

Exploratory Data Analysis

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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)

```
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 ...

```

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## ..$ 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 ...

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## ..$ 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 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 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 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 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 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 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 ...

```

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## ..$ 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 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 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 ...

```

```

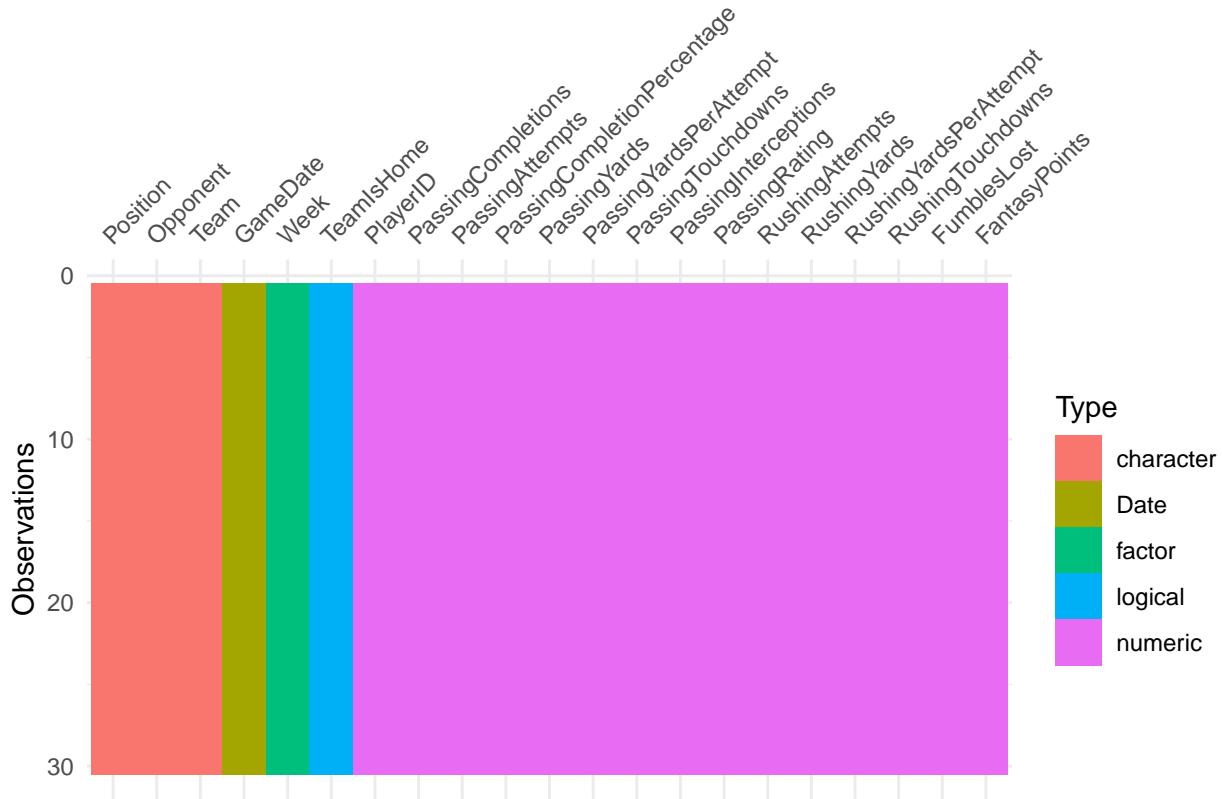
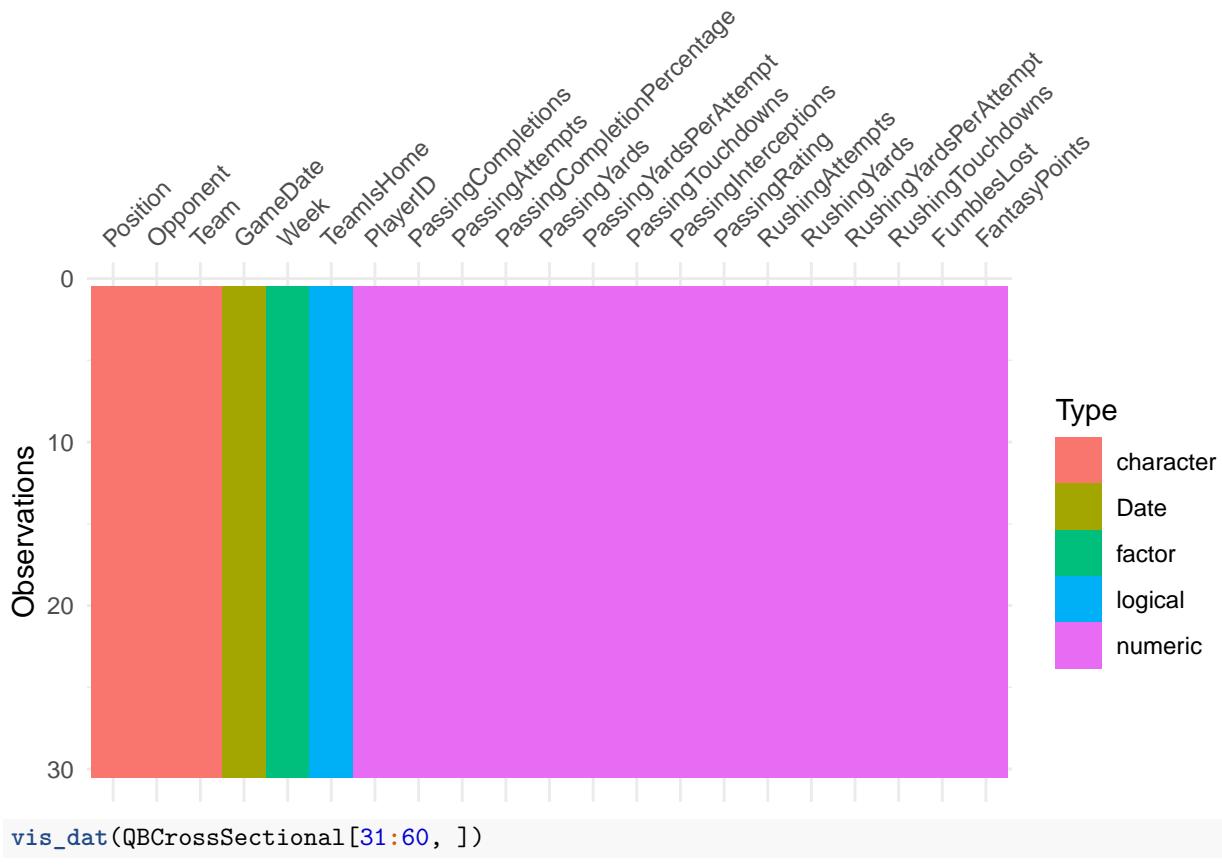
##   ..$ 14      : num [1:56] 16.8 NA NA NA 28.7 ...
##   ..$ 15      : num [1:56] 21.8 15.4 NA 21.9 18.2 ...
##   ..$ 16      : num [1:56] 17.3 14.2 NA NA 16.9 ...
##   ..$ 17      : num [1:56] 14.1 18.1 NA NA NA ...
## $ Team           :Classes 'tbl_df', 'tbl' and 'data.frame': 56 obs. of 18 variables:
##   ..$ 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 ...

