Exploratory Data Analysis

Kevin Thompson, Sean Kennedy, Sachin Chavan

September 29, 2019

1.1: Load data

```
load("../analysis/data/.RData")
#load("../analysis/data/RData.dms")
QBCrossSectional$Week <- as.factor(QBCrossSectional$Week)
attach(QBCrossSectional)
```

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

1.2: Structures QBCrossSectional and QBPanels

1.2.1 QB (Quarterback)

```
head(QBCrossSectional)
```

```
## # A tibble: 6 x 21
##   PlayerID Week  Position Opponent TeamIsHome GameDate   PassingCompleti~
##      <dbl> <fct> <chr>    <chr>    <lgl>      <date>                <dbl>
## 1     6739 13    QB       NYJ      FALSE      2017-12-03               19
## 2     4314 3     QB       HOU      TRUE       2017-09-24               25
## 3    13320 10    QB       MIA      TRUE       2017-11-13               21
## 4    18857 5     QB       KC       TRUE       2017-10-08               16
## 5    14536 8     QB       HOU      TRUE       2017-10-29               26
## 6    18857 4     QB       TEN      TRUE       2017-10-01               25
## # ... with 14 more variables: PassingAttempts <dbl>,
## #   PassingCompletionPercentage <dbl>, PassingYards <dbl>,
## #   PassingYardsPerAttempt <dbl>, PassingTouchdowns <dbl>,
## #   PassingInterceptions <dbl>, PassingRating <dbl>,
## #   RushingAttempts <dbl>, RushingYards <dbl>,
## #   RushingYardsPerAttempt <dbl>, RushingTouchdowns <dbl>,
## #   FumblesLost <dbl>, FantasyPoints <dbl>, Team <chr>
```

```
summary(QBCrossSectional)
```

```
##     PlayerID          Week       Position           Opponent
##  Min.   :  611   2      : 30   Length:453         Length:453
##  1st Qu.: 7242   13     : 29   Class :character   Class :character
##  Median :13723   14     : 29   Mode  :character   Mode  :character
##  Mean   :11932   3      : 28
##  3rd Qu.:16763   4      : 28
##  Max.   :19029   12     : 28
##                  (Other):281
##  TeamIsHome         GameDate          PassingCompletions PassingAttempts
##  Mode :logical   Min.   :2017-09-07   Min.   : 5.00      Min.   :10.00
##  FALSE:226       1st Qu.:2017-10-08   1st Qu.:18.00      1st Qu.:29.00
##  TRUE :227       Median :2017-11-05   Median :21.00      Median :33.00
```

```
##                  Mean   :2017-11-05   Mean   :21.24      Mean   :33.62
##                  3rd Qu.:2017-12-03   3rd Qu.:25.00      3rd Qu.:38.00
##                  Max.   :2017-12-31   Max.   :44.00      Max.   :66.00
##
##  PassingCompletionPercentage  PassingYards   PassingYardsPerAttempt
##  Min.   :38.70                Min.   : 57.0   Min.   : 3.100
##  1st Qu.:57.10                1st Qu.:199.0   1st Qu.: 6.200
##  Median :63.20                Median :241.0   Median : 7.200
##  Mean   :63.48                Mean   :244.6   Mean   : 7.378
##  3rd Qu.:69.40                3rd Qu.:291.0   3rd Qu.: 8.400
##  Max.   :87.00                Max.   :506.0   Max.   :14.100
##
##  PassingTouchdowns PassingInterceptions PassingRating    RushingAttempts
##  Min.   :0.000     Min.   :0.00         Min.   : 31.14   Min.   : 0.000
##  1st Qu.:1.000     1st Qu.:0.00         1st Qu.: 77.92   1st Qu.: 1.000
##  Median :1.000     Median :0.00         Median : 92.94   Median : 3.000
##  Mean   :1.587     Mean   :0.66         Mean   : 93.88   Mean   : 3.185
##  3rd Qu.:2.000     3rd Qu.:1.00         3rd Qu.:109.84   3rd Qu.: 5.000
##  Max.   :5.000     Max.   :4.00         Max.   :150.69   Max.   :14.000
##
##   RushingYards   RushingYardsPerAttempt RushingTouchdowns  FumblesLost
##  Min.   :-8.00   Min.   :-2.700         Min.   :0.0000    Min.   :0.0000
##  1st Qu.: 0.00   1st Qu.: 0.000         1st Qu.:0.0000    1st Qu.:0.0000
##  Median : 8.00   Median : 3.000         Median :0.0000    Median :0.0000
##  Mean   :14.38   Mean   : 3.839         Mean   :0.1457    Mean   :0.1766
##  3rd Qu.:23.00   3rd Qu.: 6.000         3rd Qu.:0.0000    3rd Qu.:0.0000
##  Max.   :95.00   Max.   :70.000         Max.   :2.0000    Max.   :3.0000
##
##  FantasyPoints       Team
##  Min.   : 7.12   Length:453
##  1st Qu.:11.86   Class :character
##  Median :15.86   Mode  :character
##  Mean   :16.89
##  3rd Qu.:20.68
##  Max.   :37.64
##
```

1.2.2 QB (Panel Data)

```
str(QBPanels)
```

```
## List of 17
##  $ Opponent                   :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : chr [1:56] NA "CHI" "DET" "SEA" ...
##   ..$ 2       : chr [1:56] "CLE" "GB" "IND" "ATL" ...
##   ..$ 3       : chr [1:56] NA "DET" "DAL" "CIN" ...
##   ..$ 4       : chr [1:56] "PIT" "BUF" "SF" "CHI" ...
##   ..$ 5       : chr [1:56] "OAK" NA "PHI" "DAL" ...
##   ..$ 6       : chr [1:56] NA "MIA" "TB" NA ...
##   ..$ 7       : chr [1:56] "MIN" "NE" NA NA ...
##   ..$ 8       : chr [1:56] "MIA" "NYJ" NA NA ...
##   ..$ 9       : chr [1:56] "TEN" "CAR" NA NA ...
##   ..$ 10      : chr [1:56] NA "DAL" NA NA ...
```

```
##   ..$ 11      : chr [1:56] "GB" "SEA" NA NA ...
##   ..$ 12      : chr [1:56] "HOU" "TB" NA NA ...
##   ..$ 13      : chr [1:56] "DET" NA NA NA ...
##   ..$ 14      : chr [1:56] "PIT" NA NA NA ...
##   ..$ 15      : chr [1:56] "CLE" "TB" NA "CAR" ...
##   ..$ 16      : chr [1:56] "IND" "NO" NA NA ...
##   ..$ 17      : chr [1:56] "CIN" "CAR" NA NA ...
##  $ TeamIsHome                :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : logi [1:56] NA FALSE FALSE TRUE FALSE TRUE ...
##   ..$ 2       : logi [1:56] TRUE TRUE FALSE FALSE TRUE FALSE ...
##   ..$ 3       : logi [1:56] NA FALSE TRUE TRUE FALSE TRUE ...
##   ..$ 4       : logi [1:56] TRUE TRUE TRUE TRUE FALSE TRUE ...
##   ..$ 5       : logi [1:56] FALSE NA FALSE FALSE NA FALSE ...
##   ..$ 6       : logi [1:56] NA TRUE TRUE NA FALSE FALSE ...
##   ..$ 7       : logi [1:56] FALSE FALSE NA NA TRUE TRUE ...
##   ..$ 8       : logi [1:56] TRUE FALSE NA NA FALSE TRUE ...
##   ..$ 9       : logi [1:56] FALSE FALSE NA NA NA NA ...
##   ..$ 10      : logi [1:56] NA TRUE NA NA FALSE FALSE ...
##   ..$ 11      : logi [1:56] FALSE FALSE NA NA TRUE FALSE ...
##   ..$ 12      : logi [1:56] TRUE TRUE NA NA TRUE TRUE ...
##   ..$ 13      : logi [1:56] TRUE NA NA NA FALSE FALSE ...
##   ..$ 14      : logi [1:56] FALSE NA NA NA TRUE FALSE ...
##   ..$ 15      : logi [1:56] FALSE FALSE NA FALSE TRUE FALSE ...
##   ..$ 16      : logi [1:56] TRUE FALSE NA NA FALSE TRUE ...
##   ..$ 17      : logi [1:56] TRUE TRUE NA NA NA TRUE ...
##  $ PassingCompletions         :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 21 27 28 24 16 NA NA 26 NA ...
##   ..$ 2       : num [1:56] 25 19 19 33 23 30 NA 22 16 NA ...
##   ..$ 3       : num [1:56] NA 24 29 28 22 25 NA 35 18 NA ...
##   ..$ 4       : num [1:56] 31 24 33 18 18 32 NA 30 NA NA ...
##   ..$ 5       : num [1:56] 19 NA 28 19 NA 30 NA 21 23 NA ...
##   ..$ 6       : num [1:56] NA 24 18 NA 17 20 NA 11 31 NA ...
##   ..$ 7       : num [1:56] 27 23 NA NA 14 21 NA 19 17 13 ...
##   ..$ 8       : num [1:56] 10 18 NA NA 17 32 NA NA 26 NA ...
##   ..$ 9       : num [1:56] 34 24 NA NA NA NA 15 20 14 NA ...
##   ..$ 10      : num [1:56] NA 22 NA NA 19 25 24 28 23 NA ...
##   ..$ 11      : num [1:56] 22 19 NA NA 30 30 NA 19 NA 17 ...
##   ..$ 12      : num [1:56] 20 26 NA NA 33 18 NA NA 19 23 ...
##   ..$ 13      : num [1:56] 23 NA NA NA 24 21 NA NA 26 NA ...
##   ..$ 14      : num [1:56] 20 NA NA NA 44 24 NA 31 NA NA ...
##   ..$ 15      : num [1:56] 26 17 NA 26 22 22 NA 37 NA NA ...
##   ..$ 16      : num [1:56] 29 22 NA NA 20 21 20 NA NA NA ...
##   ..$ 17      : num [1:56] 25 28 NA NA NA 18 15 NA NA NA ...
##  $ PassingAttempts            :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 30 48 42 36 36 NA NA 39 NA ...
##   ..$ 2       : num [1:56] 34 28 36 50 35 39 NA 32 24 NA ...
##   ..$ 3       : num [1:56] NA 35 48 42 39 35 NA 47 23 NA ...
##   ..$ 4       : num [1:56] 49 42 51 26 30 45 NA 49 NA NA ...
##   ..$ 5       : num [1:56] 26 NA 44 29 NA 40 NA 36 30 NA ...
##   ..$ 6       : num [1:56] NA 35 22 NA 25 38 NA 19 47 NA ...
##   ..$ 7       : num [1:56] 39 33 NA NA 24 29 NA 39 27 21 ...
```

```
##   ..$ 8       : num [1:56] 15 29 NA NA 31 47 NA NA 33 NA ...
##   ..$ 9       : num [1:56] 52 38 NA NA NA NA 30 36 20 NA ...
##   ..$ 10      : num [1:56] NA 29 NA NA 31 34 47 37 39 NA ...
##   ..$ 11      : num [1:56] 28 27 NA NA 45 37 NA 35 NA 28 ...
##   ..$ 12      : num [1:56] 32 35 NA NA 45 28 NA NA 36 34 ...
##   ..$ 13      : num [1:56] 36 NA NA NA 40 30 NA NA 36 NA ...
##   ..$ 14      : num [1:56] 35 NA NA NA 66 43 NA 46 NA NA ...
##   ..$ 15      : num [1:56] 42 31 NA 45 30 35 NA 57 NA NA ...
##   ..$ 16      : num [1:56] 38 36 NA NA 29 28 34 NA NA NA ...
##   ..$ 17      : num [1:56] 47 45 NA NA NA 37 34 NA NA NA ...
##  $ PassingCompletionPercentage:Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 70 56.2 66.7 66.7 44.4 NA NA 66.7 NA ...
##   ..$ 2       : num [1:56] 73.5 67.9 52.8 66 65.7 76.9 NA 68.8 66.7 NA ...
##   ..$ 3       : num [1:56] NA 68.6 60.4 66.7 56.4 71.4 NA 74.5 78.3 NA ...
##   ..$ 4       : num [1:56] 63.3 57.1 64.7 69.2 60 71.1 NA 61.2 NA NA ...
##   ..$ 5       : num [1:56] 73.1 NA 63.6 65.5 NA 75 NA 58.3 76.7 NA ...
##   ..$ 6       : num [1:56] NA 68.6 81.8 NA 68 52.6 NA 57.9 66 NA ...
##   ..$ 7       : num [1:56] 69.2 69.7 NA NA 58.3 72.4 NA 48.7 63 61.9 ...
##   ..$ 8       : num [1:56] 66.7 62.1 NA NA 54.8 68.1 NA NA 78.8 NA ...
##   ..$ 9       : num [1:56] 65.4 63.2 NA NA NA NA 50 55.6 70 NA ...
##   ..$ 10      : num [1:56] NA 75.9 NA NA 61.3 73.5 51.1 75.7 59 NA ...
##   ..$ 11      : num [1:56] 78.6 70.4 NA NA 66.7 81.1 NA 54.3 NA 60.7 ...
##   ..$ 12      : num [1:56] 62.5 74.3 NA NA 73.3 64.3 NA NA 52.8 67.6 ...
##   ..$ 13      : num [1:56] 63.9 NA NA NA 60 70 NA NA 72.2 NA ...
##   ..$ 14      : num [1:56] 57.1 NA NA NA 66.7 55.8 NA 67.4 NA NA ...
##   ..$ 15      : num [1:56] 61.9 54.8 NA 57.8 73.3 62.9 NA 64.9 NA NA ...
##   ..$ 16      : num [1:56] 76.3 61.1 NA NA 69 75 58.8 NA NA NA ...
##   ..$ 17      : num [1:56] 53.2 62.2 NA NA NA 48.6 44.1 NA NA NA ...
##  $ PassingYards              :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 321 268 311 263 267 NA NA 187 NA ...
##   ..$ 2       : num [1:56] 217 252 332 343 243 447 NA 239 166 NA ...
##   ..$ 3       : num [1:56] NA 294 325 313 235 378 NA 366 249 NA ...
##   ..$ 4       : num [1:56] 235 242 357 179 216 307 NA 288 NA NA ...
##   ..$ 5       : num [1:56] 222 NA 291 221 NA 303 NA 225 194 NA ...
##   ..$ 6       : num [1:56] NA 248 283 NA 252 257 NA 128 354 NA ...
##   ..$ 7       : num [1:56] 186 233 NA NA 224 249 NA 134 209 188 ...
##   ..$ 8       : num [1:56] 101 254 NA NA 317 333 NA NA 257 NA ...
##   ..$ 9       : num [1:56] 261 313 NA NA NA NA 201 220 140 NA ...
##   ..$ 10      : num [1:56] NA 215 NA NA 236 266 273 273 262 NA ...
##   ..$ 11      : num [1:56] 183 195 NA NA 299 340 NA 205 NA 282 ...
##   ..$ 12      : num [1:56] 141 317 NA NA 351 227 NA NA 307 215 ...
##   ..$ 13      : num [1:56] 269 NA NA NA 290 258 NA NA 331 NA ...
##   ..$ 14      : num [1:56] 269 NA NA NA 506 233 NA 228 NA NA ...
##   ..$ 15      : num [1:56] 288 212 NA 290 281 298 NA 434 NA NA ...
##   ..$ 16      : num [1:56] 237 288 NA NA 226 224 209 NA NA NA ...
##   ..$ 17      : num [1:56] 203 317 NA NA NA 190 145 NA NA NA ...
##  $ PassingYardsPerAttempt    :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 10.7 5.6 7.4 7.3 7.4 NA NA 4.8 NA ...
##   ..$ 2       : num [1:56] 6.4 9 9.2 6.9 6.9 11.5 NA 7.5 6.9 NA ...
##   ..$ 3       : num [1:56] NA 8.4 6.8 7.5 6 10.8 NA 7.8 10.8 NA ...
##   ..$ 4       : num [1:56] 4.8 5.8 7 6.9 7.2 6.8 NA 5.9 NA NA ...
```

```
##   ..$ 5       : num [1:56] 8.5 NA 6.6 7.6 NA 7.6 NA 6.2 6.5 NA ...
##   ..$ 6       : num [1:56] NA 7.1 12.9 NA 10.1 6.8 NA 6.7 7.5 NA ...
##   ..$ 7       : num [1:56] 4.8 7.1 NA NA 9.3 8.6 NA 3.4 7.7 9 ...
##   ..$ 8       : num [1:56] 6.7 8.8 NA NA 10.2 7.1 NA NA 7.8 NA ...
##   ..$ 9       : num [1:56] 5 8.2 NA NA NA NA 6.7 6.1 7 NA ...
##   ..$ 10      : num [1:56] NA 7.4 NA NA 7.6 7.8 5.8 7.4 6.7 NA ...
##   ..$ 11      : num [1:56] 6.5 7.2 NA NA 6.6 9.2 NA 5.9 NA 10.1 ...
##   ..$ 12      : num [1:56] 4.4 9.1 NA NA 7.8 8.1 NA NA 8.5 6.3 ...
##   ..$ 13      : num [1:56] 7.5 NA NA NA 7.2 8.6 NA NA 9.2 NA ...
##   ..$ 14      : num [1:56] 7.7 NA NA NA 7.7 5.4 NA 5 NA NA ...
##   ..$ 15      : num [1:56] 6.9 6.8 NA 6.4 9.4 8.5 NA 7.6 NA NA ...
##   ..$ 16      : num [1:56] 6.2 8 NA NA 7.8 8 6.1 NA NA NA ...
##   ..$ 17      : num [1:56] 4.3 7 NA NA NA 5.1 4.3 NA NA NA ...
##  $ PassingTouchdowns          :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 1 1 1 2 0 NA NA 0 NA ...
##   ..$ 2       : num [1:56] 2 1 1 2 2 3 NA 1 2 NA ...
##   ..$ 3       : num [1:56] NA 2 2 3 1 5 NA 3 1 NA ...
##   ..$ 4       : num [1:56] 1 1 1 4 1 2 NA 2 NA NA ...
##   ..$ 5       : num [1:56] 0 NA 1 3 NA 1 NA 2 2 NA ...
##   ..$ 6       : num [1:56] NA 1 3 NA 1 2 NA 1 2 NA ...
##   ..$ 7       : num [1:56] 1 1 NA NA 2 2 NA 1 3 2 ...
##   ..$ 8       : num [1:56] 1 2 NA NA 1 1 NA NA 2 NA ...
##   ..$ 9       : num [1:56] 2 2 NA NA NA NA 2 2 1 NA ...
##   ..$ 10      : num [1:56] NA 2 NA NA 2 3 1 2 1 NA ...
##   ..$ 11      : num [1:56] 1 2 NA NA 4 3 NA 0 NA 1 ...
##   ..$ 12      : num [1:56] 0 1 NA NA 4 4 NA NA 3 1 ...
##   ..$ 13      : num [1:56] 2 NA NA NA 2 0 NA NA 1 NA ...
##   ..$ 14      : num [1:56] 2 NA NA NA 2 1 NA 1 NA NA ...
##   ..$ 15      : num [1:56] 1 1 NA 3 2 1 NA 3 NA NA ...
##   ..$ 16      : num [1:56] 2 1 NA NA 2 2 2 NA NA NA ...
##   ..$ 17      : num [1:56] 2 1 NA NA NA 2 1 NA NA NA ...
##  $ PassingInterceptions       :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 0 3 1 1 0 NA NA 2 NA ...
##   ..$ 2       : num [1:56] 1 0 1 1 0 0 NA 1 0 NA ...
##   ..$ 3       : num [1:56] NA 3 0 1 0 0 NA 2 0 NA ...
##   ..$ 4       : num [1:56] 2 2 1 0 1 0 NA 0 NA NA ...
##   ..$ 5       : num [1:56] 0 NA 0 0 NA 1 NA 1 1 NA ...
##   ..$ 6       : num [1:56] NA 1 1 NA 1 1 NA 0 2 NA ...
##   ..$ 7       : num [1:56] 0 0 NA NA 0 0 NA 0 1 1 ...
##   ..$ 8       : num [1:56] 0 0 NA NA 1 0 NA NA 0 NA ...
##   ..$ 9       : num [1:56] 2 1 NA NA NA NA 1 1 0 NA ...
##   ..$ 10      : num [1:56] NA 1 NA NA 1 0 0 0 1 NA ...
##   ..$ 11      : num [1:56] 1 0 NA NA 0 0 NA 0 NA 0 ...
##   ..$ 12      : num [1:56] 0 0 NA NA 2 1 NA NA 0 2 ...
##   ..$ 13      : num [1:56] 0 NA NA NA 1 1 NA NA 0 NA ...
##   ..$ 14      : num [1:56] 1 NA NA NA 0 2 NA 2 NA NA ...
##   ..$ 15      : num [1:56] 0 0 NA 3 1 1 NA 1 NA NA ...
##   ..$ 16      : num [1:56] 0 1 NA NA 0 1 2 NA NA NA ...
##   ..$ 17      : num [1:56] 1 0 NA NA NA 0 1 NA NA NA ...
##  $ PassingRating              :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 116.1 53.1 86.5 95 ...
```

```
##   ..$ 2       : num [1:56] 97.3 108 82.2 90.7 104.8 ...
##   ..$ 3       : num [1:56] NA 77.6 94.5 102.6 82.8 ...
##   ..$ 4       : num [1:56] 64.6 61.8 83.5 128 79.3 ...
##   ..$ 5       : num [1:56] 98.6 NA 90.2 122.9 NA ...
##   ..$ 6       : num [1:56] NA 86.4 139.4 NA 97.4 ...
##   ..$ 7       : num [1:56] 88.2 99.7 NA NA 117.4 ...
##   ..$ 8       : num [1:56] 107.9 113.3 NA NA 87.7 ...
##   ..$ 9       : num [1:56] 74.3 95.6 NA NA NA ...
##   ..$ 10      : num [1:56] NA 104.8 NA NA 92.9 ...
##   ..$ 11      : num [1:56] 90.9 115.5 NA NA 115 ...
##   ..$ 12      : num [1:56] 72.5 111.2 NA NA 106.8 ...
##   ..$ 13      : num [1:56] 105 NA NA NA 88.5 ...
##   ..$ 14      : num [1:56] 88.9 NA NA NA 99.7 ...
##   ..$ 15      : num [1:56] 90.2 87 NA 71.5 110.6 ...
##   ..$ 16      : num [1:56] 109 84 NA NA 115 ...
##   ..$ 17      : num [1:56] 69.7 90.7 NA NA NA ...
##  $ RushingAttempts           :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 3 1 7 3 2 NA NA 2 NA ...
##   ..$ 2       : num [1:56] 1 1 3 2 2 2 NA 0 4 NA ...
##   ..$ 3       : num [1:56] NA 1 3 4 1 1 NA 0 4 NA ...
##   ..$ 4       : num [1:56] 0 1 2 1 1 1 NA 3 NA NA ...
##   ..$ 5       : num [1:56] 3 NA 0 4 NA 2 NA 0 3 NA ...
##   ..$ 6       : num [1:56] NA 0 5 NA 2 1 NA 1 3 NA ...
##   ..$ 7       : num [1:56] 1 3 NA NA 3 5 NA 0 3 0 ...
##   ..$ 8       : num [1:56] 1 6 NA NA 3 1 NA NA 1 NA ...
##   ..$ 9       : num [1:56] 1 1 NA NA NA NA 4 0 5 NA ...
##   ..$ 10      : num [1:56] NA 0 NA NA 2 1 1 0 0 NA ...
##   ..$ 11      : num [1:56] 2 3 NA NA 1 0 NA 2 NA 1 ...
##   ..$ 12      : num [1:56] 6 1 NA NA 3 5 NA NA 2 2 ...
##   ..$ 13      : num [1:56] 1 NA NA NA 1 0 NA NA 7 NA ...
##   ..$ 14      : num [1:56] 0 NA NA NA 1 0 NA 0 NA NA ...
##   ..$ 15      : num [1:56] 4 3 NA 6 3 2 NA 0 NA NA ...
##   ..$ 16      : num [1:56] 4 2 NA NA 1 2 2 NA NA NA ...
##   ..$ 17      : num [1:56] 0 3 NA NA NA 0 1 NA NA NA ...
##  $ RushingYards              :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 11 2 21 -8 0 NA NA 0 NA ...
##   ..$ 2       : num [1:56] -1 8 6 8 -2 9 NA 0 31 NA ...
##   ..$ 3       : num [1:56] NA -1 7 23 6 6 NA 0 7 NA ...
##   ..$ 4       : num [1:56] 0 8 1 -1 -1 2 NA 22 NA NA ...
##   ..$ 5       : num [1:56] -4 NA 0 32 NA 5 NA 0 -3 NA ...
##   ..$ 6       : num [1:56] NA 0 -4 NA -2 -1 NA 0 21 NA ...
##   ..$ 7       : num [1:56] 0 37 NA NA -3 5 NA 0 1 0 ...
##   ..$ 8       : num [1:56] 9 17 NA NA -2 2 NA NA 0 NA ...
##   ..$ 9       : num [1:56] 7 -1 NA NA NA NA 2 0 13 NA ...
##   ..$ 10      : num [1:56] NA 0 NA NA 5 0 1 0 0 NA ...
##   ..$ 11      : num [1:56] -1 12 NA NA 10 0 NA 5 NA 0 ...
##   ..$ 12      : num [1:56] 42 1 NA NA 25 -4 NA NA 28 9 ...
##   ..$ 13      : num [1:56] -1 NA NA NA 4 0 NA NA 19 NA ...
##   ..$ 14      : num [1:56] 0 NA NA NA 5 0 NA 0 NA NA ...
##   ..$ 15      : num [1:56] 3 29 NA 43 10 -2 NA 0 NA NA ...
##   ..$ 16      : num [1:56] -2 7 NA NA -1 6 1 NA NA NA ...
##   ..$ 17      : num [1:56] 0 14 NA NA NA 0 -1 NA NA NA ...
```

