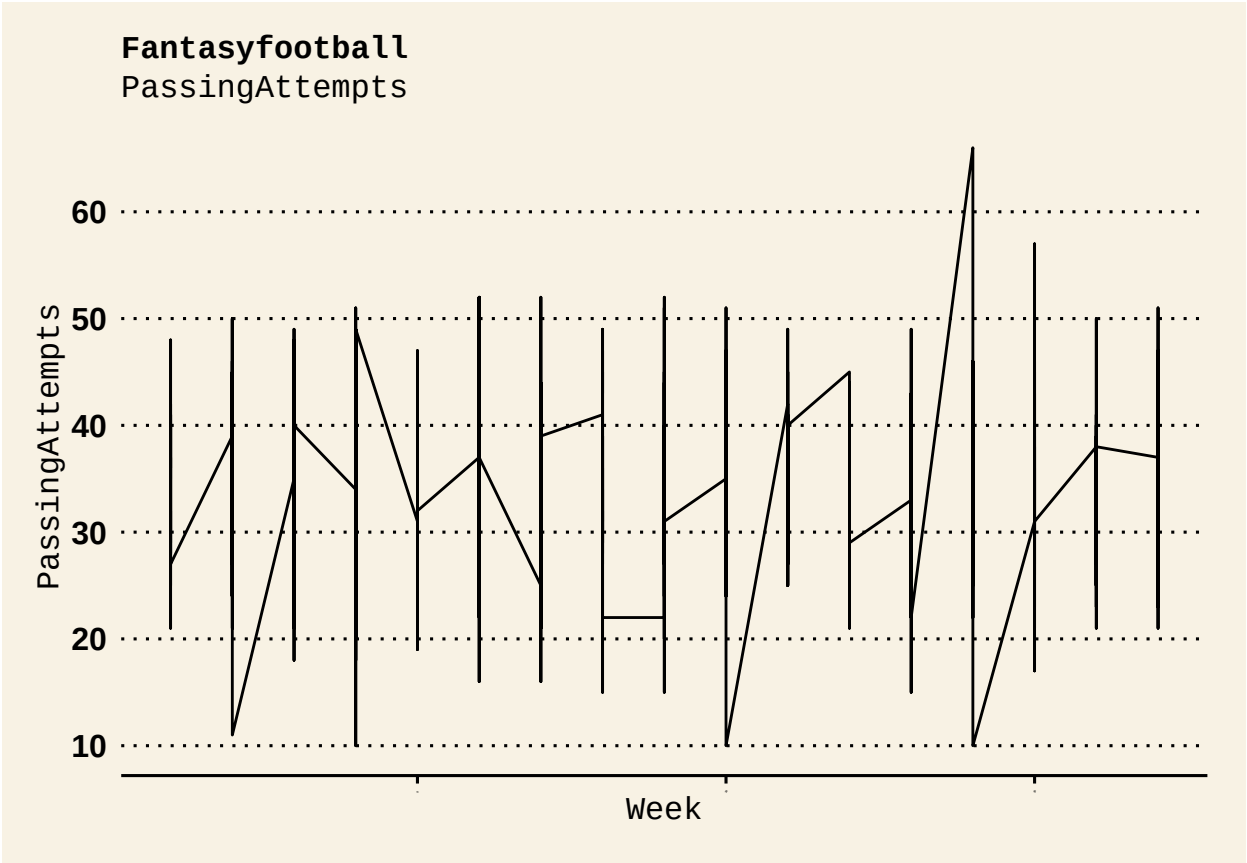
10.1 Base Features

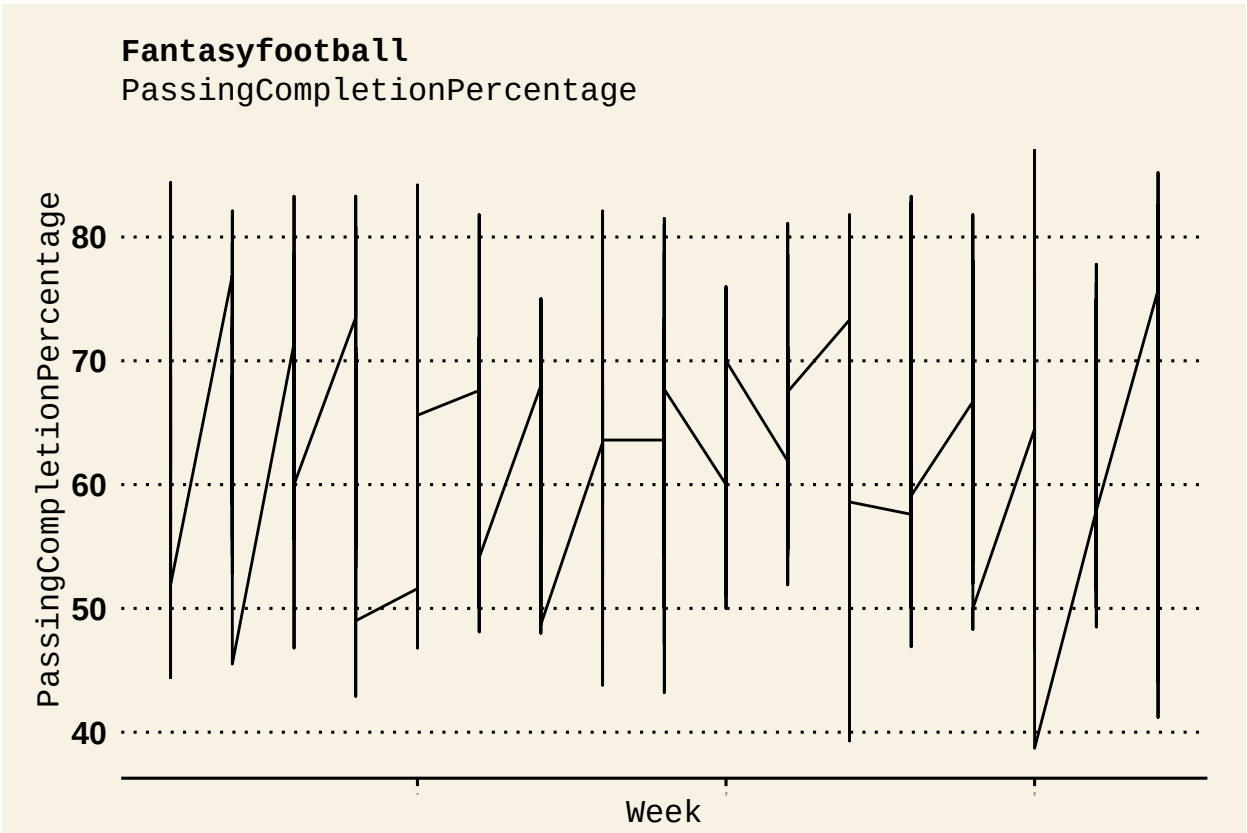
```
line_ds <- eda_base %>% group_by(Week) %>% arrange(Week)

for(p in 2:15){

   line_plot  <-  line_ds %>%
                  ggplot(aes_string(x="as.numeric(Week)",y=names(line_ds[p])))+
                  ggtitle(names(line_ds[p]))+
                  geom_line(show.legend = FALSE)+
                  xlab("Week")+
                  ylab(names(line_ds[p]))+
                  labs(title="Fantasyfootball",
                       subtitle=names(line_ds[p]),
                       aption="Source: Fantasyfootball")+
                  theme_wsj()+
                  theme(plot.title    = element_text(size = rel(0.5)),
                        plot.subtitle = element_text(size = rel(0.5)),
                        axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                        axis.title    = element_text(size = rel(0.5)),
                        legend.position  = "right",
                        legend.direction ="vertical",
                        legend.title = element_text(size = rel(0.5)))
```