```

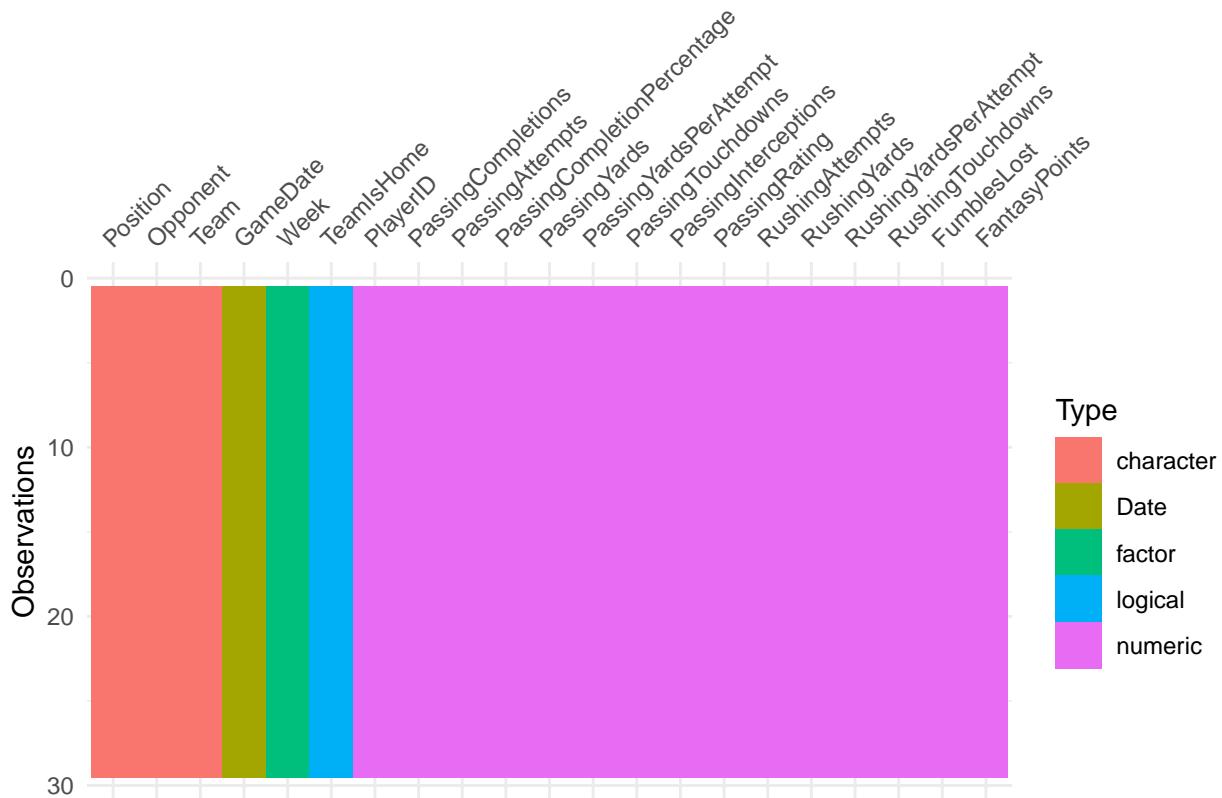
1.3: Missing Data

1.3.1 Quarterbacks (Old Data QBdata dataset)

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

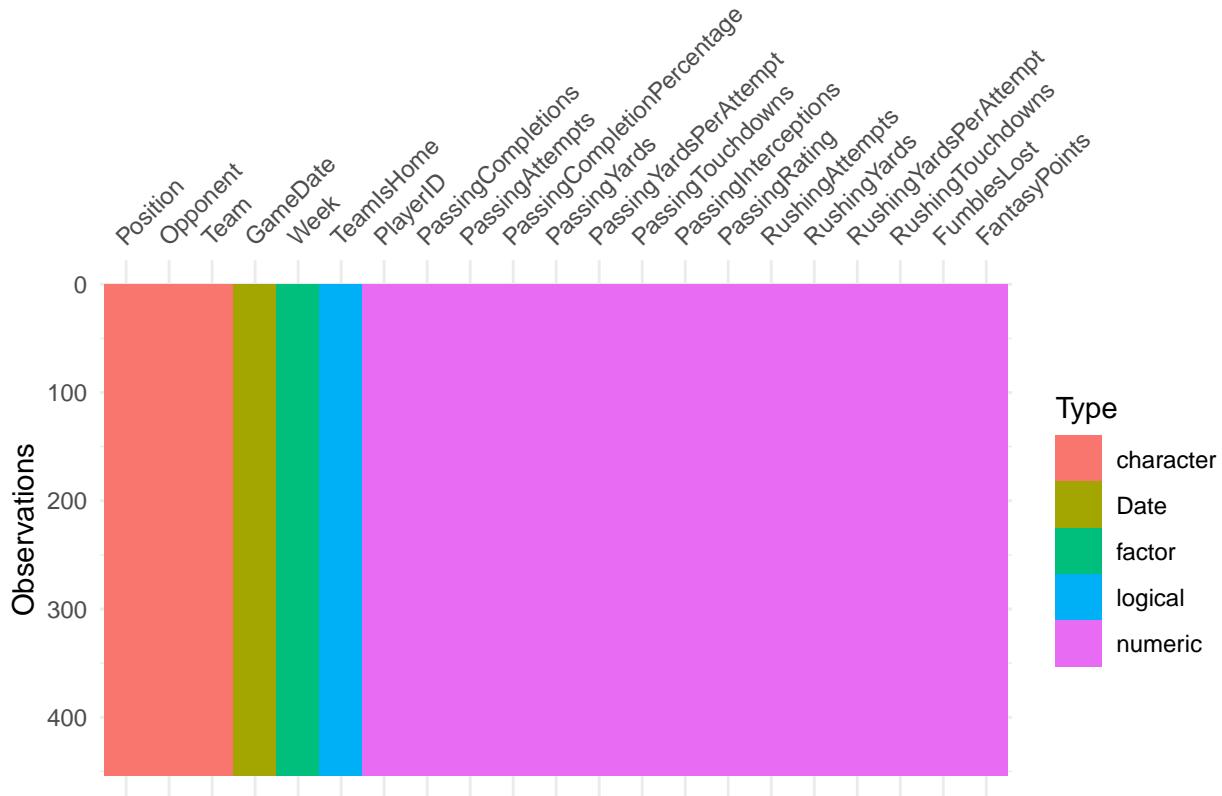


```
vis_dat(QBCrossSectional[61:89, ])
```



1.3.2 QBCrossSectional dataset (New dataset)

```
vis_dat(QBCrossSectional)
```



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> 
## 1     611 CLE  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> 
## 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 NA    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` <lg1>, `12` <lg1>,
## # `13` <lg1>, `14` <lg1>, `15` <lg1>, `16` <lg1>, `17` <lg1>
##
## $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>
## 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>
## 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>
## 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  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>
## 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>
## 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>
## 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
## 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    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>
## 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    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>
## 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>
## 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> 
## 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> 
## 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> 
## 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   0   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    0   NA 
## 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>
## 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>
## 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>
## 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 <NA> <NA> <NA> <NA> <NA>
## 4   2593 GB GB GB GB GB <NA> <NA> <NA> <NA> <NA>
## 5   3807 PIT PIT PIT <NA> PIT PIT PIT PIT <NA> PIT
## 6   4314 NE NE NE NE NE NE NE NE <NA> <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> 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_dat(as.data.frame(QBPanels[panel]))
  #print(missing_plot) Uncomment if you want to see plots
}

```

1.4: Correlogram

1.4.1 Correlogram 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)
```

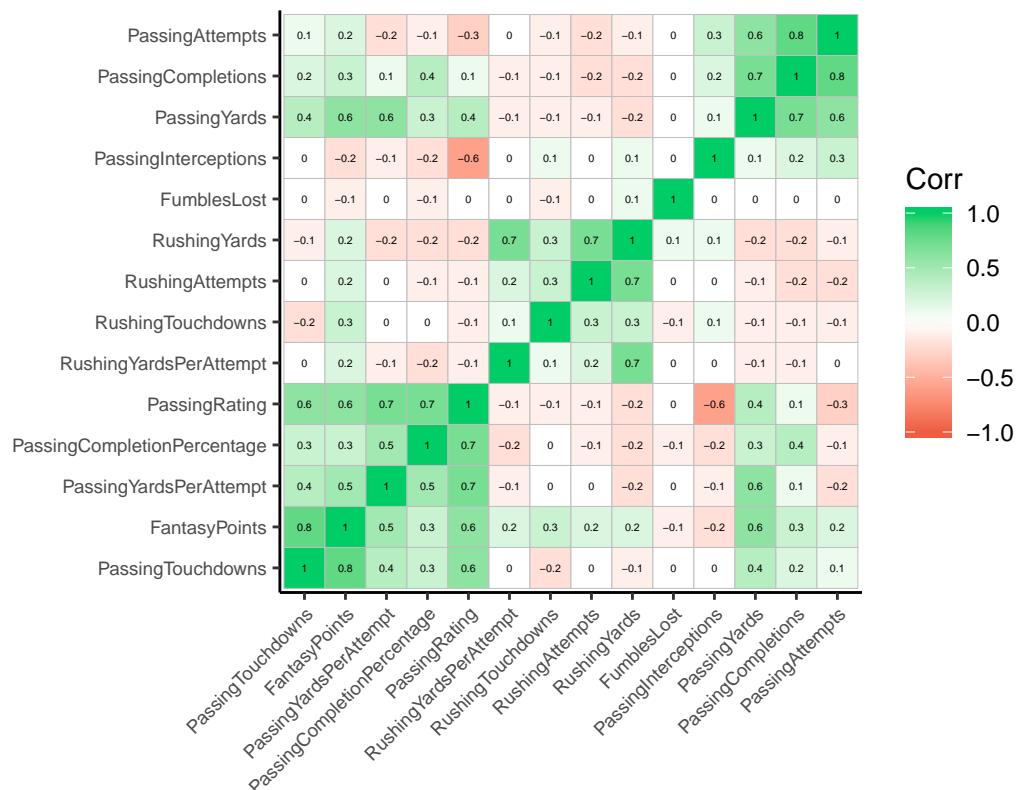
1.4.2 Correlogram Style2 QBData (Old dataset)