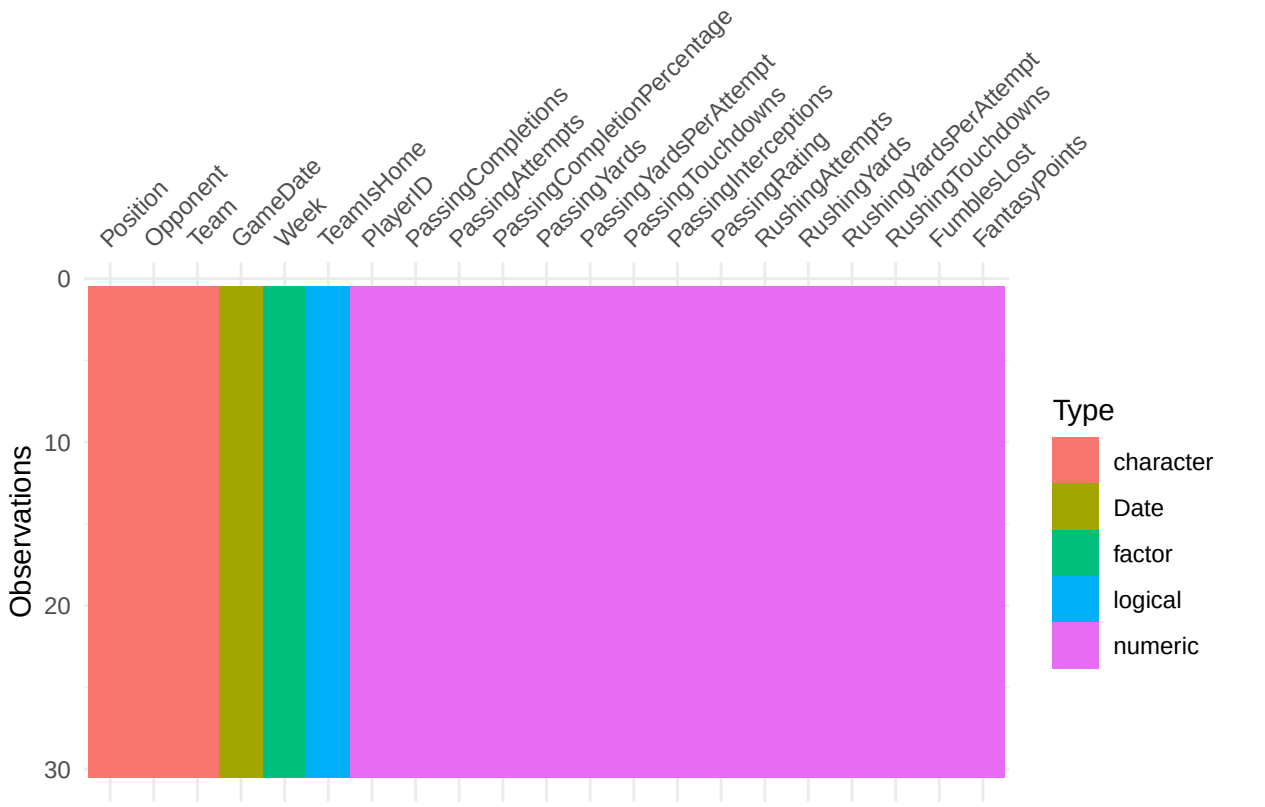
```
##  $ RushingYardsPerAttempt     :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 3.7 2 3 -2.7 0 NA NA 0 NA ...
##   ..$ 2       : num [1:56] -1 8 2 4 -1 4.5 NA 0 7.8 NA ...
##   ..$ 3       : num [1:56] NA -1 2.3 5.8 6 6 NA 0 1.8 NA ...
##   ..$ 4       : num [1:56] 0 8 0.5 -1 -1 2 NA 7.3 NA NA ...
##   ..$ 5       : num [1:56] -1.3 NA 0 8 NA 2.5 NA 0 -1 NA ...
##   ..$ 6       : num [1:56] NA 0 -0.8 NA -1 -1 NA 0 7 NA ...
##   ..$ 7       : num [1:56] 0 12.3 NA NA -1 1 NA 0 0.3 0 ...
##   ..$ 8       : num [1:56] 9 2.8 NA NA -0.7 2 NA NA 0 NA ...
##   ..$ 9       : num [1:56] 7 -1 NA NA NA NA 0.5 0 2.6 NA ...
##   ..$ 10      : num [1:56] NA 0 NA NA 2.5 0 1 0 0 NA ...
##   ..$ 11      : num [1:56] -0.5 4 NA NA 10 0 NA 2.5 NA 0 ...
##   ..$ 12      : num [1:56] 7 1 NA NA 8.3 -0.8 NA NA 14 4.5 ...
##   ..$ 13      : num [1:56] -1 NA NA NA 4 0 NA NA 2.7 NA ...
##   ..$ 14      : num [1:56] 0 NA NA NA 5 0 NA 0 NA NA ...
##   ..$ 15      : num [1:56] 0.8 9.7 NA 7.2 3.3 -1 NA 0 NA NA ...
##   ..$ 16      : num [1:56] -0.5 3.5 NA NA -1 3 0.5 NA NA NA ...
##   ..$ 17      : num [1:56] 0 4.7 NA NA NA 0 -1 NA NA NA ...
##  $ RushingTouchdowns          :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 0 0 0 0 0 NA NA 1 NA ...
##   ..$ 2       : num [1:56] 0 0 0 0 0 0 NA 0 0 NA ...
##   ..$ 3       : num [1:56] NA 0 0 0 0 0 NA 0 0 NA ...
##   ..$ 4       : num [1:56] 0 0 0 0 0 0 NA 1 NA NA ...
##   ..$ 5       : num [1:56] 0 NA 0 0 NA 0 NA 0 0 NA ...
##   ..$ 6       : num [1:56] NA 0 0 NA 0 0 NA 0 0 NA ...
##   ..$ 7       : num [1:56] 0 0 NA NA 0 0 NA 0 1 0 ...
##   ..$ 8       : num [1:56] 0 0 NA NA 0 0 NA NA 0 NA ...
##   ..$ 9       : num [1:56] 0 0 NA NA NA NA 0 0 1 NA ...
##   ..$ 10      : num [1:56] NA 0 NA NA 0 0 0 0 0 NA ...
##   ..$ 11      : num [1:56] 0 0 NA NA 0 0 NA 0 NA 0 ...
##   ..$ 12      : num [1:56] 0 0 NA NA 0 0 NA NA 0 0 ...
##   ..$ 13      : num [1:56] 0 NA NA NA 0 0 NA NA 2 NA ...
##   ..$ 14      : num [1:56] 0 NA NA NA 0 0 NA 0 NA NA ...
##   ..$ 15      : num [1:56] 1 0 NA 0 0 0 NA 0 NA NA ...
##   ..$ 16      : num [1:56] 0 0 NA NA 0 0 0 NA NA NA ...
##   ..$ 17      : num [1:56] 0 0 NA NA NA 0 0 NA NA NA ...
##  $ FumblesLost                :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 0 0 0 0 0 NA NA 0 NA ...
##   ..$ 2       : num [1:56] 0 0 0 1 0 0 NA 0 1 NA ...
##   ..$ 3       : num [1:56] NA 0 0 0 1 1 NA 0 0 NA ...
##   ..$ 4       : num [1:56] 0 1 0 0 0 0 NA 0 NA NA ...
##   ..$ 5       : num [1:56] 0 NA 0 0 NA 1 NA 1 0 NA ...
##   ..$ 6       : num [1:56] NA 0 0 NA 0 0 NA 0 0 NA ...
##   ..$ 7       : num [1:56] 0 0 NA NA 0 0 NA 1 0 0 ...
##   ..$ 8       : num [1:56] 0 2 NA NA 0 0 NA NA 0 NA ...
##   ..$ 9       : num [1:56] 0 0 NA NA NA NA 0 1 0 NA ...
##   ..$ 10      : num [1:56] NA 0 NA NA 0 0 0 1 0 NA ...
##   ..$ 11      : num [1:56] 0 0 NA NA 0 0 NA 0 NA 0 ...
##   ..$ 12      : num [1:56] 0 0 NA NA 0 1 NA NA 1 0 ...
##   ..$ 13      : num [1:56] 0 NA NA NA 0 0 NA NA 0 NA ...
##   ..$ 14      : num [1:56] 0 NA NA NA 0 0 NA 0 NA NA ...
```

```
##   ..$ 15      : num [1:56] 0 0 NA 0 0 0 NA 0 NA NA ...
##   ..$ 16      : num [1:56] 0 0 NA NA 0 0 0 NA NA NA ...
##   ..$ 17      : num [1:56] 0 0 NA NA NA 0 0 NA NA NA ...
##  $ FantasyPoints             :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : num [1:56] NA 17.94 8.92 16.54 15.72 ...
##   ..$ 2       : num [1:56] 14.6 14.9 15.9 18.5 17.5 ...
##   ..$ 3       : num [1:56] NA 13.7 21.7 24.8 12 ...
##   ..$ 4       : num [1:56] 9.4 8.48 16.38 23.06 10.54 ...
##   ..$ 5       : num [1:56] 8.48 NA 15.64 24.04 NA ...
##   ..$ 6       : num [1:56] NA 11.9 20.9 NA 11.9 ...
##   ..$ 7       : num [1:56] 11.4 17 NA NA 16.7 ...
##   ..$ 8       : num [1:56] 8.94 15.86 NA NA 14.48 ...
##   ..$ 9       : num [1:56] 15.1 18.4 NA NA NA ...
##   ..$ 10      : num [1:56] NA 14.6 NA NA 17.9 ...
##   ..$ 11      : num [1:56] 9.22 17 NA NA 28.96 ...
##   ..$ 12      : num [1:56] 9.84 16.78 NA NA 30.54 ...
##   ..$ 13      : num [1:56] 18.7 NA NA NA 18 ...
##   ..$ 14      : num [1:56] 16.8 NA NA NA 28.7 ...
##   ..$ 15      : num [1:56] 21.8 15.4 NA 21.9 18.2 ...
##   ..$ 16      : num [1:56] 17.3 14.2 NA NA 16.9 ...
##   ..$ 17      : num [1:56] 14.1 18.1 NA NA NA ...
##  $ Team                      :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of  18 variables:
##   ..$ PlayerID: num [1:56] 611 732 2428 2593 3807 ...
##   ..$ 1       : chr [1:56] NA "ATL" "ARI" "GB" ...
##   ..$ 2       : chr [1:56] "BAL" "ATL" "ARI" "GB" ...
##   ..$ 3       : chr [1:56] NA "ATL" "ARI" "GB" ...
##   ..$ 4       : chr [1:56] "BAL" "ATL" "ARI" "GB" ...
##   ..$ 5       : chr [1:56] "BAL" NA "ARI" "GB" ...
##   ..$ 6       : chr [1:56] NA "ATL" "ARI" NA ...
##   ..$ 7       : chr [1:56] "BAL" "ATL" NA NA ...
##   ..$ 8       : chr [1:56] "BAL" "ATL" NA NA ...
##   ..$ 9       : chr [1:56] "BAL" "ATL" NA NA ...
##   ..$ 10      : chr [1:56] NA "ATL" NA NA ...
##   ..$ 11      : chr [1:56] "BAL" "ATL" NA NA ...
##   ..$ 12      : chr [1:56] "BAL" "ATL" NA NA ...
##   ..$ 13      : chr [1:56] "BAL" NA NA NA ...
##   ..$ 14      : chr [1:56] "BAL" NA NA NA ...
##   ..$ 15      : chr [1:56] "BAL" "ATL" NA "GB" ...
##   ..$ 16      : chr [1:56] "BAL" "ATL" NA NA ...
##   ..$ 17      : chr [1:56] "BAL" "ATL" NA NA ...
```

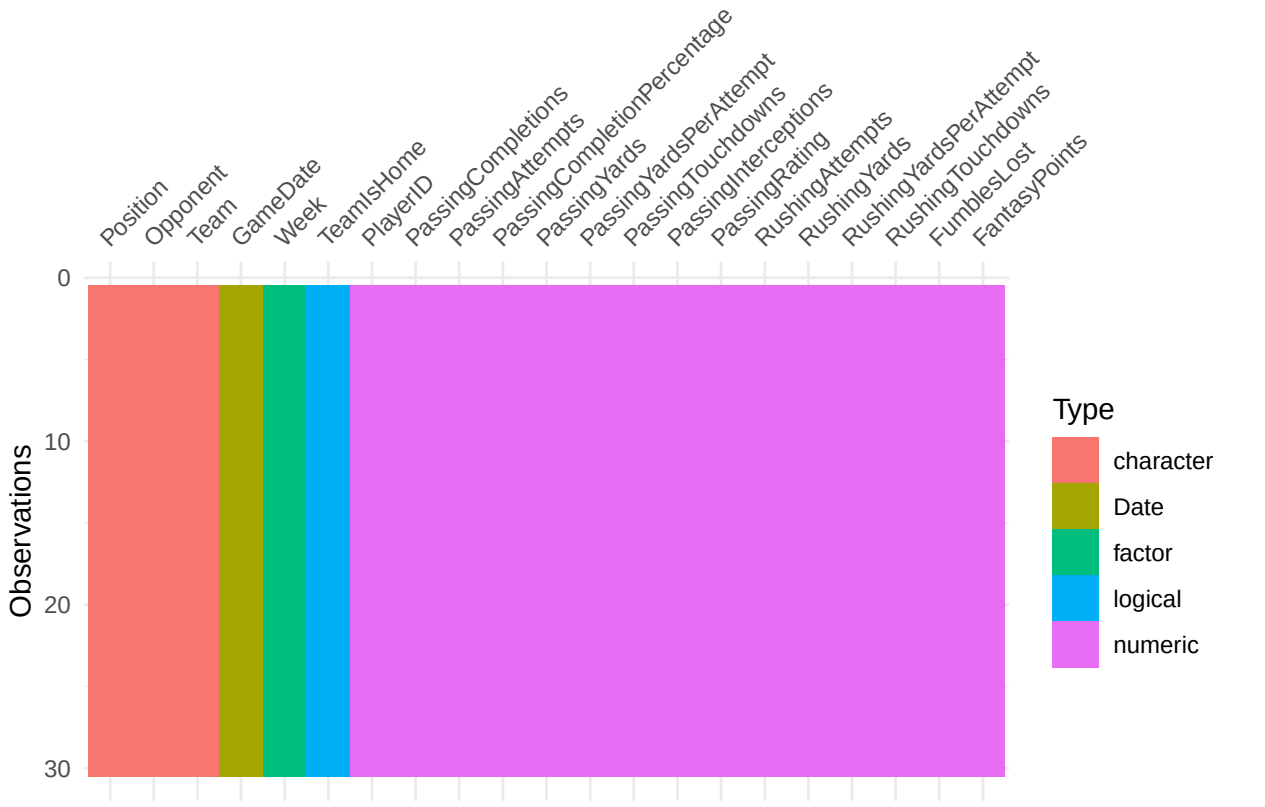
1.3: Missing Data

1.3.1 Quarterbacks (Old Data QBdata dataset)

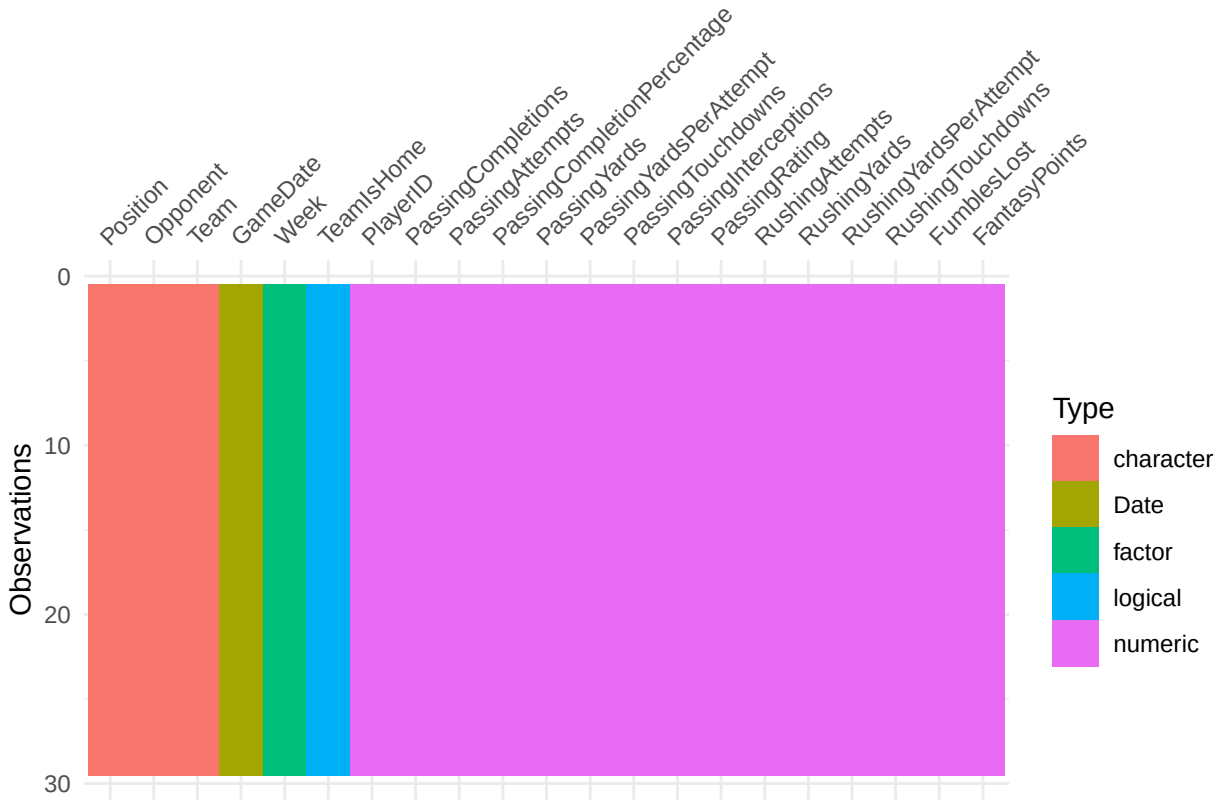
```
vis_dat(QBCrossSectional[1:30,])
```




```
vis_dat(QBCrossSectional[31:60, ])
```

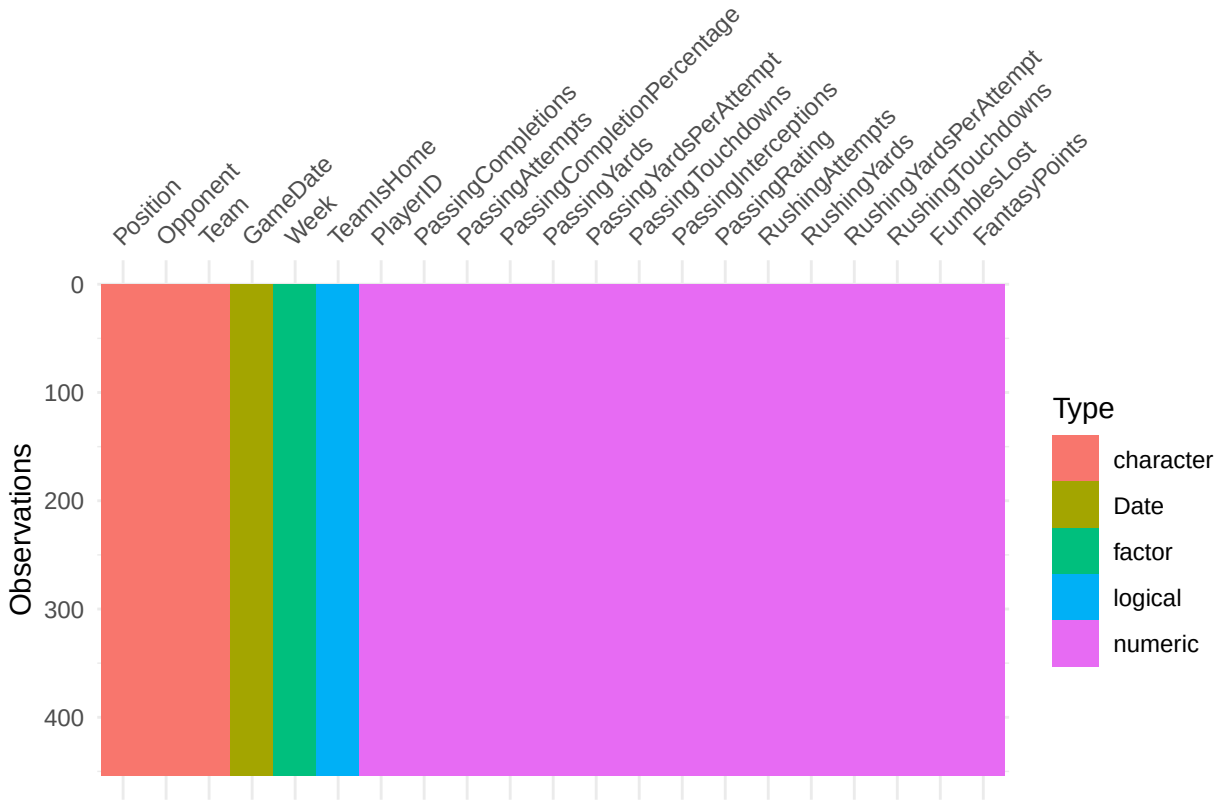


```
vis_dat(QBCrossSectional[61:89, ])
```



1.3.2 QBCrossSectional dataset (New dataset)

```
vis_dat(QBCrossSectional)
```




```
print(QBCrossSectional)
```

```
## # A tibble: 453 x 21
##    PlayerID Week  Position Opponent TeamIsHome GameDate   PassingCompleti~
##       <dbl> <fct> <chr>    <chr>    <lgl>      <date>                <dbl>
##  1     6739 13    QB       NYJ      FALSE      2017-12-03               19
##  2     4314 3     QB       HOU      TRUE       2017-09-24               25
##  3    13320 10    QB       MIA      TRUE       2017-11-13               21
##  4    18857 5     QB       KC       TRUE       2017-10-08               16
##  5    14536 8     QB       HOU      TRUE       2017-10-29               26
##  6    18857 4     QB       TEN      TRUE       2017-10-01               25
##  7    14536 3     QB       TEN      FALSE      2017-09-24               29
##  8    13320 4     QB       NE       FALSE      2017-10-01               22
##  9    18857 8     QB       SEA      FALSE      2017-10-29               19
## 10    13320 15    QB       GB       TRUE       2017-12-17               20
## # ... with 443 more rows, and 14 more variables: PassingAttempts <dbl>,
## #   PassingCompletionPercentage <dbl>, PassingYards <dbl>,
## #   PassingYardsPerAttempt <dbl>, PassingTouchdowns <dbl>,
## #   PassingInterceptions <dbl>, PassingRating <dbl>,
## #   RushingAttempts <dbl>, RushingYards <dbl>,
## #   RushingYardsPerAttempt <dbl>, RushingTouchdowns <dbl>,
## #   FumblesLost <dbl>, FantasyPoints <dbl>, Team <chr>
```

1.3.3 QBPanels dataset (New dataset)

```
print(QBPanels)
```

```
## $Opponent
## # A tibble: 56 x 18
```

```
##    PlayerID `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`   `10`
##       <dbl> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
##  1      611 <NA>  CLE   <NA>  PIT   OAK   <NA>  MIN   MIA   TEN   <NA>
##  2      732 CHI   GB    DET   BUF   <NA>  MIA   NE    NYJ   CAR   DAL
##  3     2428 DET   IND   DAL   SF    PHI   TB    <NA>  <NA>  <NA>  <NA>
##  4     2593 SEA   ATL   CIN   CHI   DAL   <NA>  <NA>  <NA>  <NA>  <NA>
##  5     3807 CLE   MIN   CHI   BAL   <NA>  KC    CIN   DET   <NA>  IND
##  6     4314 KC    NO    HOU   CAR   TB    NYJ   ATL   LAC   <NA>  DEN
##  7     4737 <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  SF    SEA
##  8     4932 <NA>  DET   PHI   TB    LAC   DEN   SEA   <NA>  LAR   SF
##  9     5282 BUF   OAK   MIA   <NA>  CLE   NE    MIA   ATL   BUF   TB
## 10     5834 <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  NYJ   <NA>  <NA>  <NA>
## # ... with 46 more rows, and 7 more variables: `11` <chr>, `12` <chr>,
## #   `13` <chr>, `14` <chr>, `15` <chr>, `16` <chr>, `17` <chr>
##
## $TeamIsHome
## # A tibble: 56 x 18
##    PlayerID `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`   `10`
##       <dbl> <lgl> <lgl> <lgl> <lgl> <lgl> <lgl> <lgl> <lgl> <lgl> <lgl>
##  1      611 NA    TRUE  NA    TRUE  FALSE NA    FALSE TRUE  FALSE NA
##  2      732 FALSE TRUE  FALSE TRUE  NA    TRUE  FALSE FALSE FALSE TRUE
##  3     2428 FALSE FALSE TRUE  TRUE  FALSE TRUE  NA    NA    NA    NA
##  4     2593 TRUE  FALSE TRUE  TRUE  FALSE NA    NA    NA    NA    NA
##  5     3807 FALSE TRUE  FALSE FALSE NA    FALSE TRUE  FALSE NA    FALSE
##  6     4314 TRUE  FALSE TRUE  TRUE  FALSE FALSE TRUE  TRUE  NA    FALSE
##  7     4737 NA    NA    NA    NA    NA    NA    NA    NA    FALSE TRUE
##  8     4932 NA    TRUE  FALSE FALSE TRUE  FALSE TRUE  NA    TRUE  FALSE
##  9     5282 FALSE FALSE TRUE  NA    FALSE TRUE  FALSE TRUE  TRUE  FALSE
## 10     5834 NA    NA    NA    NA    NA    NA    TRUE  NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <lgl>, `12` <lgl>,
## #   `13` <lgl>, `14` <lgl>, `15` <lgl>, `16` <lgl>, `17` <lgl>
##
## $PassingCompletions
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA    25    NA    31    19    NA    27    10    34    NA
##  2      732    21    19    24    24    NA    24    23    18    24    22
##  3     2428    27    19    29    33    28    18    NA    NA    NA    NA
##  4     2593    28    33    28    18    19    NA    NA    NA    NA    NA
##  5     3807    24    23    22    18    NA    17    14    17    NA    19
##  6     4314    16    30    25    32    30    20    21    32    NA    25
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA    15    24
##  8     4932    NA    22    35    30    21    11    19    NA    20    28
##  9     5282    26    16    18    NA    23    31    17    26    14    23
## 10     5834    NA    NA    NA    NA    NA    NA    13    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $PassingAttempts
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA    34    NA    49    26    NA    39    15    52    NA
```

```
##  2      732    30    28    35    42    NA    35    33    29    38    29
##  3     2428    48    36    48    51    44    22    NA    NA    NA    NA
##  4     2593    42    50    42    26    29    NA    NA    NA    NA    NA
##  5     3807    36    35    39    30    NA    25    24    31    NA    31
##  6     4314    36    39    35    45    40    38    29    47    NA    34
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA    30    47
##  8     4932    NA    32    47    49    36    19    39    NA    36    37
##  9     5282    39    24    23    NA    30    47    27    33    20    39
## 10     5834    NA    NA    NA    NA    NA    NA    21    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $PassingCompletionPercentage
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611  NA    73.5  NA    63.3  73.1  NA    69.2  66.7  65.4  NA
##  2      732  70    67.9  68.6  57.1  NA    68.6  69.7  62.1  63.2  75.9
##  3     2428  56.2  52.8  60.4  64.7  63.6  81.8  NA    NA    NA    NA
##  4     2593  66.7  66    66.7  69.2  65.5  NA    NA    NA    NA    NA
##  5     3807  66.7  65.7  56.4  60    NA    68    58.3  54.8  NA    61.3
##  6     4314  44.4  76.9  71.4  71.1  75    52.6  72.4  68.1  NA    73.5
##  7     4737  NA    NA    NA    NA    NA    NA    NA    NA    50    51.1
##  8     4932  NA    68.8  74.5  61.2  58.3  57.9  48.7  NA    55.6  75.7
##  9     5282  66.7  66.7  78.3  NA    76.7  66    63    78.8  70    59
## 10     5834  NA    NA    NA    NA    NA    NA    61.9  NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $PassingYards
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA   217    NA   235   222    NA   186   101   261    NA
##  2      732   321   252   294   242    NA   248   233   254   313   215
##  3     2428   268   332   325   357   291   283    NA    NA    NA    NA
##  4     2593   311   343   313   179   221    NA    NA    NA    NA    NA
##  5     3807   263   243   235   216    NA   252   224   317    NA   236
##  6     4314   267   447   378   307   303   257   249   333    NA   266
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA   201   273
##  8     4932    NA   239   366   288   225   128   134    NA   220   273
##  9     5282   187   166   249    NA   194   354   209   257   140   262
## 10     5834    NA    NA    NA    NA    NA    NA   188    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $PassingYardsPerAttempt
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611  NA     6.4  NA     4.8   8.5  NA     4.8   6.7   5    NA
##  2      732  10.7   9     8.4   5.8  NA     7.1   7.1   8.8   8.2   7.4
##  3     2428   5.6   9.2   6.8   7     6.6  12.9  NA    NA    NA    NA
##  4     2593   7.4   6.9   7.5   6.9   7.6  NA    NA    NA    NA    NA
```

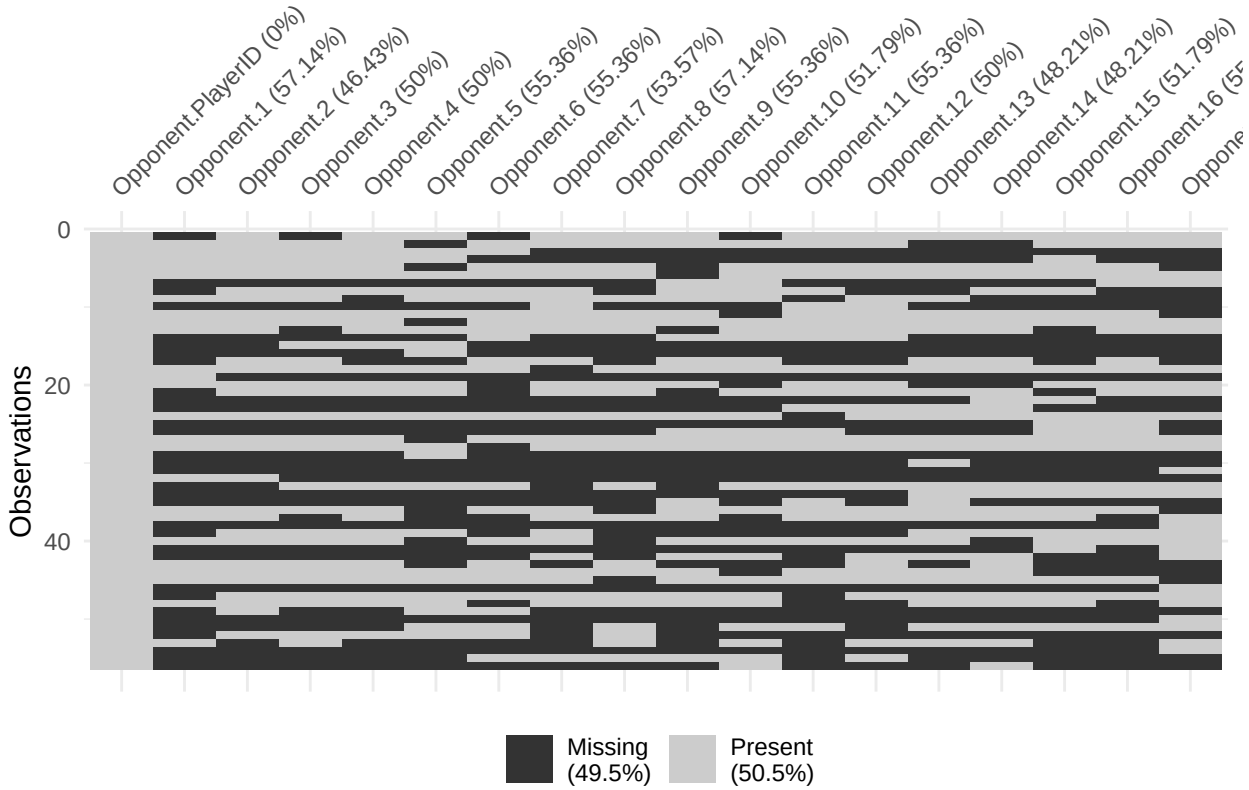
```
##  5     3807   7.3   6.9   6     7.2  NA    10.1   9.3  10.2  NA     7.6
##  6     4314   7.4  11.5  10.8   6.8   7.6   6.8   8.6   7.1  NA     7.8
##  7     4737  NA    NA    NA    NA    NA    NA    NA    NA     6.7   5.8
##  8     4932  NA     7.5   7.8   5.9   6.2   6.7   3.4  NA     6.1   7.4
##  9     5282   4.8   6.9  10.8  NA     6.5   7.5   7.7   7.8   7     6.7
## 10     5834  NA    NA    NA    NA    NA    NA     9    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $PassingTouchdowns
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA     2    NA     1     0    NA     1     1     2    NA
##  2      732     1     1     2     1    NA     1     1     2     2     2
##  3     2428     1     1     2     1     1     3    NA    NA    NA    NA
##  4     2593     1     2     3     4     3    NA    NA    NA    NA    NA
##  5     3807     2     2     1     1    NA     1     2     1    NA     2
##  6     4314     0     3     5     2     1     2     2     1    NA     3
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA     2     1
##  8     4932    NA     1     3     2     2     1     1    NA     2     2
##  9     5282     0     2     1    NA     2     2     3     2     1     1
## 10     5834    NA    NA    NA    NA    NA    NA     2    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $PassingInterceptions
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA     1    NA     2     0    NA     0     0     2    NA
##  2      732     0     0     3     2    NA     1     0     0     1     1
##  3     2428     3     1     0     1     0     1    NA    NA    NA    NA
##  4     2593     1     1     1     0     0    NA    NA    NA    NA    NA
##  5     3807     1     0     0     1    NA     1     0     1    NA     1
##  6     4314     0     0     0     0     1     1     0     0    NA     0
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA     1     0
##  8     4932    NA     1     2     0     1     0     0    NA     1     0
##  9     5282     2     0     0    NA     1     2     1     0     0     1
## 10     5834    NA    NA    NA    NA    NA    NA     1    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $PassingRating
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611  NA    97.3  NA    64.6  98.6  NA    88.2 108.   74.3  NA
##  2      732 116.  108.   77.6  61.8  NA    86.4  99.7 113.   95.6 105.
##  3     2428  53.1  82.2  94.5  83.5  90.2 139.   NA    NA    NA    NA
##  4     2593  86.5  90.7 103.  128.  123.   NA    NA    NA    NA    NA
##  5     3807  95.0 105.   82.8  79.3  NA    97.4 117.   87.7  NA    92.9
##  6     4314  70.0 140.  146.  105.   94.1  80.7 121.   95.4  NA   125.
##  7     4737  NA    NA    NA    NA    NA    NA    NA    NA    80    75.9
```