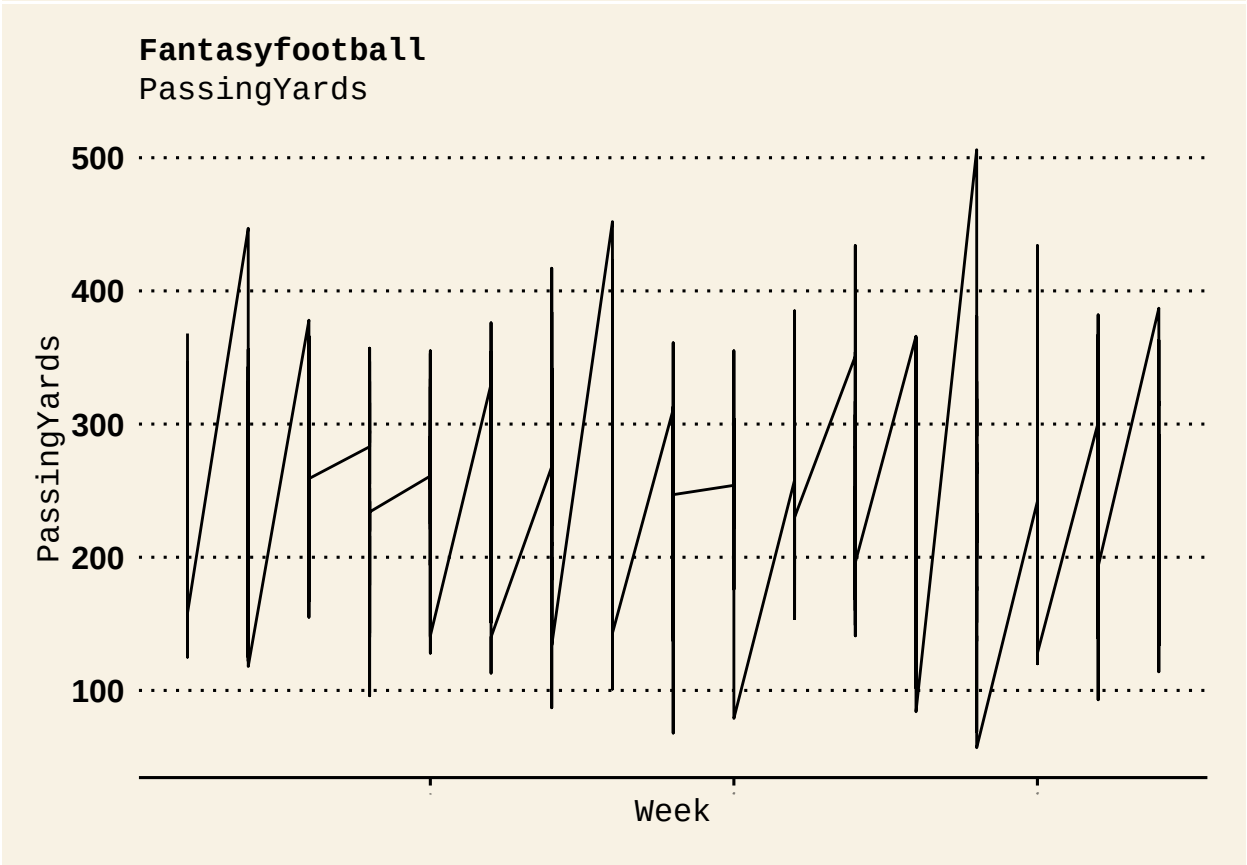
```
   print(line_plot)
}
```

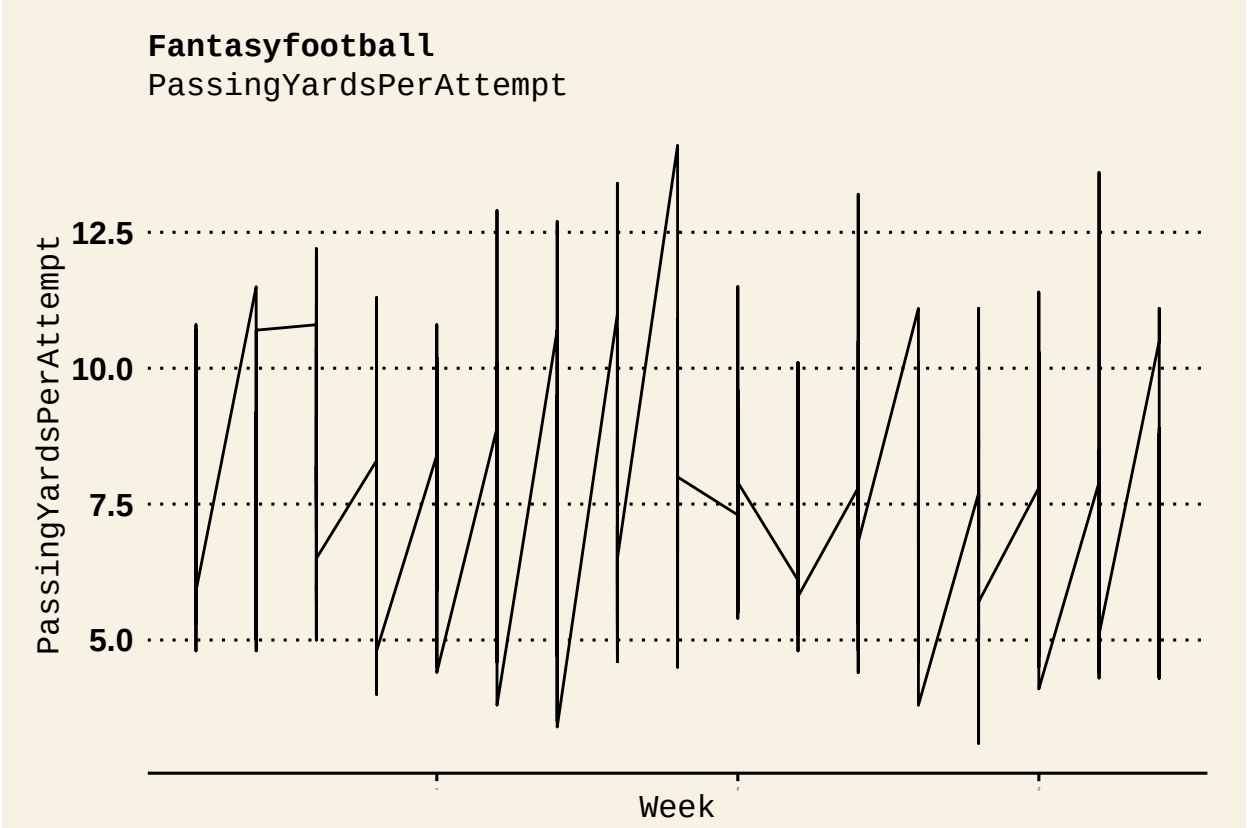


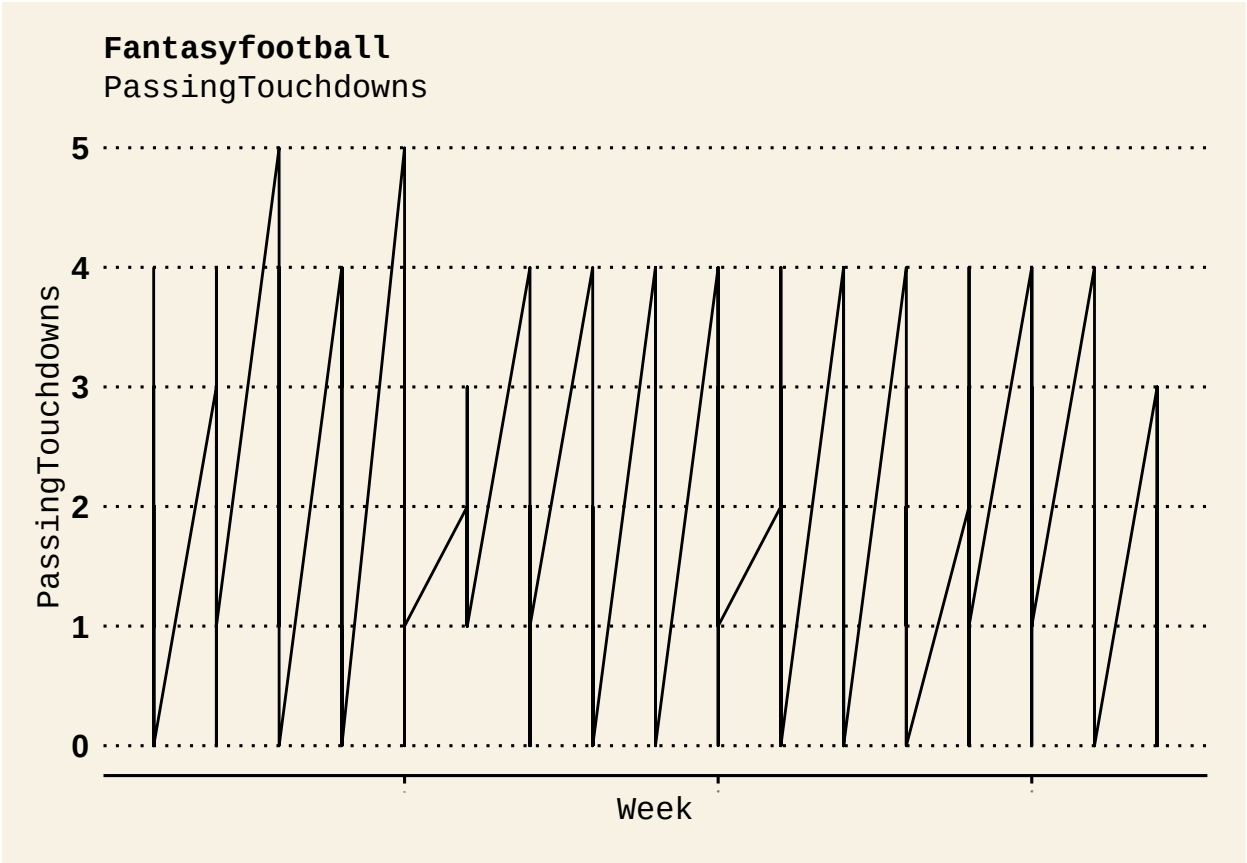

Fantasyfootball
PassingCompletions
PassingCompletions
40
30
20
10
Week

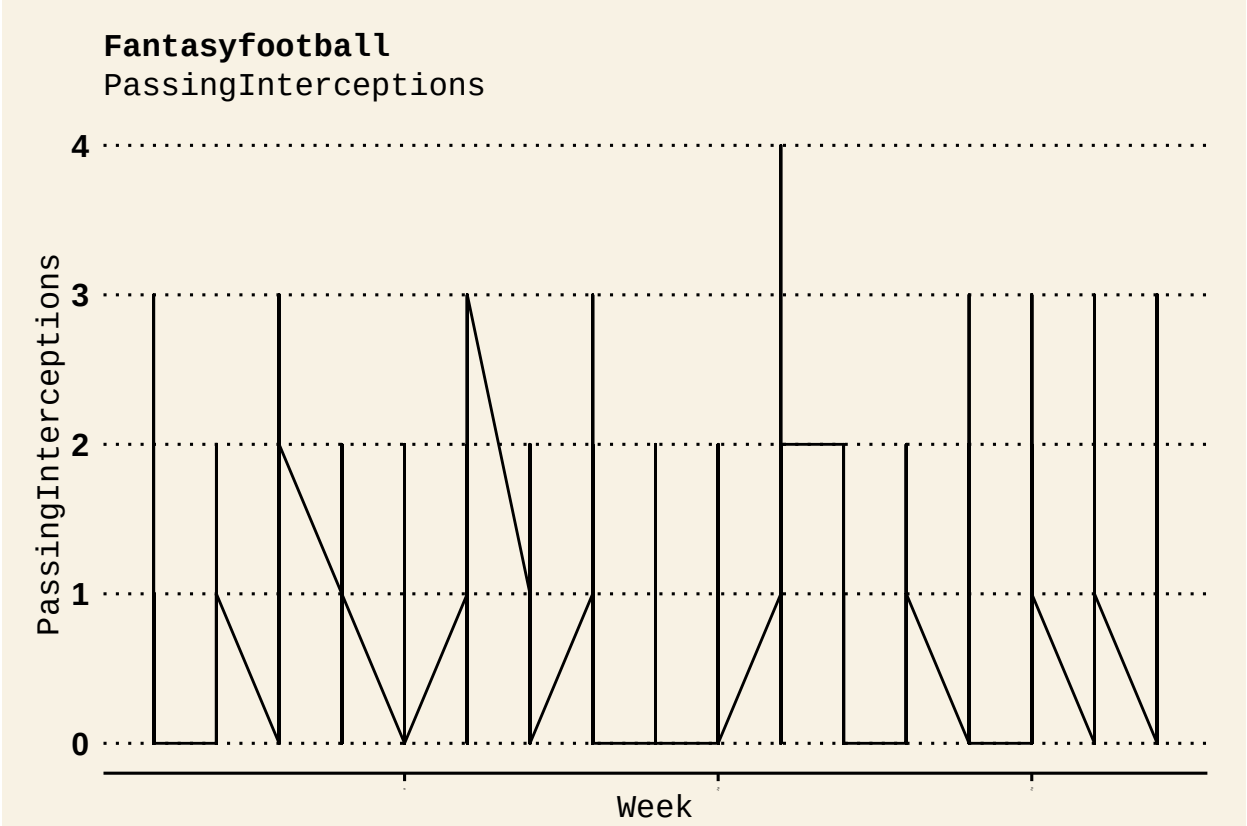

Fantasyfootball
PassingAttempts
PassingAttempts
60
50
40
30
20
10
Week

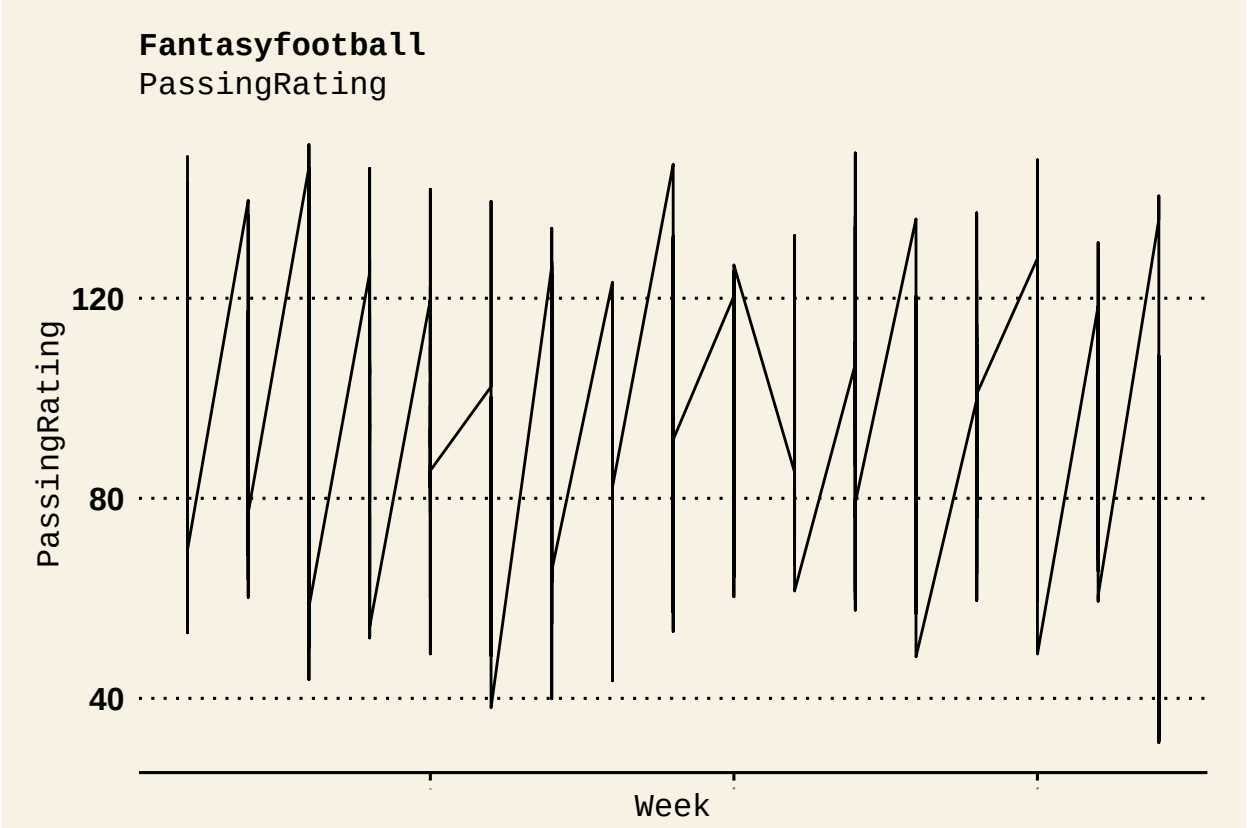

Fantasyfootball
PassingCompletionPercentage
PassingCompletionPercentage
80
70
60
50
40
Week