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

1.4.3 Correlogram 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)
```

Correlogram of Quarterbacks

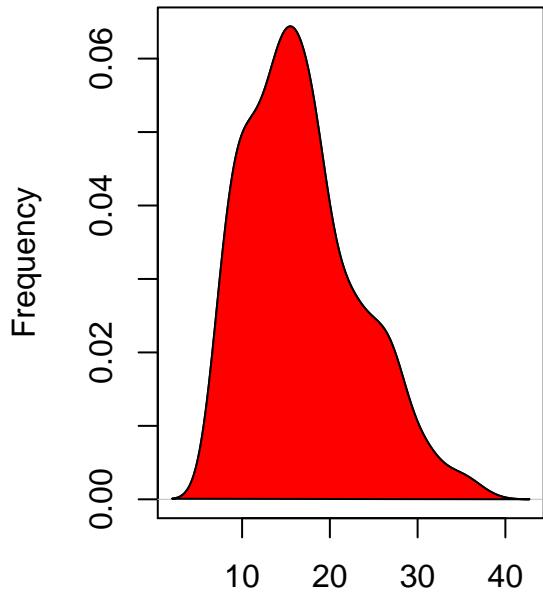


1.5: Distributions

1.5.1 Density plot for FantasyPoints is approximately 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(e1071
polygon(density(target), col="red",asp=1.2 )
```

QBdata: FantasyPoints

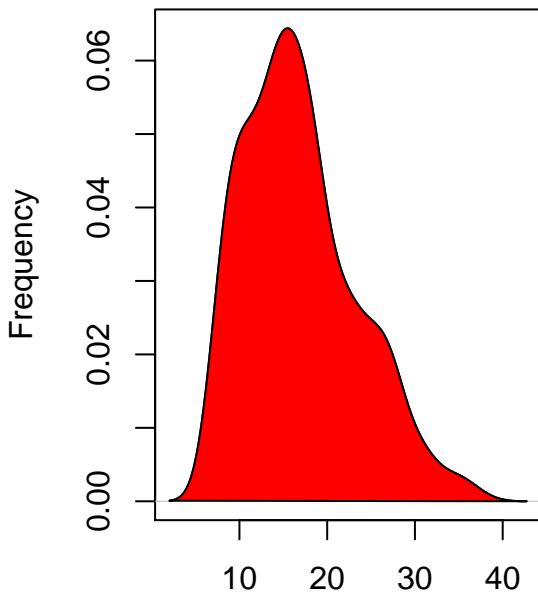


N = 453 Bandwidth = 1.7
Skewness: 0.67

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("Skewne")
polygon(density(target), col="red")
```

CrossSectional Dataset: FantasyPc



N = 453 Bandwidth = 1.7
Skewness: 0.67

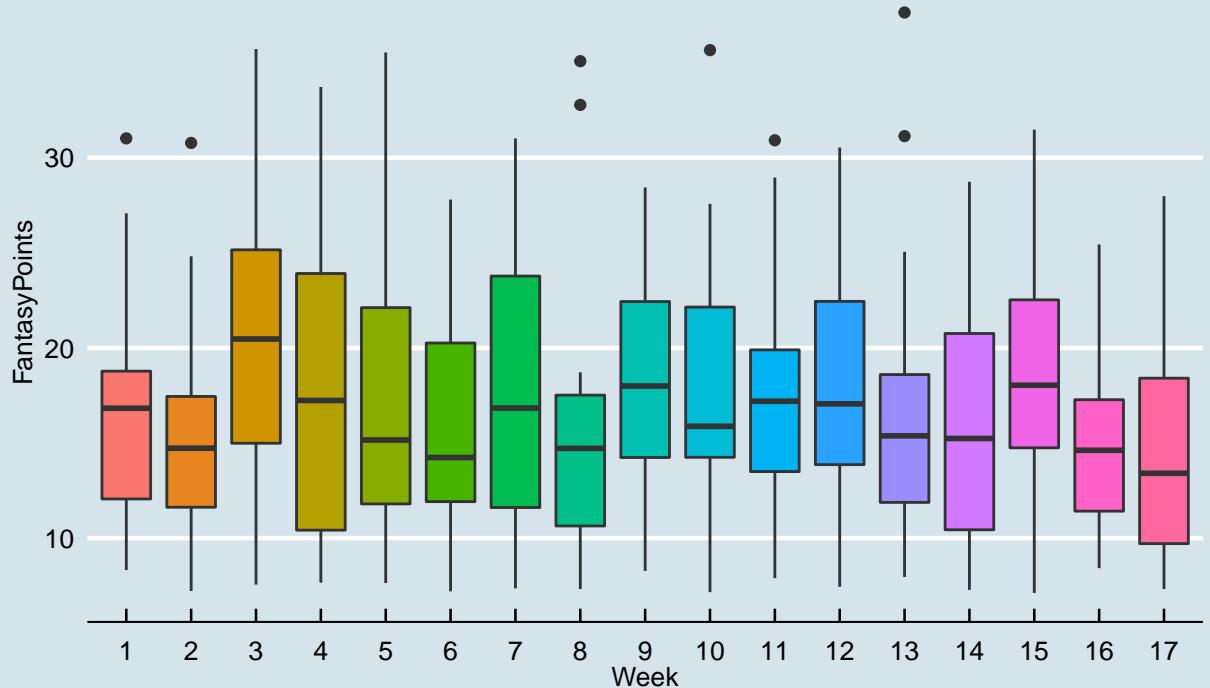
1.5.3 Boxplots - Target and Individual Predictor Behavior for per Team

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

```
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",
  caption="Source: Fantasyfootball")+theme_economist()
```

Fantasyfootball

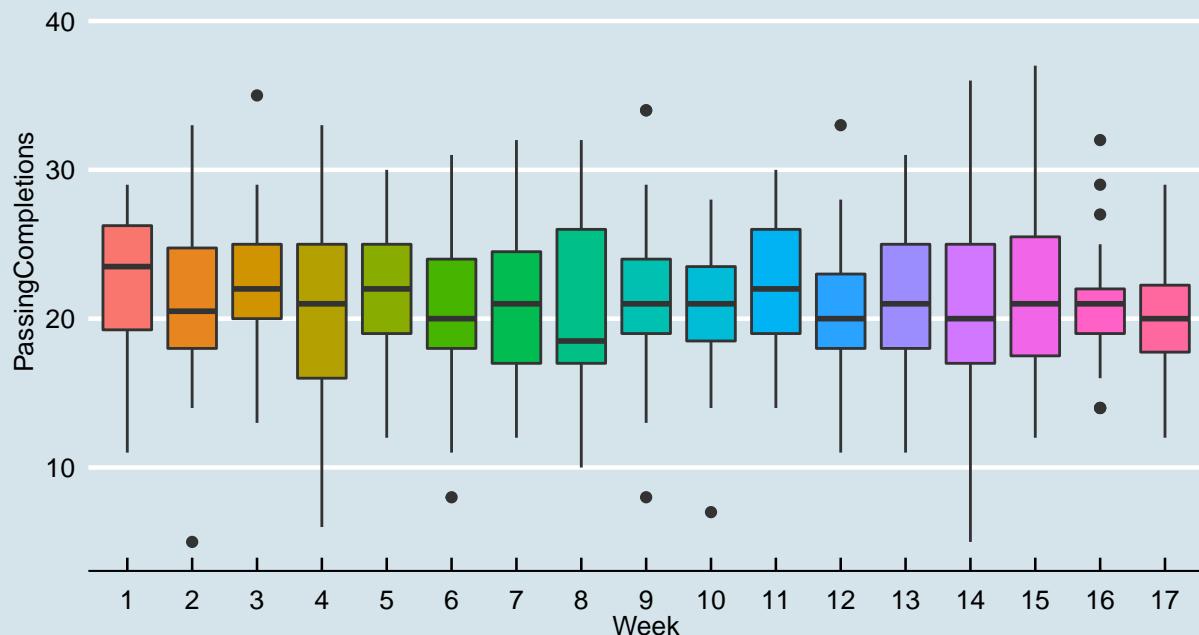
Weekly fantasypoints