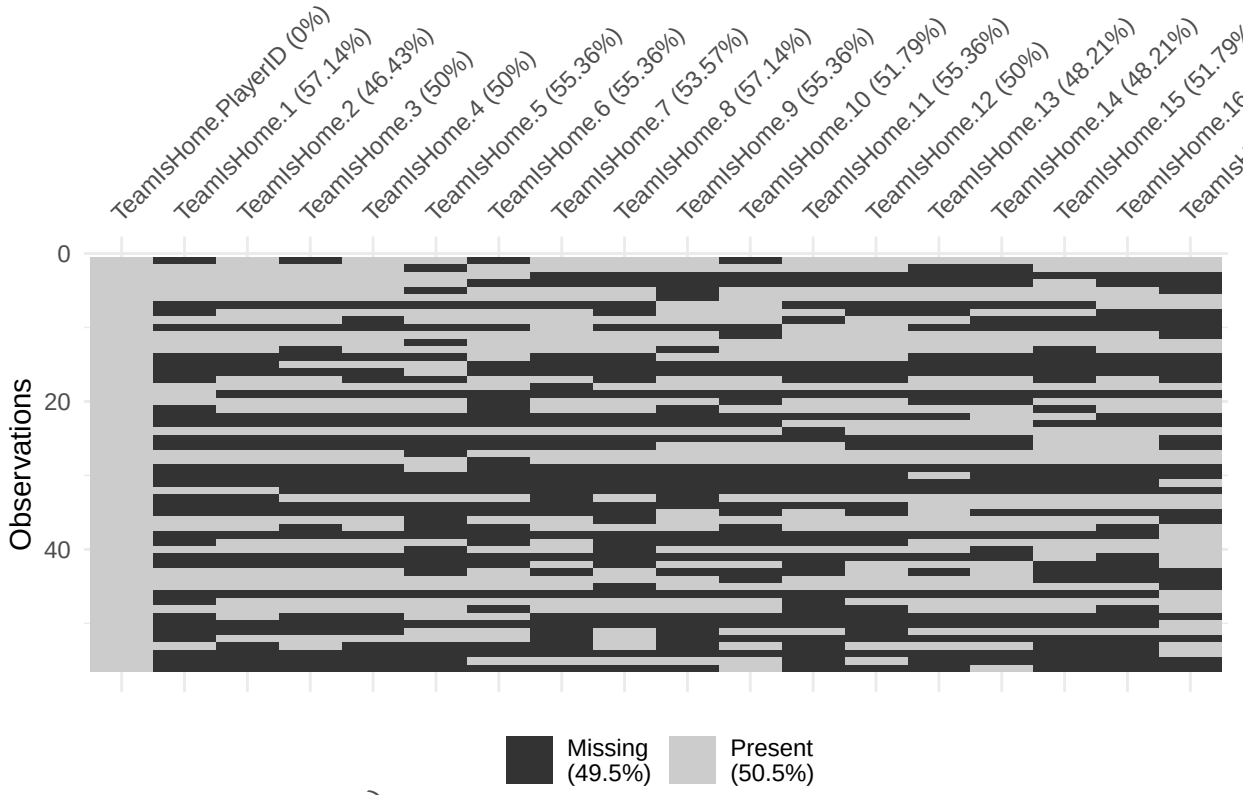
```
##  8     4932  NA    87.9 100.   91.2  83.7  95.9  65.5  NA    80.8 114.
##  9     5282  56.2 114.  126.   NA   101.   84.9 108.  119.  106.   77.1
## 10     5834  NA    NA    NA    NA    NA    NA   103.   NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $RushingAttempts
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA     1    NA     0     3    NA     1     1     1    NA
##  2      732     3     1     1     1    NA     0     3     6     1     0
##  3     2428     1     3     3     2     0     5    NA    NA    NA    NA
##  4     2593     7     2     4     1     4    NA    NA    NA    NA    NA
##  5     3807     3     2     1     1    NA     2     3     3    NA     2
##  6     4314     2     2     1     1     2     1     5     1    NA     1
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA     4     1
##  8     4932    NA     0     0     3     0     1     0    NA     0     0
##  9     5282     2     4     4    NA     3     3     3     1     5     0
## 10     5834    NA    NA    NA    NA    NA    NA     0    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $RushingYards
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA    -1    NA     0    -4    NA     0     9     7    NA
##  2      732    11     8    -1     8    NA     0    37    17    -1     0
##  3     2428     2     6     7     1     0    -4    NA    NA    NA    NA
##  4     2593    21     8    23    -1    32    NA    NA    NA    NA    NA
##  5     3807    -8    -2     6    -1    NA    -2    -3    -2    NA     5
##  6     4314     0     9     6     2     5    -1     5     2    NA     0
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA     2     1
##  8     4932    NA     0     0    22     0     0     0    NA     0     0
##  9     5282     0    31     7    NA    -3    21     1     0    13     0
## 10     5834    NA    NA    NA    NA    NA    NA     0    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $RushingYardsPerAttempt
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611  NA    -1    NA     0    -1.3  NA     0     9     7    NA
##  2      732   3.7   8    -1     8    NA     0    12.3   2.8  -1     0
##  3     2428   2     2     2.3   0.5   0    -0.8  NA    NA    NA    NA
##  4     2593   3     4     5.8  -1     8    NA    NA    NA    NA    NA
##  5     3807  -2.7  -1     6    -1    NA    -1    -1    -0.7  NA     2.5
##  6     4314   0     4.5   6     2     2.5  -1     1     2    NA     0
##  7     4737  NA    NA    NA    NA    NA    NA    NA    NA     0.5   1
##  8     4932  NA     0     0     7.3   0     0     0    NA     0     0
##  9     5282   0     7.8   1.8  NA    -1     7     0.3   0     2.6   0
## 10     5834  NA    NA    NA    NA    NA    NA     0    NA    NA    NA
```

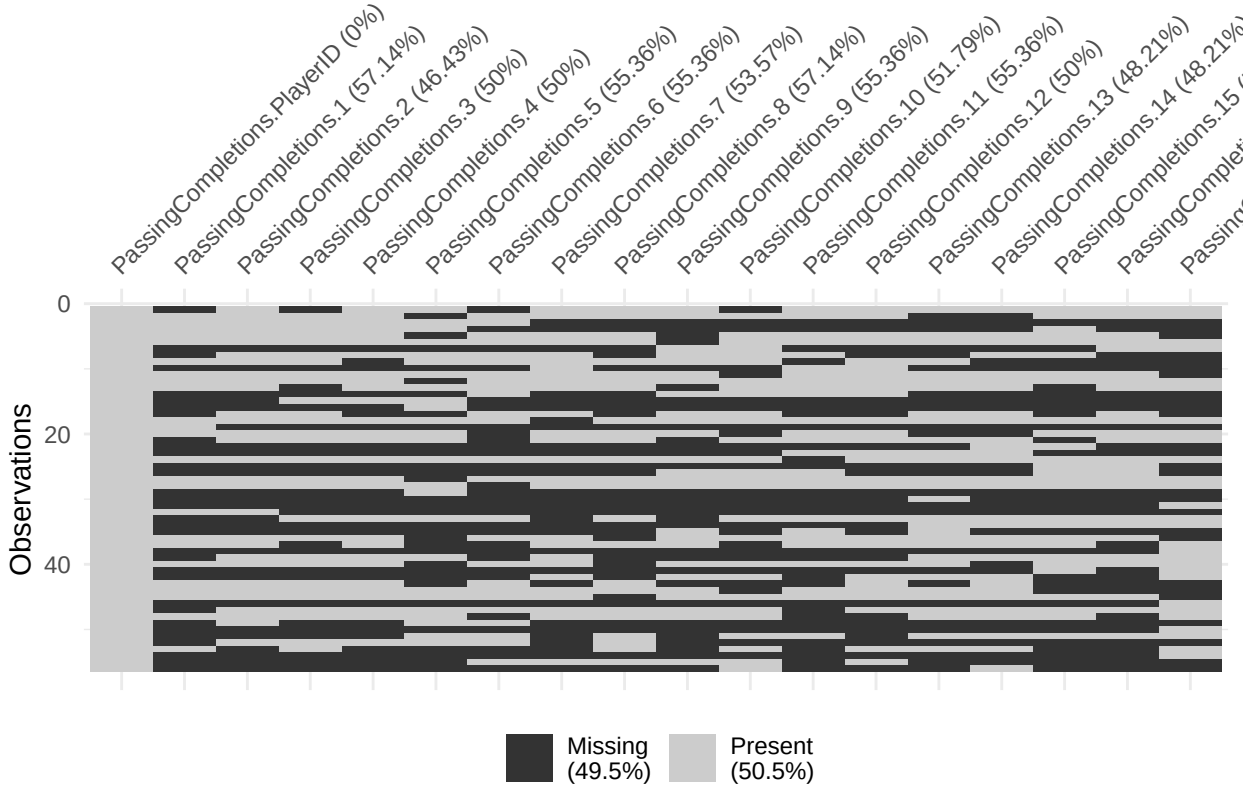
```
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $RushingTouchdowns
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA     0    NA     0     0    NA     0     0     0    NA
##  2      732     0     0     0     0    NA     0     0     0     0     0
##  3     2428     0     0     0     0     0     0    NA    NA    NA    NA
##  4     2593     0     0     0     0     0    NA    NA    NA    NA    NA
##  5     3807     0     0     0     0    NA     0     0     0    NA     0
##  6     4314     0     0     0     0     0     0     0     0    NA     0
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA     0     0
##  8     4932    NA     0     0     1     0     0     0    NA     0     0
##  9     5282     1     0     0    NA     0     0     1     0     1     0
## 10     5834    NA    NA    NA    NA    NA    NA     0    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $FumblesLost
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611    NA     0    NA     0     0    NA     0     0     0    NA
##  2      732     0     0     0     1    NA     0     0     2     0     0
##  3     2428     0     0     0     0     0     0    NA    NA    NA    NA
##  4     2593     0     1     0     0     0    NA    NA    NA    NA    NA
##  5     3807     0     0     1     0    NA     0     0     0    NA     0
##  6     4314     0     0     1     0     1     0     0     0    NA     0
##  7     4737    NA    NA    NA    NA    NA    NA    NA    NA     0     0
##  8     4932    NA     0     0     0     1     0     1    NA     1     1
##  9     5282     0     1     0    NA     0     0     0     0     0     0
## 10     5834    NA    NA    NA    NA    NA    NA     0    NA    NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
## $FantasyPoints
## # A tibble: 56 x 18
##    PlayerID   `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`  `10`
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1      611 NA     14.6  NA    9.4   8.48 NA    11.4   8.94  15.1  NA
##  2      732 17.9   14.9  13.7  8.48 NA    11.9  17.0  15.9   18.4  14.6
##  3     2428  8.92  15.9  21.7 16.4  15.6  20.9  NA    NA     NA    NA
##  4     2593 16.5   18.5  24.8 23.1  24.0  NA    NA    NA     NA    NA
##  5     3807 15.7   17.5  12   10.5  NA    11.9  16.7  14.5   NA    17.9
##  6     4314 10.7   30.8  35.7 20.5  12.6  16.2  18.5  17.5   NA    22.6
##  7     4737 NA     NA    NA   NA    NA    NA    NA    NA     14.2  15.0
##  8     4932 NA     11.6  22.6 27.7  13     9.12  7.36 NA     12.8  16.9
##  9     5282  9.48  15.7  14.7 NA    13.5  20.3  24.5  18.3   16.9  12.5
## 10     5834 NA     NA    NA   NA    NA    NA    13.5  NA     NA    NA
## # ... with 46 more rows, and 7 more variables: `11` <dbl>, `12` <dbl>,
## #   `13` <dbl>, `14` <dbl>, `15` <dbl>, `16` <dbl>, `17` <dbl>
##
```

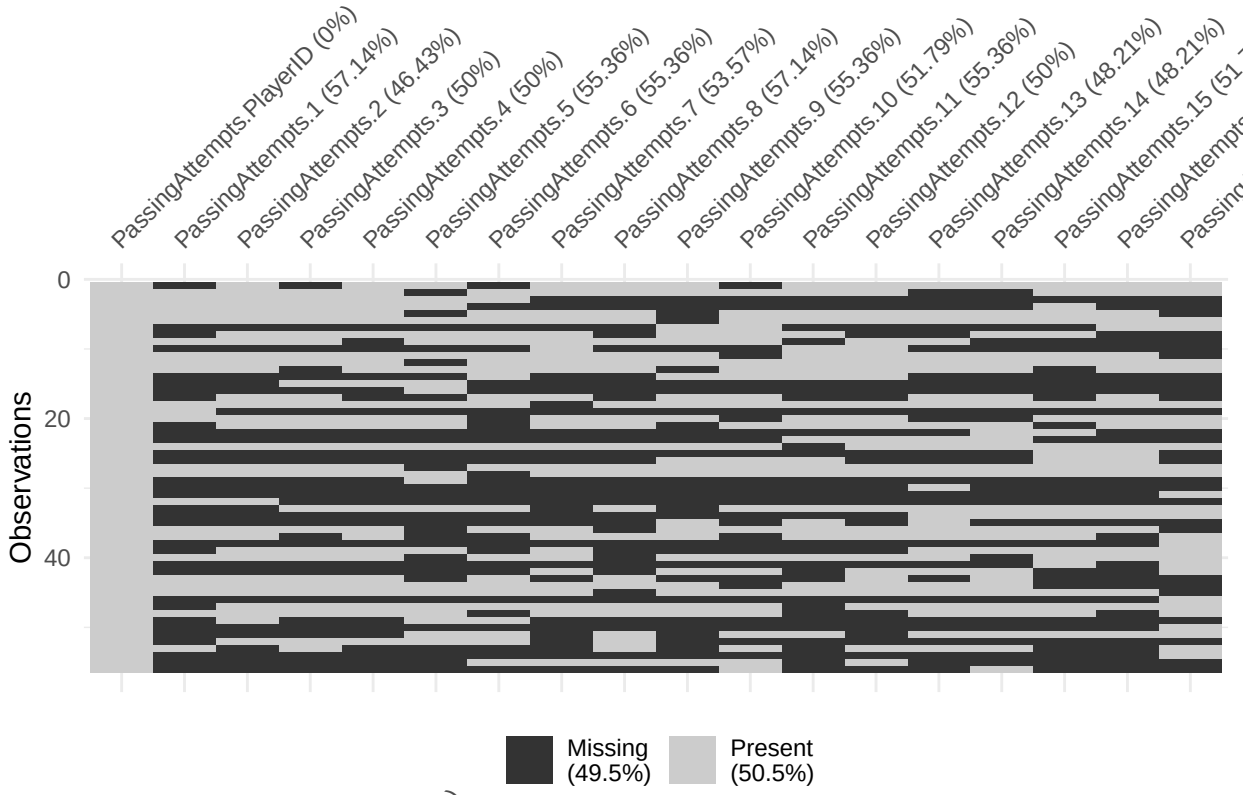
```
## $Team
## # A tibble: 56 x 18
##    PlayerID `1`   `2`   `3`   `4`   `5`   `6`   `7`   `8`   `9`   `10`
##       <dbl> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
##  1      611 <NA>  BAL   <NA>  BAL   BAL   <NA>  BAL   BAL   BAL   <NA>
##  2      732 ATL   ATL   ATL   ATL   <NA>  ATL   ATL   ATL   ATL   ATL
##  3     2428 ARI   ARI   ARI   ARI   ARI   ARI   <NA>  <NA>  <NA>  <NA>
##  4     2593 GB    GB    GB    GB    GB    <NA>  <NA>  <NA>  <NA>  <NA>
##  5     3807 PIT   PIT   PIT   PIT   <NA>  PIT   PIT   PIT   <NA>  PIT
##  6     4314 NE    NE    NE    NE    NE    NE    NE    NE    <NA>  NE
##  7     4737 <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  ARI   ARI
##  8     4932 <NA>  NYG   NYG   NYG   NYG   NYG   NYG   <NA>  NYG   NYG
##  9     5282 NYJ   NYJ   NYJ   <NA>  NYJ   NYJ   NYJ   NYJ   NYJ   NYJ
## 10     5834 <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  MIA   <NA>  <NA>  <NA>
## # ... with 46 more rows, and 7 more variables: `11` <chr>, `12` <chr>,
## #   `13` <chr>, `14` <chr>, `15` <chr>, `16` <chr>, `17` <chr>
```

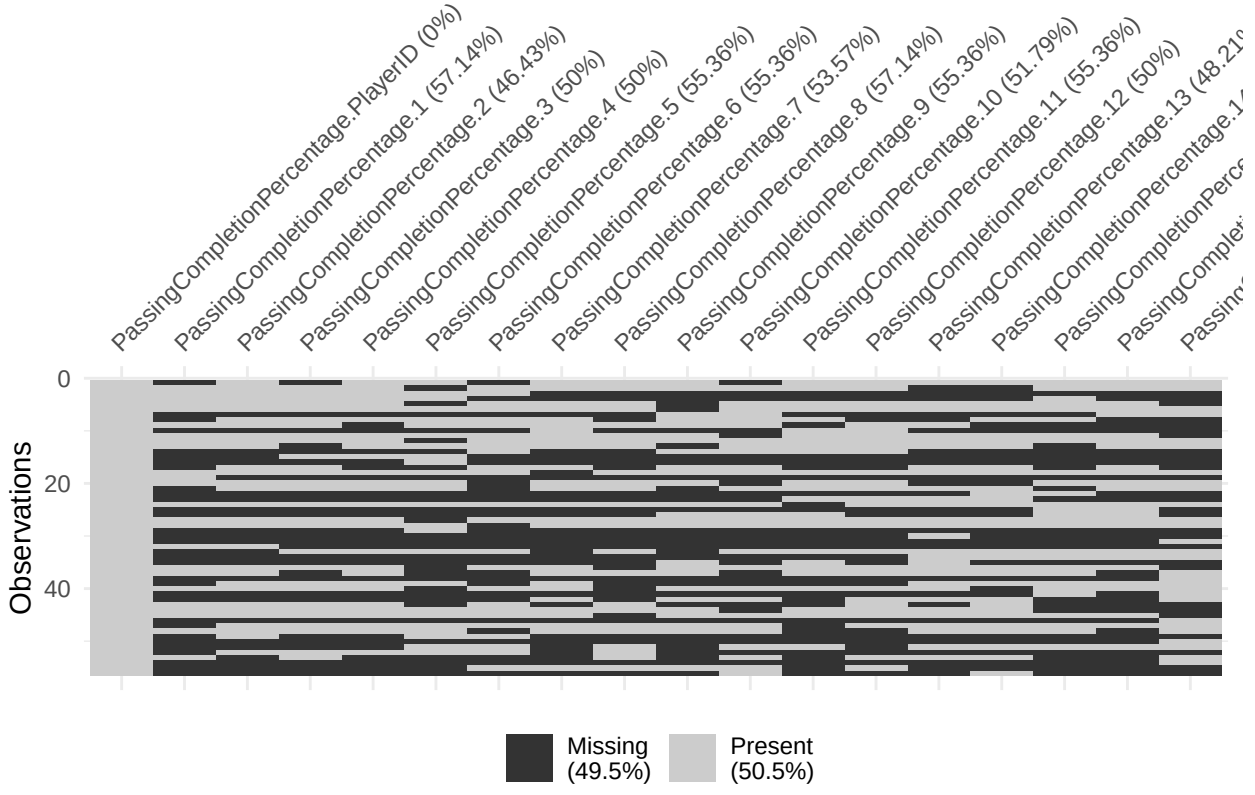
```
for (panel in 1:length(QBPanels)) {
   missing_plot <- vis_miss(as.data.frame(QBPanels[panel]))
   print(missing_plot)
}
```

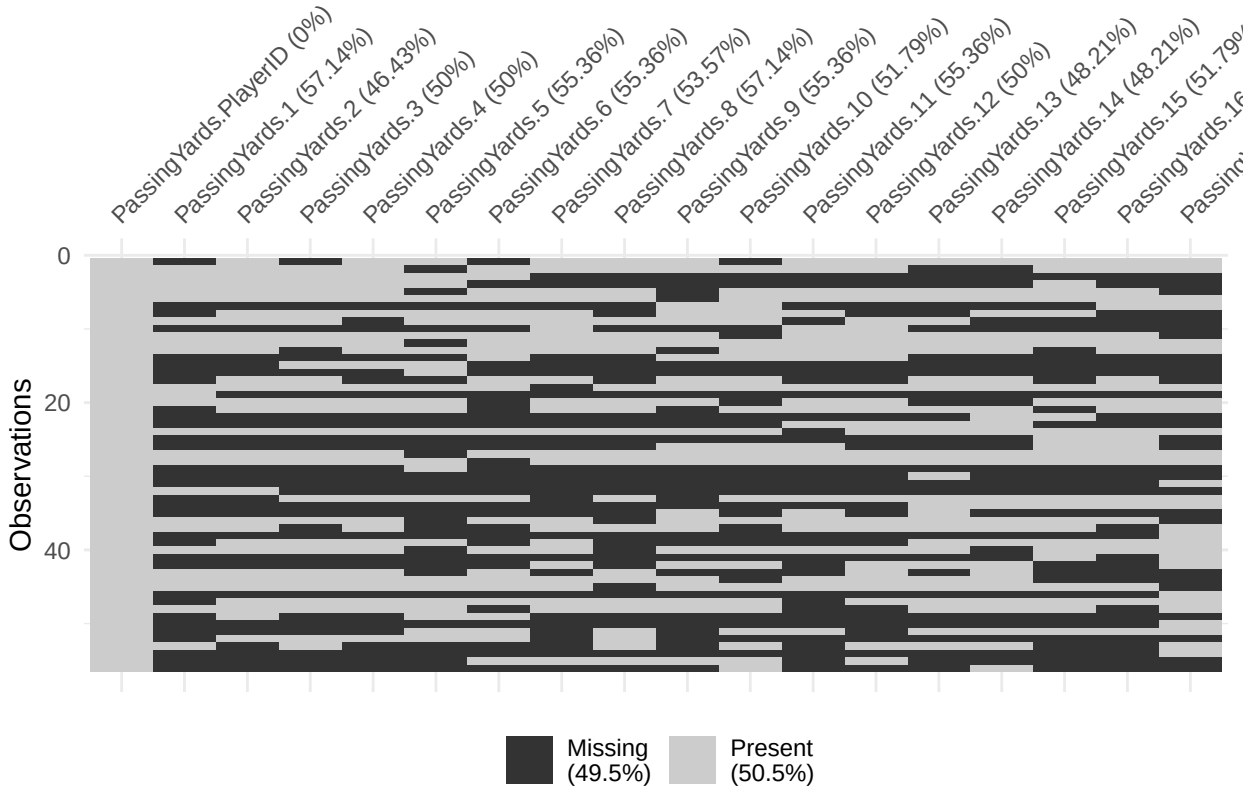


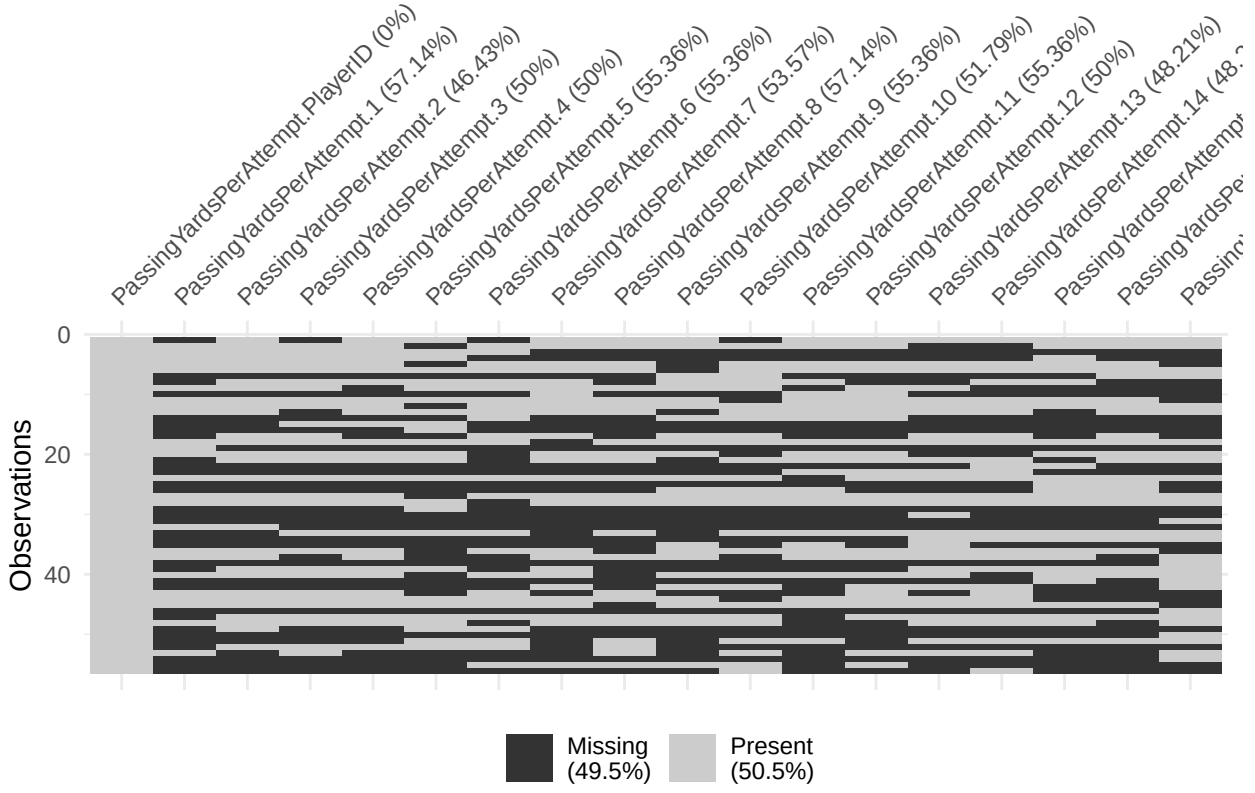

TeamIsHome.PlayerID (0%)
TeamIsHome.1 (57.14%)
TeamIsHome.2 (46.43%)
TeamIsHome.3 (50%)
TeamIsHome.4 (50%)
TeamIsHome.5 (55.36%)
TeamIsHome.6 (55.36%)
TeamIsHome.7 (53.57%)
TeamIsHome.8 (57.14%)
TeamIsHome.9 (55.36%)
TeamIsHome.10 (51.79%)
TeamIsHome.11 (55.36%)
TeamIsHome.12 (50%)
TeamIsHome.13 (48.21%)
TeamIsHome.14 (48.21%)
TeamIsHome.15 (51.79%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)

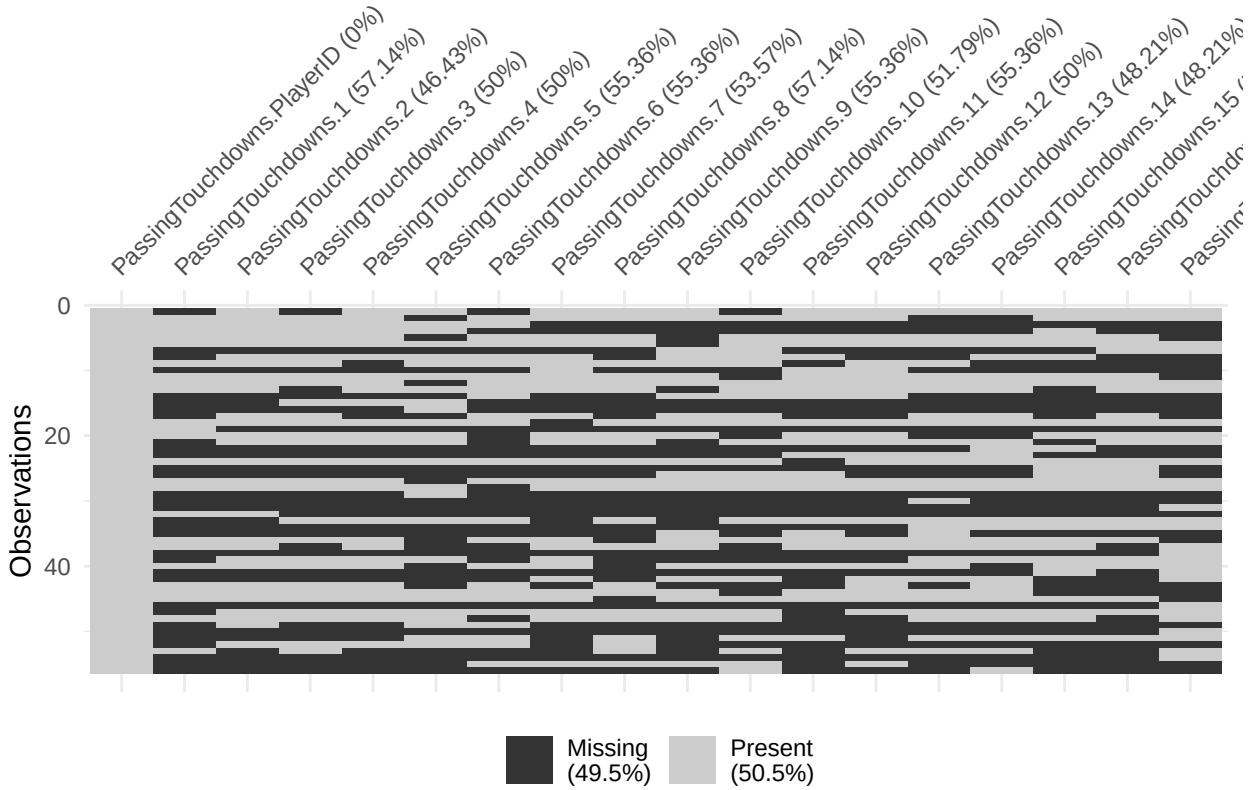

PassingCompletions.PlayerID (0%)
PassingCompletions.1 (57.14%)
PassingCompletions.2 (46.43%)
PassingCompletions.3 (50%)
PassingCompletions.4 (50%)
PassingCompletions.5 (55.36%)
PassingCompletions.6 (55.36%)
PassingCompletions.7 (53.57%)
PassingCompletions.8 (57.14%)
PassingCompletions.9 (55.36%)
PassingCompletions.10 (51.79%)
PassingCompletions.11 (55.36%)
PassingCompletions.12 (50%)
PassingCompletions.13 (48.21%)
PassingCompletions.14 (48.21%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)

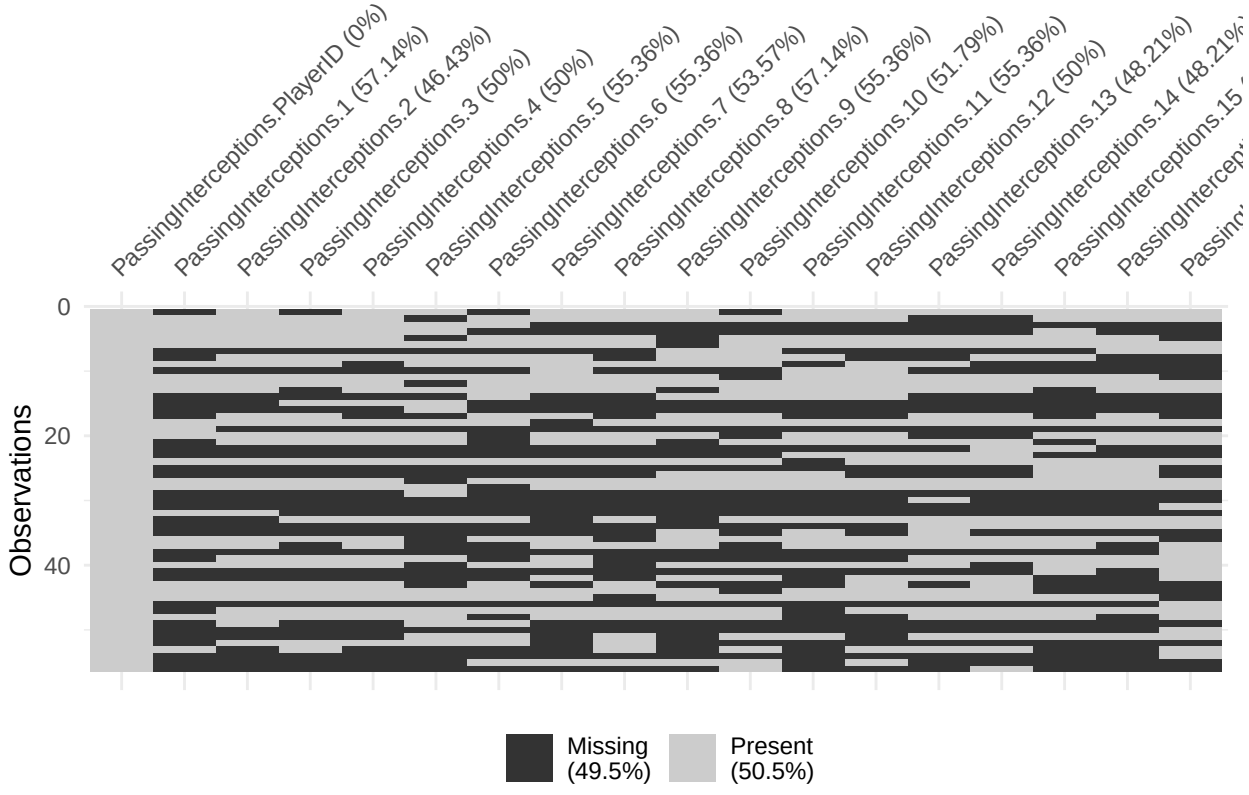

PassingAttempts.PlayerID (0%)
PassingAttempts.1 (57.14%)
PassingAttempts.2 (46.43%)
PassingAttempts.3 (50%)
PassingAttempts.4 (50%)
PassingAttempts.5 (55.36%)
PassingAttempts.6 (55.36%)
PassingAttempts.7 (53.57%)
PassingAttempts.8 (57.14%)
PassingAttempts.9 (55.36%)
PassingAttempts.10 (51.79%)
PassingAttempts.11 (55.36%)
PassingAttempts.12 (50%)
PassingAttempts.13 (48.21%)
PassingAttempts.14 (48.21%)
PassingAttempts.15 (51
0
20
40
Observations
Missing (49.5%)
Present (50.5%)