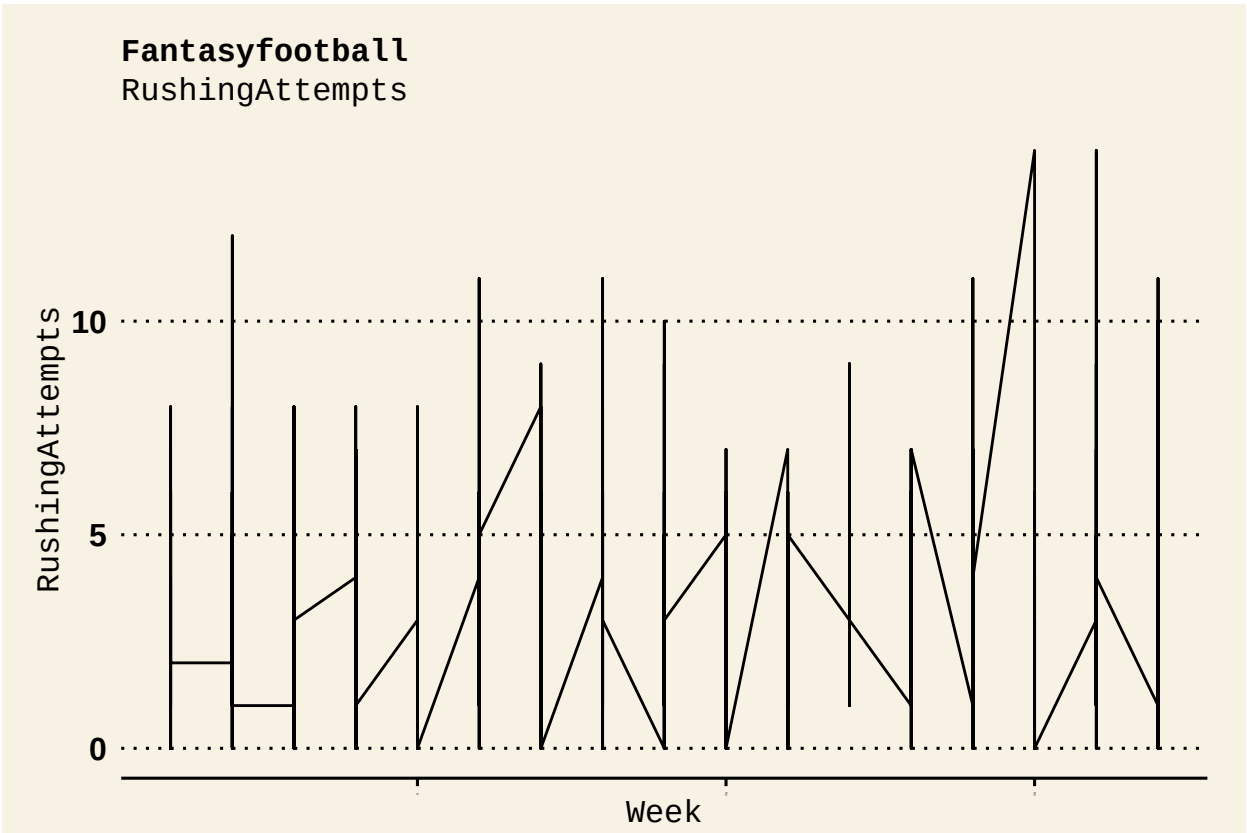

Fantasyfootball
PassingYards
PassingYards
500
400
300
200
100
Week

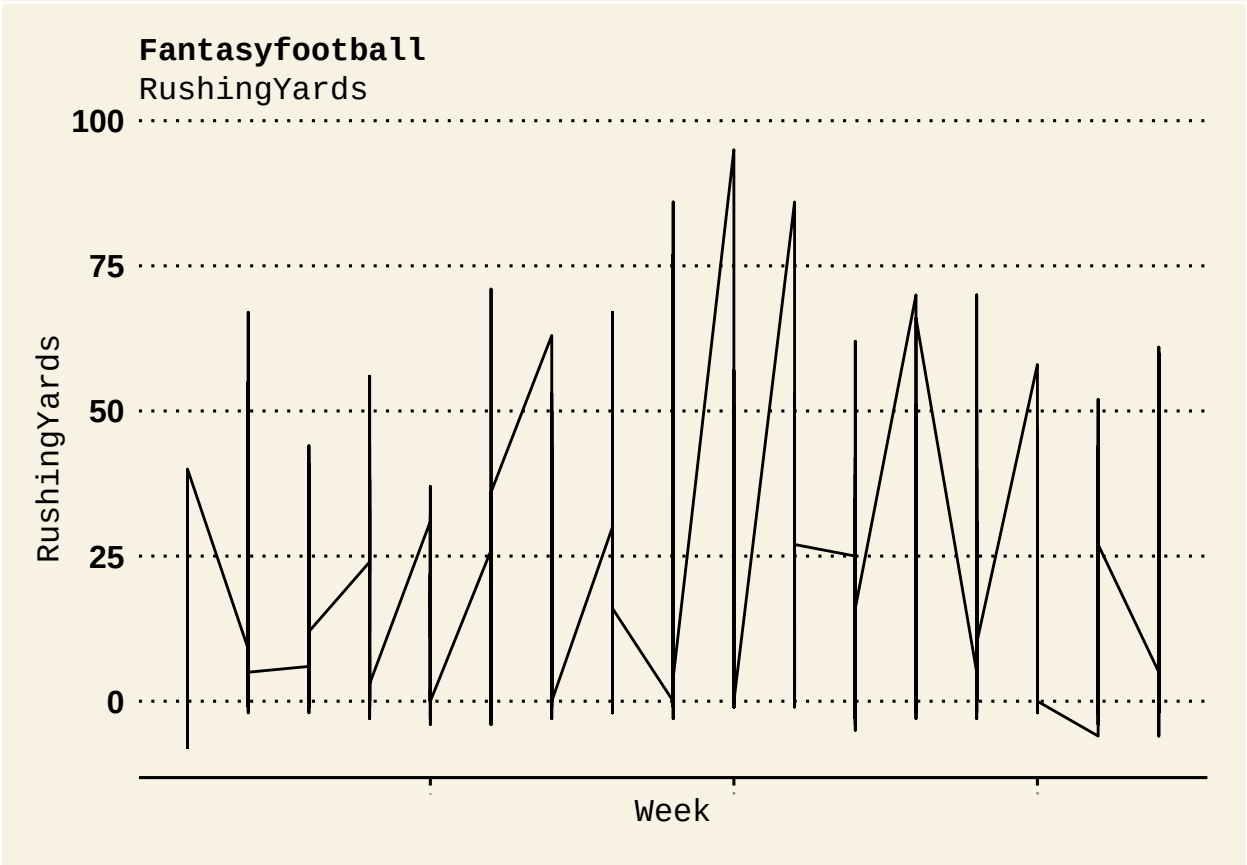

Fantasyfootball
PassingYardsPerAttempt
PassingYardsPerAttempt
12.5
10.0
7.5
5.0
Week