```
for (i in 7:19) {  
  
  ggplotp <- QBCrossSectional %>% ggplot(aes_string(y=names(QBCrossSectional[i]), x=Week, fill=Week, group=Week)) +  
    geom_boxplot(show.legend = FALSE) +  
    xlab("Week") + ylab(names(QBCrossSectional[i])) +  
    labs(title="Fantasyfootball",  
         subtitle="Weekly fantasypoints",  
         caption="Source: Fantasyfootball") + theme_economist()  
  print(ggplotp)  
}
```

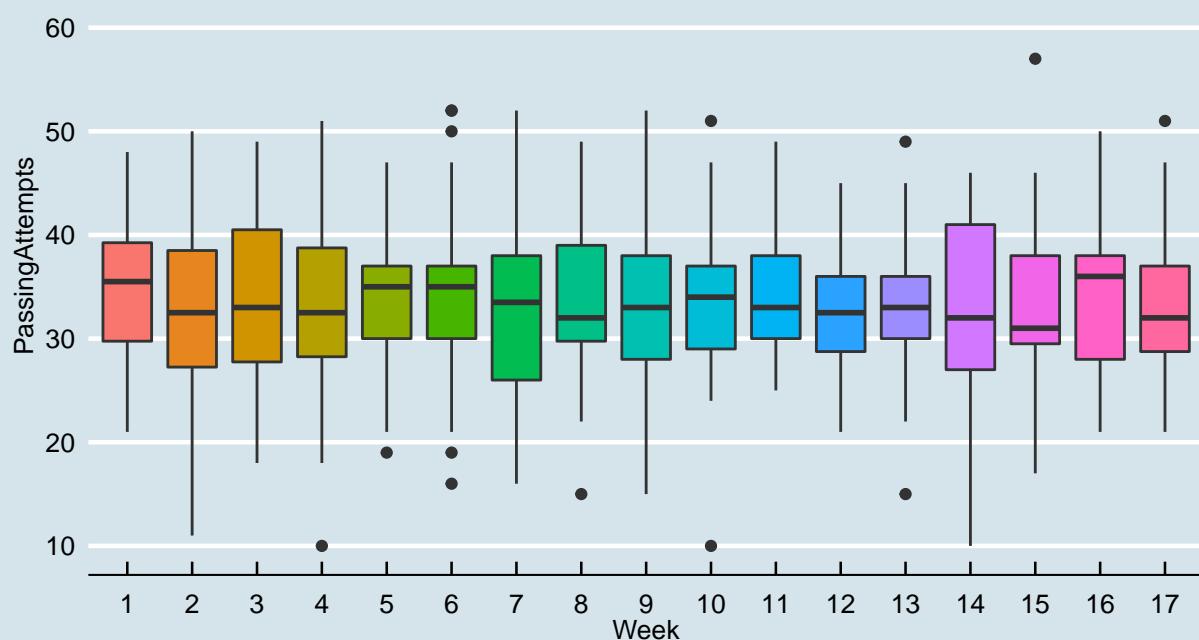
Fantasyfootball

Weekly fantasypoints



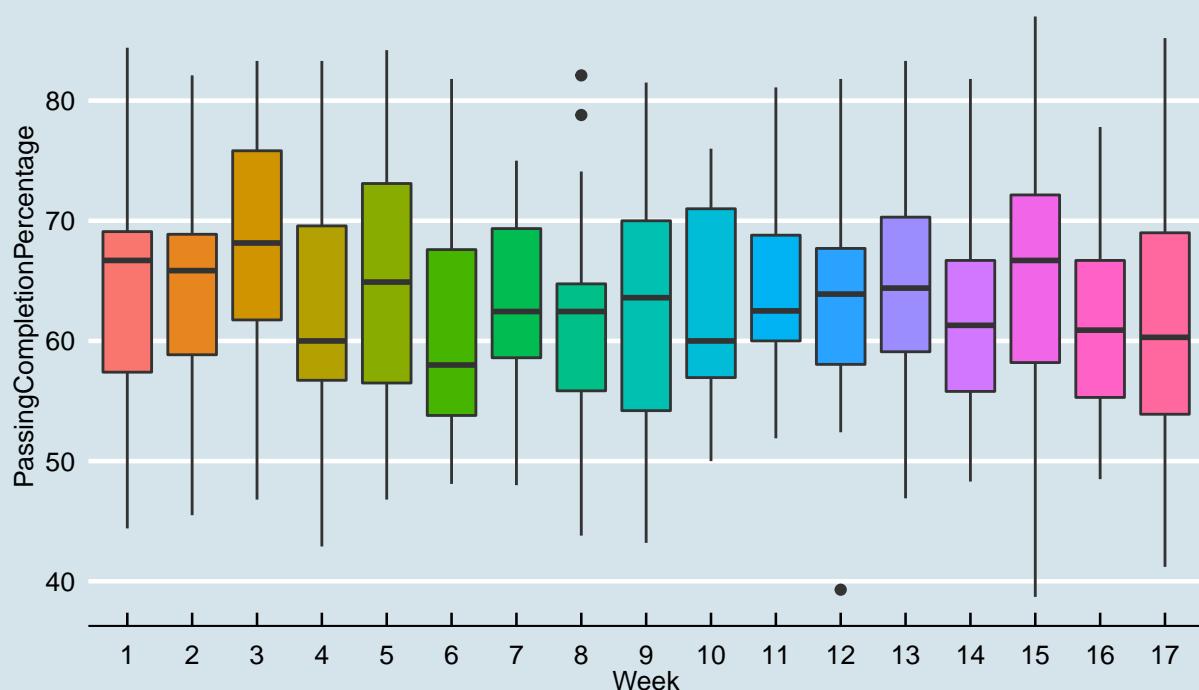
Fantasyfootball

Weekly fantasypoints



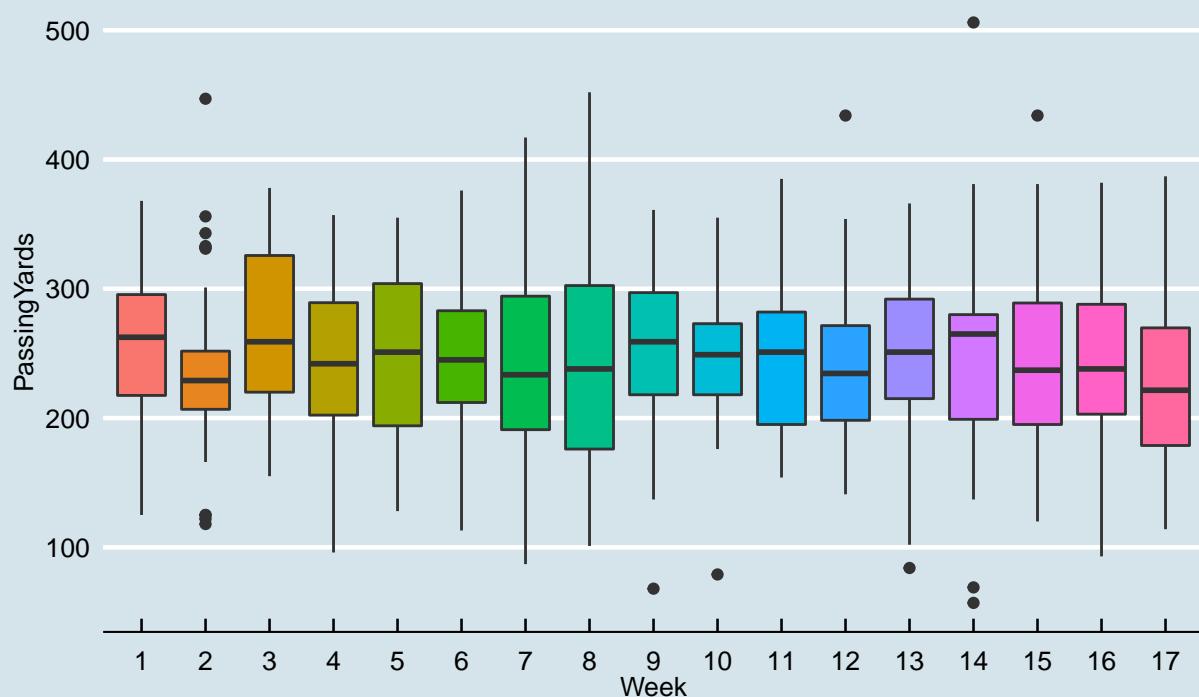