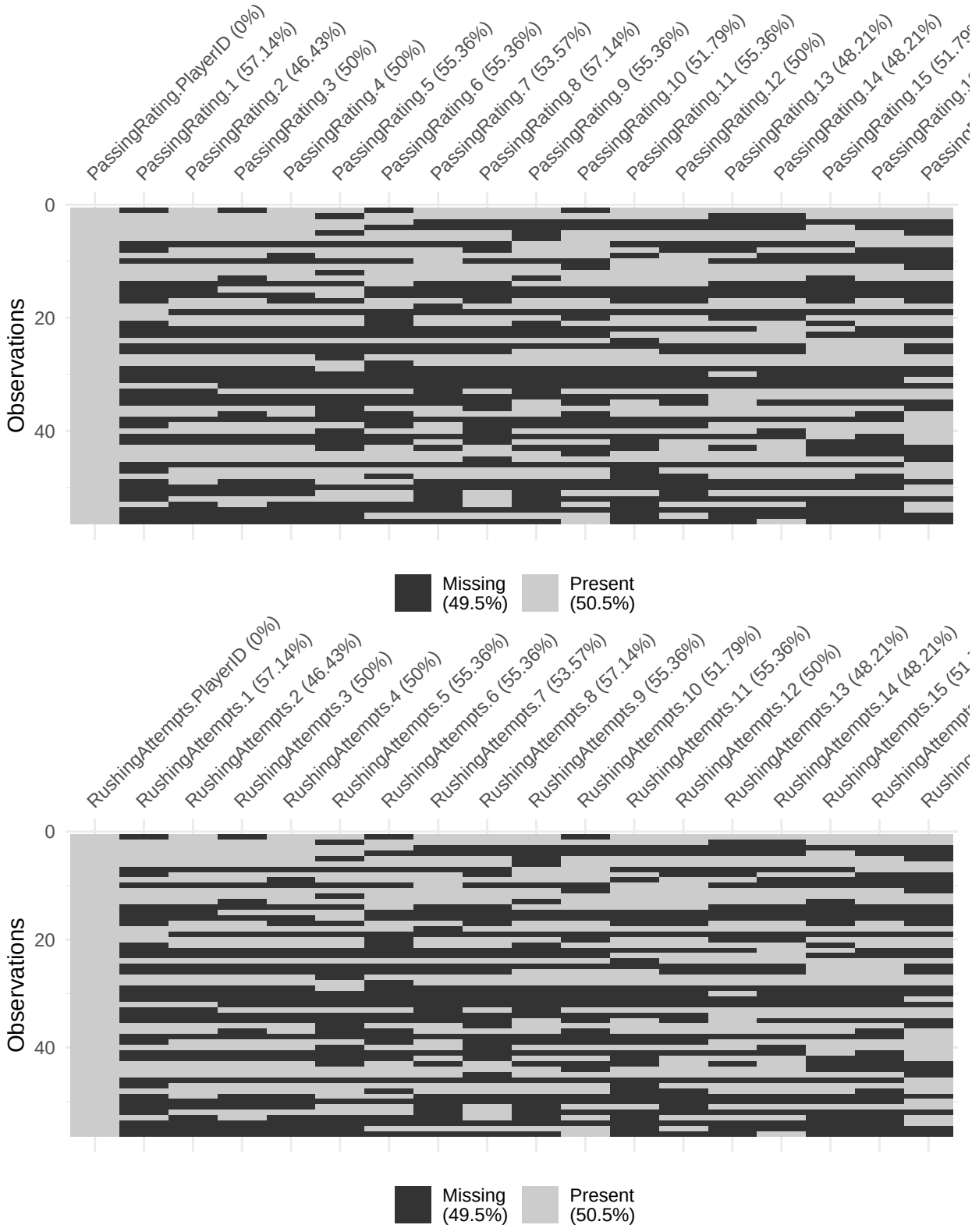

PassingCompletionPercentage.PlayerID (0%)
PassingCompletionPercentage.1 (57.14%)
PassingCompletionPercentage.2 (46.43%)
PassingCompletionPercentage.3 (50%)
PassingCompletionPercentage.4 (50%)
PassingCompletionPercentage.5 (55.36%)
PassingCompletionPercentage.6 (55.36%)
PassingCompletionPercentage.7 (53.57%)
PassingCompletionPercentage.8 (57.14%)
PassingCompletionPercentage.9 (55.36%)
PassingCompletionPercentage.10 (51.79%)
PassingCompletionPercentage.11 (55.36%)
PassingCompletionPercentage.12 (50%)
PassingCompletionPercentage.13 (48.21%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)

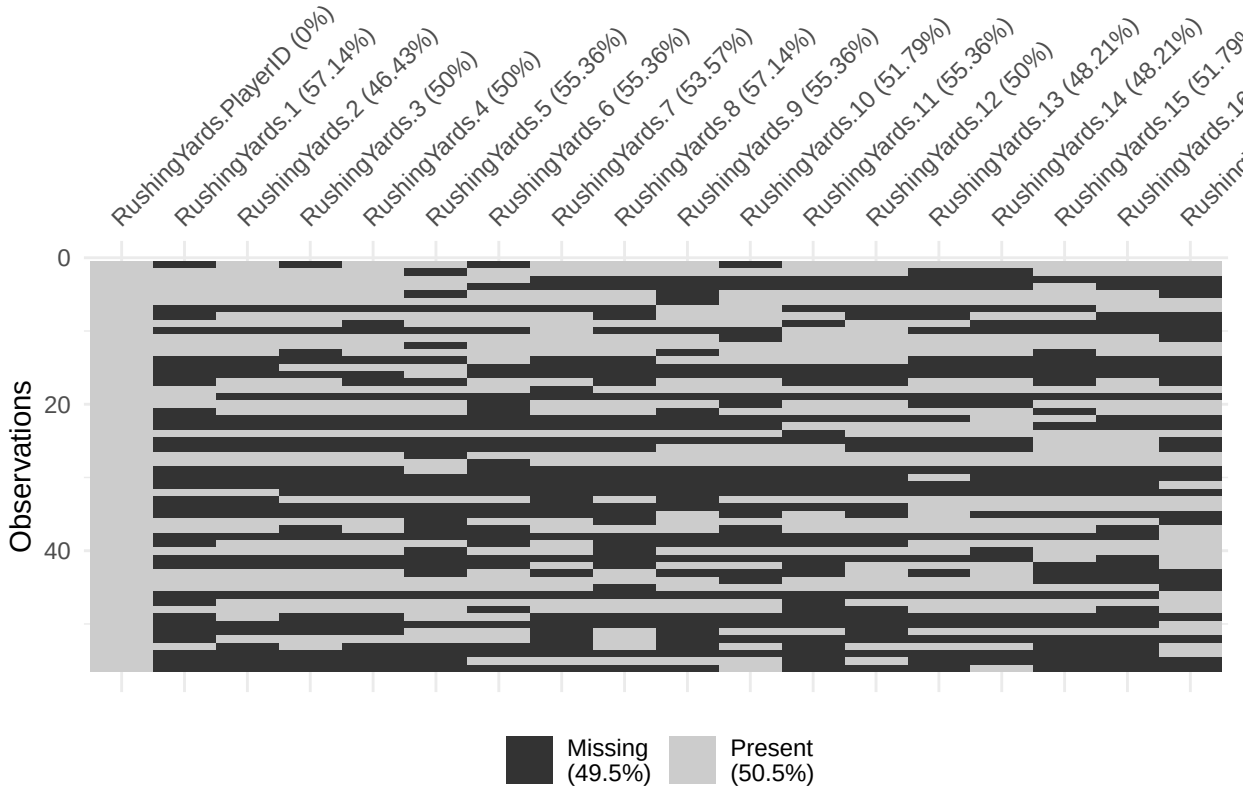

PassingYards.PlayerID (0%)
PassingYards.1 (57.14%)
PassingYards.2 (46.43%)
PassingYards.3 (50%)
PassingYards.4 (50%)
PassingYards.5 (55.36%)
PassingYards.6 (55.36%)
PassingYards.7 (53.57%)
PassingYards.8 (57.14%)
PassingYards.9 (55.36%)
PassingYards.10 (51.79%)
PassingYards.11 (55.36%)
PassingYards.12 (50%)
PassingYards.13 (48.21%)
PassingYards.14 (48.21%)
PassingYards.15 (51.79%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)

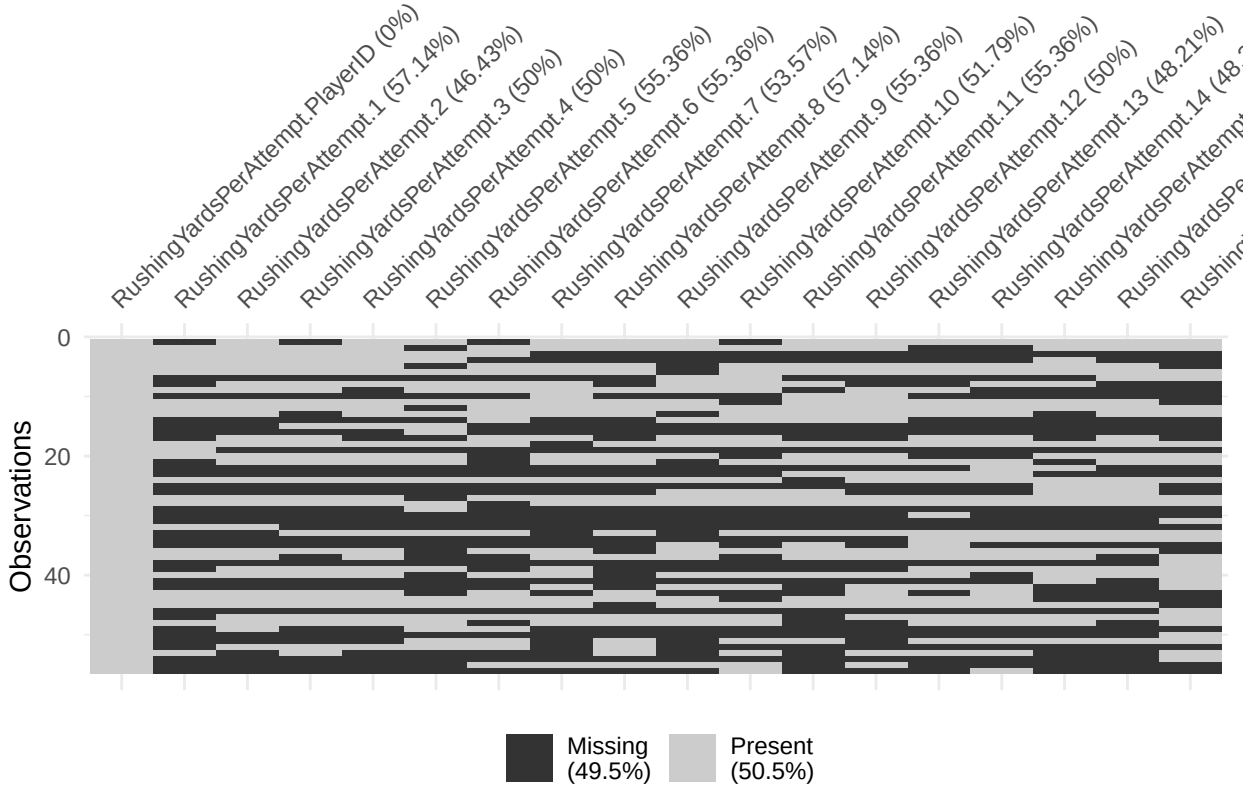

PassingYardsPerAttempt.PlayerID (0%)
PassingYardsPerAttempt.1 (57.14%)
PassingYardsPerAttempt.2 (46.43%)
PassingYardsPerAttempt.3 (50%)
PassingYardsPerAttempt.4 (50%)
PassingYardsPerAttempt.5 (55.36%)
PassingYardsPerAttempt.6 (55.36%)
PassingYardsPerAttempt.7 (53.57%)
PassingYardsPerAttempt.8 (57.14%)
PassingYardsPerAttempt.9 (55.36%)
PassingYardsPerAttempt.10 (51.79%)
PassingYardsPerAttempt.11 (55.36%)
PassingYardsPerAttempt.12 (50%)
PassingYardsPerAttempt.13 (48.21%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)

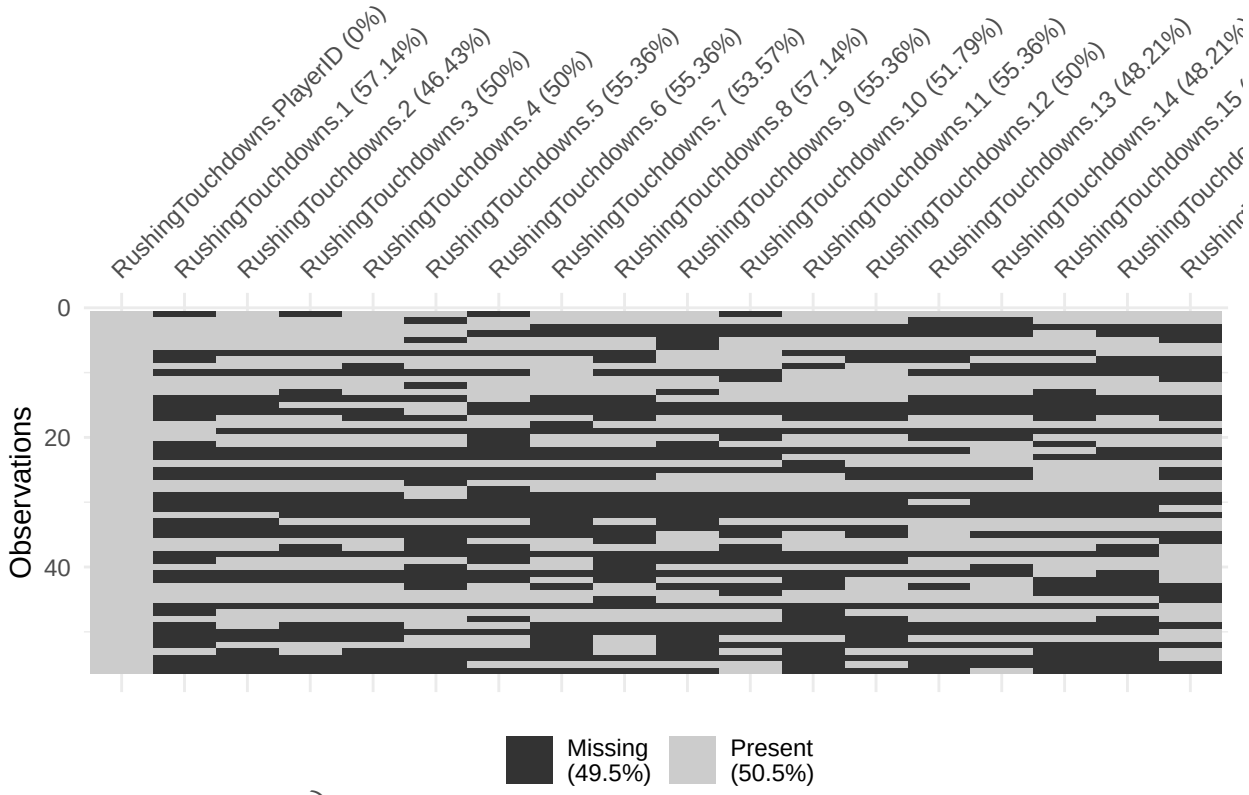

PassingTouchdowns.PlayerID (0%)
PassingTouchdowns.1 (57.14%)
PassingTouchdowns.2 (46.43%)
PassingTouchdowns.3 (50%)
PassingTouchdowns.4 (50%)
PassingTouchdowns.5 (55.36%)
PassingTouchdowns.6 (55.36%)
PassingTouchdowns.7 (53.57%)
PassingTouchdowns.8 (57.14%)
PassingTouchdowns.9 (55.36%)
PassingTouchdowns.10 (51.79%)
PassingTouchdowns.11 (55.36%)
PassingTouchdowns.12 (50%)
PassingTouchdowns.13 (48.21%)
PassingTouchdowns.14 (48.21%)
Observations
0
20
40
Missing (49.5%)
Present (50.5%)

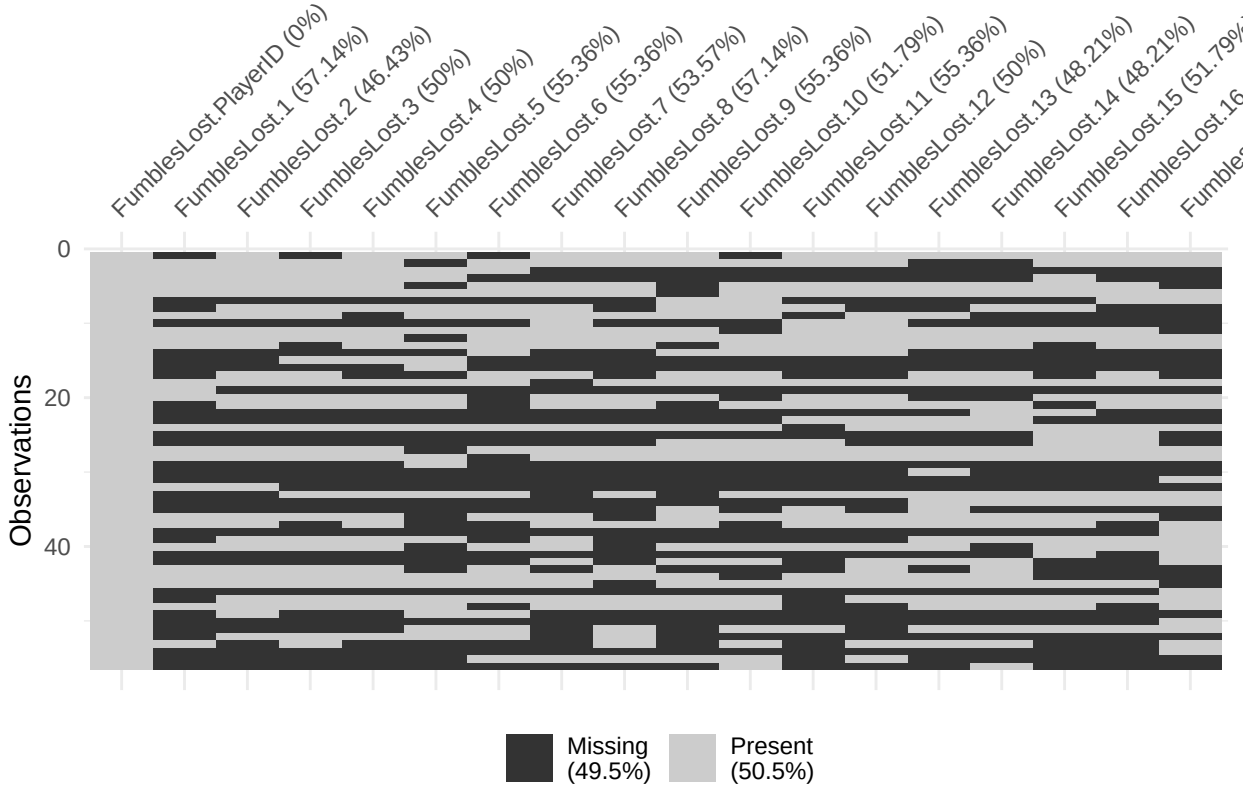

PassingInterceptions.PlayerID (0%)
PassingInterceptions.1 (57.14%)
PassingInterceptions.2 (46.43%)
PassingInterceptions.3 (50%)
PassingInterceptions.4 (50%)
PassingInterceptions.5 (55.36%)
PassingInterceptions.6 (55.36%)
PassingInterceptions.7 (53.57%)
PassingInterceptions.8 (57.14%)
PassingInterceptions.9 (55.36%)
PassingInterceptions.10 (51.79%)
PassingInterceptions.11 (55.36%)
PassingInterceptions.12 (50%)
PassingInterceptions.13 (48.21%)
PassingInterceptions.14 (48.21%)
Observations
0
20
40
Missing (49.5%)
Present (50.5%)

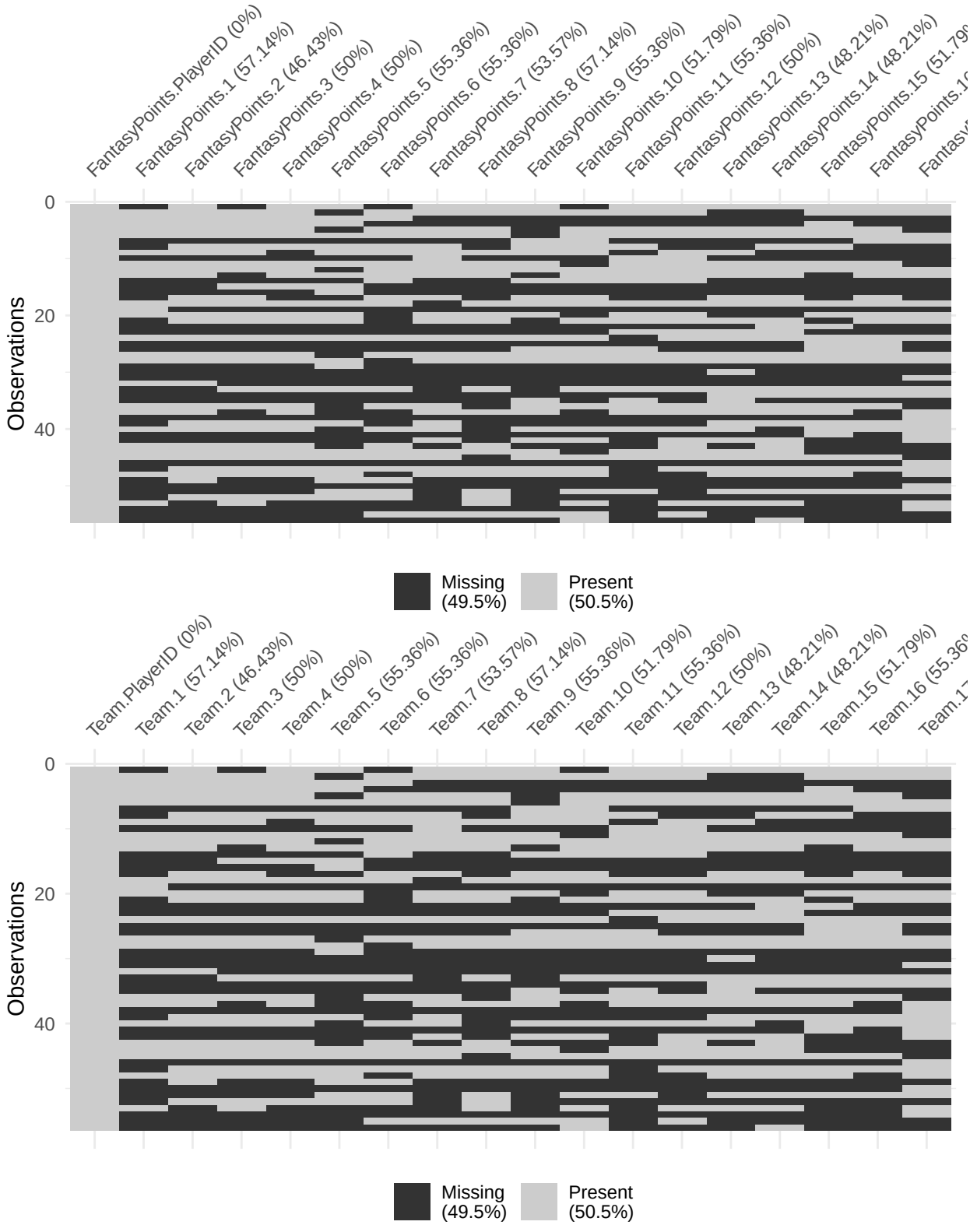

PassingRating.PlayerID (0%)
PassingRating.1 (57.14%)
PassingRating.2 (46.43%)
PassingRating.3 (50%)
PassingRating.4 (50%)
PassingRating.5 (55.36%)
PassingRating.6 (55.36%)
PassingRating.7 (53.57%)
PassingRating.8 (57.14%)
PassingRating.9 (55.36%)
PassingRating.10 (51.79%)
PassingRating.11 (55.36%)
PassingRating.12 (50%)
PassingRating.13 (48.21%)
PassingRating.14 (48.21%)
PassingRating.15 (51.79%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)
RushingAttempts.PlayerID (0%)
RushingAttempts.1 (57.14%)
RushingAttempts.2 (46.43%)
RushingAttempts.3 (50%)
RushingAttempts.4 (50%)
RushingAttempts.5 (55.36%)
RushingAttempts.6 (55.36%)
RushingAttempts.7 (53.57%)
RushingAttempts.8 (57.14%)
RushingAttempts.9 (55.36%)
RushingAttempts.10 (51.79%)
RushingAttempts.11 (55.36%)
RushingAttempts.12 (50%)
RushingAttempts.13 (48.21%)
RushingAttempts.14 (48.21%)
RushingAttempts.15 (51
0
20
40
Observations
Missing (49.5%)
Present (50.5%)


RushingYards.PlayerID (0%)
RushingYards.1 (57.14%)
RushingYards.2 (46.43%)
RushingYards.3 (50%)
RushingYards.4 (50%)
RushingYards.5 (55.36%)
RushingYards.6 (55.36%)
RushingYards.7 (53.57%)
RushingYards.8 (57.14%)
RushingYards.9 (55.36%)
RushingYards.10 (51.79%)
RushingYards.11 (55.36%)
RushingYards.12 (50%)
RushingYards.13 (48.21%)
RushingYards.14 (48.21%)
RushingYards.15 (51.79%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)


RushingYardsPerAttempt.PlayerID (0%)
RushingYardsPerAttempt.1 (57.14%)
RushingYardsPerAttempt.2 (46.43%)
RushingYardsPerAttempt.3 (50%)
RushingYardsPerAttempt.4 (50%)
RushingYardsPerAttempt.5 (55.36%)
RushingYardsPerAttempt.6 (55.36%)
RushingYardsPerAttempt.7 (53.57%)
RushingYardsPerAttempt.8 (57.14%)
RushingYardsPerAttempt.9 (55.36%)
RushingYardsPerAttempt.10 (51.79%)
RushingYardsPerAttempt.11 (55.36%)
RushingYardsPerAttempt.12 (50%)
RushingYardsPerAttempt.13 (48.21%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)


RushingTouchdowns.PlayerID (0%)
RushingTouchdowns.1 (57.14%)
RushingTouchdowns.2 (46.43%)
RushingTouchdowns.3 (50%)
RushingTouchdowns.4 (50%)
RushingTouchdowns.5 (55.36%)
RushingTouchdowns.6 (55.36%)
RushingTouchdowns.7 (53.57%)
RushingTouchdowns.8 (57.14%)
RushingTouchdowns.9 (55.36%)
RushingTouchdowns.10 (51.79%)
RushingTouchdowns.11 (55.36%)
RushingTouchdowns.12 (50%)
RushingTouchdowns.13 (48.21%)
RushingTouchdowns.14 (48.21%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)


FumblesLost.PlayerID (0%)
FumblesLost.1 (57.14%)
FumblesLost.2 (46.43%)
FumblesLost.3 (50%)
FumblesLost.4 (50%)
FumblesLost.5 (55.36%)
FumblesLost.6 (55.36%)
FumblesLost.7 (53.57%)
FumblesLost.8 (57.14%)
FumblesLost.9 (55.36%)
FumblesLost.10 (51.79%)
FumblesLost.11 (55.36%)
FumblesLost.12 (50%)
FumblesLost.13 (48.21%)
FumblesLost.14 (48.21%)
FumblesLost.15 (51.79%)
0
20
40
Observations
Missing (49.5%)
Present (50.5%)


FantasyPoints.PlayerID (0%)
FantasyPoints.1 (57.14%)
FantasyPoints.2 (46.43%)
FantasyPoints.3 (50%)
FantasyPoints.4 (50%)
FantasyPoints.5 (55.36%)
FantasyPoints.6 (55.36%)
FantasyPoints.7 (53.57%)
FantasyPoints.8 (57.14%)
FantasyPoints.9 (55.36%)
FantasyPoints.10 (51.79%)
FantasyPoints.11 (55.36%)
FantasyPoints.12 (50%)
FantasyPoints.13 (48.21%)
FantasyPoints.14 (48.21%)
FantasyPoints.15 (51.79%)
Observations
0
20
40
Missing (49.5%)
Present (50.5%)
Team.PlayerID (0%)
Team.1 (57.14%)
Team.2 (46.43%)
Team.3 (50%)
Team.4 (50%)
Team.5 (55.36%)
Team.6 (55.36%)
Team.7 (53.57%)
Team.8 (57.14%)
Team.9 (55.36%)
Team.10 (51.79%)
Team.11 (55.36%)
Team.12 (50%)
Team.13 (48.21%)
Team.14 (48.21%)
Team.15 (51.79%)
Observations
0
20
40
Missing (49.5%)
Present (50.5%)

1.4: Corrrelogram

1.4.1 Corrrelogram Style1 QBData (Old dataset)

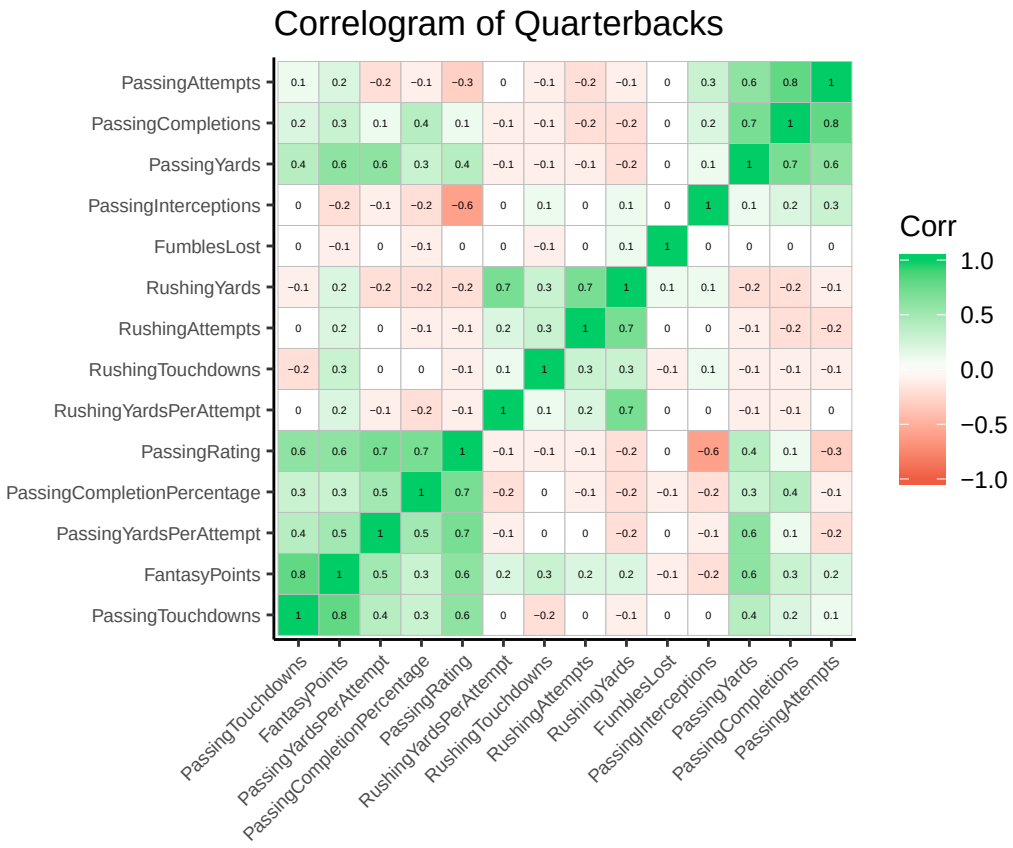
```
#QBdata_num <- QBCrossSectional[-c(1:3,5:16,29:36,39:52,55:56,74:89)]
#corr <- round(cor(QBdata_num), 1)

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

1.4.2 Corrrelogram Style2 QBData (Old dataset)