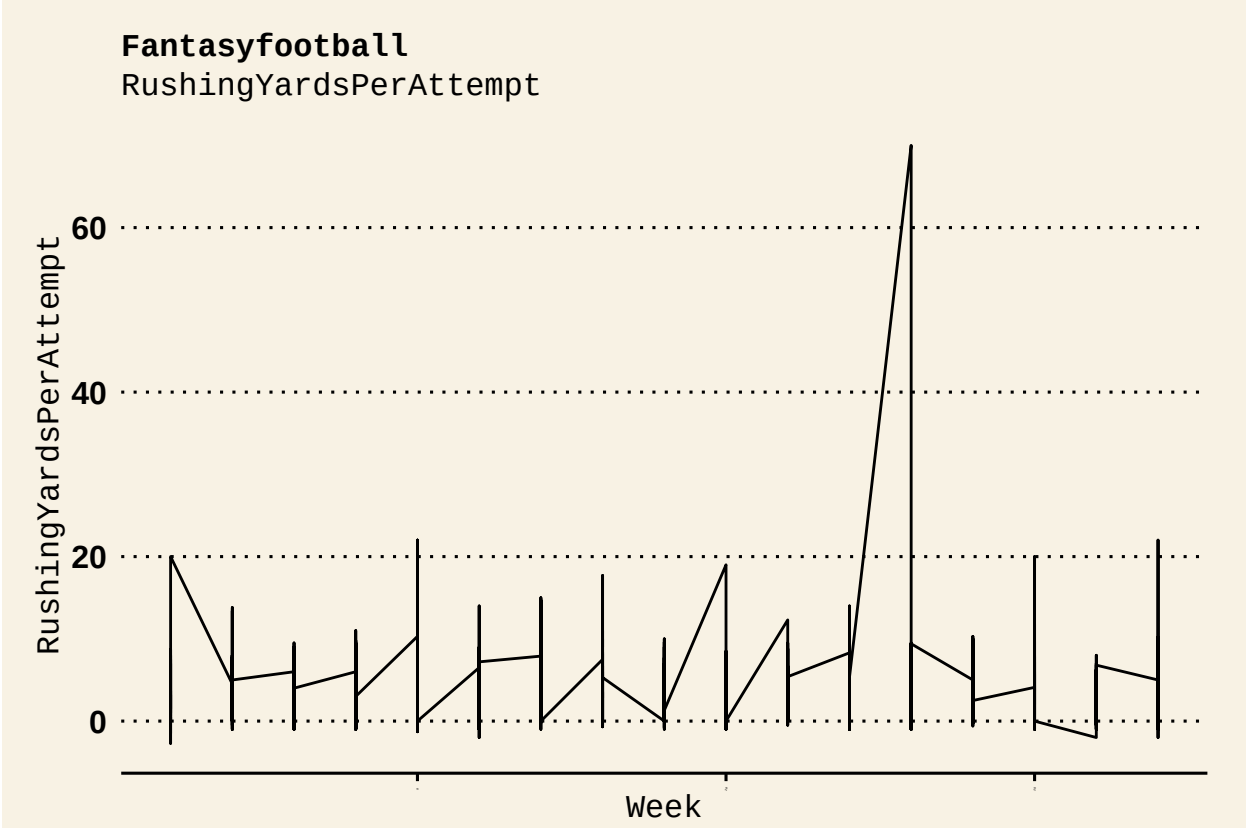

Fantasyfootball
PassingTouchdowns
PassingTouchdowns
5
4
3
2
1
0
Week

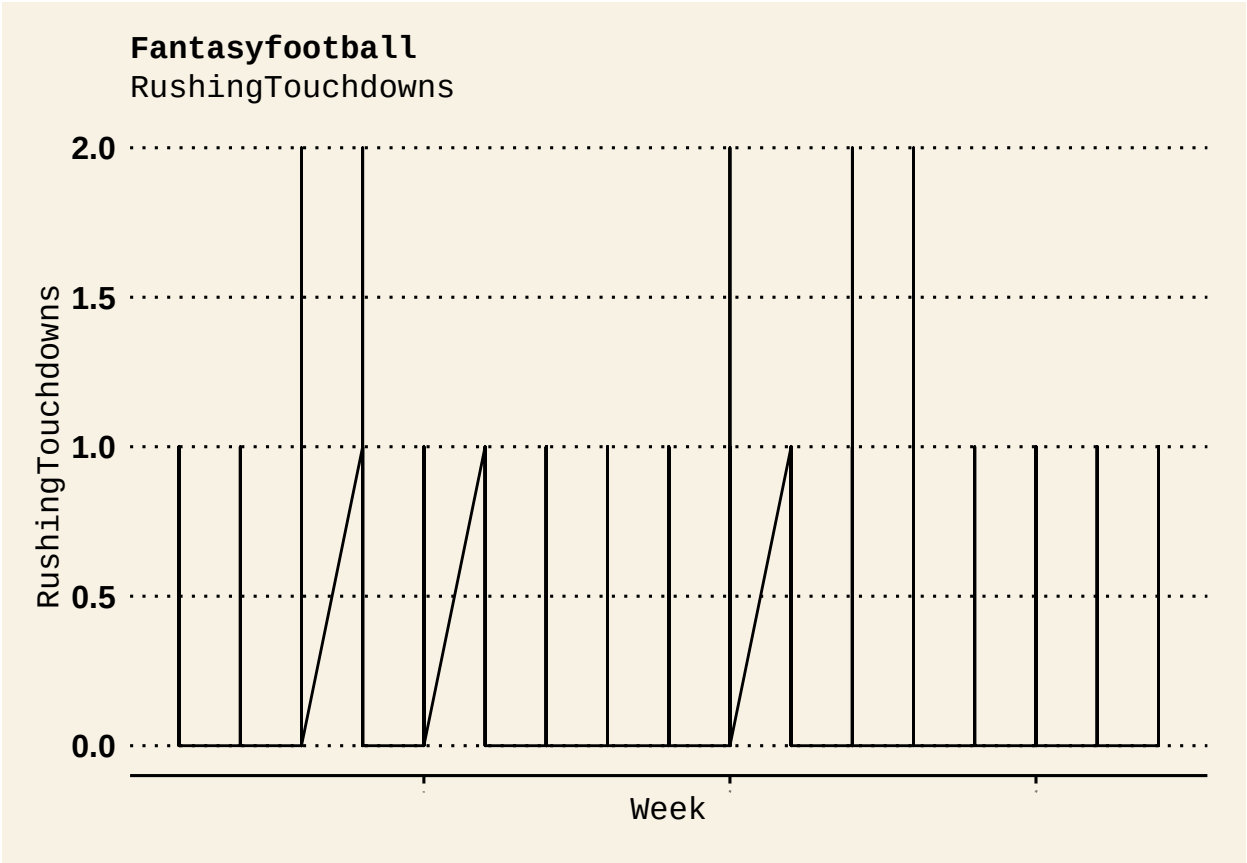

Fantasyfootball
PassingInterceptions
4
3
2
1
0
PassingInterceptions
Week

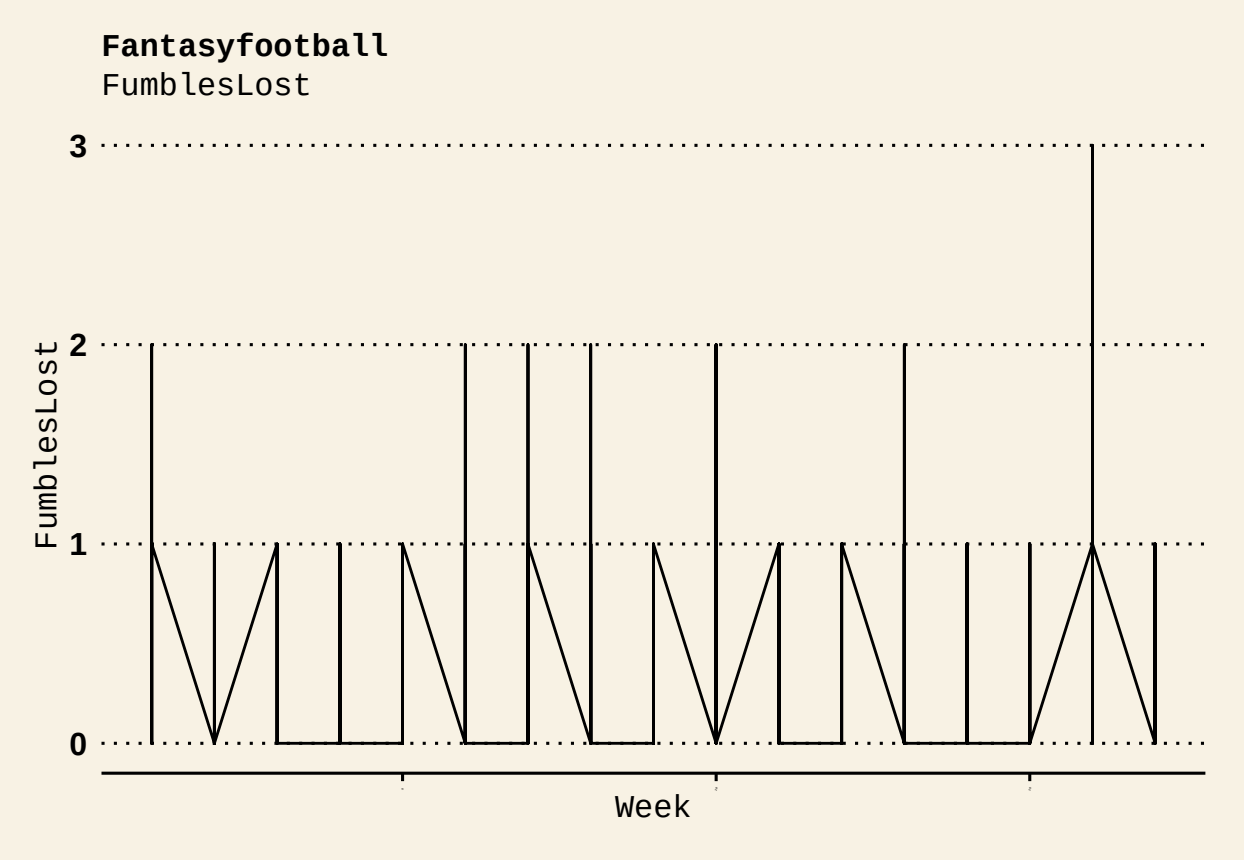

Fantasyfootball
PassingRating
120
80
40
PassingRating
Week


Fantasyfootball
RushingAttempts
RushingAttempts
10
5
0
Week


Fantasyfootball
RushingYards
RushingYards
100
75
50
25
0
Week

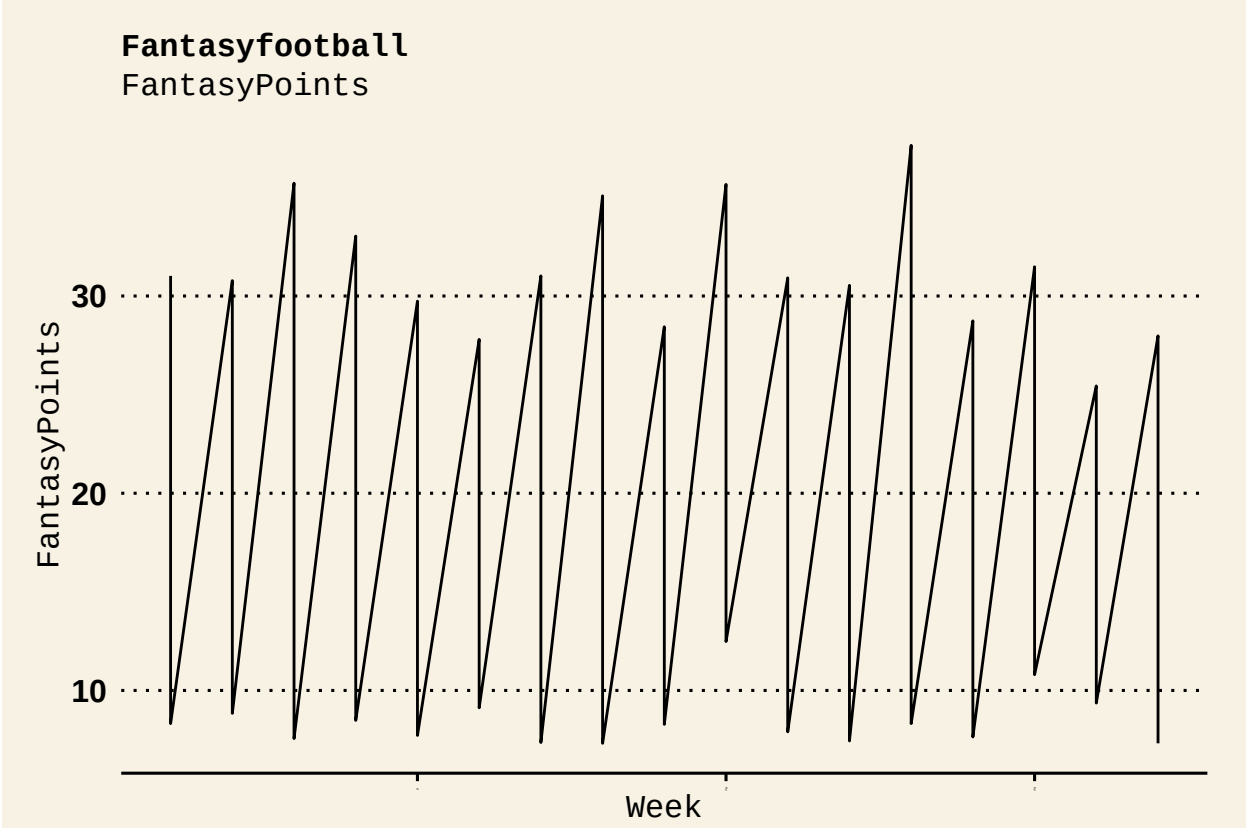

Fantasyfootball
RushingYardsPerAttempt
RushingYardsPerAttempt
60
40
20
0
Week

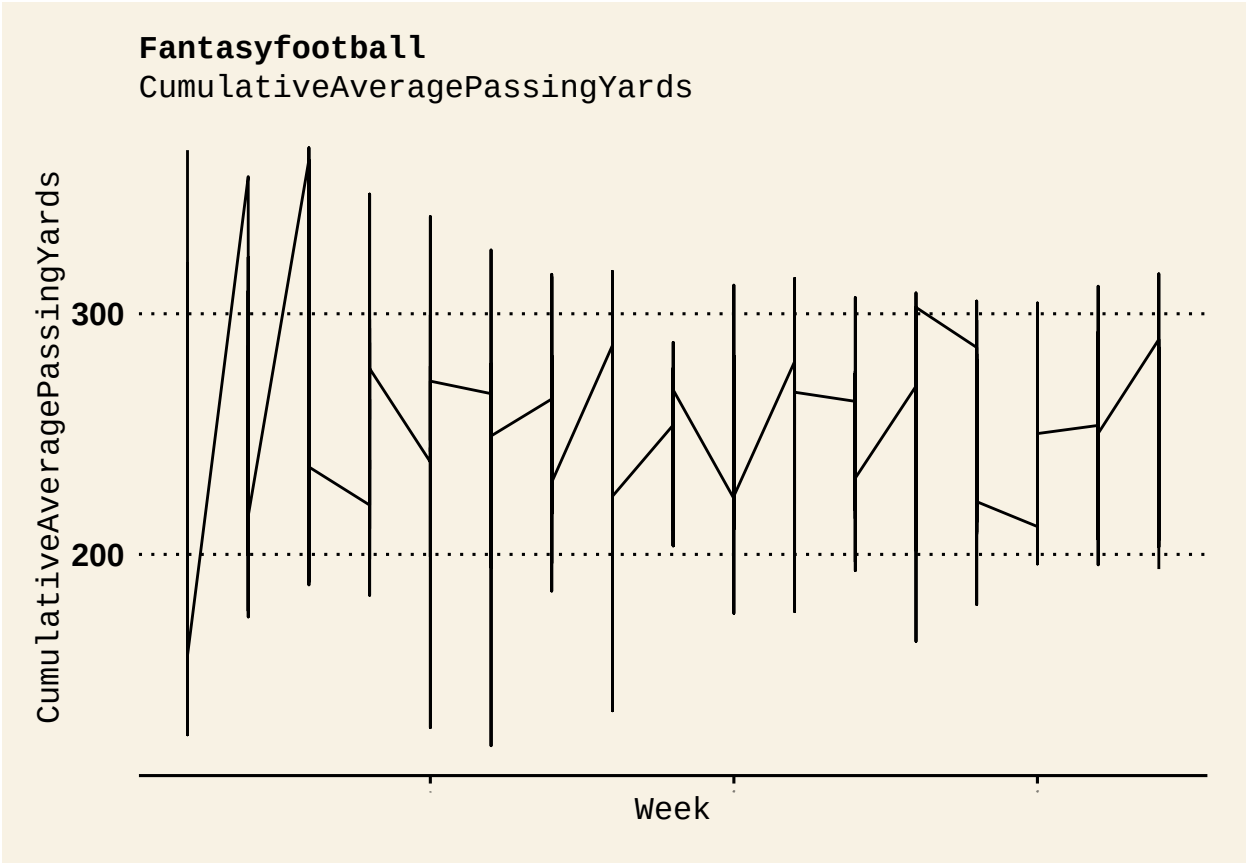

Fantasyfootball
RushingTouchdowns
RushingTouchdowns
2.0
1.5
1.0
0.5
0.0
Week

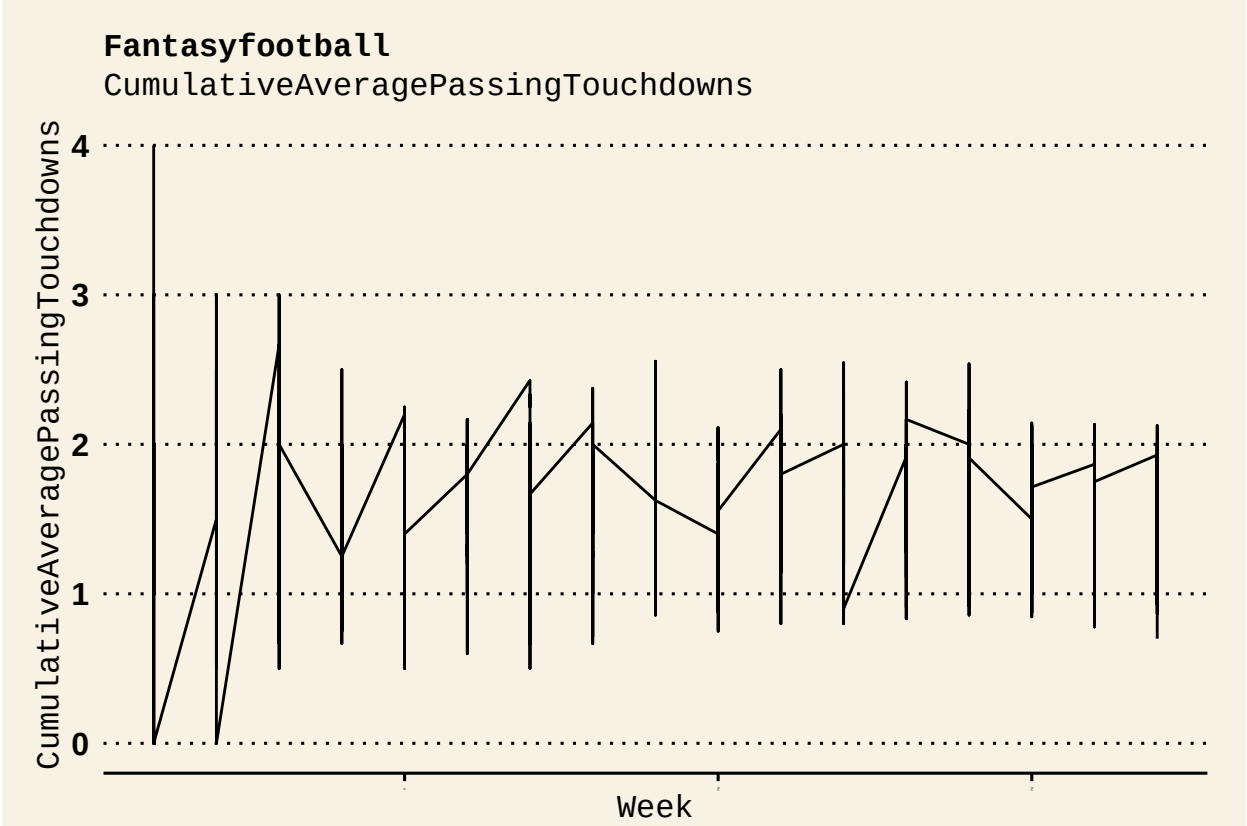


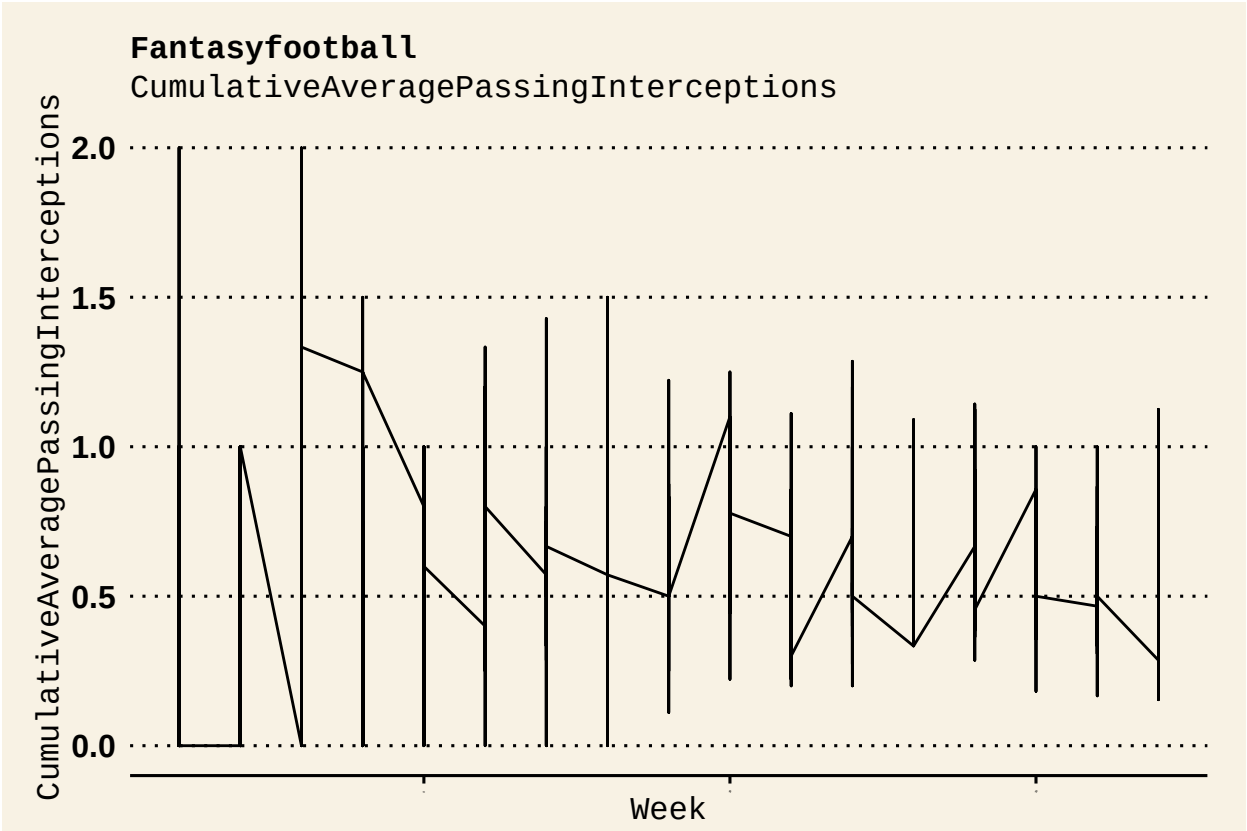
10.2 Derived Features

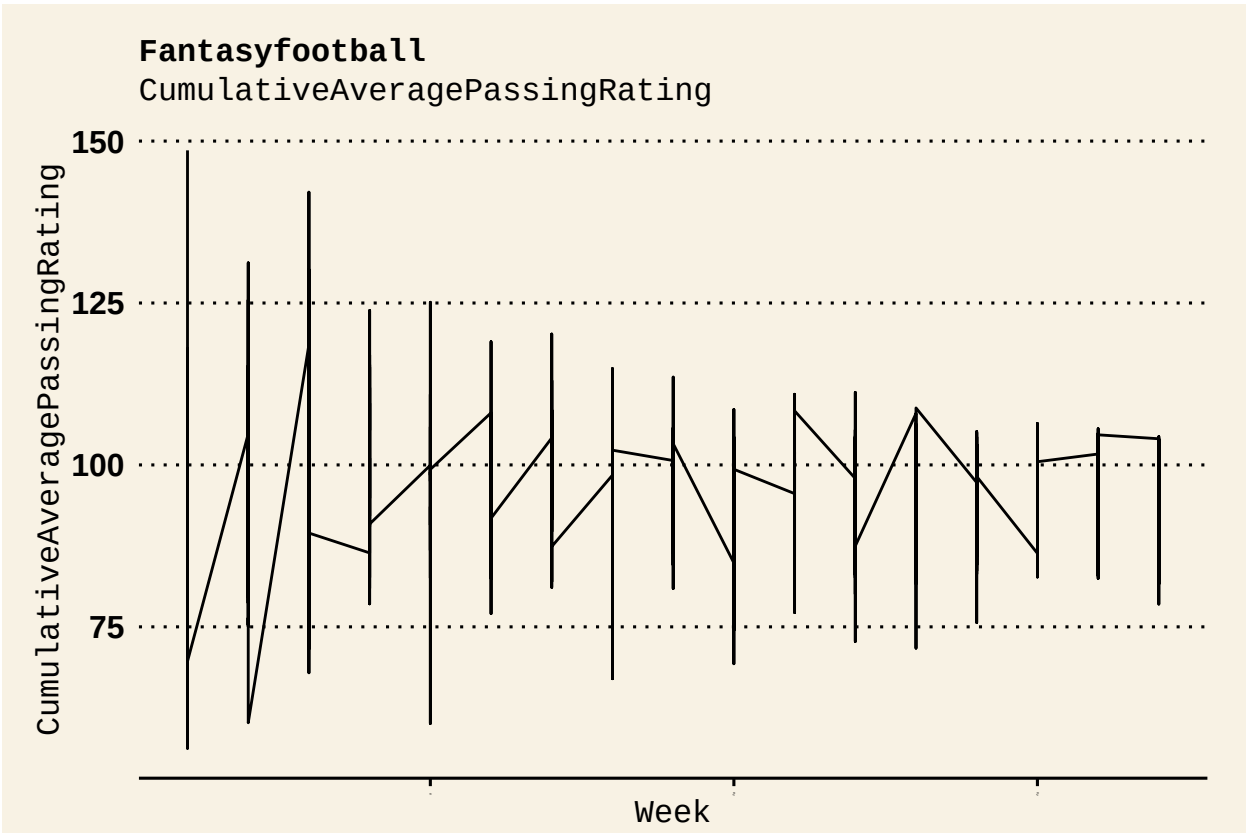
```
line_ds <- eda_derived %>% group_by(Week) %>% arrange(Week)

for(p in 2:20){

   line_plot  <-  line_ds %>%
                  ggplot(aes_string(x="as.numeric(Week)",y=names(line_ds[p])))+
                  ggtitle(names(line_ds[p]))+