Fantasyfootball

Weekly fantasypoints



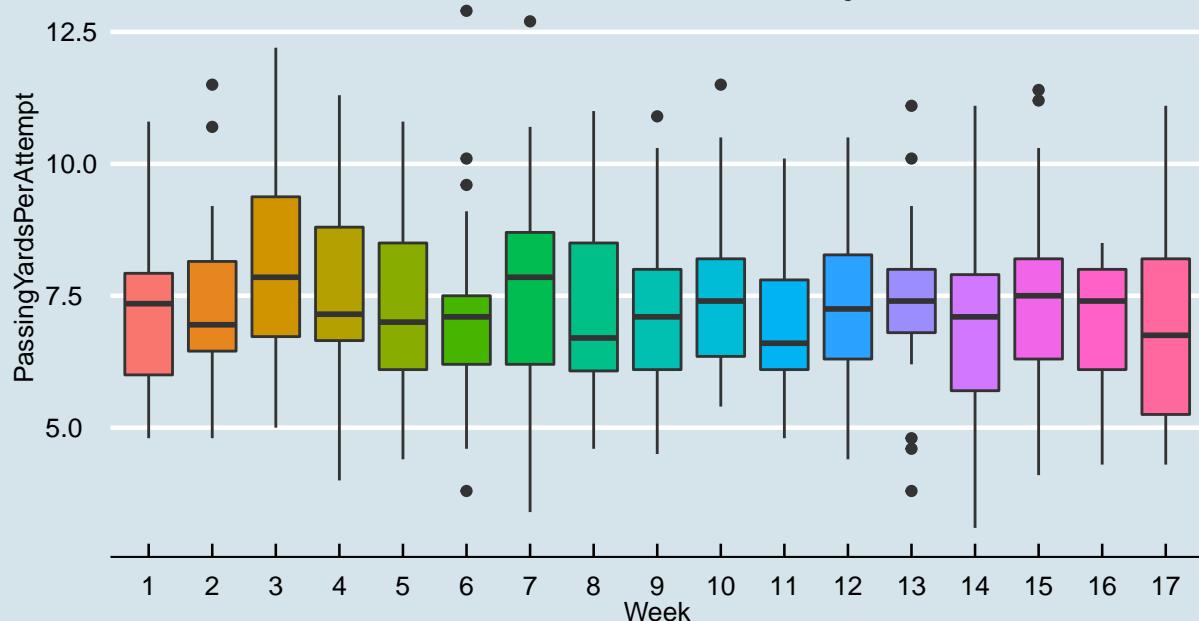
Fantasyfootball

Weekly fantasypoints



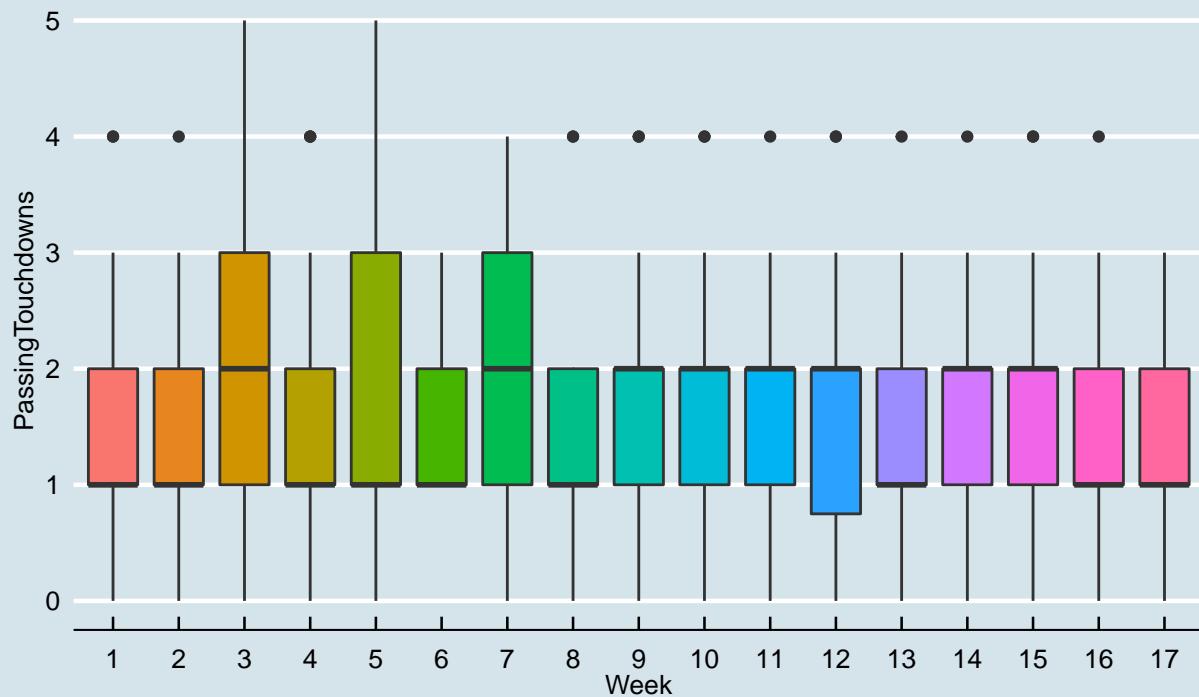
Fantasyfootball

Weekly fantasypoints



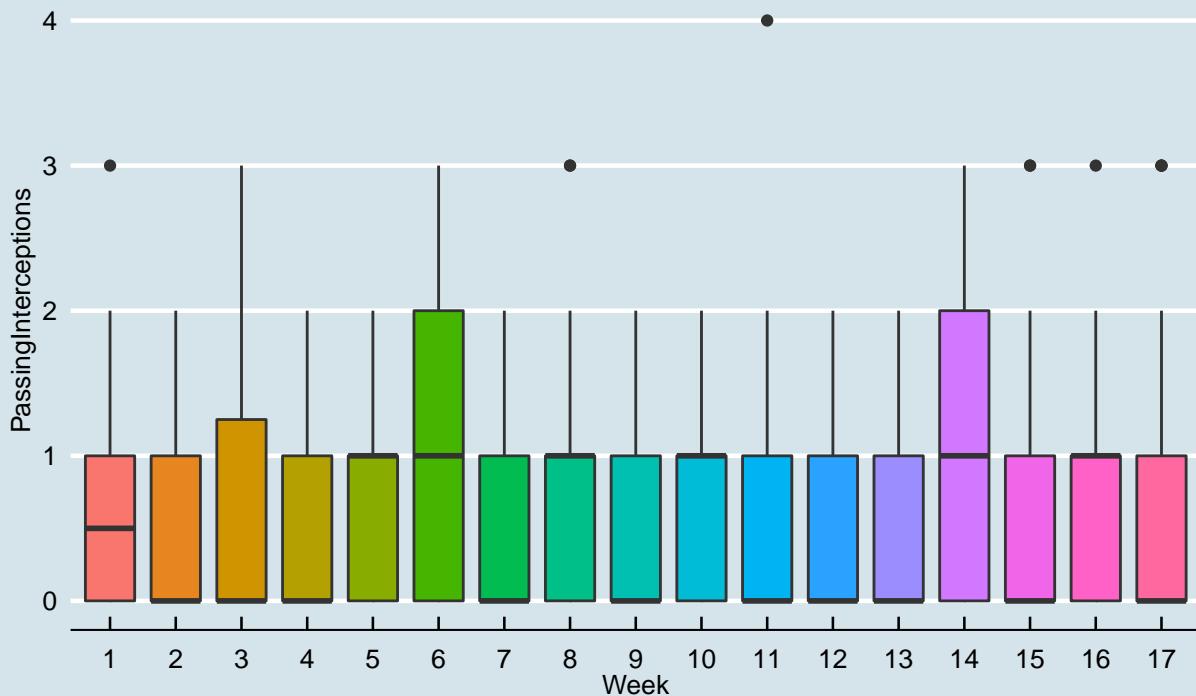
Fantasyfootball

Weekly fantasypoints