```
#corrplot(corr, method="circle",tl.cex = 0.55,tl.col = "#1C1C1C")
```

1.4.3 Corrrelogram of Crosssectional data (New dataset)

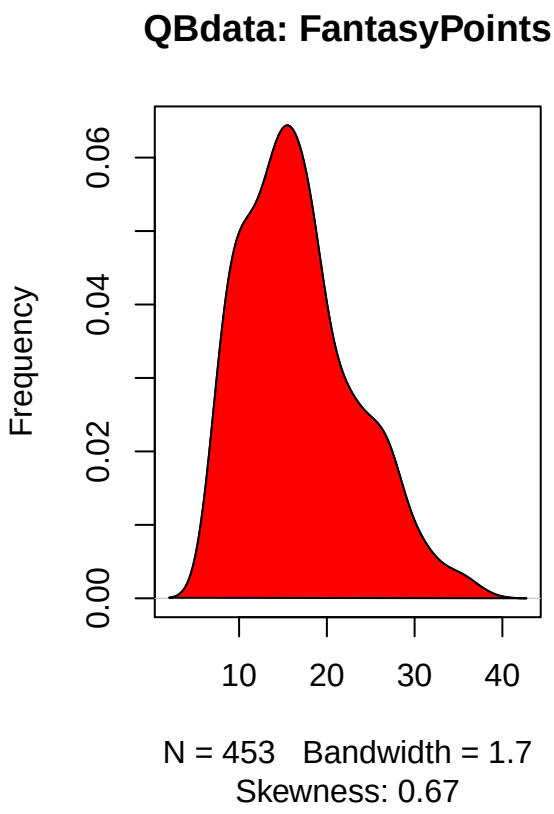
```
QBX_ds <- QBCrossSectional[-c(1:6,21)]
corr <- round(cor(QBX_ds), 1)
ggcorrplot(corr, hc.order = TRUE,
           type = "full",
           lab = TRUE,
           lab_size = 1.5,
           method="square",
           colors = c("tomato2", "white", "springgreen3"),
           title="Correlogram of Quarterbacks", tl.cex = 7,pch=2,pch.col =3,show.diag = T,
           ggtheme=theme_classic)
```



1.5: Distributions

1.5.1 Density plot for Fantasypoints is approxmiately Normal (Old QBData)

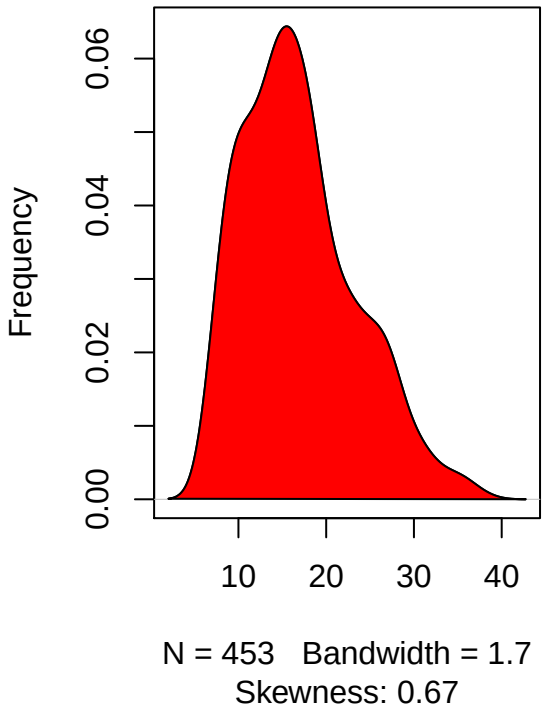
```
library(e1071)
par(mfrow=c(1, 2))  # divide graph area in 2 columns
target <- QBCrossSectional$FantasyPoints
plot(density(target), main="QBdata: FantasyPoints", ylab="Frequency", sub=paste("Skewness:", round(e107
polygon(density(target), col="red",asp=1.2 )
```



1.5.2 Density plot for Fantasypoints is approxmiately Normal (New QBCrossSectional)

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

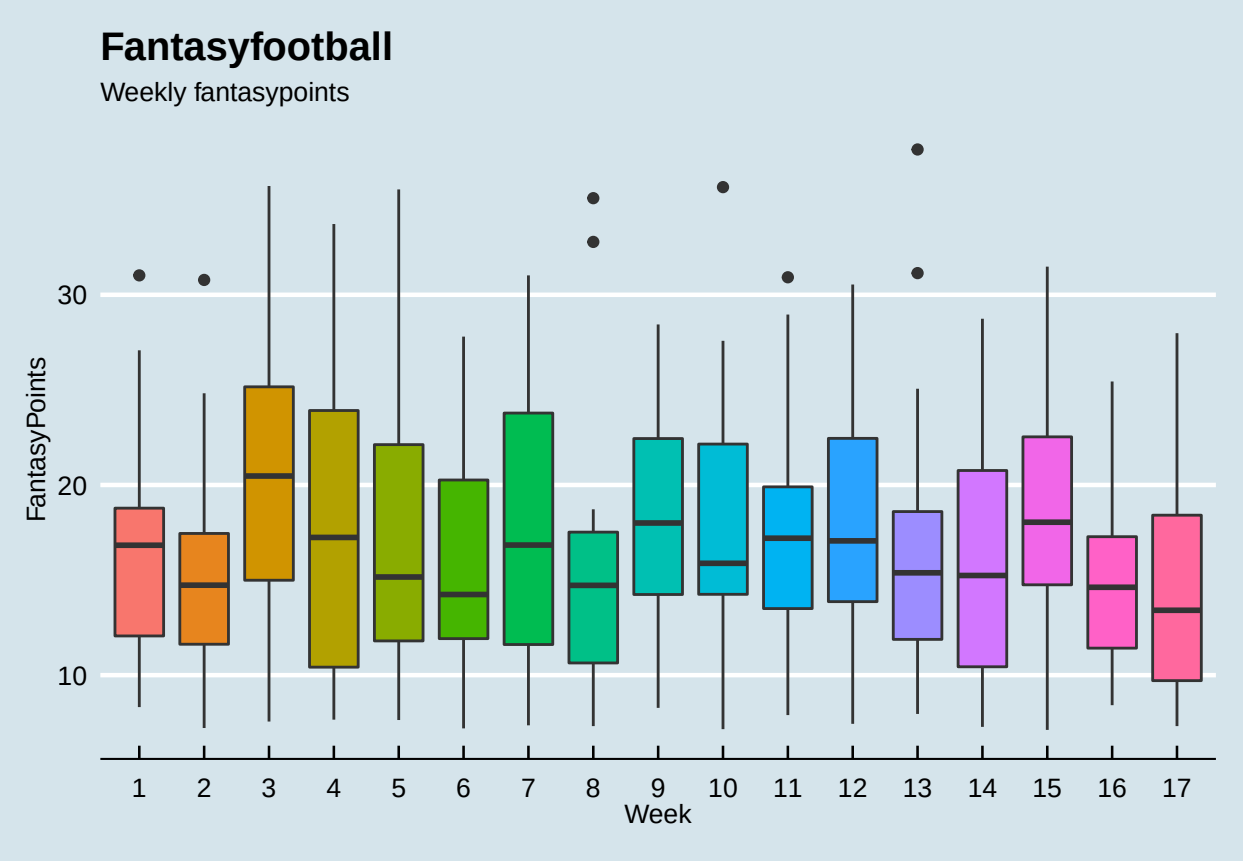
CrossSectional Dataset: FantasyPo



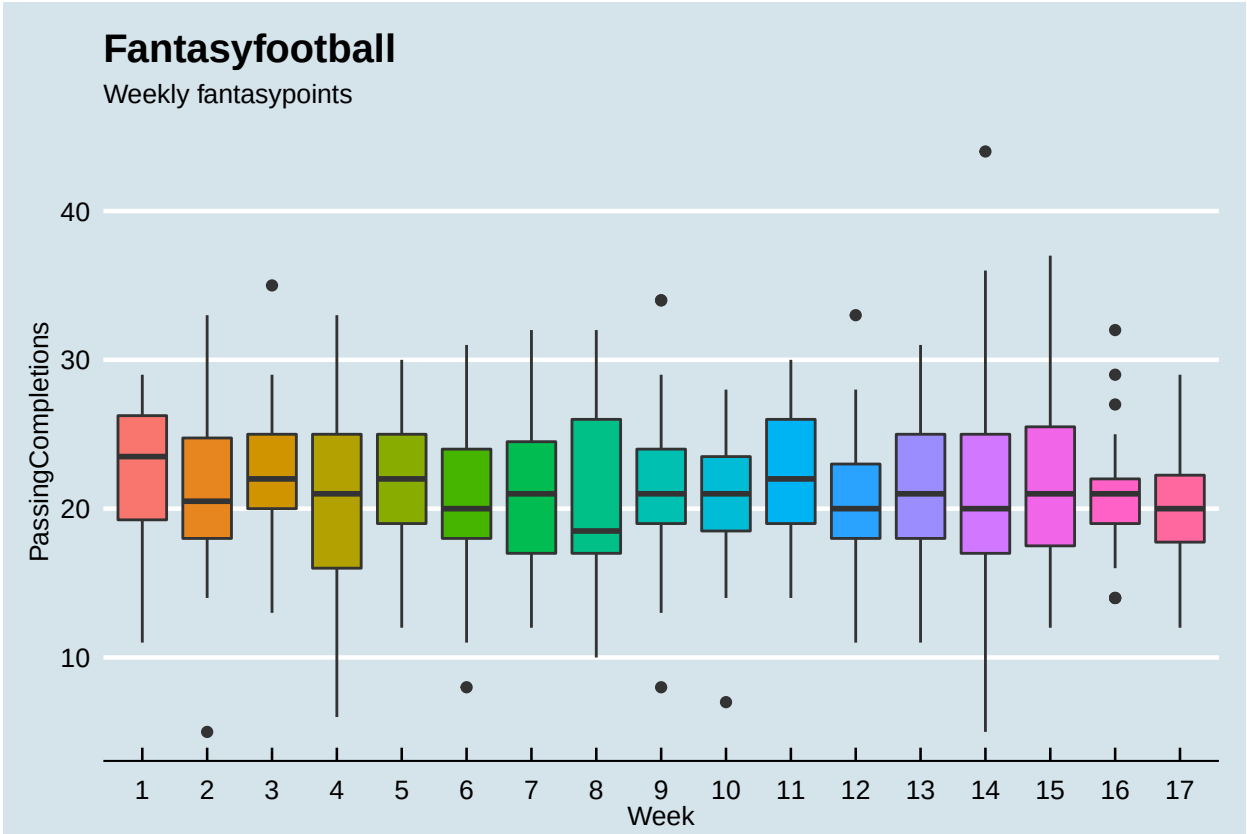
1.5.3 Boxplots - Target and Individual Predictor Bevavior for per Team

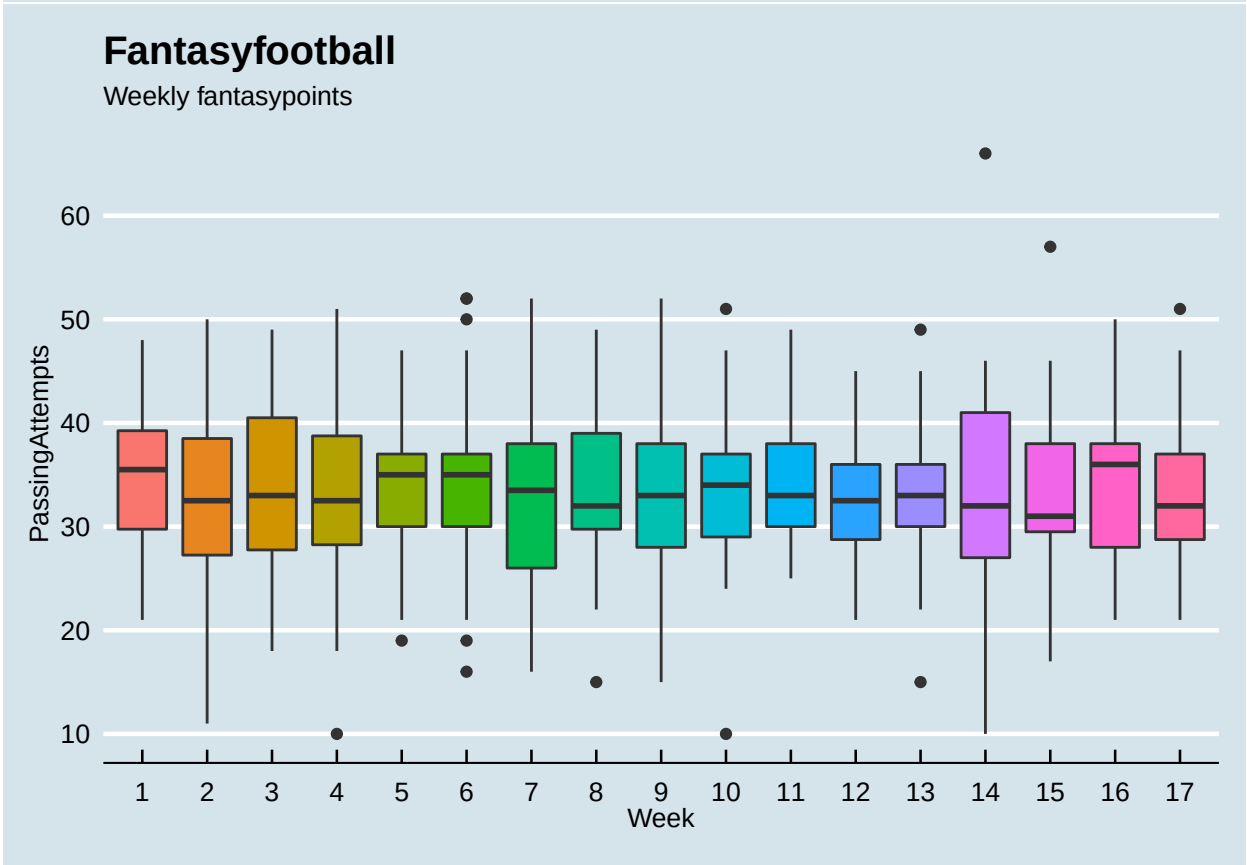
I think we should do these by week - not team - we want to look at variance of the time series across obervations

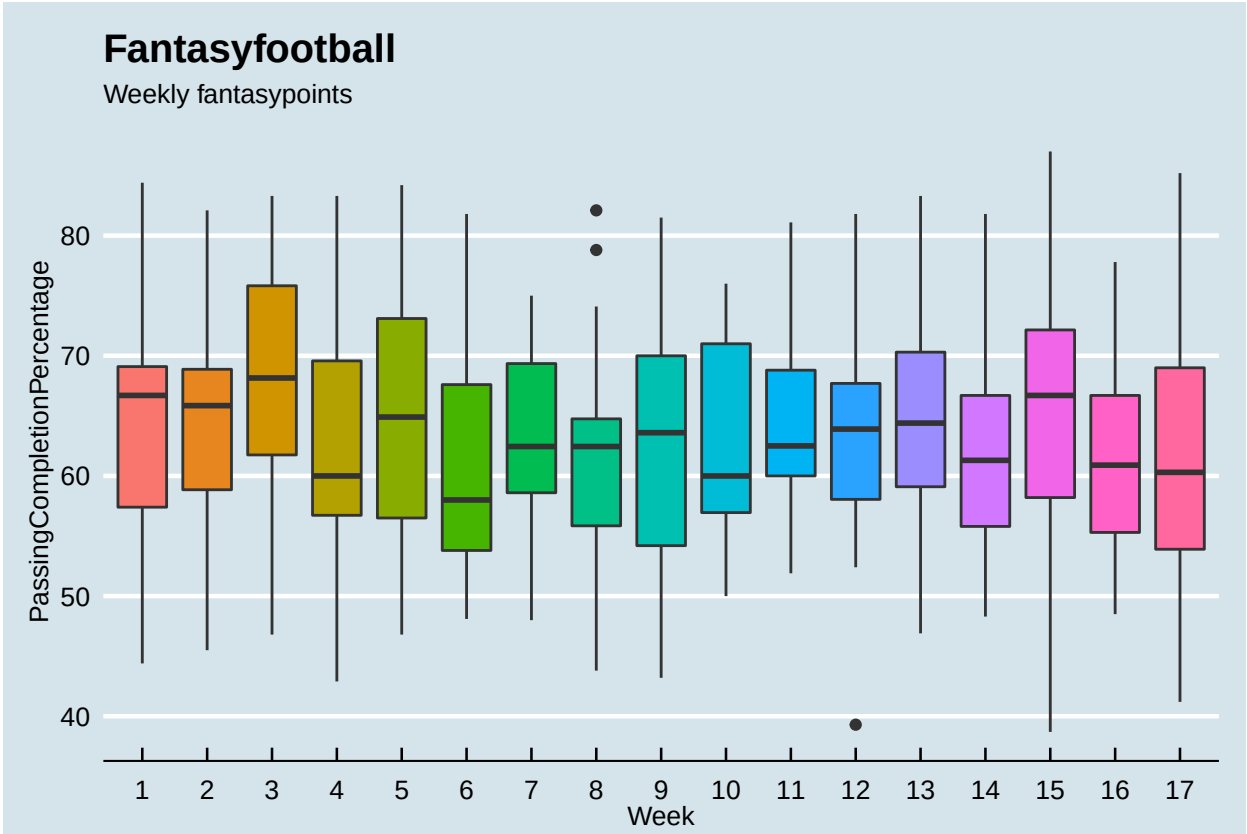
```
QBCrossSectional %>% ggplot(aes(y=FantasyPoints,x=Week,fill=Week,group=Week))+
                     geom_boxplot(show.legend = FALSE)+
                     xlab("Week")+ylab("FantasyPoints")+
                     labs(title="Fantasyfootball",
                     subtitle="Weekly fantasypoints",
                     aption="Source: Fantasyfootball")+theme_economist()
```

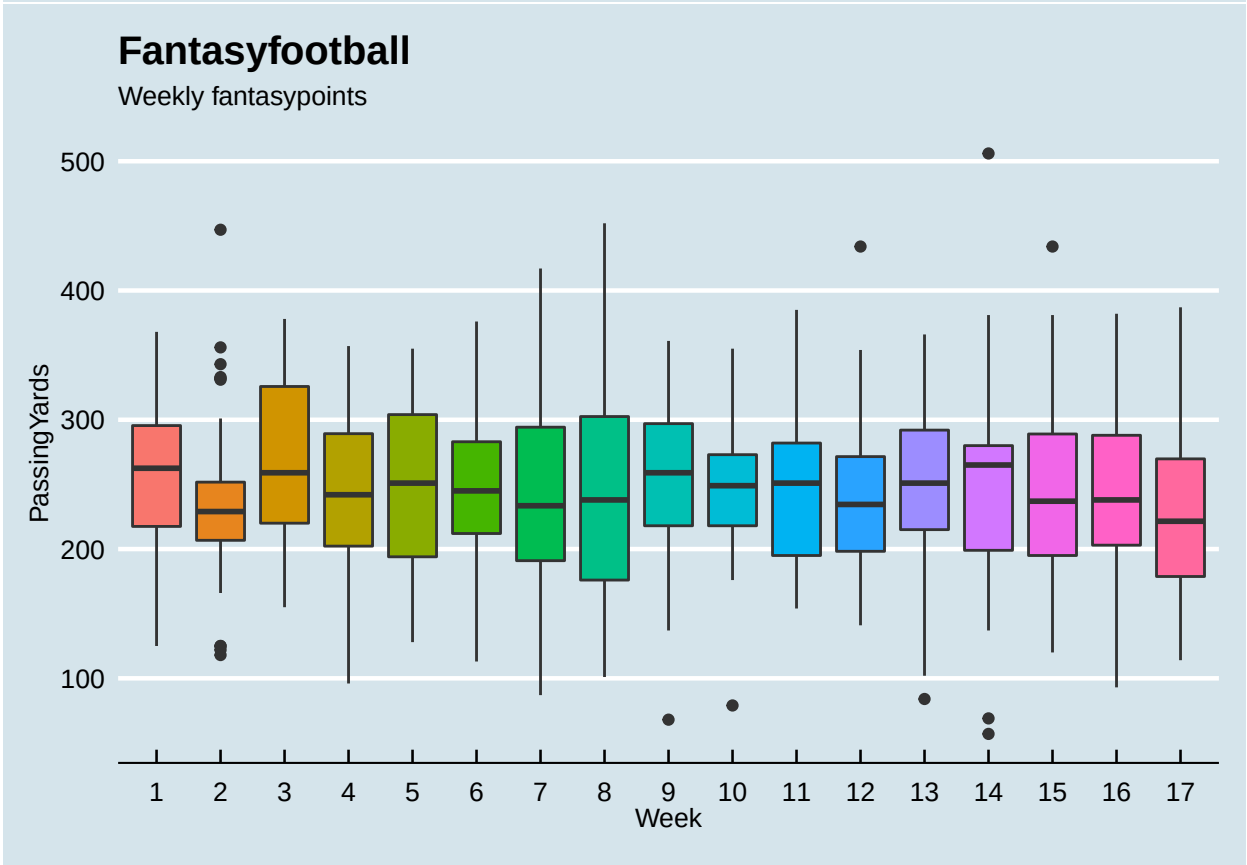


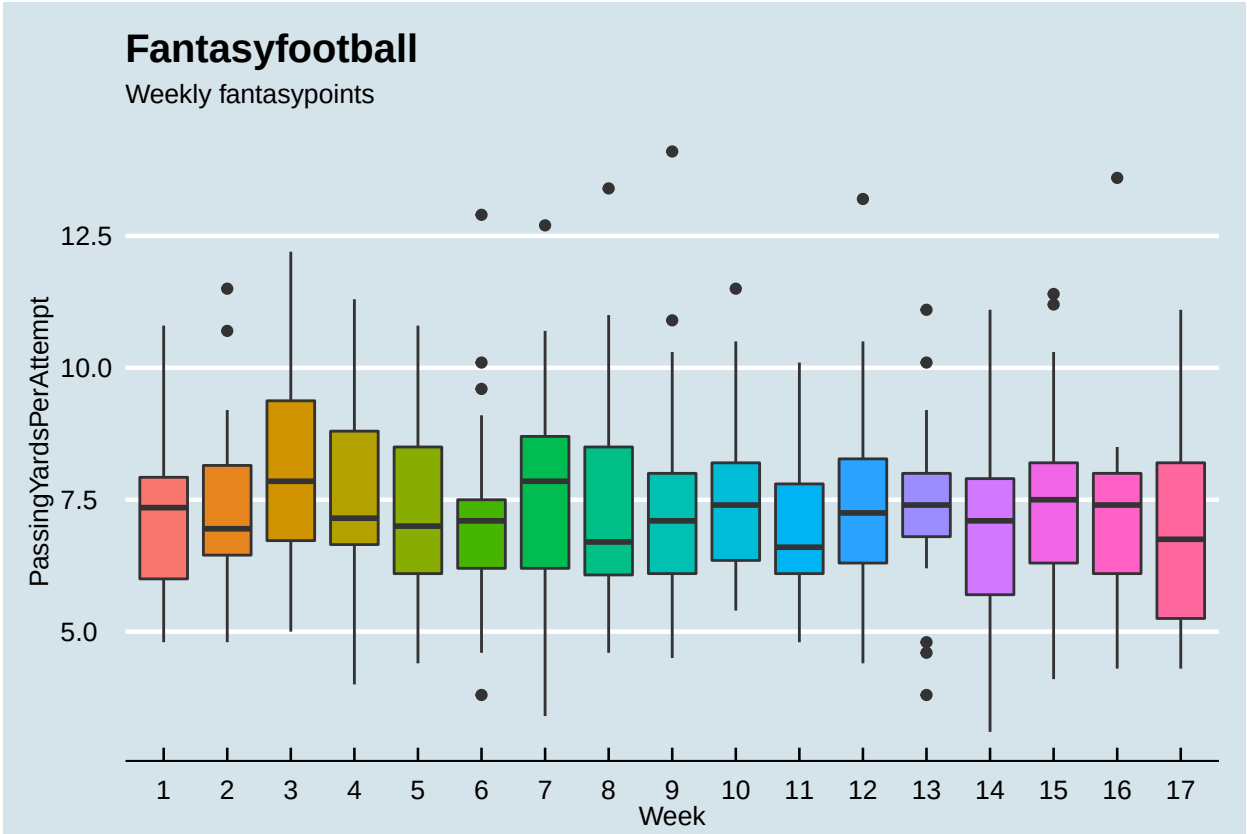

```
for (i in 7:19) {

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

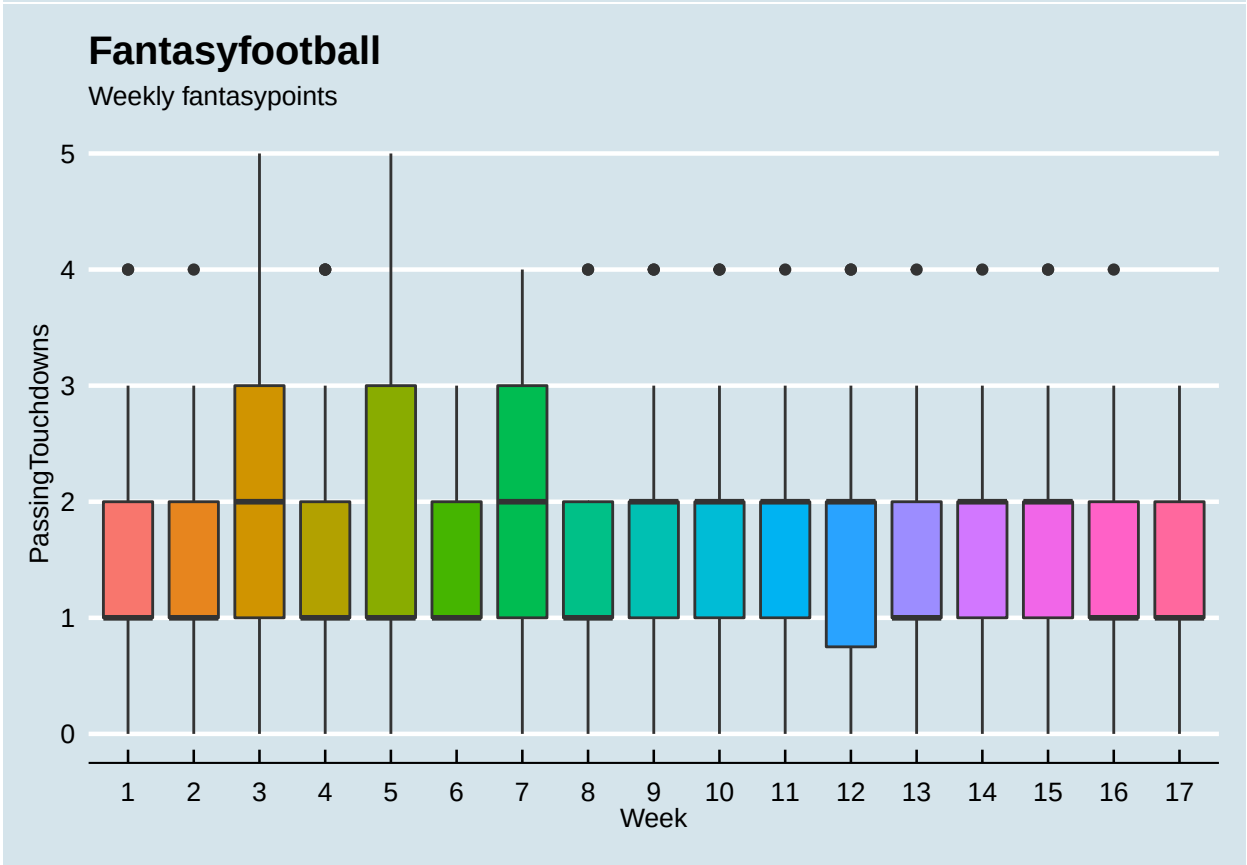

Fantasyfootball
Weekly fantasypoints
PassingCompletions
40
30
20
10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week

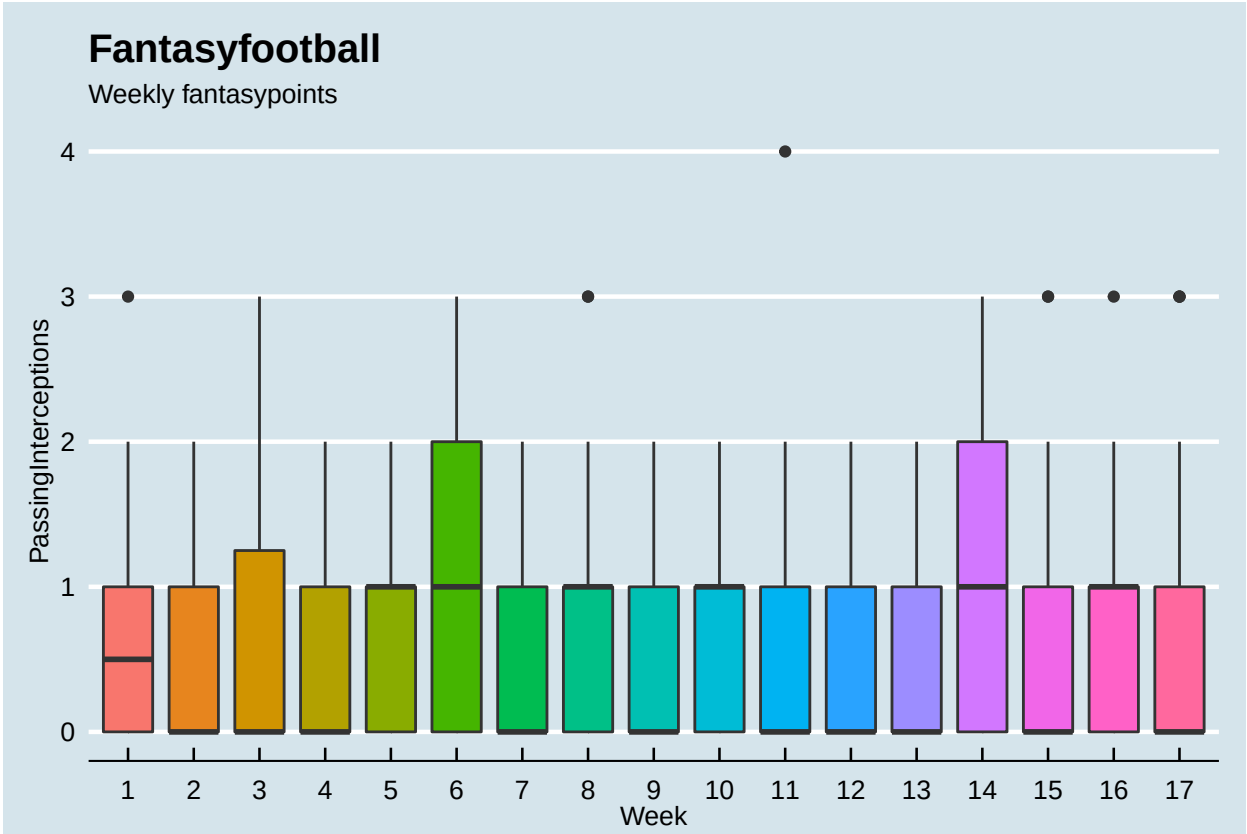

Fantasyfootball
Weekly fantasypoints
PassingAttempts
60
50
40
30
20
10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week