                  geom_line(show.legend = FALSE)+
                  xlab("Week")+
                  ylab(names(line_ds[p]))+
                  labs(title="Fantasyfootball",
                       subtitle=names(line_ds[p]),
                       aption="Source: Fantasyfootball")+
                  theme_wsj()+
                  theme(plot.title    = element_text(size = rel(0.5)),
                        plot.subtitle = element_text(size = rel(0.5)),
                        axis.text.x   = element_text(angle=65, vjust=0.6,size=1),
                        axis.title    = element_text(size = rel(0.5)),
                        legend.position  = "right",
                        legend.direction ="vertical",
                        legend.title = element_text(size = rel(0.5)))

   print(line_plot)
}
```

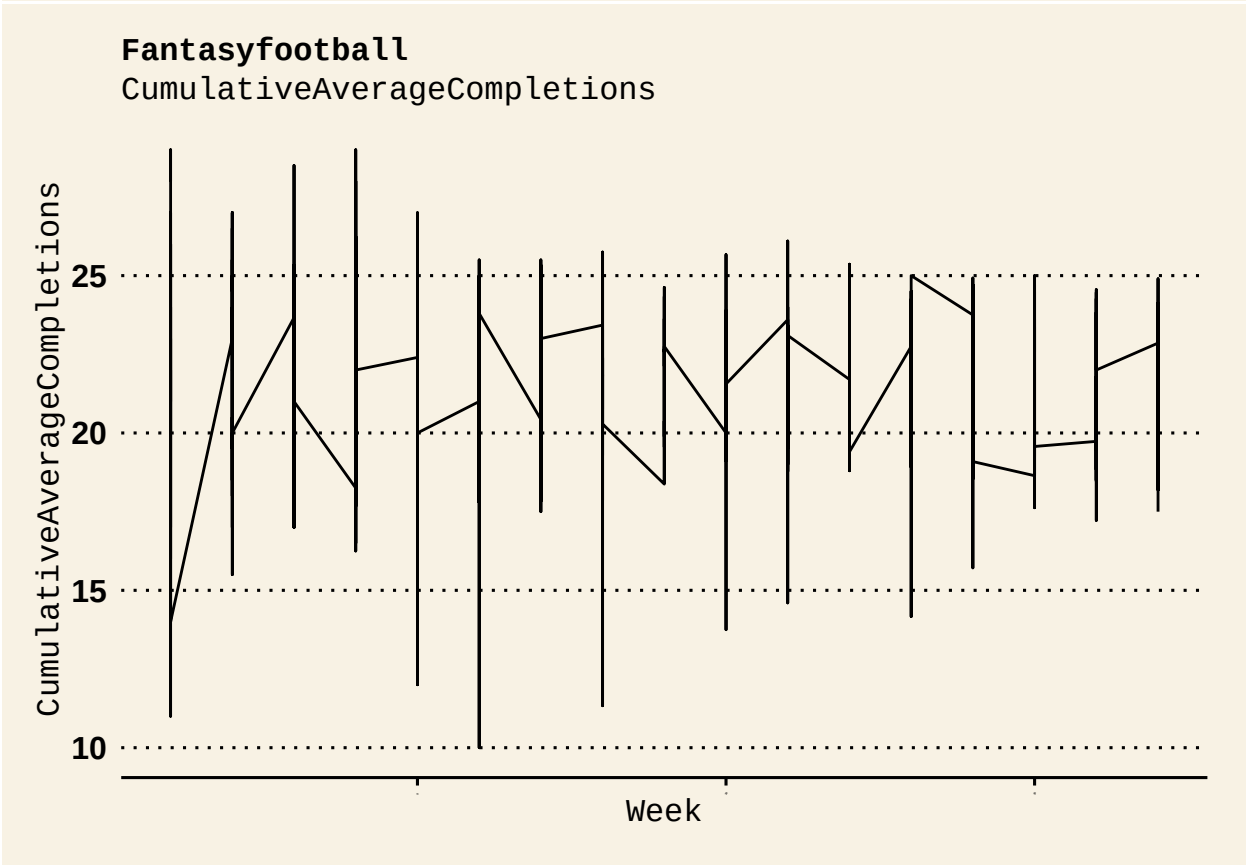

Fantasyfootball
FantasyPoints
FantasyPoints
30
20
10
Week

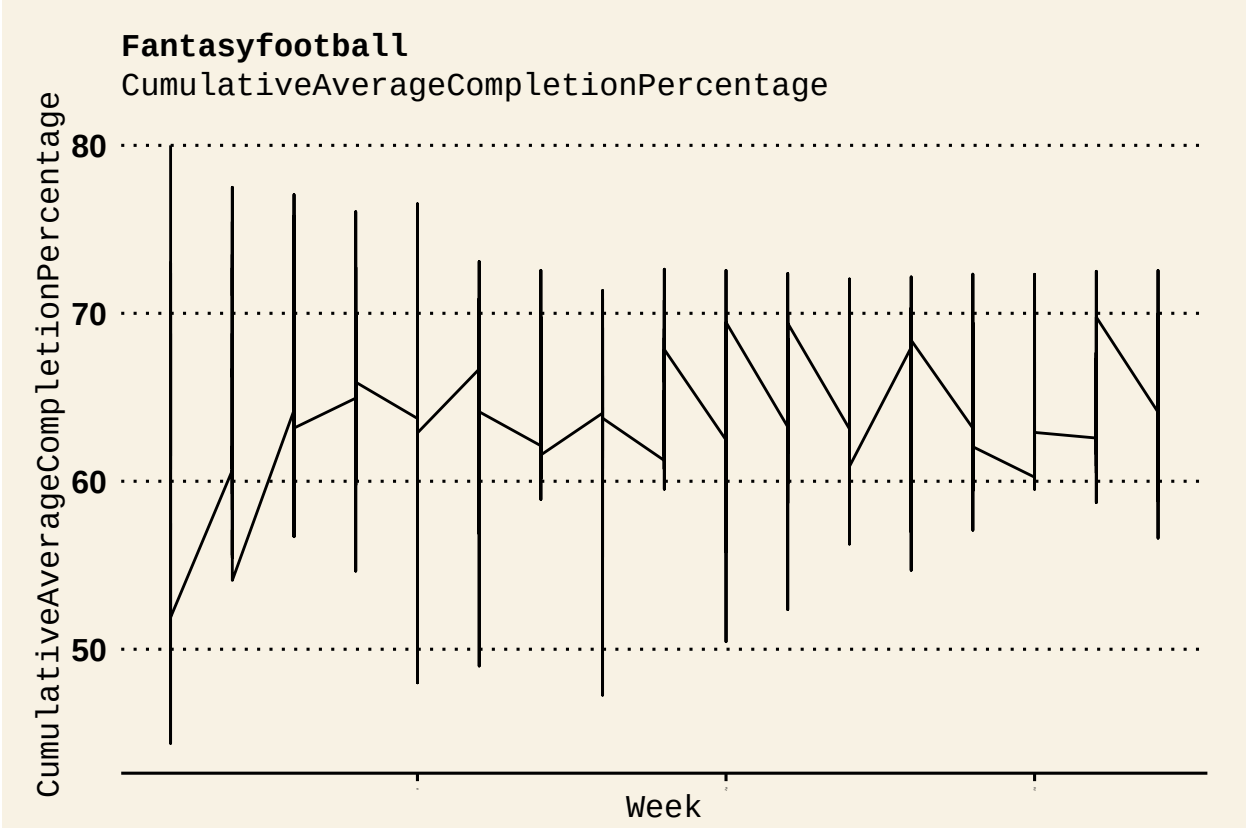

Fantasyfootball
CumulativeAveragePassingYards
CumulativeAveragePassingYards
300
200
Week