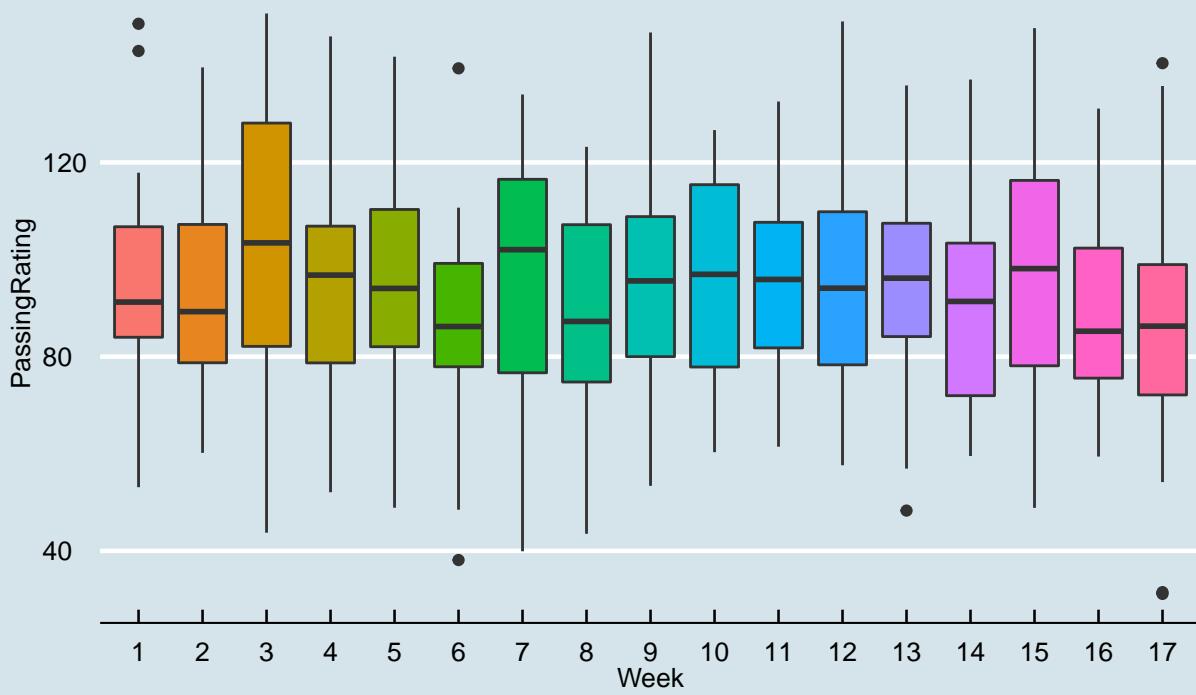
Fantasyfootball

Weekly fantasypoints



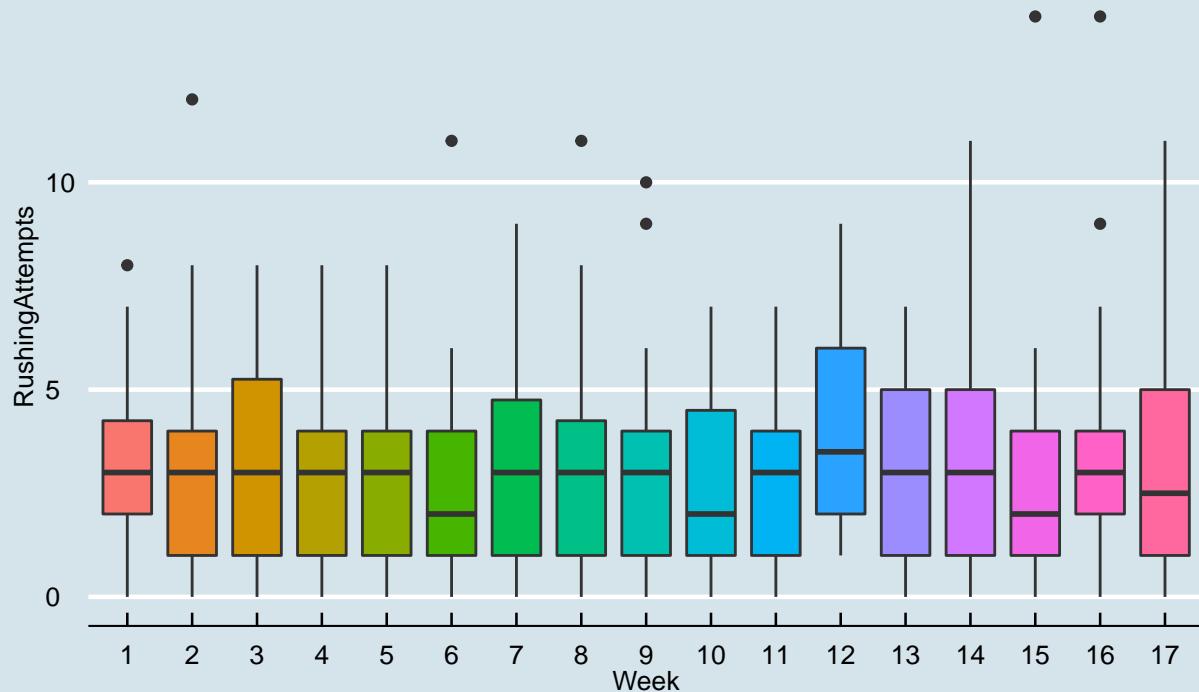
Fantasyfootball

Weekly fantasypoints



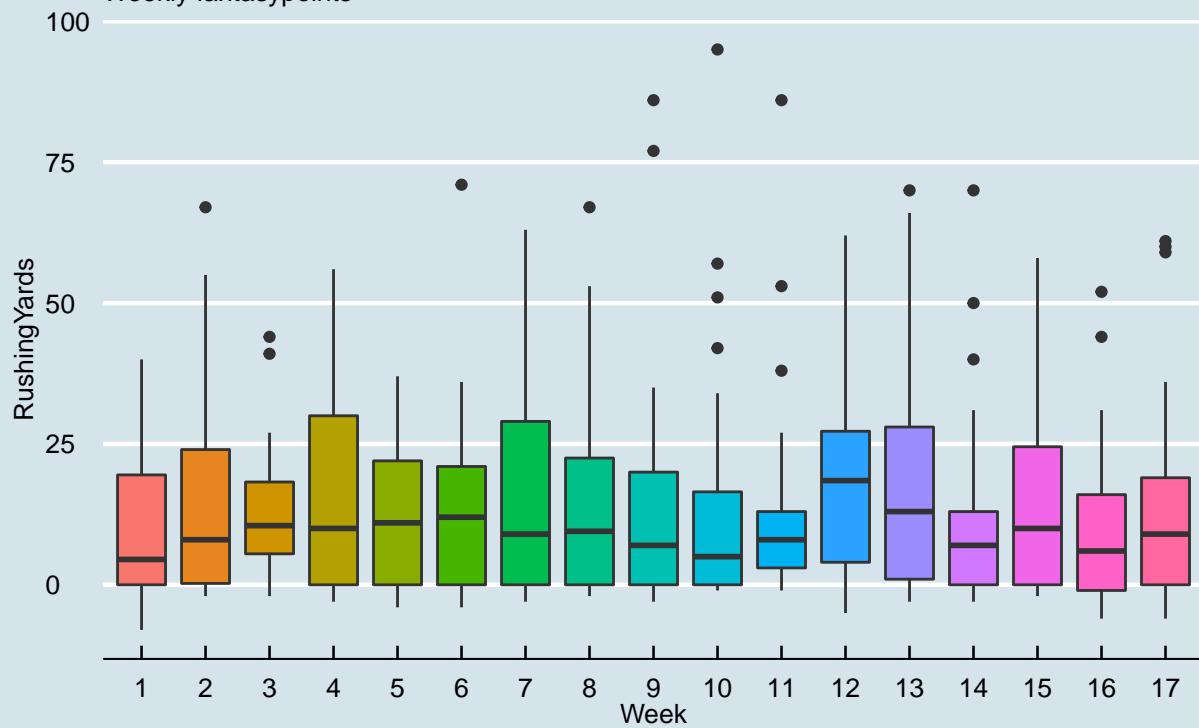
Fantasyfootball

Weekly fantasypoints



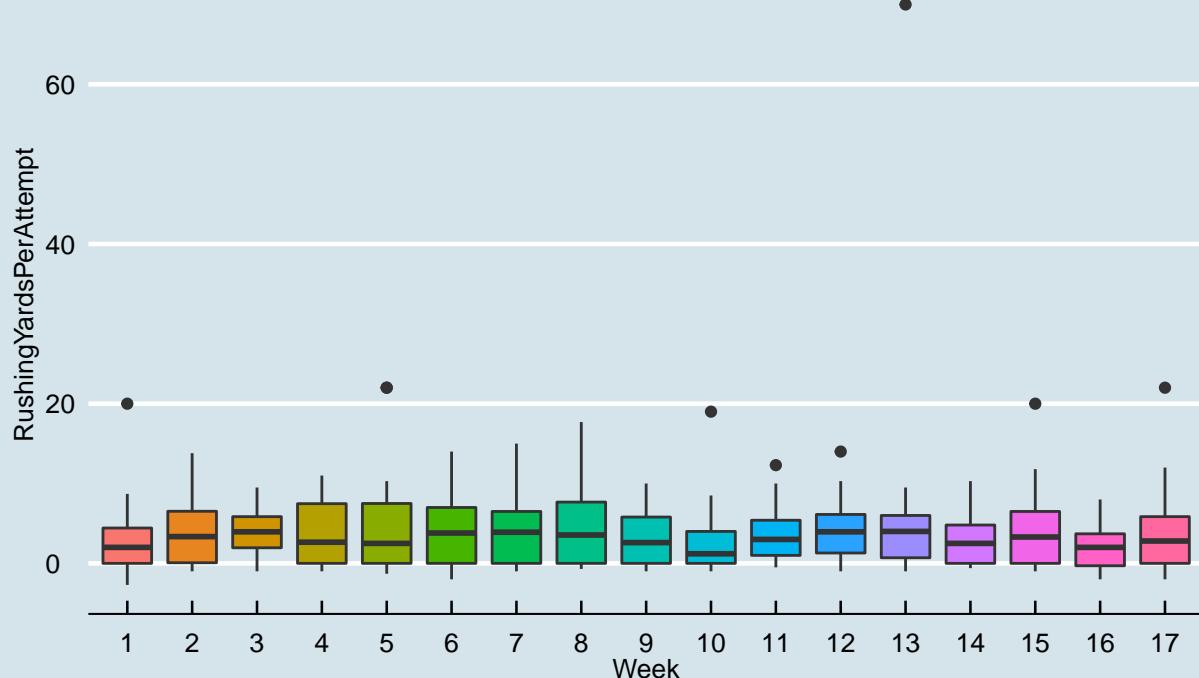
Fantasyfootball