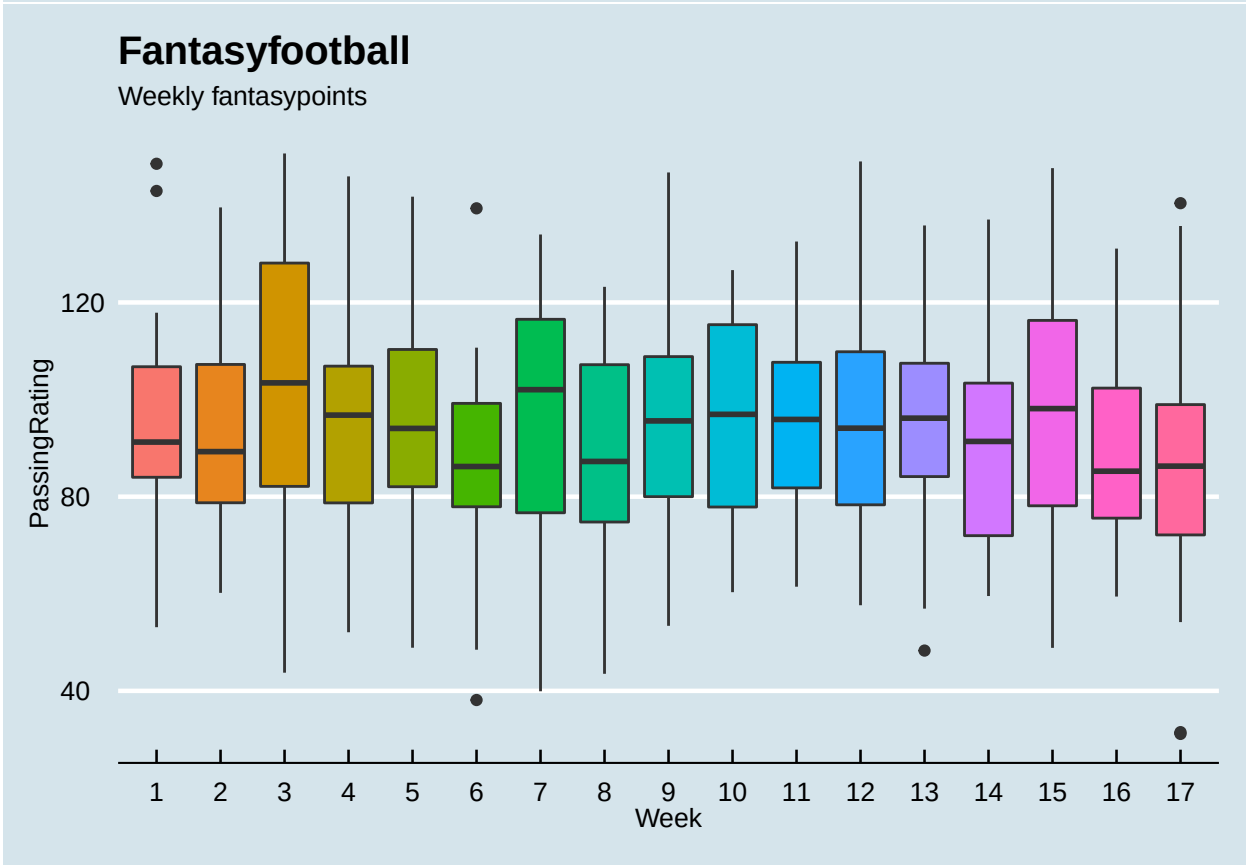

Fantasyfootball
Weekly fantasypoints
PassingCompletionPercentage
80
70
60
50
40
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week

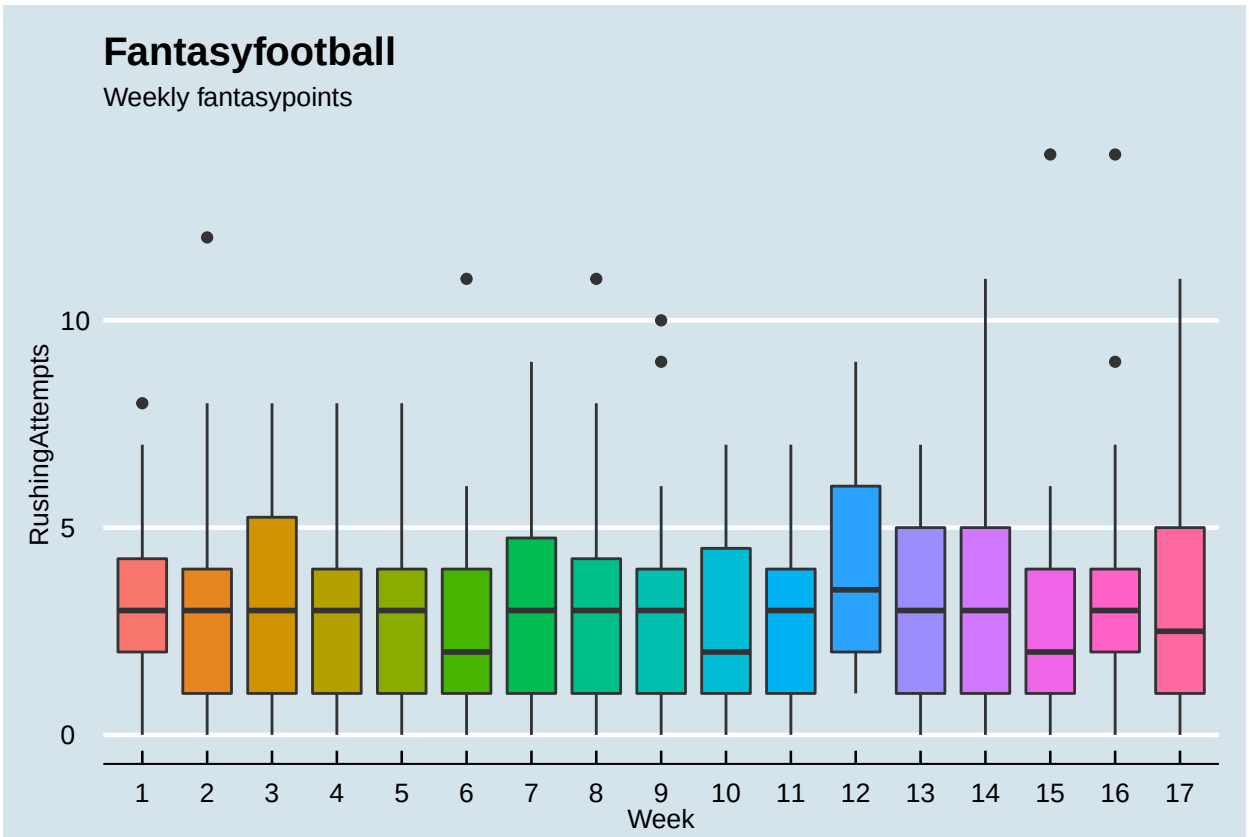

Fantasyfootball
Weekly fantasypoints
PassingYards
500
400
300
200
100
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week

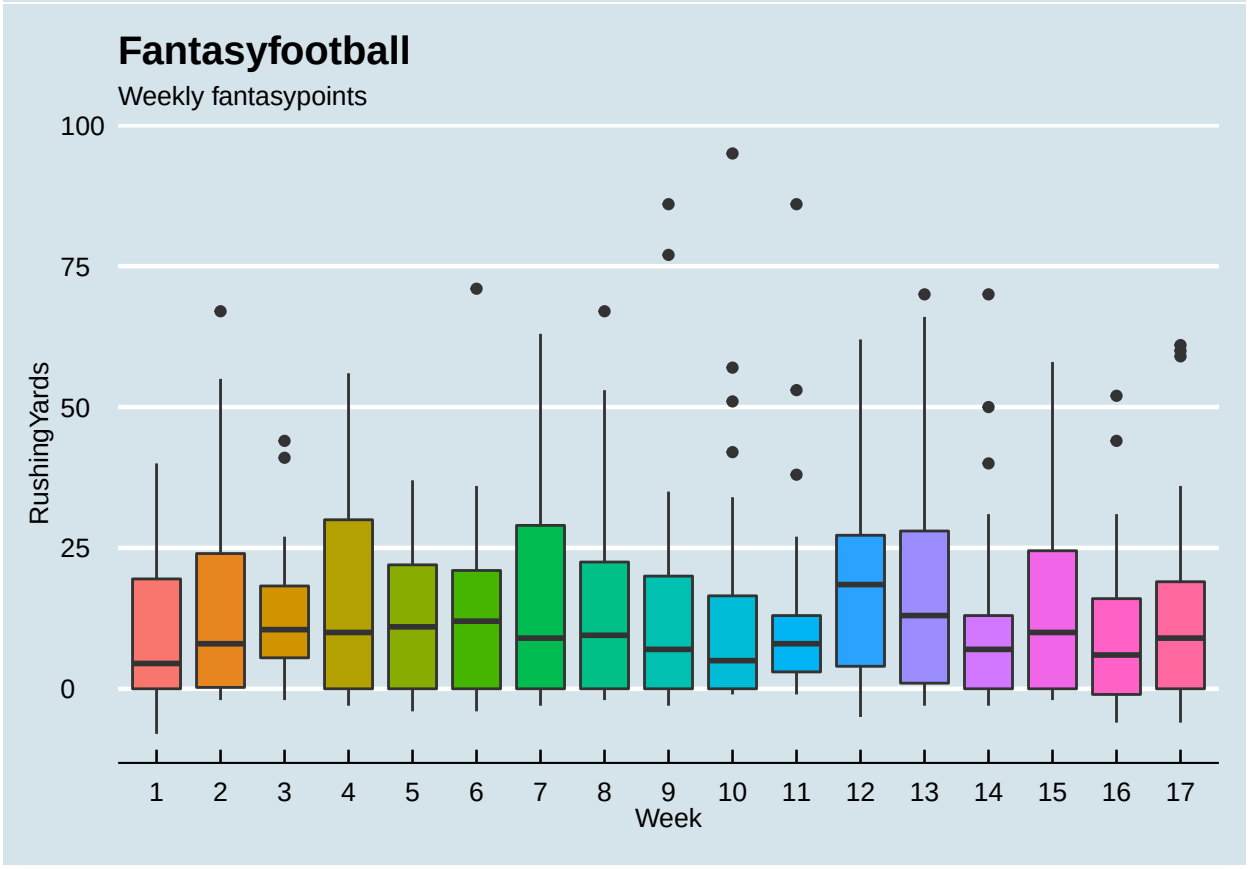

Fantasyfootball
Weekly fantasypoints
PassingYardsPerAttempt
12.5
10.0
7.5
5.0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week

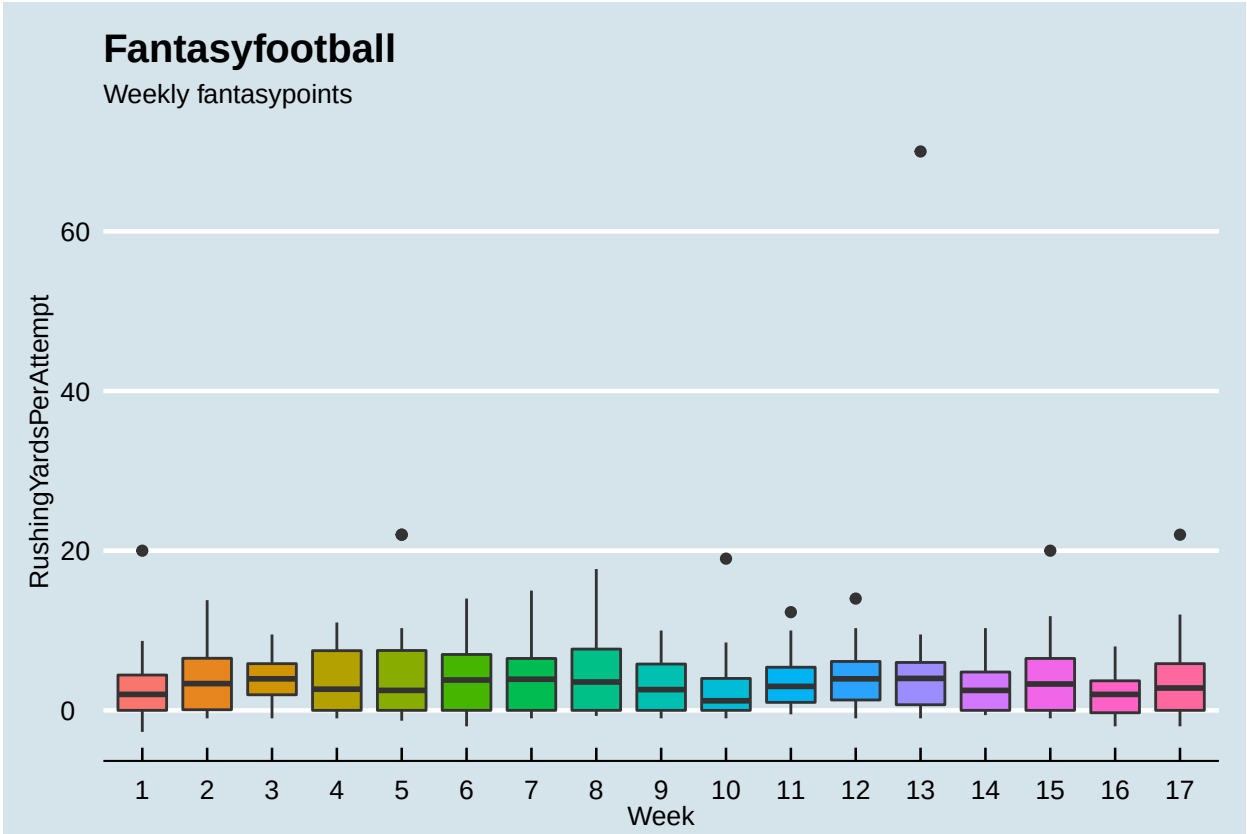

Fantasyfootball
Weekly fantasypoints
PassingTouchdowns
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week

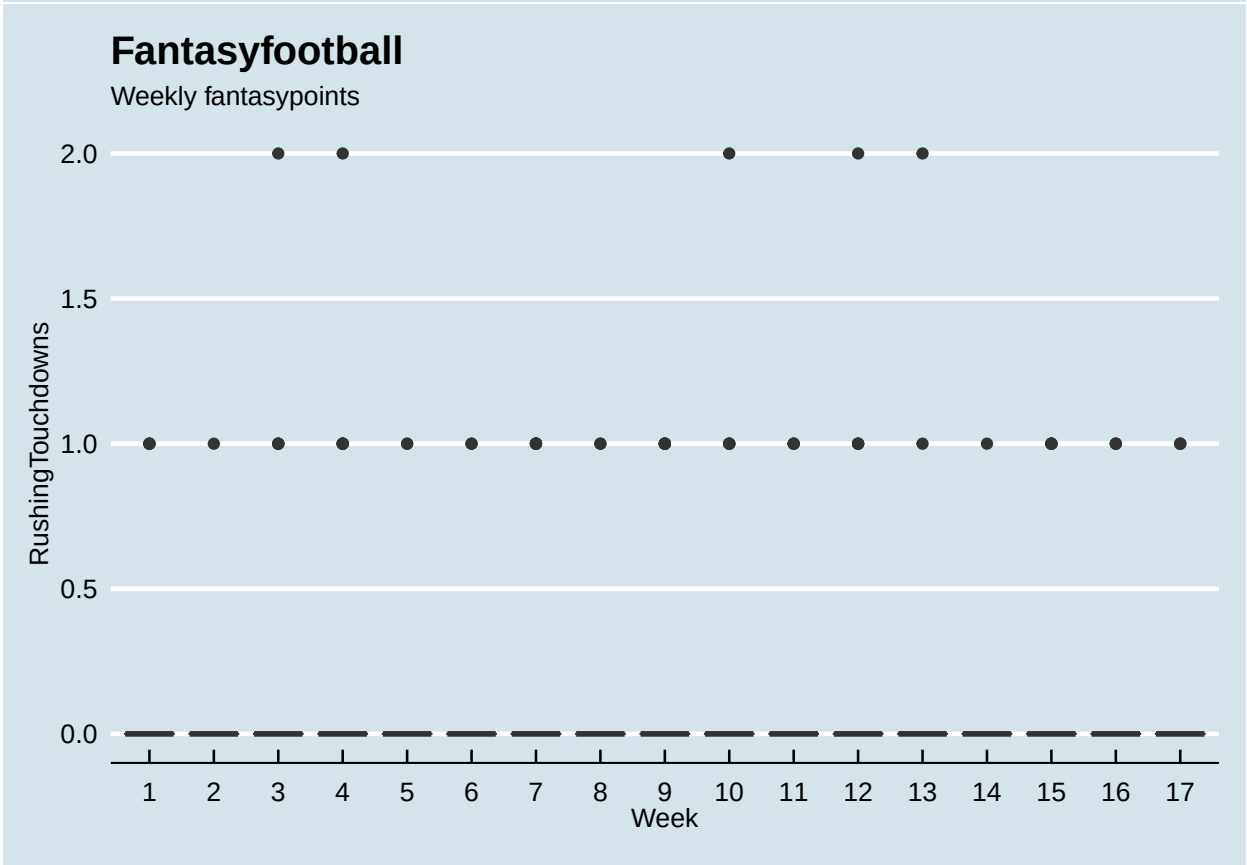

Fantasyfootball
Weekly fantasypoints
PassingInterceptions
0
1
2
3
4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Week

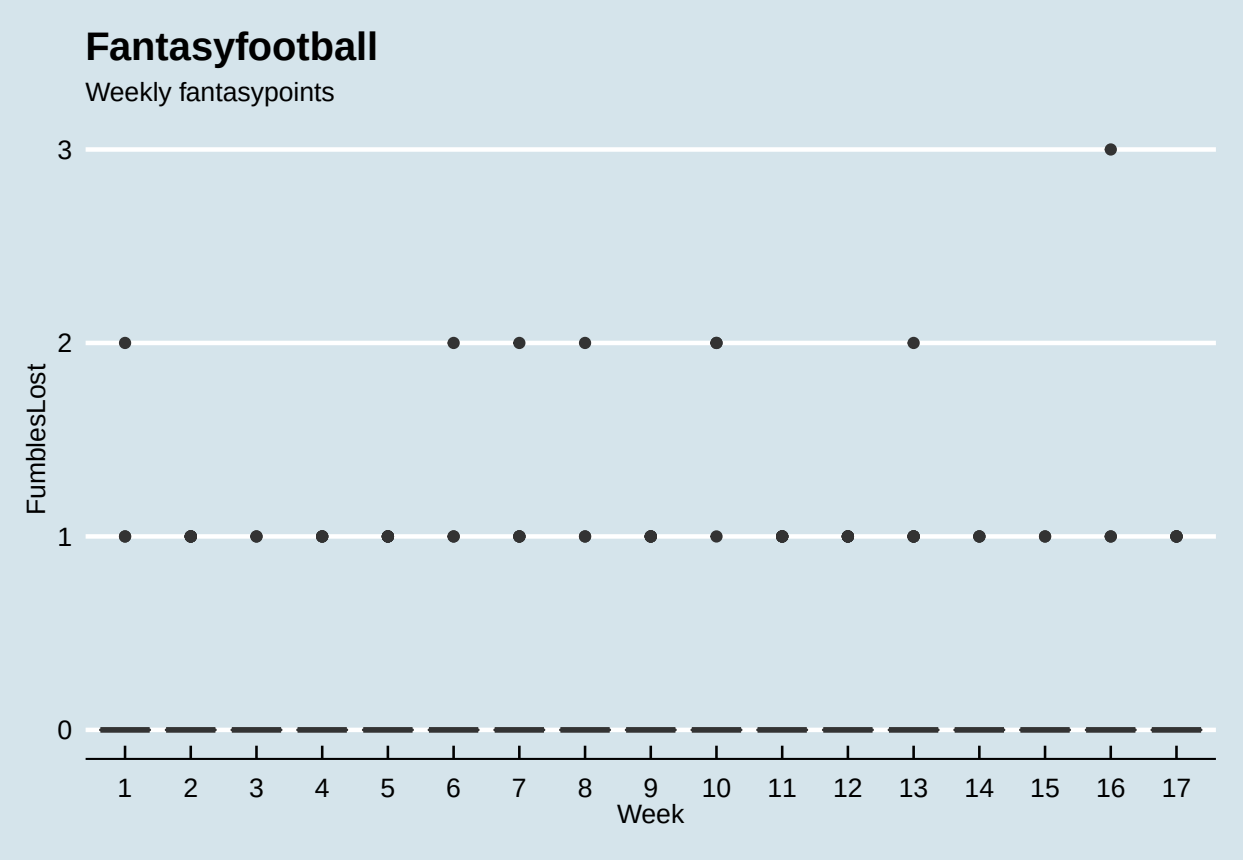

Fantasyfootball
Weekly fantasypoints
PassingRating
40
80
120
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Week


Fantasyfootball
Weekly fantasypoints
RushingAttempts
0
5
10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week


Fantasyfootball
Weekly fantasypoints
RushingYards
0
25
50
75
100
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week


Fantasyfootball
Weekly fantasypoints
RushingYardsPerAttempt
60
40
20
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week

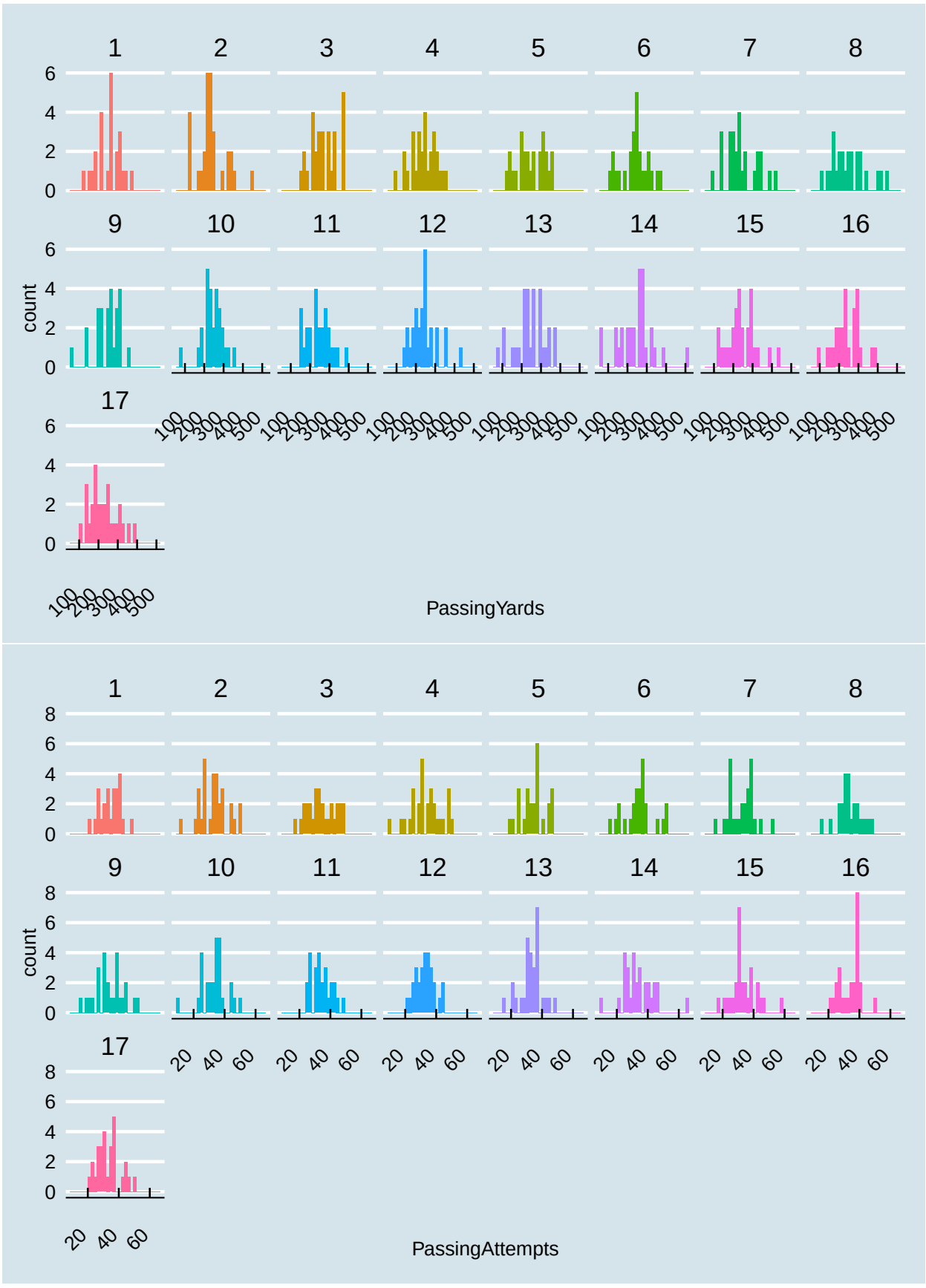

Fantasyfootball
Weekly fantasypoints
RushingTouchdowns
2.0
1.5
1.0
0.5
0.0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Week

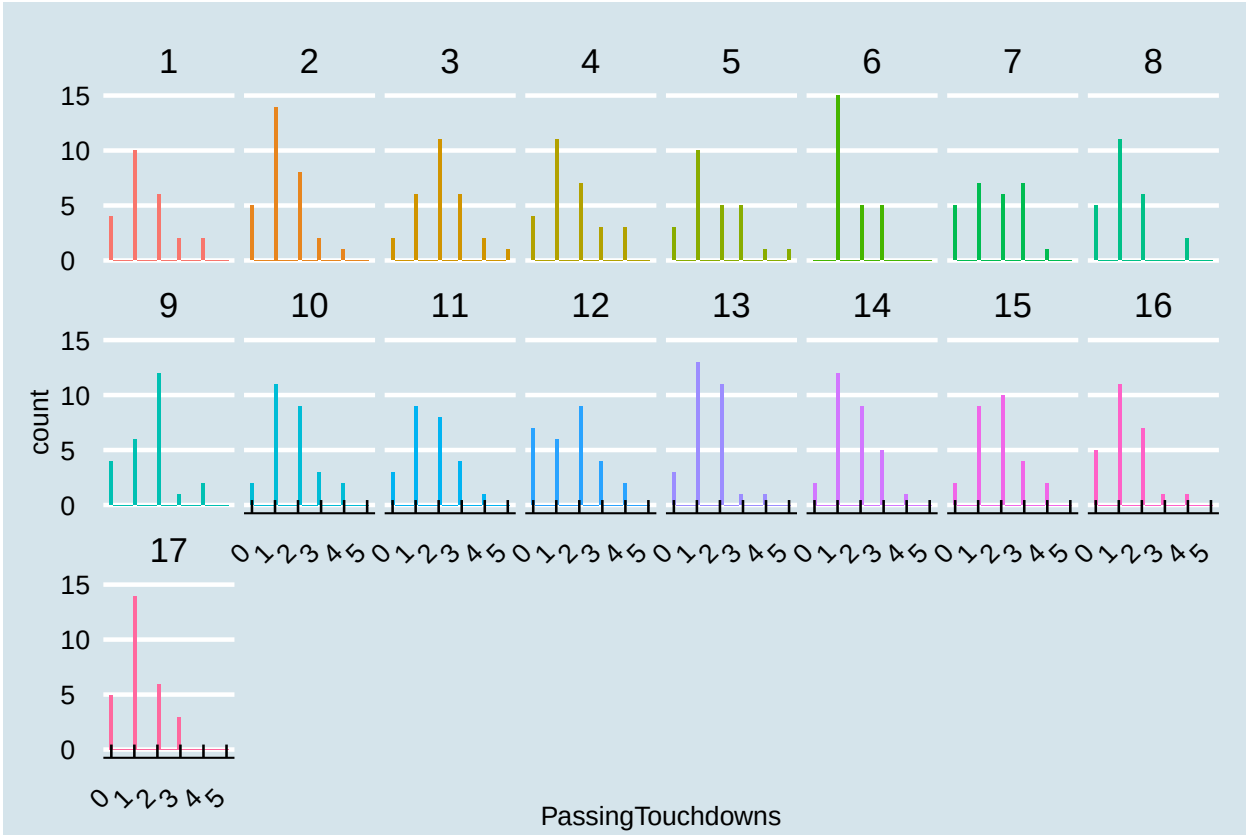


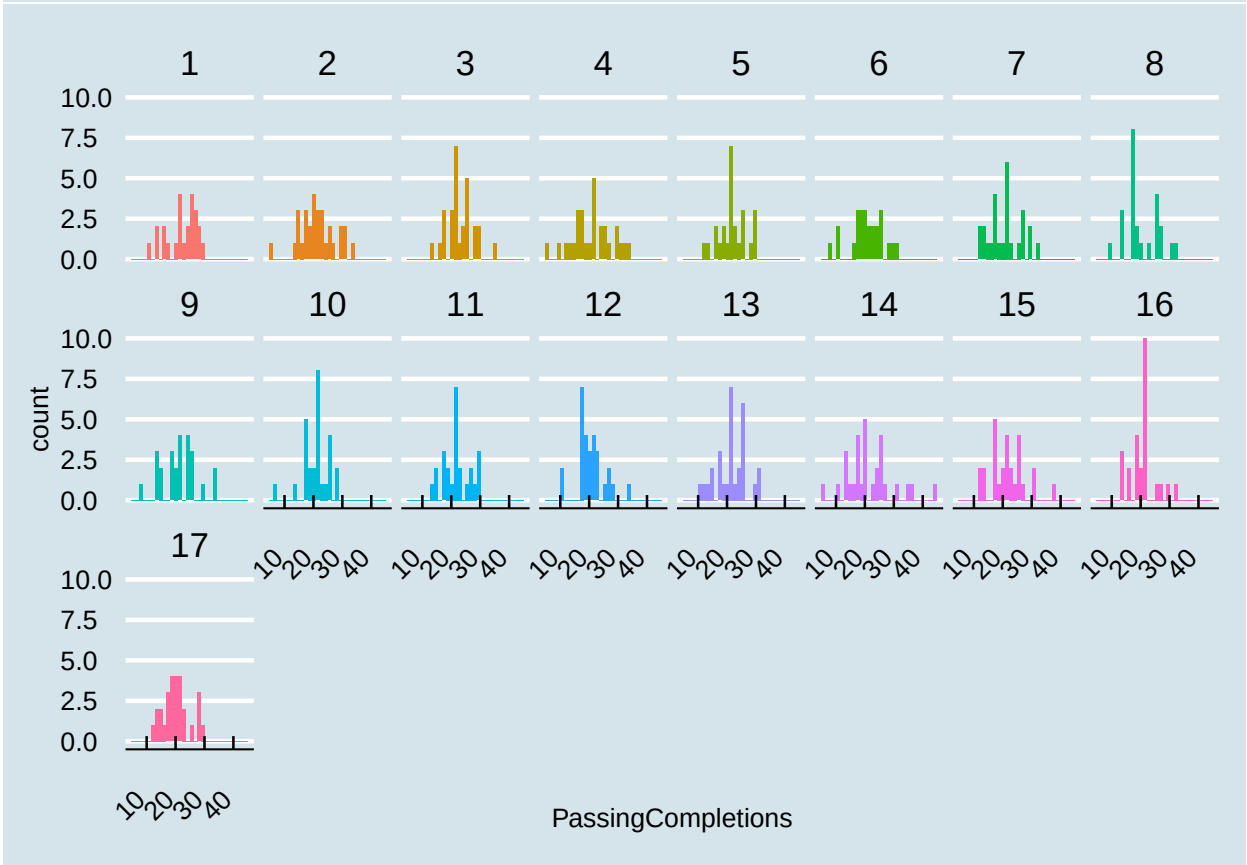
Check for skewed predictors

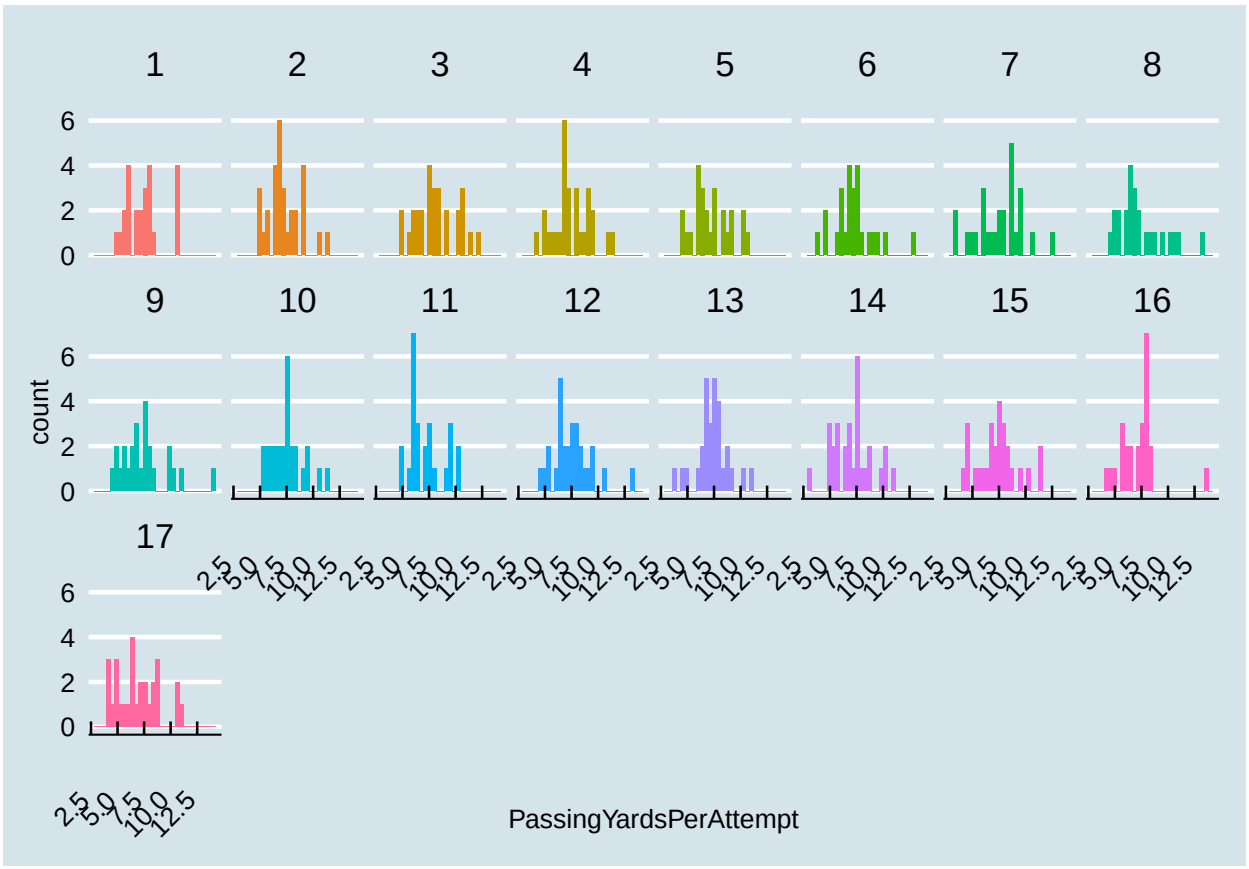
1.5.4 Histograms - Normality by Week

```
features_to_keep = c('PassingYards', 'PassingAttempts', 'PassingTouchdowns', 'PassingCompletions', 'Pass
for(f in features_to_keep){
  hist = QBCrossSectional %>% ggplot(aes_string(x=f))+
                              geom_histogram(bins=30,aes(fill=Week),show.legend = FALSE)+
                              facet_wrap(~Week,ncol=8)+theme_economist()+theme(axis.text.x = element_te

  print(hist)
}
```