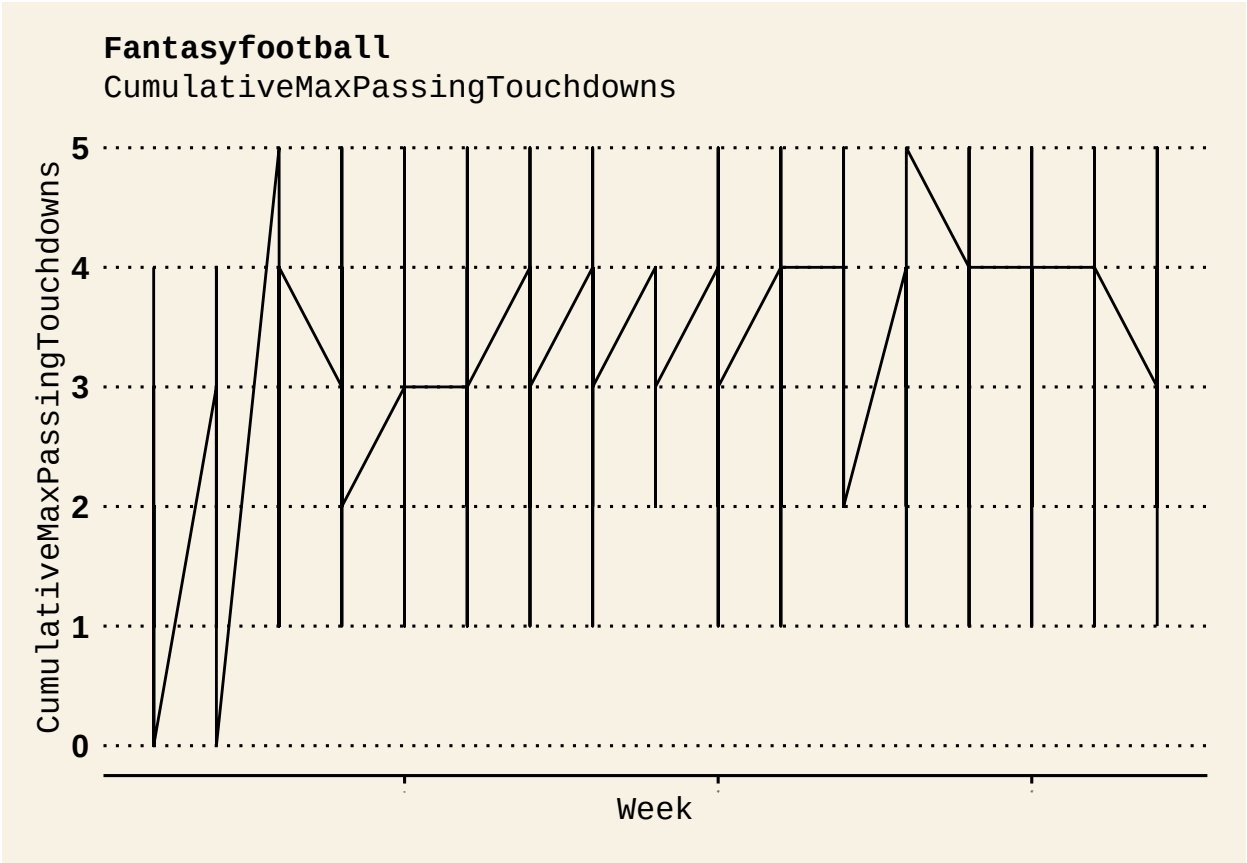

Fantasyfootball
CumulativeAveragePassingTouchdowns
CumulativeAveragePassingTouchdowns
4
3
2
1
0
Week

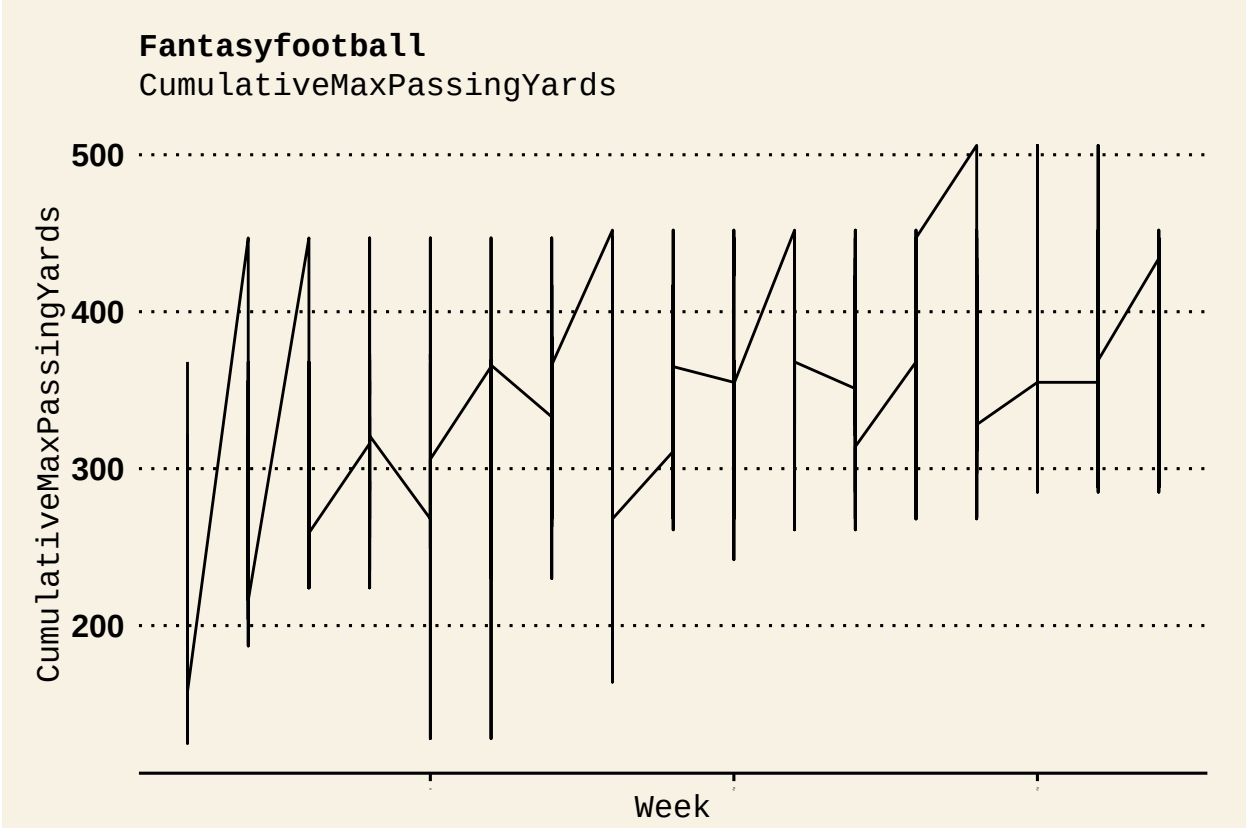

Fantasyfootball
CumulativeAveragePassingInterceptions
CumulativeAveragePassingInterceptions
2.0
1.5
1.0
0.5
0.0
Week

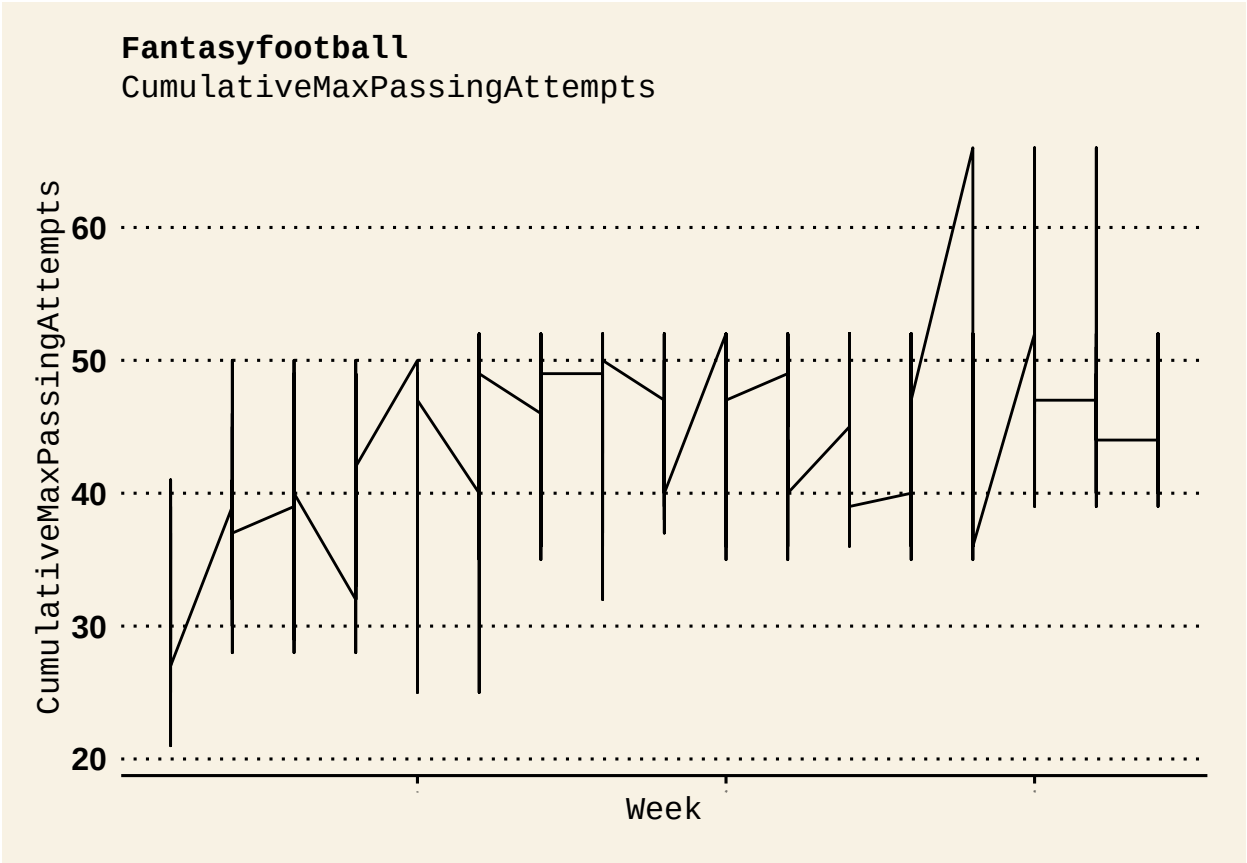

Fantasyfootball
CumulativeAveragePassingRating
150
125
100
75
CumulativeAveragePassingRating
Week

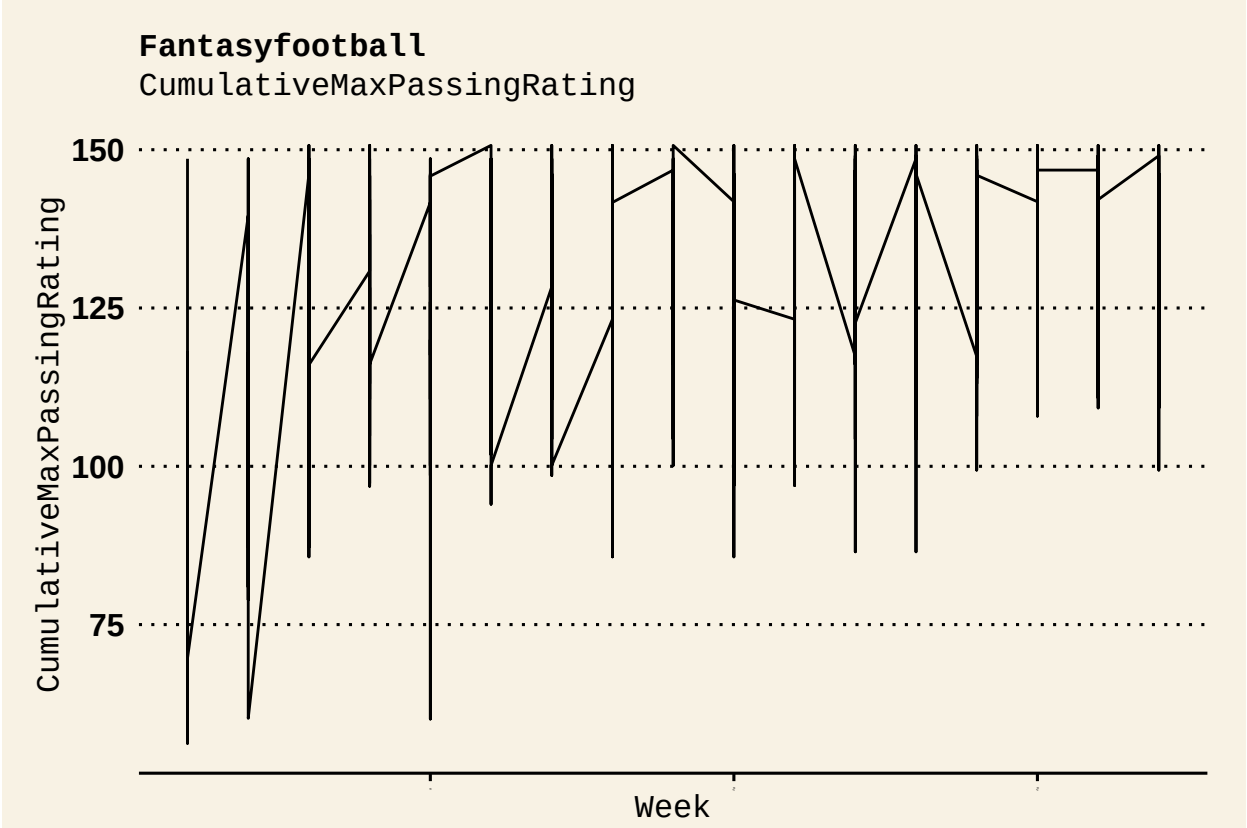

Fantasyfootball
CumulativeAverageCompletions
25
20
15
10
CumulativeAverageCompletions
Week