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
count
PassingYards
PassingAttempts


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
count
0
5
10
15
0 1 2 3 4 5
PassingTouchdowns


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
count
0.0
2.5
5.0
7.5
10.0
10
20
30
40
PassingCompletions



1.6: Relationships

1.6.1 Relationship between FanatasyPoints with all predictors and taking Opponent into consideration

Not sure that combining these is useful

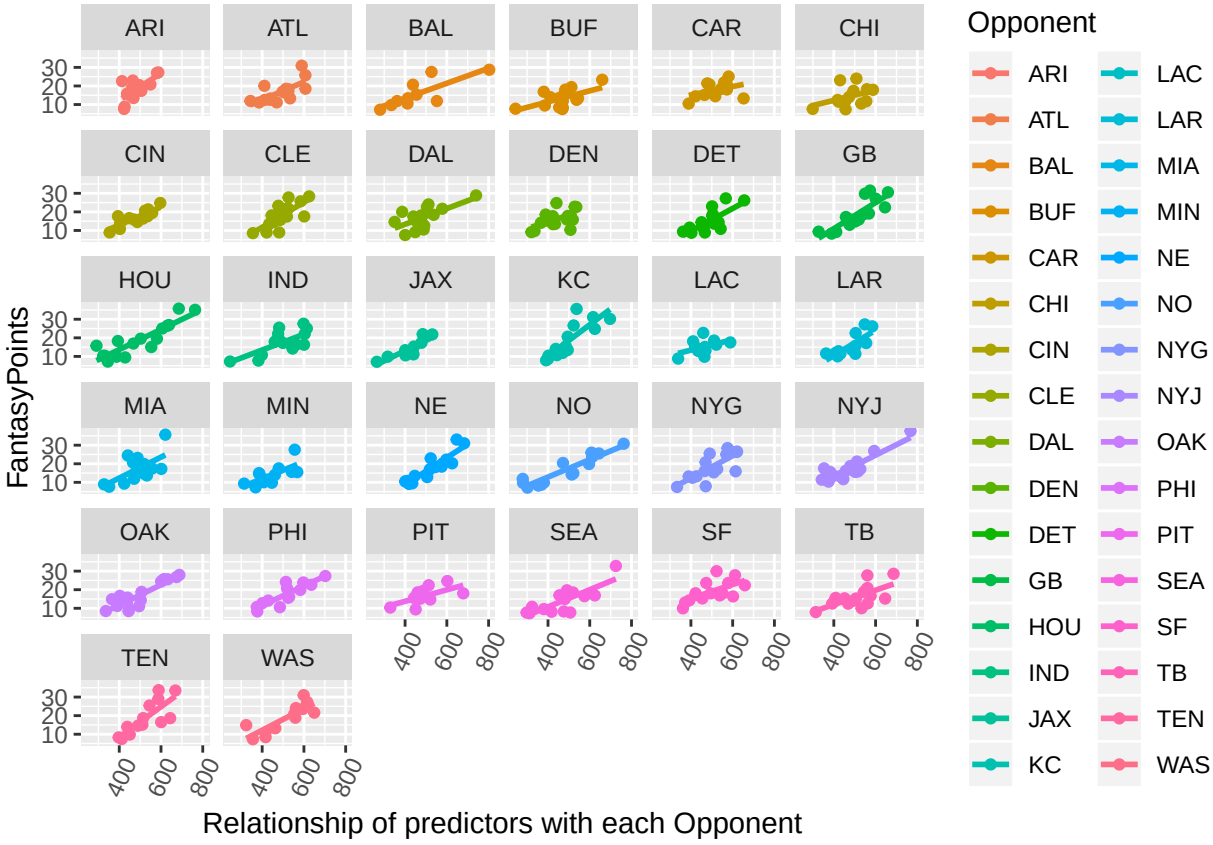
```
attach(QBCrossSectional)
```

```
## The following objects are masked from QBCrossSectional (pos = 4):
##
##     FantasyPoints, FumblesLost, GameDate, Opponent,
##     PassingAttempts, PassingCompletionPercentage,
##     PassingCompletions, PassingInterceptions, PassingRating,
##     PassingTouchdowns, PassingYards, PassingYardsPerAttempt,
##     PlayerID, Position, RushingAttempts, RushingTouchdowns,
##     RushingYards, RushingYardsPerAttempt, Team, TeamIsHome, Week
```

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

```
QBCrossSectional %>% ggplot(aes(y=FantasyPoints,x=PassingCompletions+PassingAttempts+
                                                  PassingCompletionPercentage+
                                                  PassingYards+PassingYardsPerAttempt+
                                                  PassingTouchdowns+PassingInterceptions+
                                                  PassingRating+RushingAttempts+RushingYards+
                                                  RushingYardsPerAttempt+RushingTouchdowns+FumblesLost,
```

```
                                                color=Opponent))+
                    xlab("Relationship of predictors with each Opponent")+
                    geom_point()+
                    geom_smooth(method="lm",se=F)+
                    theme(axis.text.x = element_text(angle=65, vjust=0.6))+facet_wrap(~Opponent)
```



1.6.2 Relationship between FanatasyPoints with all predictors and taking Home turf into consideration

Same here. . . ..

```
attach(QBCrossSectional)
```

```
## The following objects are masked from QBCrossSectional (pos = 3):
##
##     FantasyPoints, FumblesLost, GameDate, Opponent,
##     PassingAttempts, PassingCompletionPercentage,
##     PassingCompletions, PassingInterceptions, PassingRating,
##     PassingTouchdowns, PassingYards, PassingYardsPerAttempt,
##     PlayerID, Position, RushingAttempts, RushingTouchdowns,
##     RushingYards, RushingYardsPerAttempt, Team, TeamIsHome, Week

## The following objects are masked from QBCrossSectional (pos = 5):
##
##     FantasyPoints, FumblesLost, GameDate, Opponent,
##     PassingAttempts, PassingCompletionPercentage,
##     PassingCompletions, PassingInterceptions, PassingRating,
##     PassingTouchdowns, PassingYards, PassingYardsPerAttempt,
```

```
##     PlayerID, Position, RushingAttempts, RushingTouchdowns,
##     RushingYards, RushingYardsPerAttempt, Team, TeamIsHome, Week

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

```
QBCrossSectional %>% ggplot(aes(y=FantasyPoints,x=PassingCompletions+PassingAttempts+
                                                  PassingCompletionPercentage+
                                                  PassingYards+PassingYardsPerAttempt+
                                                  PassingTouchdowns+PassingInterceptions+
                                                  PassingRating+RushingAttempts+RushingYards+
                                                  RushingYardsPerAttempt+RushingTouchdowns+FumblesLost,
                                                  color=TeamIsHome))+
                    geom_point()+
                    geom_smooth(method="lm",se=F)+
                    theme(axis.text.x = element_text(angle=65, vjust=0.6))+facet_wrap(~TeamIsHome)
```

1.6.3 Relationship between FanatasyPoints with all predictors per team

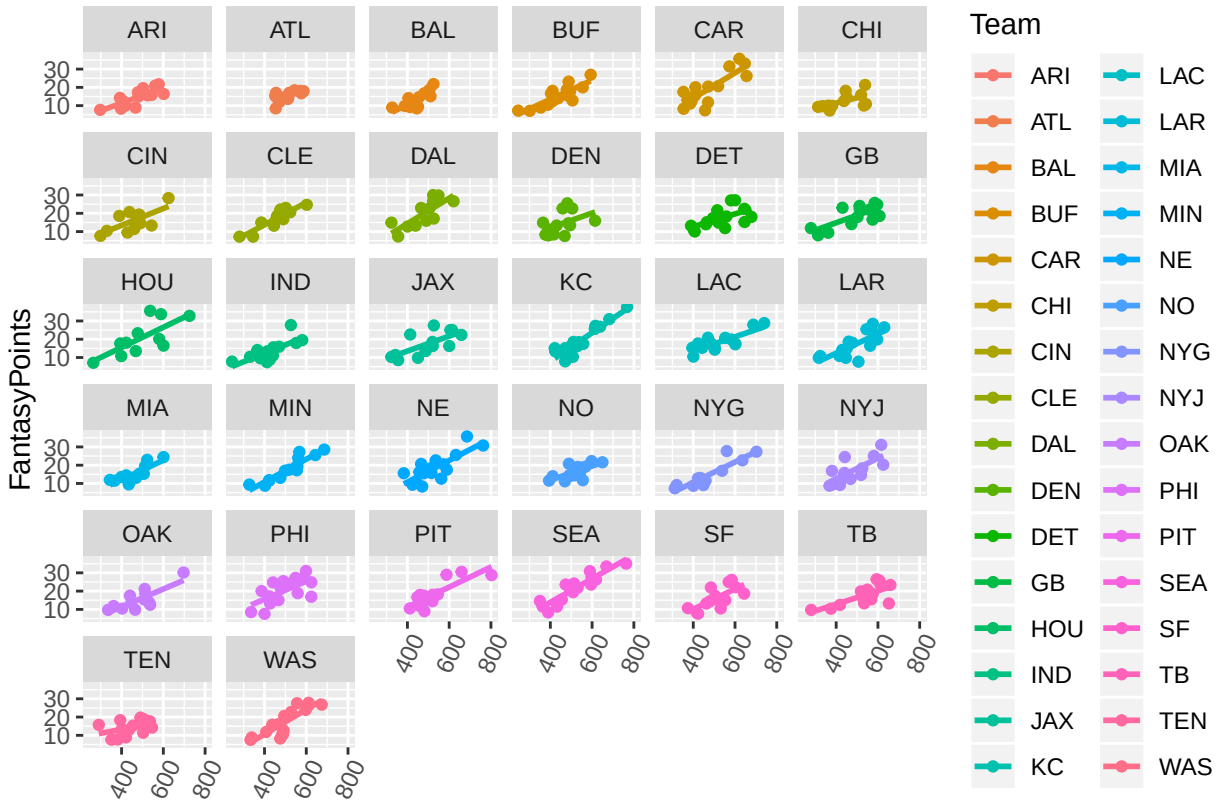
and here.....

```
attach(QBCrossSectional)
```

```
## The following objects are masked from QBCrossSectional (pos = 3):
##
##     FantasyPoints, FumblesLost, GameDate, Opponent,
##     PassingAttempts, PassingCompletionPercentage,
##     PassingCompletions, PassingInterceptions, PassingRating,
```

```
##     PassingTouchdowns, PassingYards, PassingYardsPerAttempt,
##     PlayerID, Position, RushingAttempts, RushingTouchdowns,
##     RushingYards, RushingYardsPerAttempt, Team, TeamIsHome, Week

## The following objects are masked from QBCrossSectional (pos = 4):
##
##     FantasyPoints, FumblesLost, GameDate, Opponent,
##     PassingAttempts, PassingCompletionPercentage,
##     PassingCompletions, PassingInterceptions, PassingRating,
##     PassingTouchdowns, PassingYards, PassingYardsPerAttempt,
##     PlayerID, Position, RushingAttempts, RushingTouchdowns,
##     RushingYards, RushingYardsPerAttempt, Team, TeamIsHome, Week

## The following objects are masked from QBCrossSectional (pos = 6):
##
##     FantasyPoints, FumblesLost, GameDate, Opponent,
##     PassingAttempts, PassingCompletionPercentage,
##     PassingCompletions, PassingInterceptions, PassingRating,
##     PassingTouchdowns, PassingYards, PassingYardsPerAttempt,
##     PlayerID, Position, RushingAttempts, RushingTouchdowns,
##     RushingYards, RushingYardsPerAttempt, Team, TeamIsHome, Week

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

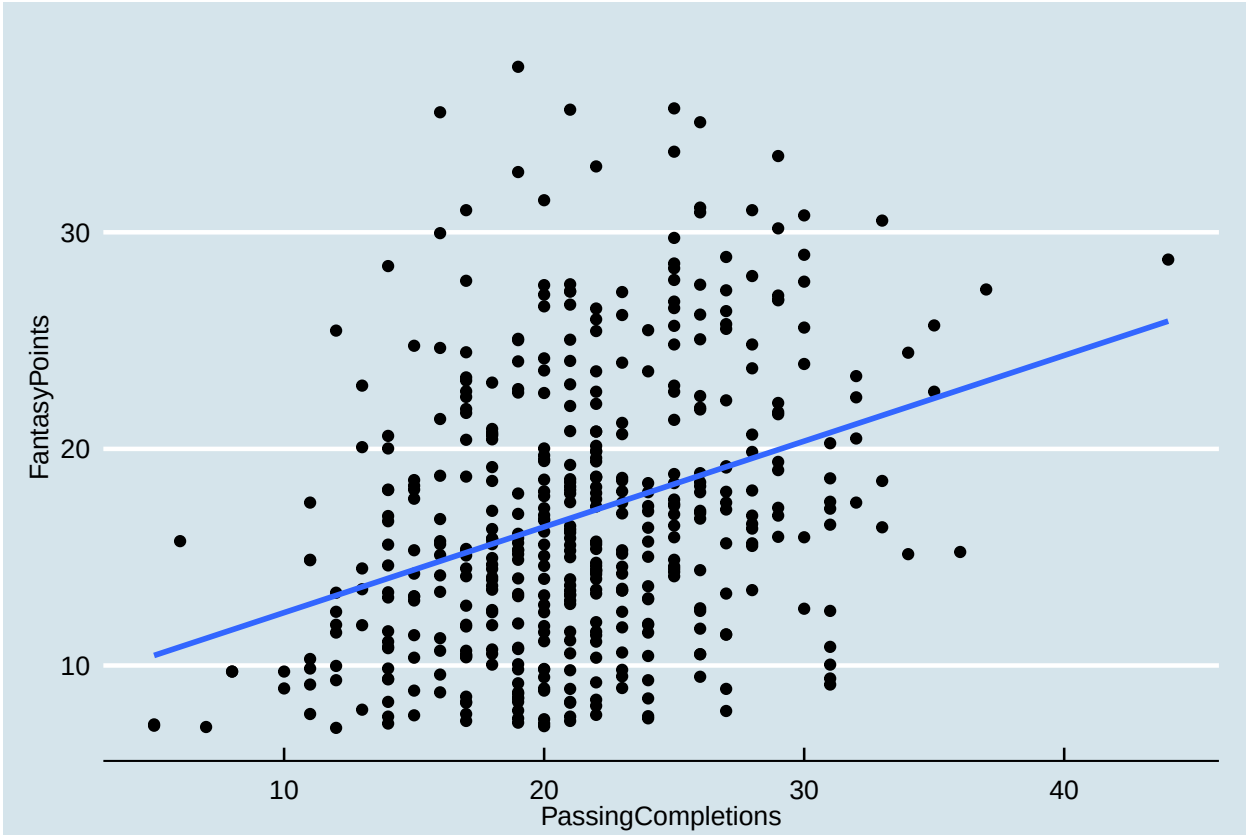
```
QBCrossSectional %>% ggplot(aes(y=FantasyPoints,x=PassingCompletions+PassingAttempts+
                                                  PassingCompletionPercentage+
                                                  PassingYards+PassingYardsPerAttempt+
                                                  PassingTouchdowns+PassingInterceptions+
                                                  PassingRating+RushingAttempts+
                                                  RushingYards+RushingYardsPerAttempt+
                                                  RushingTouchdowns+FumblesLost,color=Team)) +
                      geom_point()+
                      geom_smooth(method="lm",se=F)+
                      theme(axis.text.x = element_text(angle=65, vjust=0.6))+facet_wrap(~Team)
```

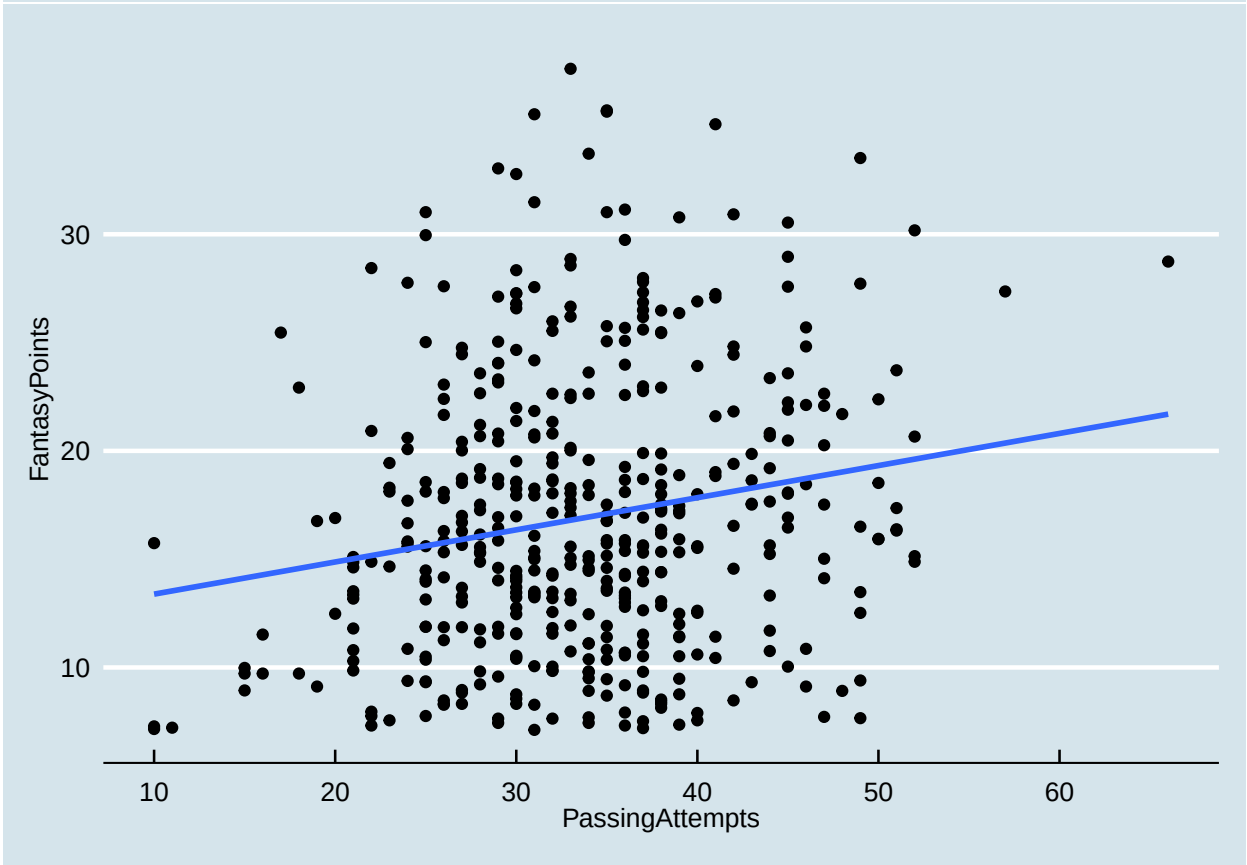


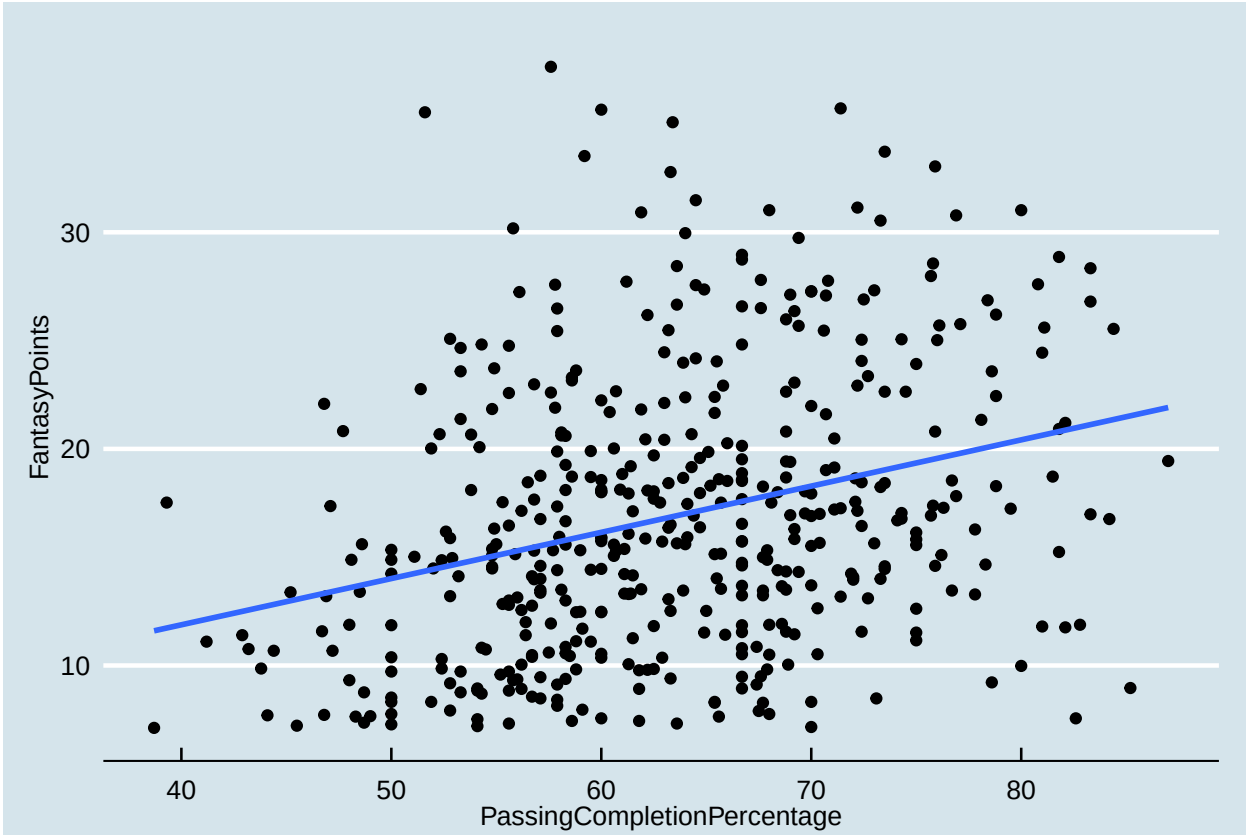
1.6.4 Relationship between FantasyPoints and Individual predictors

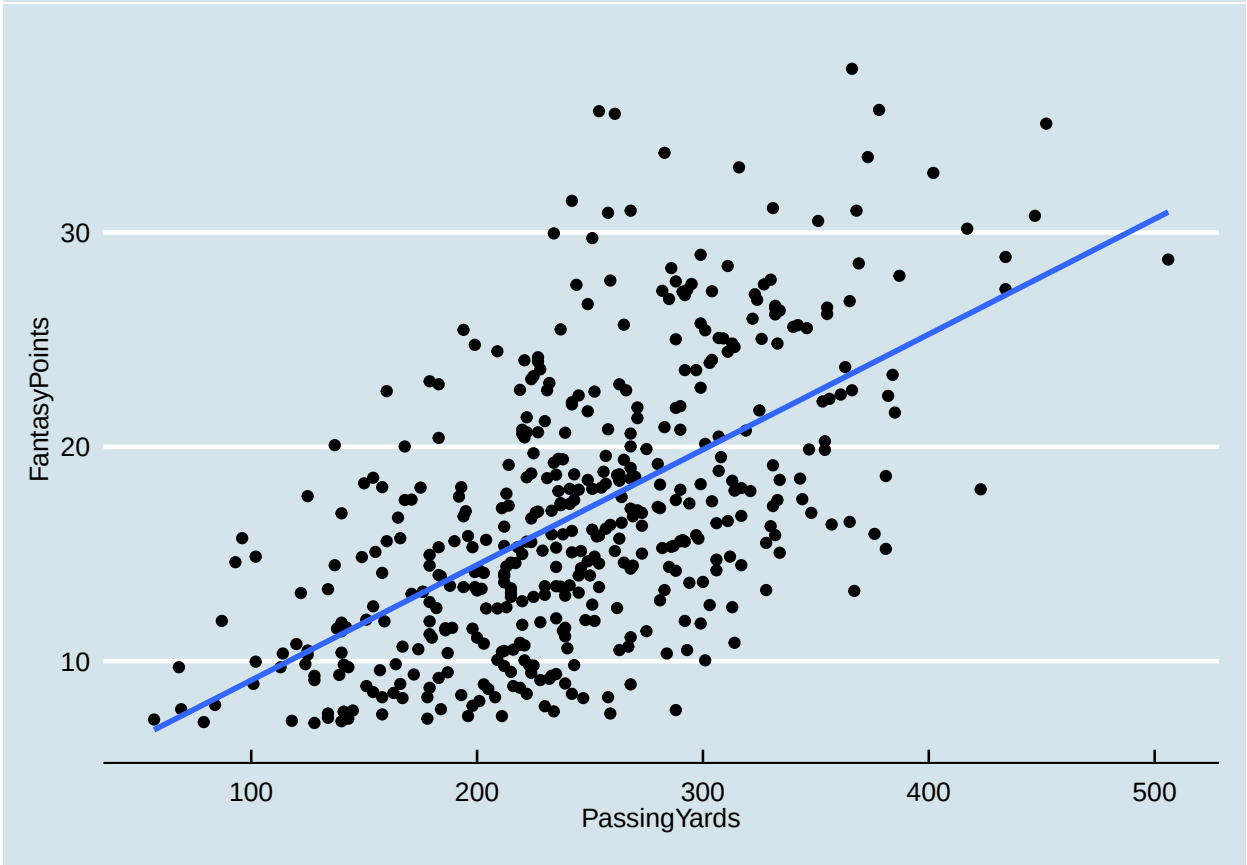
This makes sense - but we are actually trying to capture what the NEXT value for fantasy points is likel
week since the fantasy score is a linear combination of the predictors for any given week. We need to sl

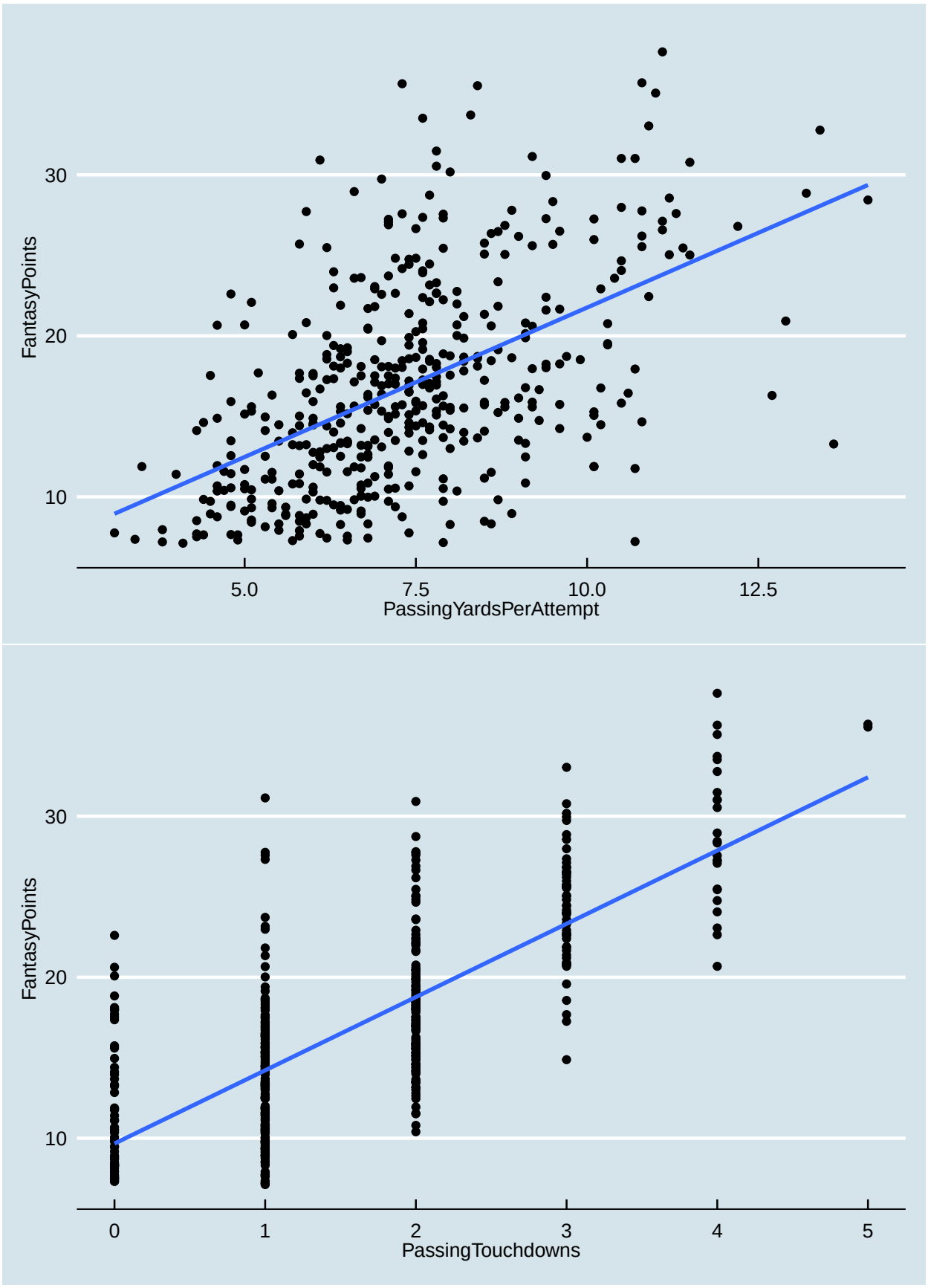
```
for (i in 7:19) {
  linear_plot <- QBCrossSectional %>%
                 ggplot(aes_string(y="FantasyPoints",x=names(QBCrossSectional[i]))) +
                 geom_point()+geom_smooth(method="lm",se=F)+
                 theme(axis.text.x = element_text(angle=65, vjust=0.6))+
                 theme_economist()
    print(linear_plot)
  }
```

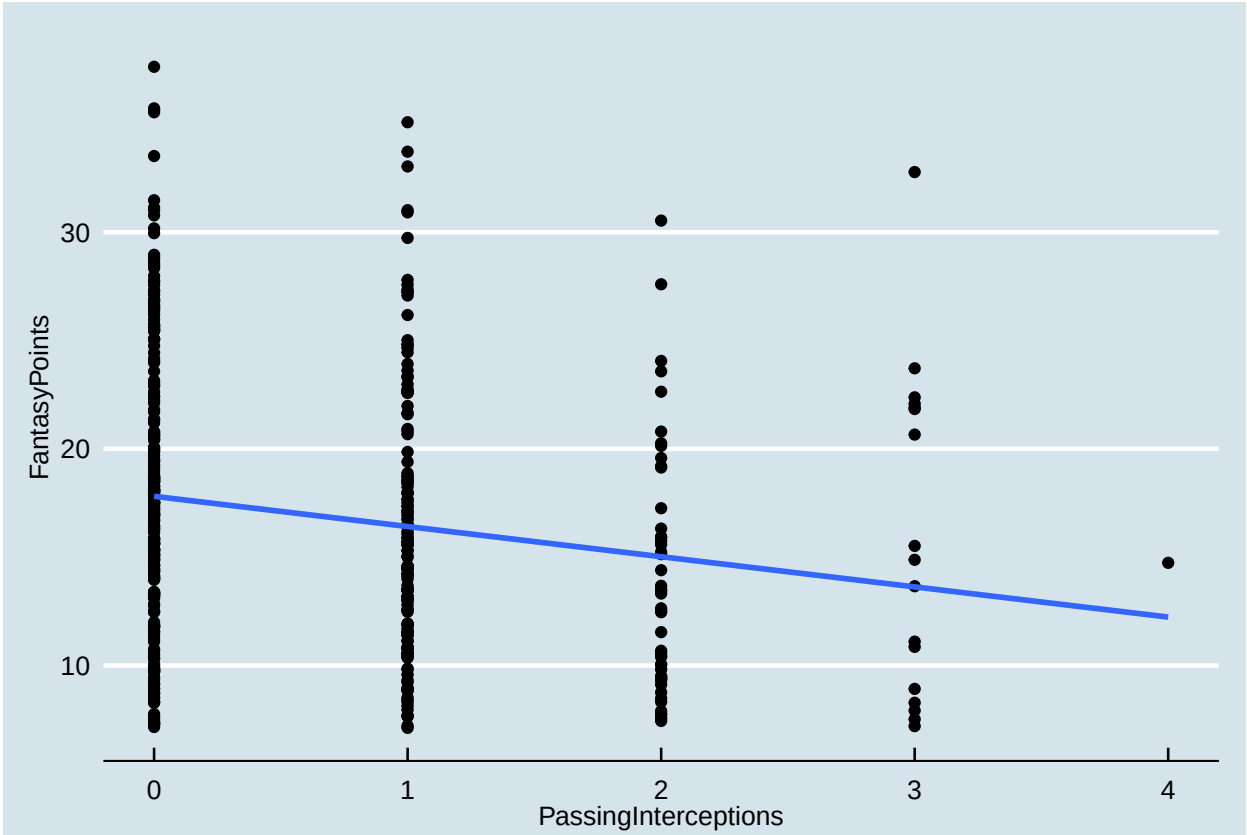

30
20
10
FantasyPoints
10
20
30
40
PassingCompletions

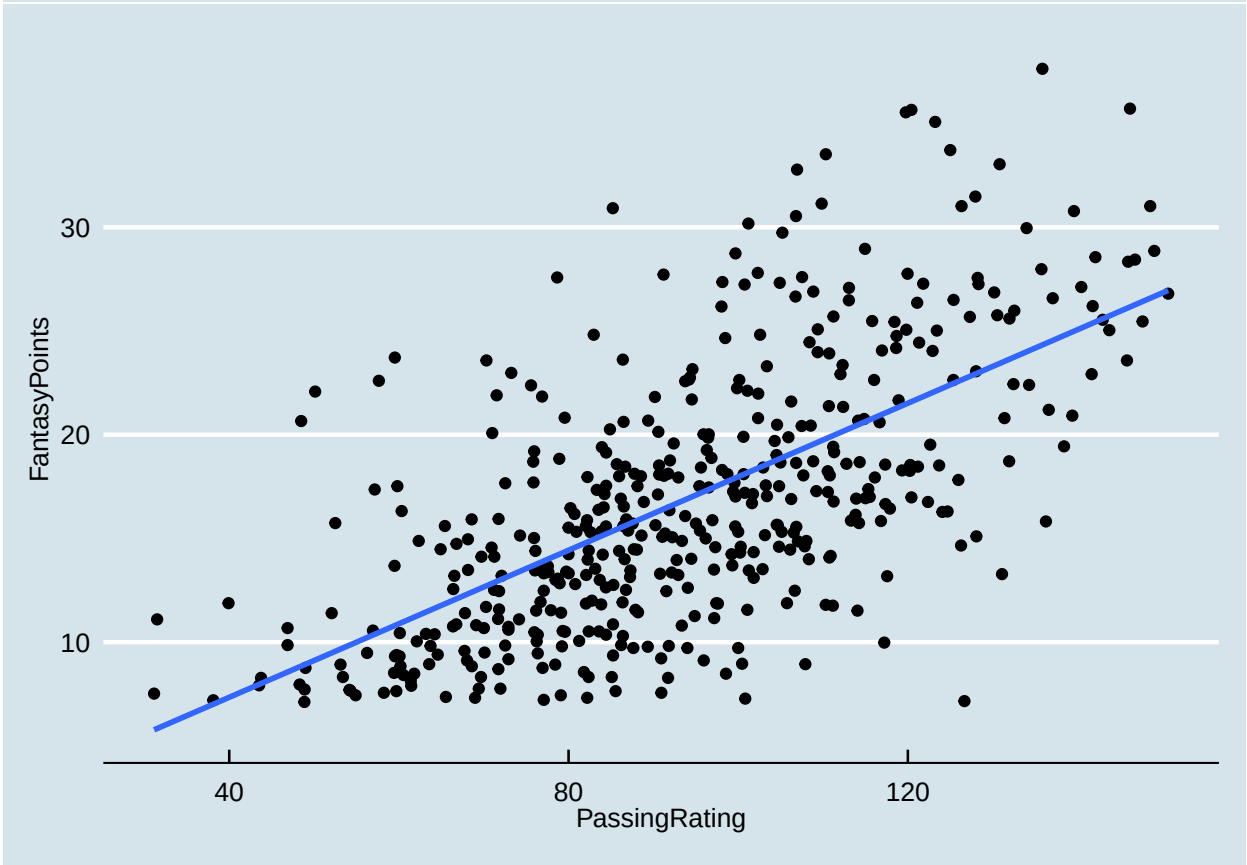

30
20
10
FantasyPoints
10
20
30
40
50
60
PassingAttempts

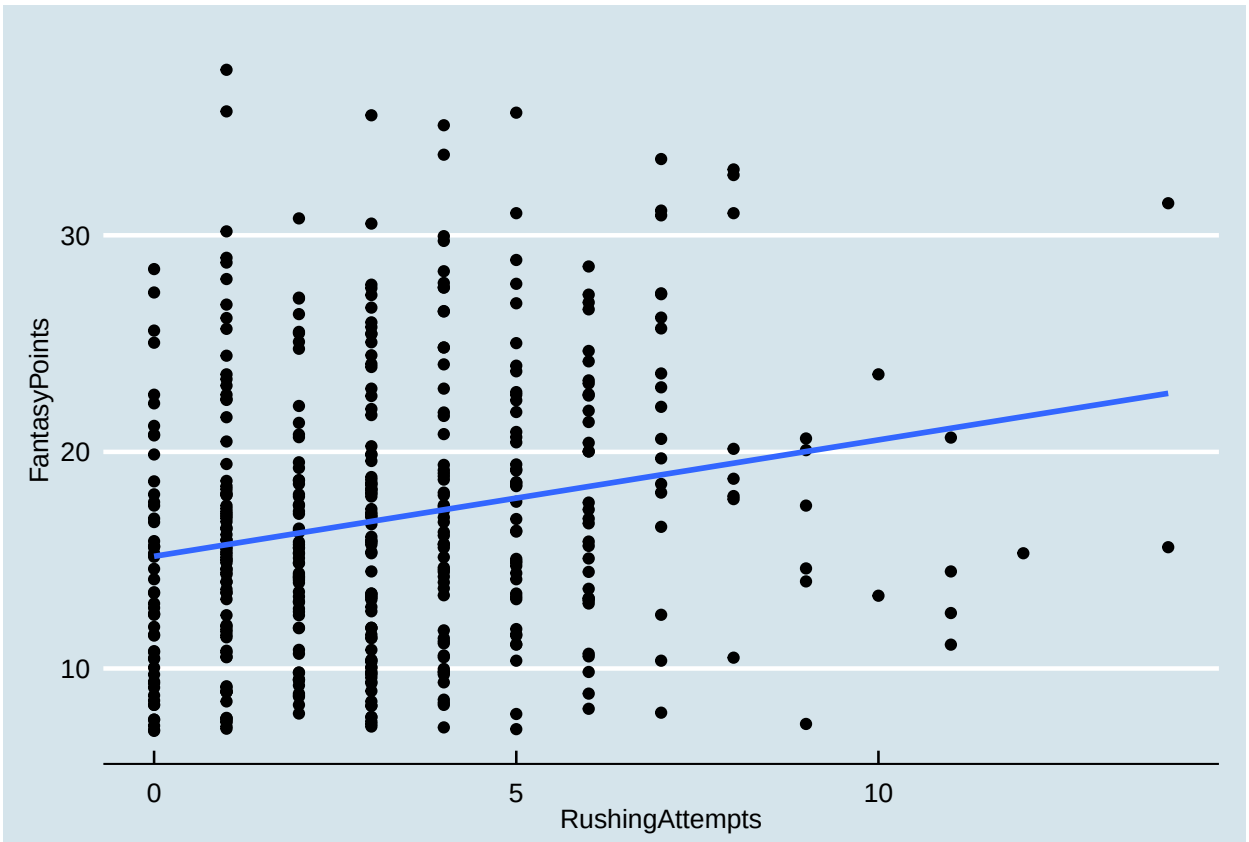

30
20
10
FantasyPoints
40
50
60
70
80
PassingCompletionPercentage

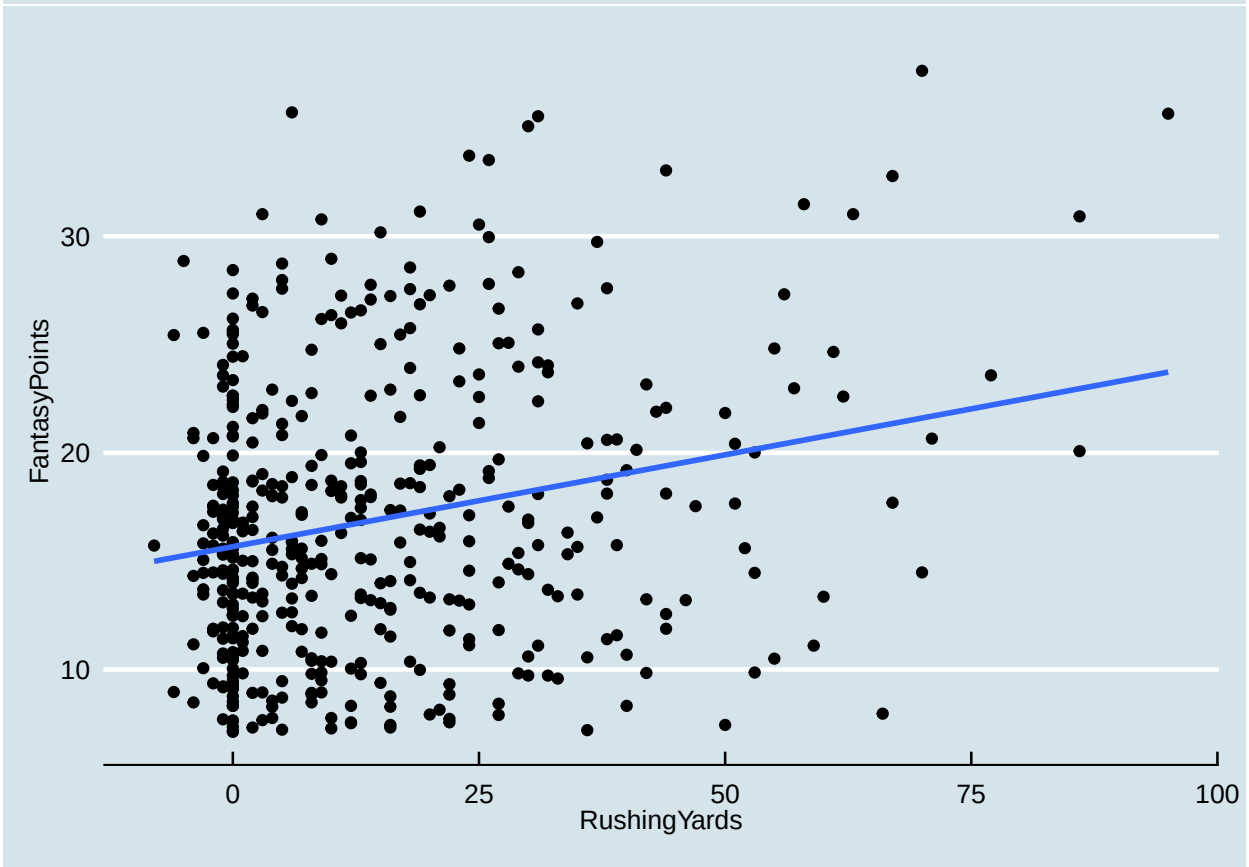

30
20
10
FantasyPoints
100
200
300
400
500
PassingYards

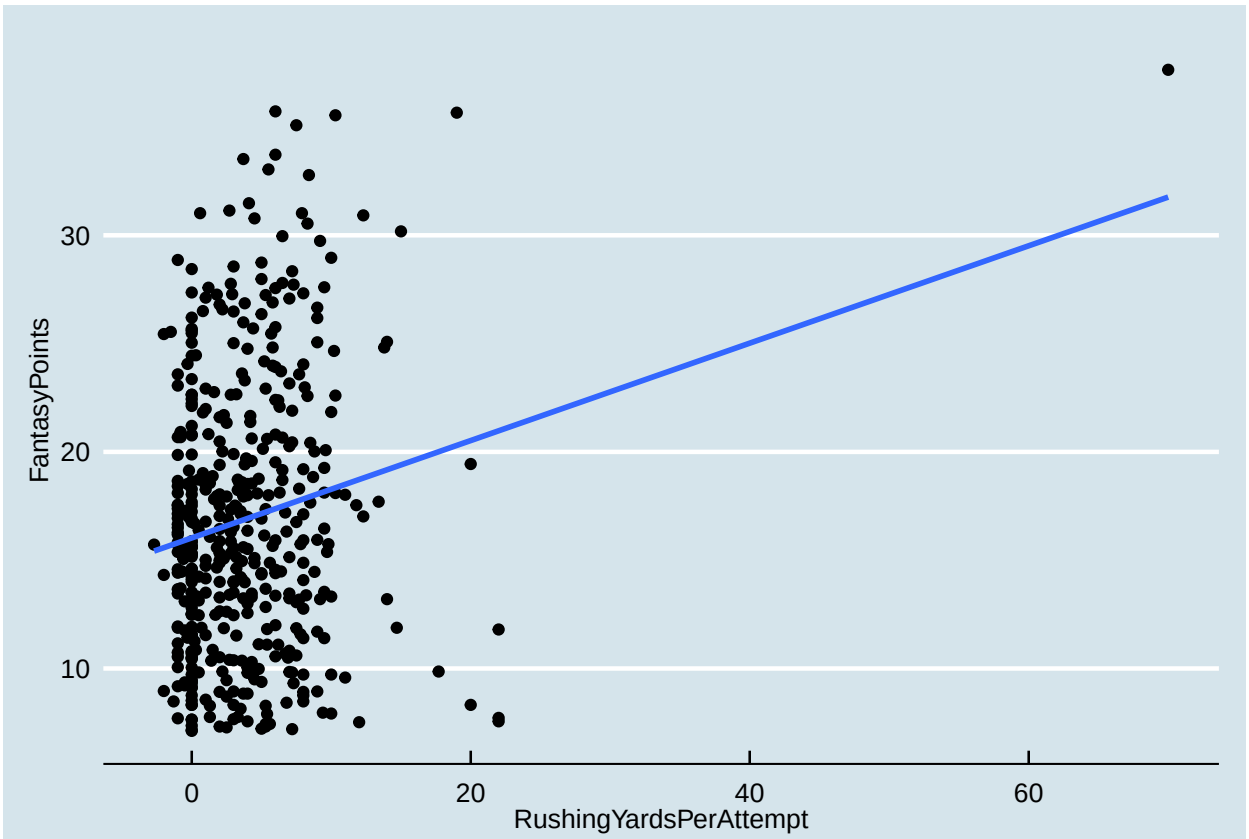

FantasyPoints
30
20
10
5.0
7.5
10.0
12.5
PassingYardsPerAttempt
FantasyPoints
30
20
10
0
1
2
3
4
5
PassingTouchdowns

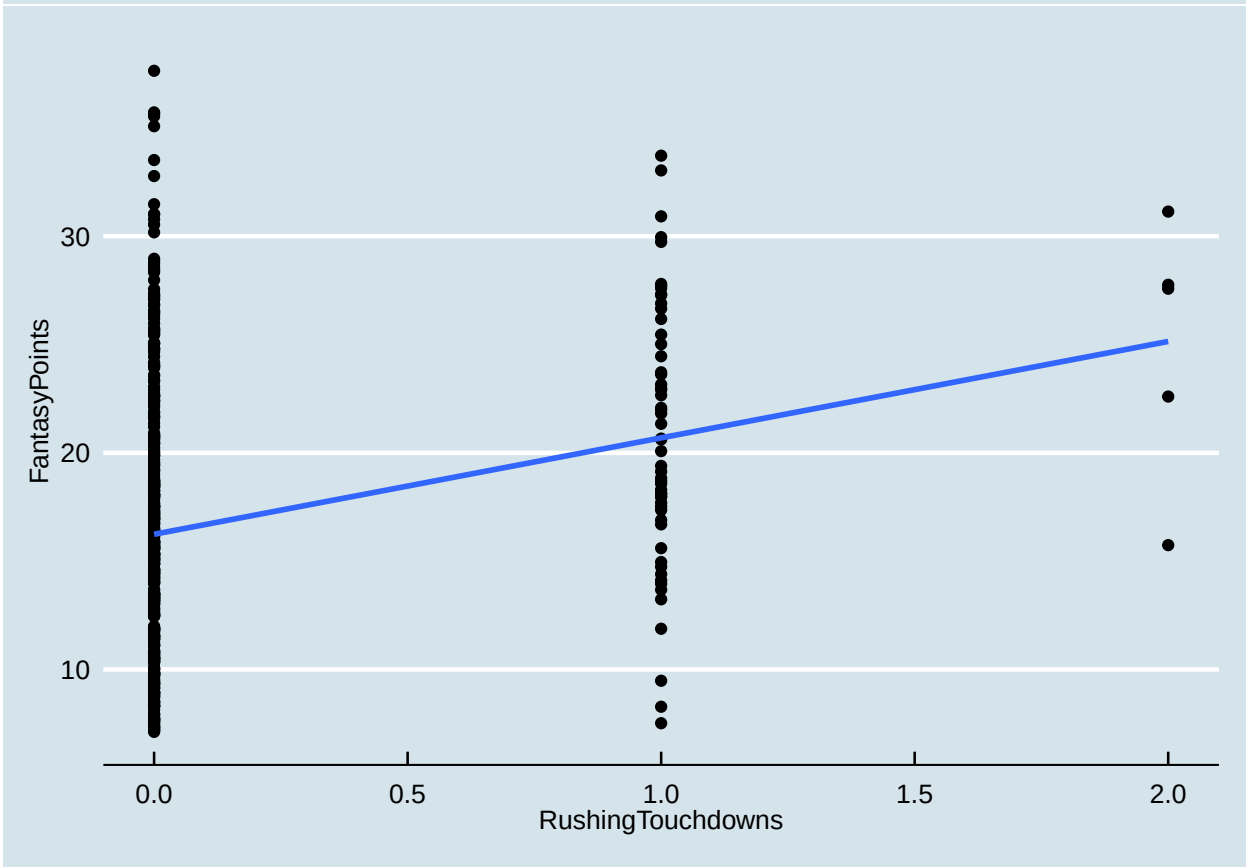

30
20
10
FantasyPoints
0
1
2
3
4
PassingInterceptions

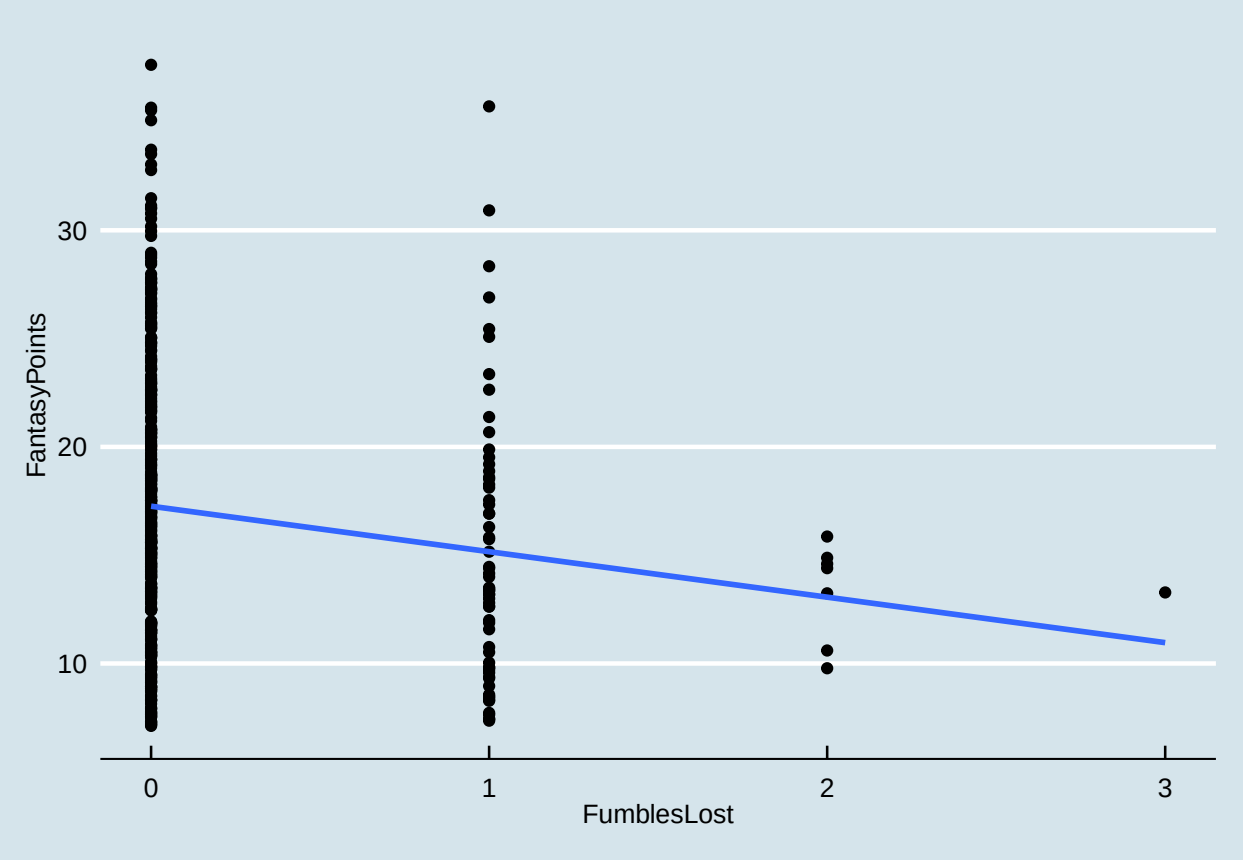

30
20
10
FantasyPoints
40
80
120
PassingRating


30
20
10
FantasyPoints
0
5
10
RushingAttempts


30
20
10
FantasyPoints
0
25
50
75
100
RushingYards


FantasyPoints
30
20
10
0
20
40
60
RushingYardsPerAttempt


FantasyPoints
30
20
10
0.0
0.5
1.0
1.5
2.0
RushingTouchdowns



Drop rushing yards per attempt

Defensive stats

Player Defensive Stats

```
defensive_positions = getFootballData("https://fantasydata.com/FantasyStatsNFL/FantasyStats_Read?sort=Fa

defensive_positions$StatSummary = c(NULL)
```

Team Defensive Stats

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

```
defensive_players_by_week =  sqldf("SELECT
                                      Week,
                                      FantasyPosition,
                                      Count(*)
                                    FROM defensive_positions
                                    GROUP BY Week, FantasyPosition")

team_defense_by_week =  sqldf("SELECT
                                      Week,
                                      FantasyPosition,
                                      Count(*)
```

```
                                    FROM team_defense
                                    GROUP BY Week, FantasyPosition")

# this looks good some teams are on bye in certain weeks
```

Do some averages for Defense before stitching on to QB data

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


team_defense = team_defense %>% select(defensive_columns) %>% rename('DefensiveFantasyPoints'='FantasyP
attach(team_defense)
```

```
## The following objects are masked from QBCrossSectional (pos = 3):
##
##     Team, Week
```

```
## The following objects are masked from QBCrossSectional (pos = 4):
##
##     Team, Week
```

```
## The following objects are masked from QBCrossSectional (pos = 5):
##
##     Team, Week
```

```
## The following objects are masked from QBCrossSectional (pos = 7):
##
##     Team, Week
```

```
team_defense$Week = as.factor(team_defense$Week)

sqldf("SELECT Week, Team, WeeklyRank FROM team_defense  WHERE Week IN(1, 2) ORDER BY Team, Week")
```

```
##    Week Team WeeklyRank
## 1     1  ARI          8
## 2     2  ARI         12
## 3     1  ATL          6
## 4     2  ATL         14
## 5     1  BAL         14
## 6     2  BAL         15
## 7     1  BUF          9
## 8     2  BUF         12
## 9     1  CAR         11
## 10    2  CAR         12
## 11    1  CHI          3
## 12    2  CHI          6
## 13    1  CIN          5
## 14    2  CIN          9
## 15    1  CLE          4
## 16    2  CLE          8
## 17    1  DAL         10
## 18    2  DAL          4
## 19    1  DEN          4
## 20    2  DEN         14
## 21    1  DET         12
```

```
## 22    2  DET         15
## 23    1   GB          9
## 24    2   GB          4
## 25    1  HOU          1
## 26    2  HOU         11
## 27    1  IND          3
## 28    2  IND          9
## 29    1  JAX         15
## 30    2  JAX          3
## 31    1   KC          4
## 32    2   KC         13
## 33    1  LAC          8
## 34    2  LAC          5
## 35    1  LAR         15
## 36    2  LAR          4
## 37    2  MIA          4
## 38    1  MIN          3
## 39    2  MIN          4
## 40    1   NE          2
## 41    2   NE          4
## 42    1   NO          1
## 43    2   NO          2
## 44    1  NYG          3
## 45    2  NYG          7
## 46    1  NYJ          5
## 47    2  NYJ          1
## 48    1  OAK          3
## 49    2  OAK         11
## 50    1  PHI         13
## 51    2  PHI          6
## 52    1  PIT         12
## 53    2  PIT         10
## 54    1  SEA          7
## 55    2  SEA         10
## 56    1   SF          5
## 57    2   SF          9
## 58    2   TB         16
## 59    1  TEN          3
## 60    2  TEN         11
## 61    1  WAS         10
## 62    2  WAS          9
```

Add defensive matchups

```
QBCrossSectionalDefensiveOverlay = QBCrossSectional %>% left_join(team_defense, by = c('Week'='Week', '
```

Add some lag data for QB

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

```
#Should we just train on second half of 2017?
QBCrossSectionalDefensiveOverlayCumulativePassYards = QBCrossSectionalDefensiveOverlay %>% group_by(Pla
        , CumulativeAveragePassingTouchdowns=cummean(PassingTouchdowns)
```

```
        , CumulativeAverageCompletions = cummean(PassingCompletions) # not sure that completions matter
        , 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)
        , LastWeekQuarterBackRating = lag(PassingRating)
        , LastWeekQuarterPassingYards = lag(PassingYards)
        , LastWeekQuarterPassingTouchdowns = lag(PassingTouchdowns)
        , NextWeekFantasyPoints = lead(FantasyPoints) #Target Variable
        )

QBCrossSectionalDefensiveOverlayCumulativePassYards %>% filter(PlayerID == 6739) %>% write.csv('alex_sm
```

Do we want to convert any of these to factors?