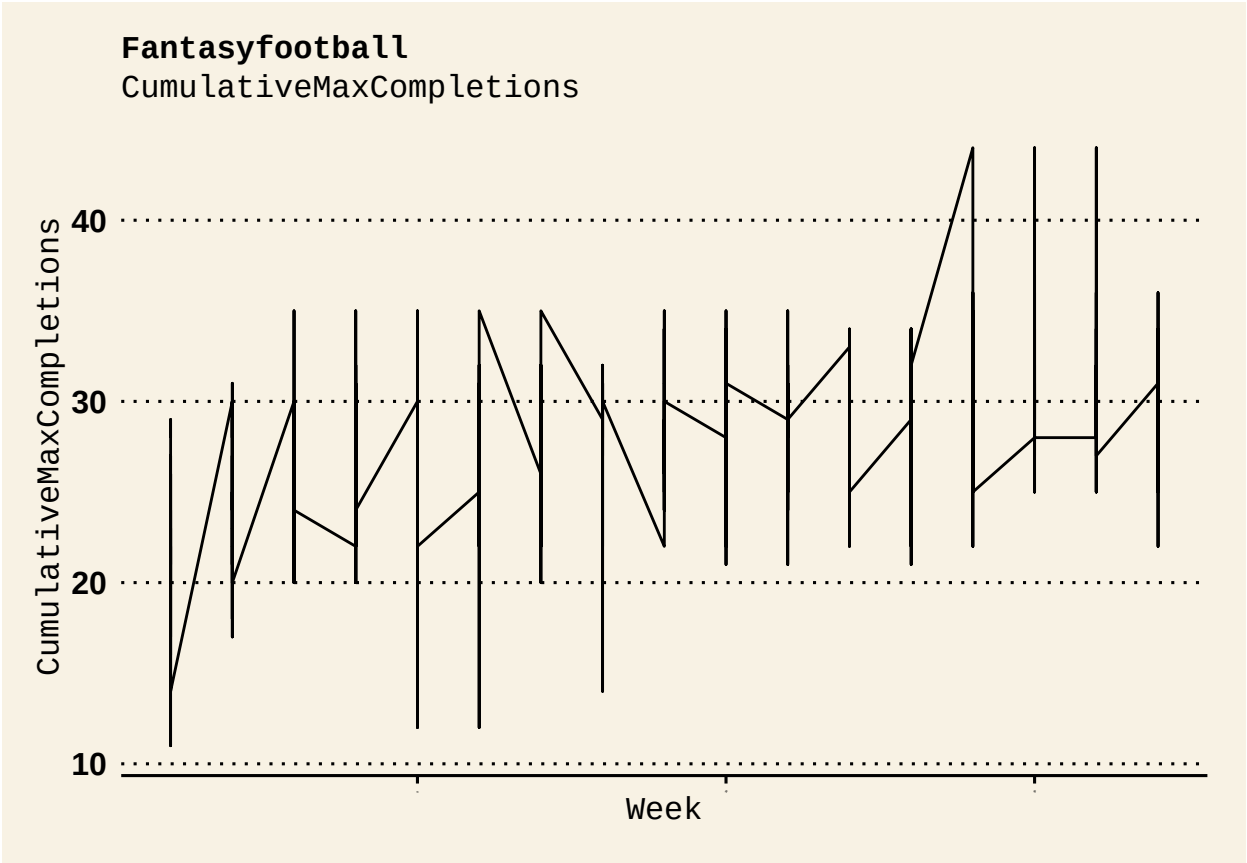

Fantasyfootball
CumulativeAverageCompletionPercentage
CumulativeAverageCompletionPercentage
80
70
60
50
Week

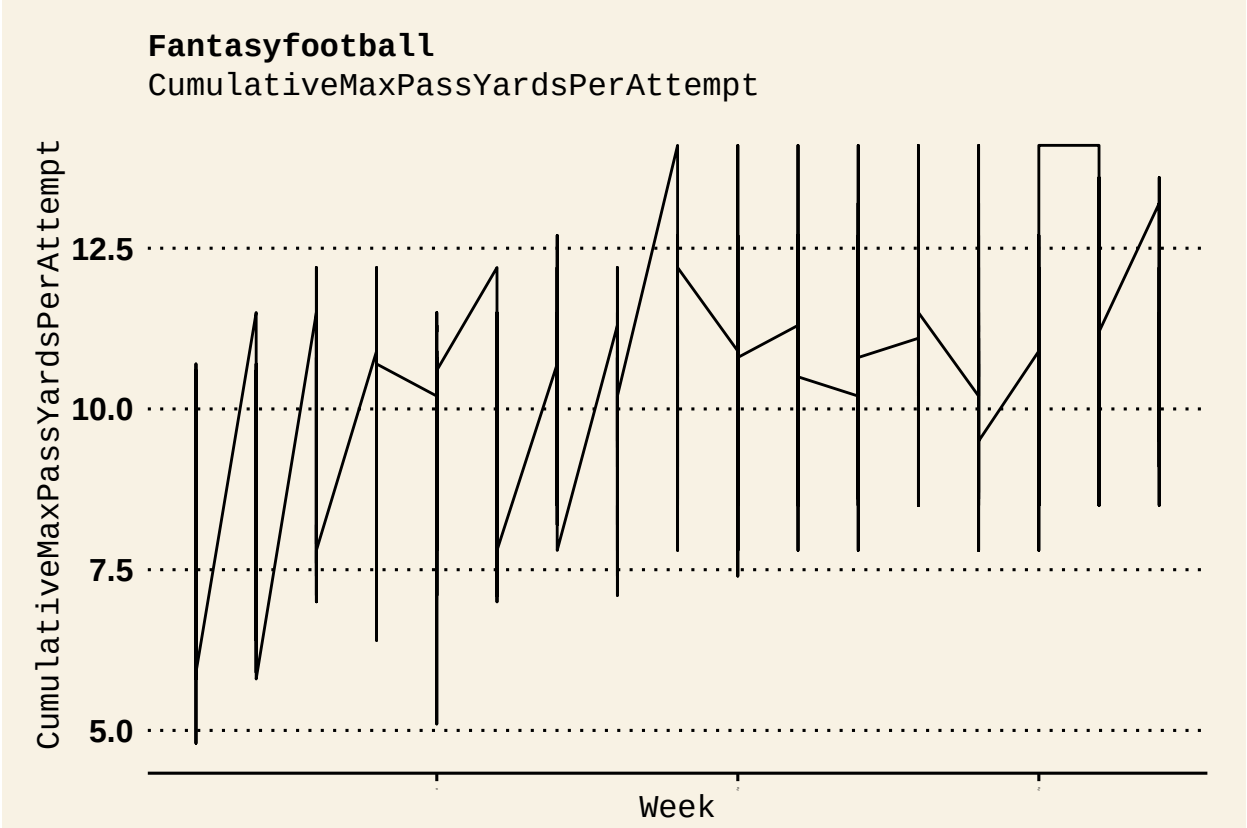

Fantasyfootball
CumulativeMaxPassingTouchdowns
CumulativeMaxPassingTouchdowns
5
4
3
2
1
0
Week

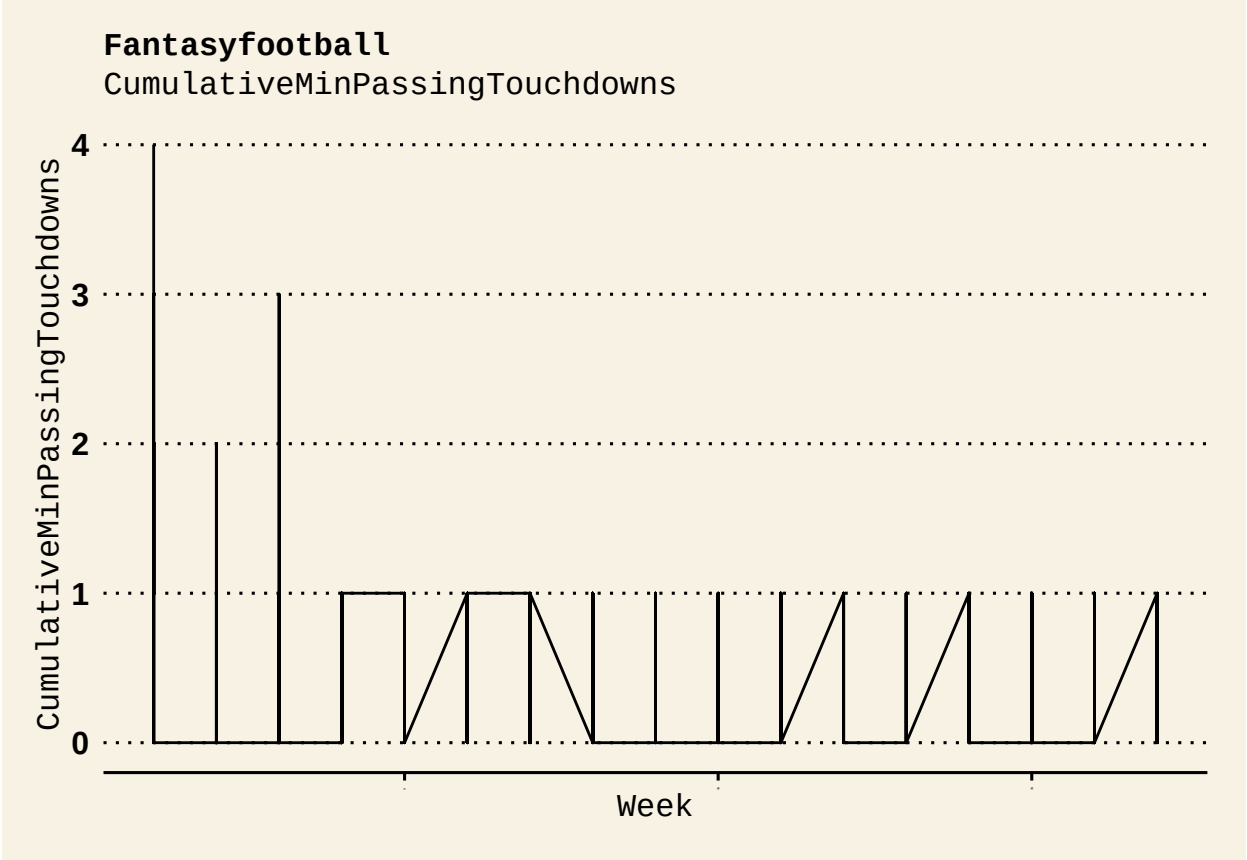

Fantasyfootball
CumulativeMaxPassingYards
500
400
300
200
CumulativeMaxPassingYards
Week

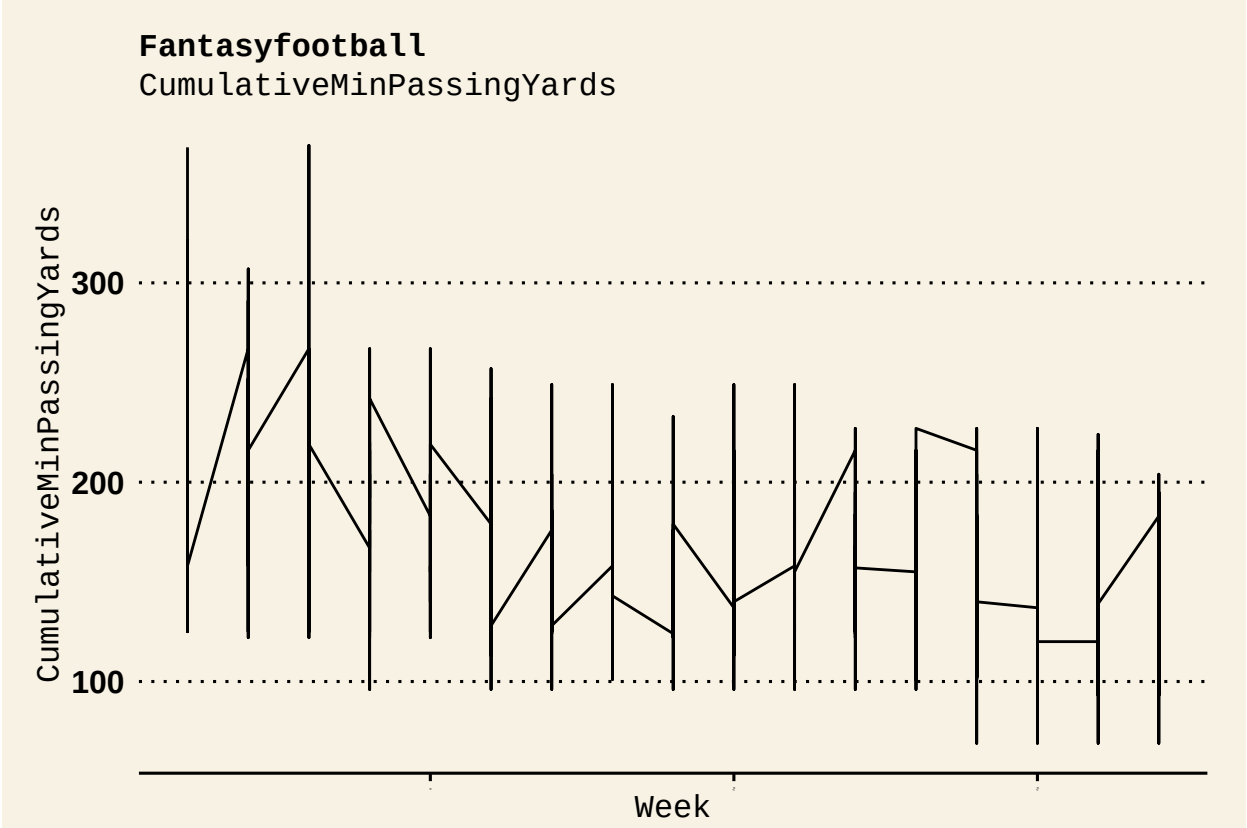

Fantasyfootball
CumulativeMaxPassingAttempts
60
50
40
30
20
CumulativeMaxPassingAttempts
Week

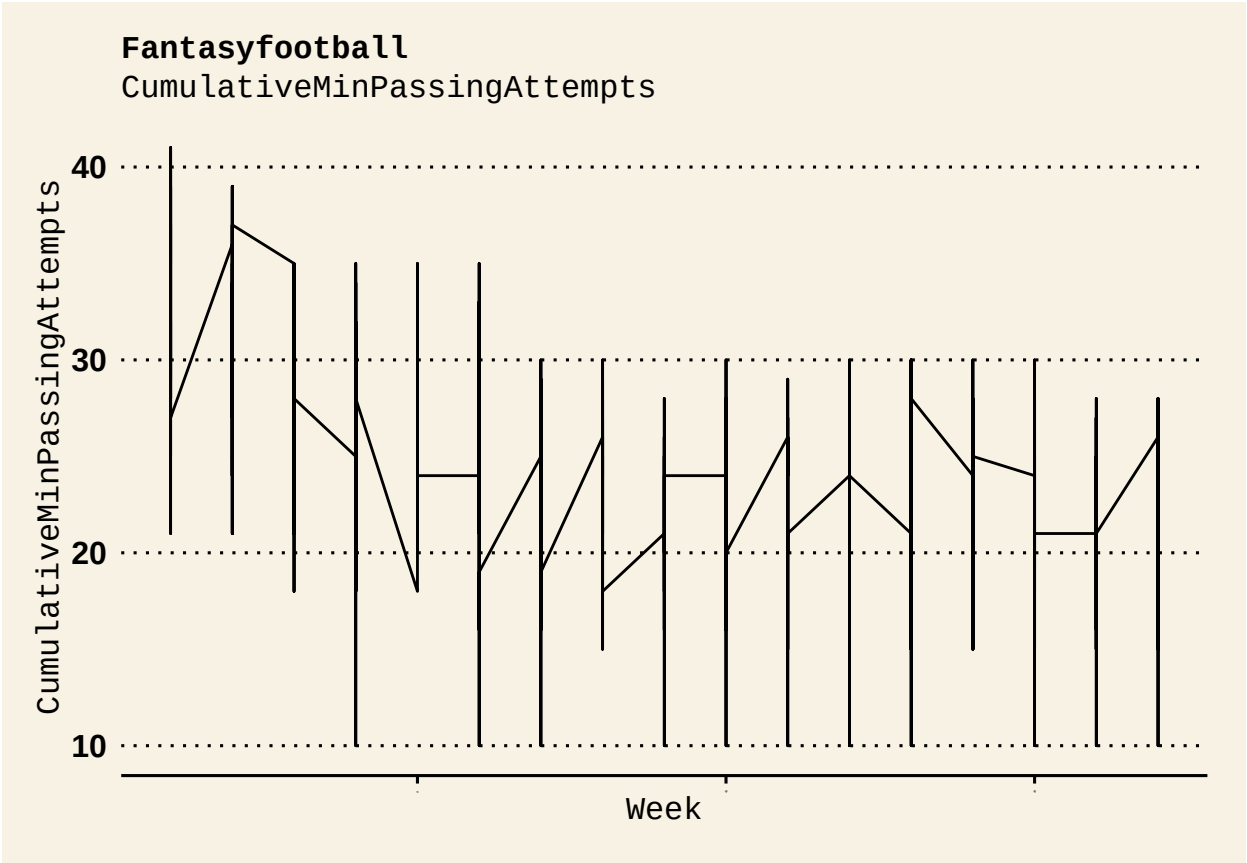

Fantasyfootball
CumulativeMaxPassingRating
150
125
100
75
CumulativeMaxPassingRating
Week

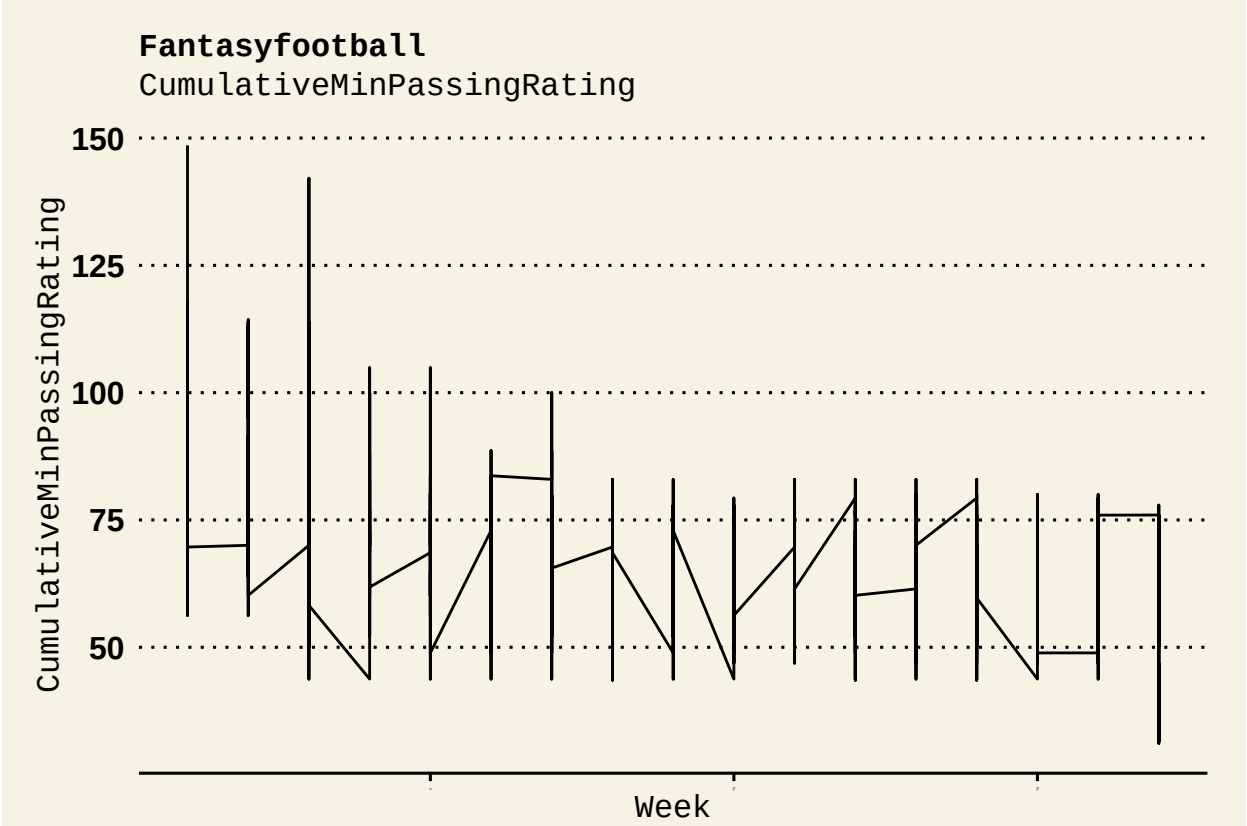

Fantasyfootball
CumulativeMaxCompletions
40
30
20
10
CumulativeMaxCompletions
Week

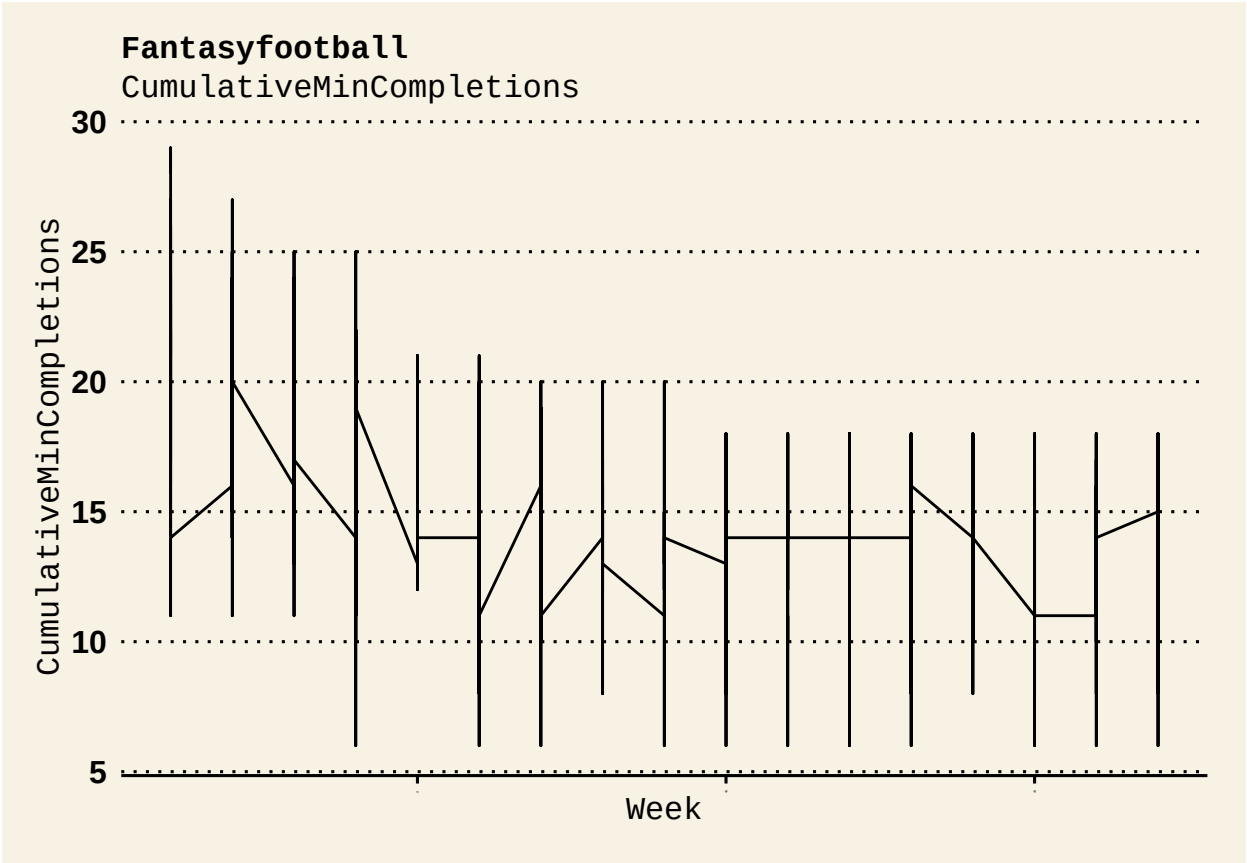

Fantasyfootball
CumulativeMaxPassYardsPerAttempt
CumulativeMaxPassYardsPerAttempt
12.5
10.0
7.5
5.0
Week

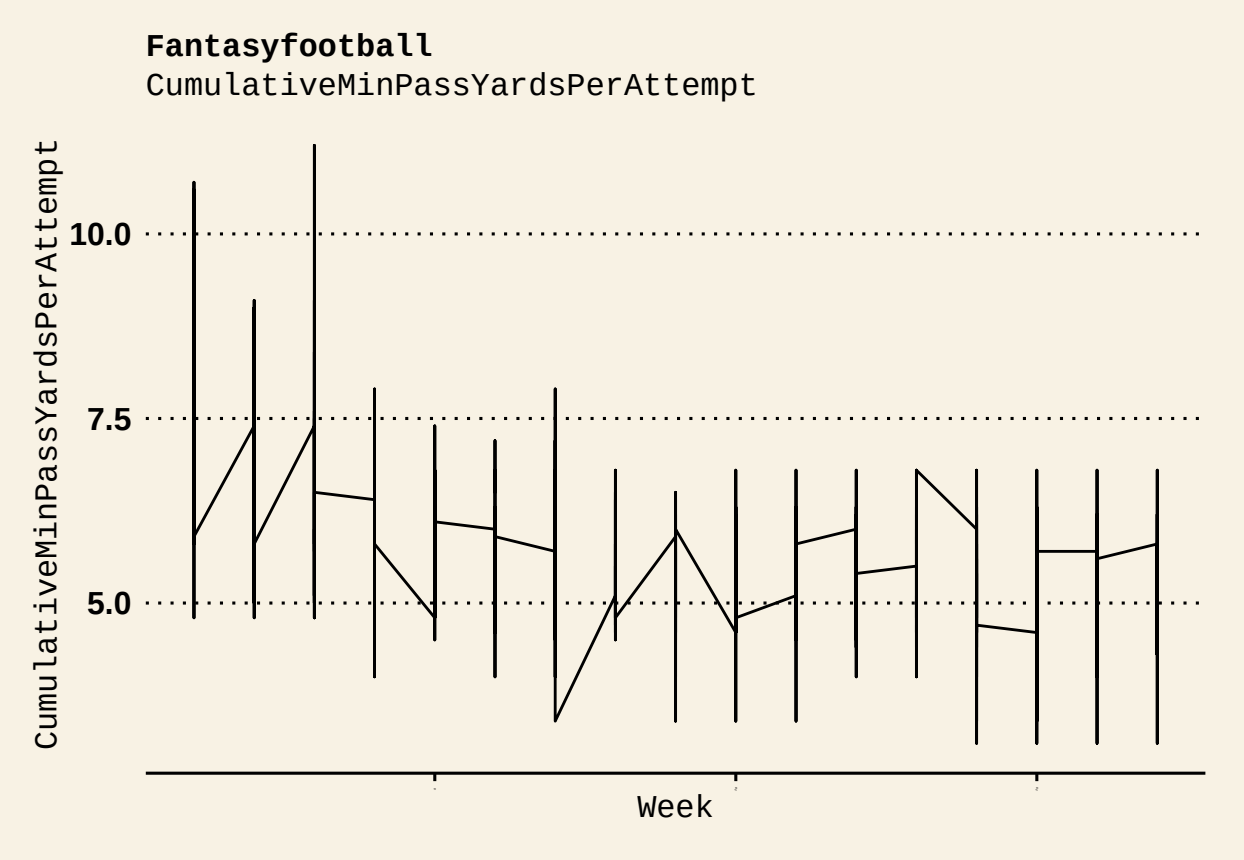

Fantasyfootball
CumulativeMinPassingTouchdowns
CumulativeMinPassingTouchdowns
4
3
2
1
0
Week


Fantasyfootball
CumulativeMinPassingYards
CumulativeMinPassingYards
300
200
100
Week


Fantasyfootball
CumulativeMinPassingAttempts
CumulativeMinPassingAttempts
40
30
20
10
Week


Fantasyfootball
CumulativeMinPassingRating
150
125
100
75
50
CumulativeMinPassingRating
Week


Fantasyfootball
CumulativeMinCompletions
30
25
20
15
10
5
CumulativeMinCompletions
Week


Fantasyfootball
CumulativeMinPassYardsPerAttempt
CumulativeMinPassYardsPerAttempt
10.0
7.5
5.0
Week