Weekly fantasypoints



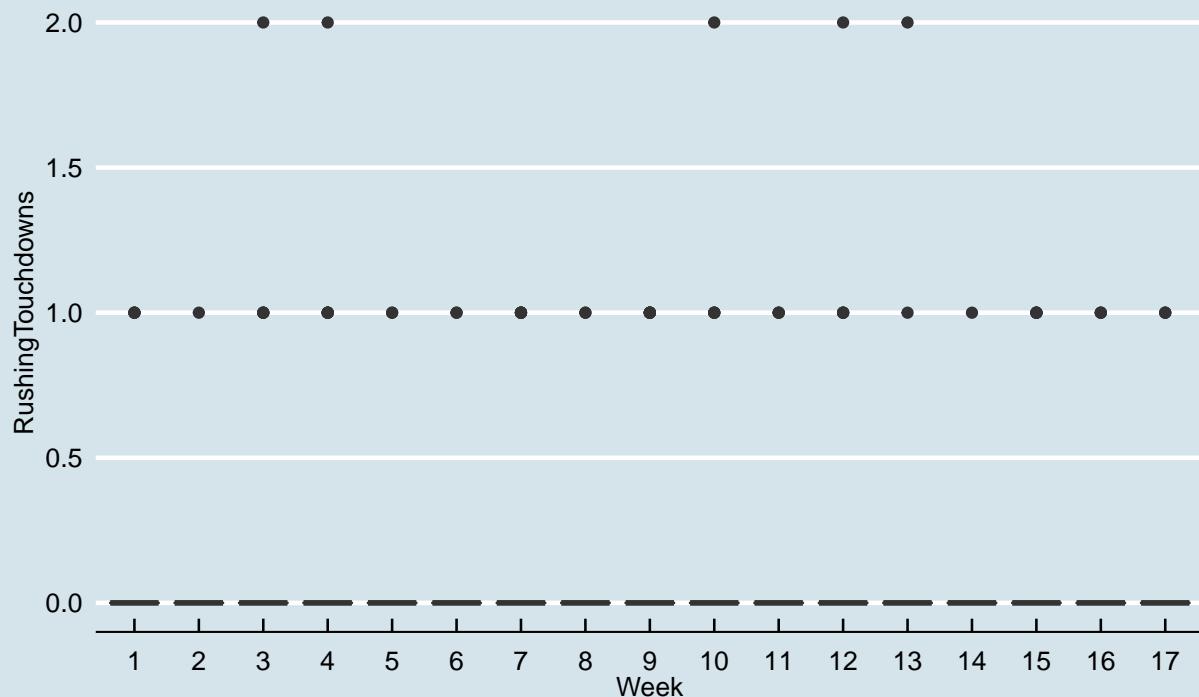
Fantasyfootball

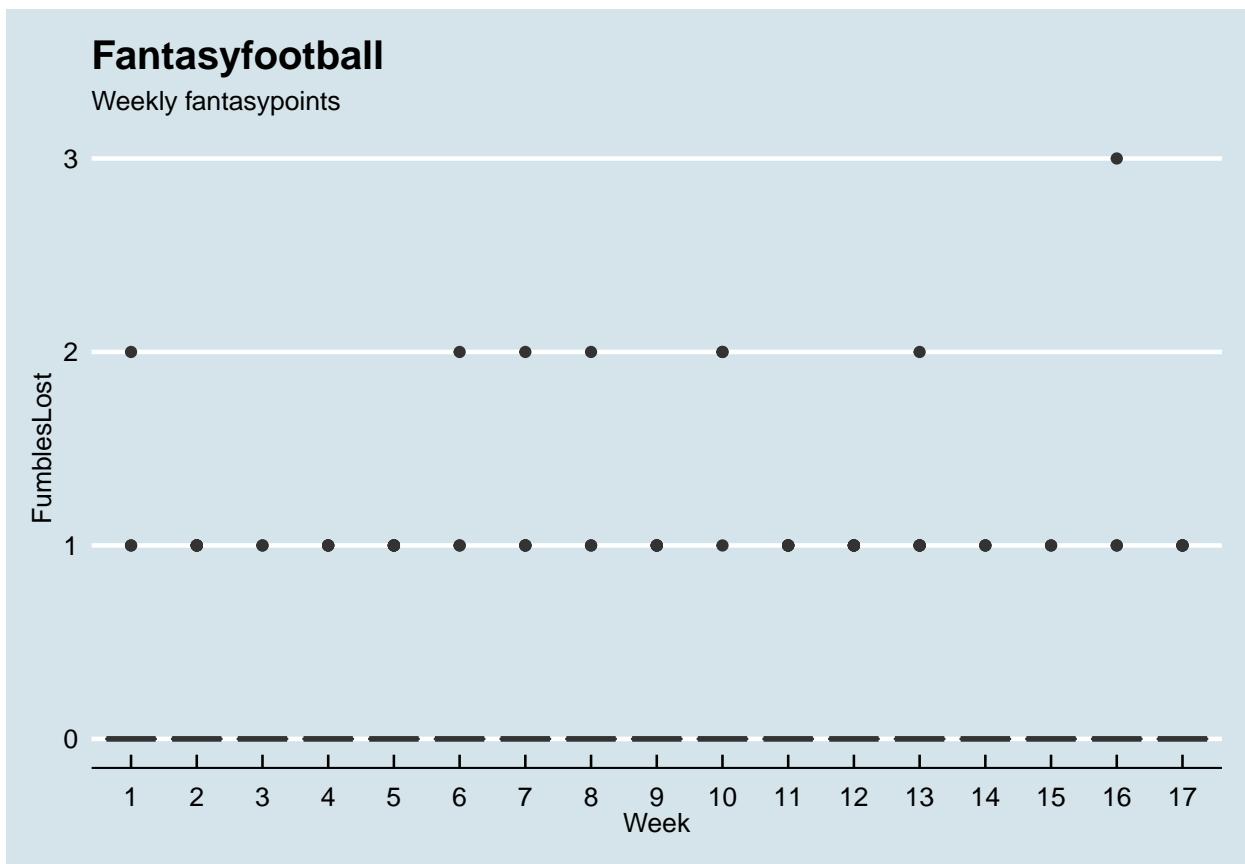
Weekly fantasypoints



Fantasyfootball

Weekly fantasypoints

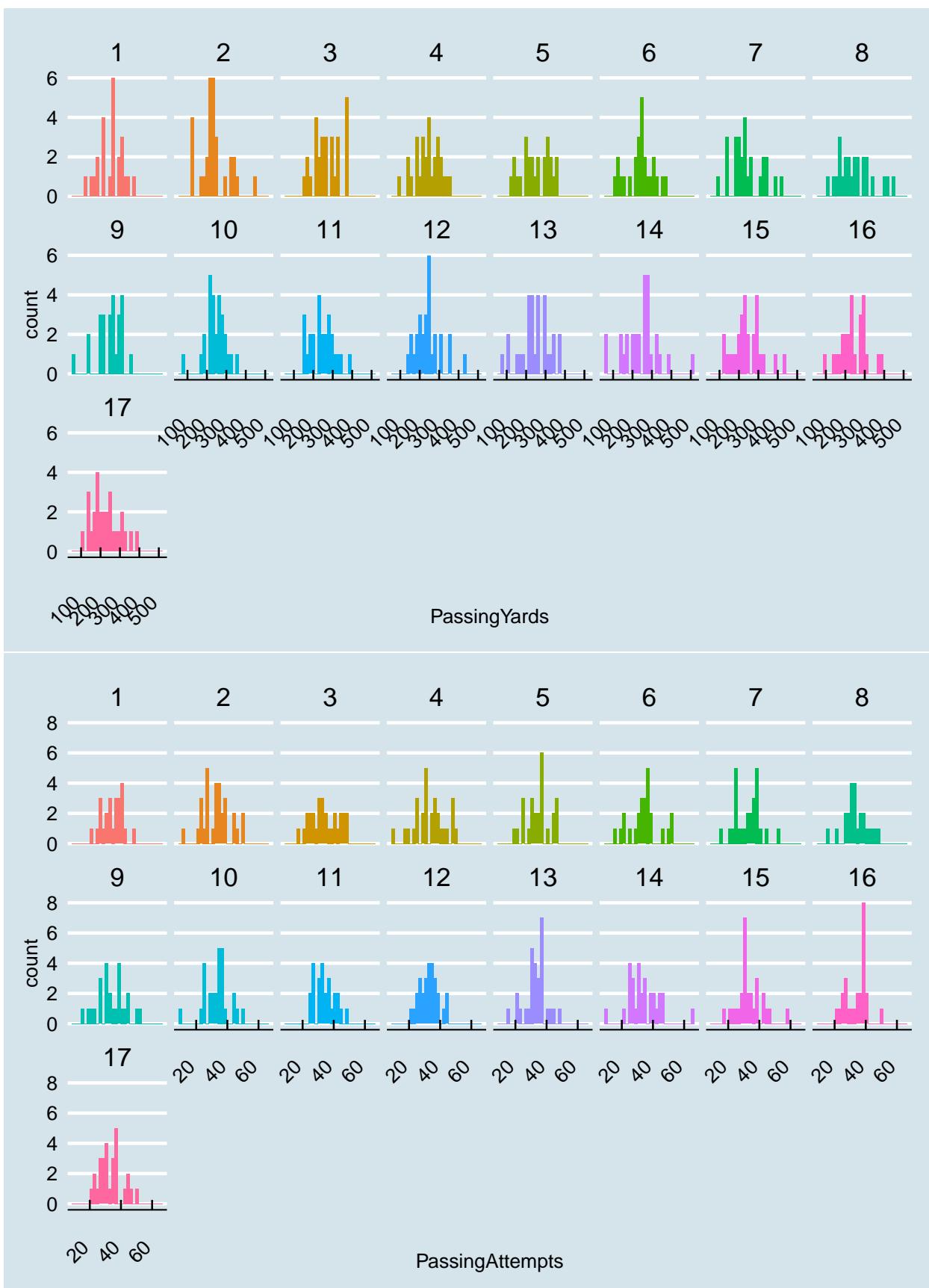


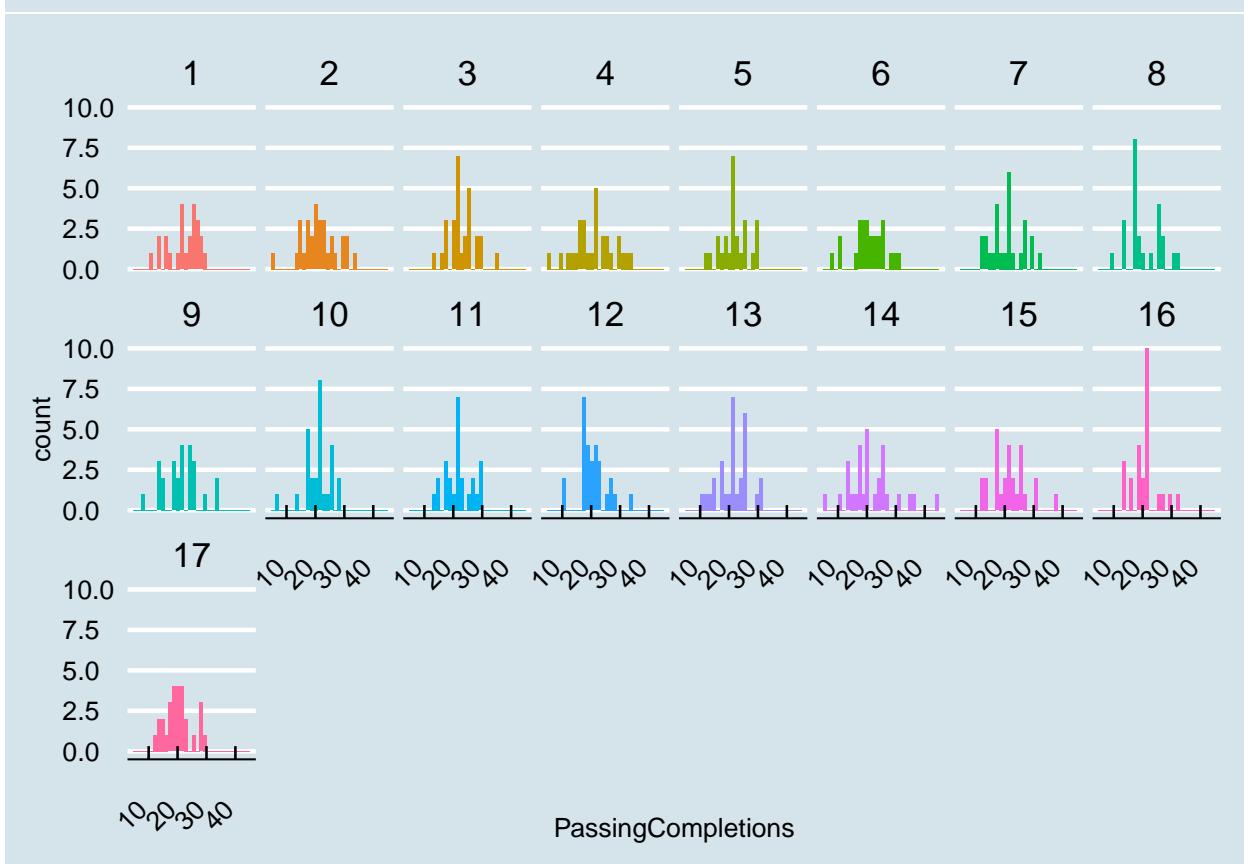
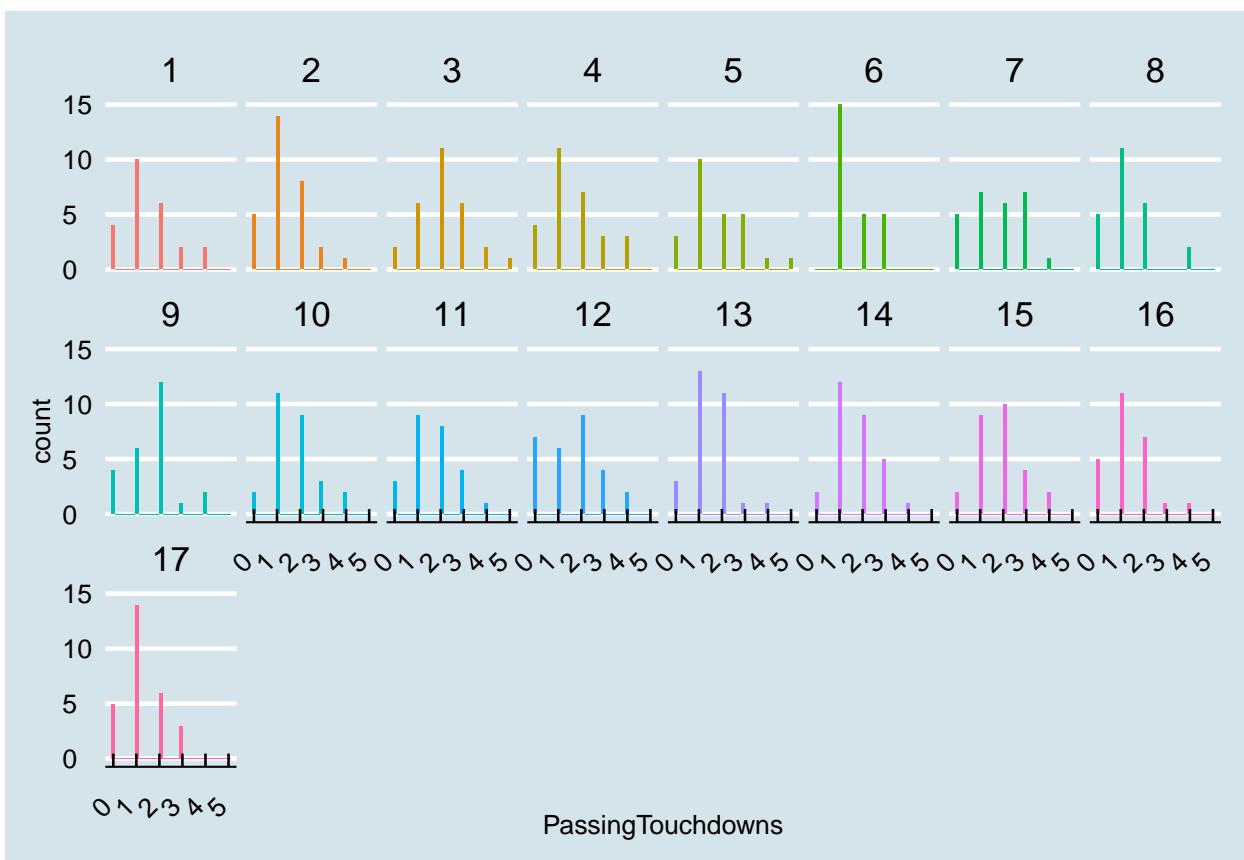


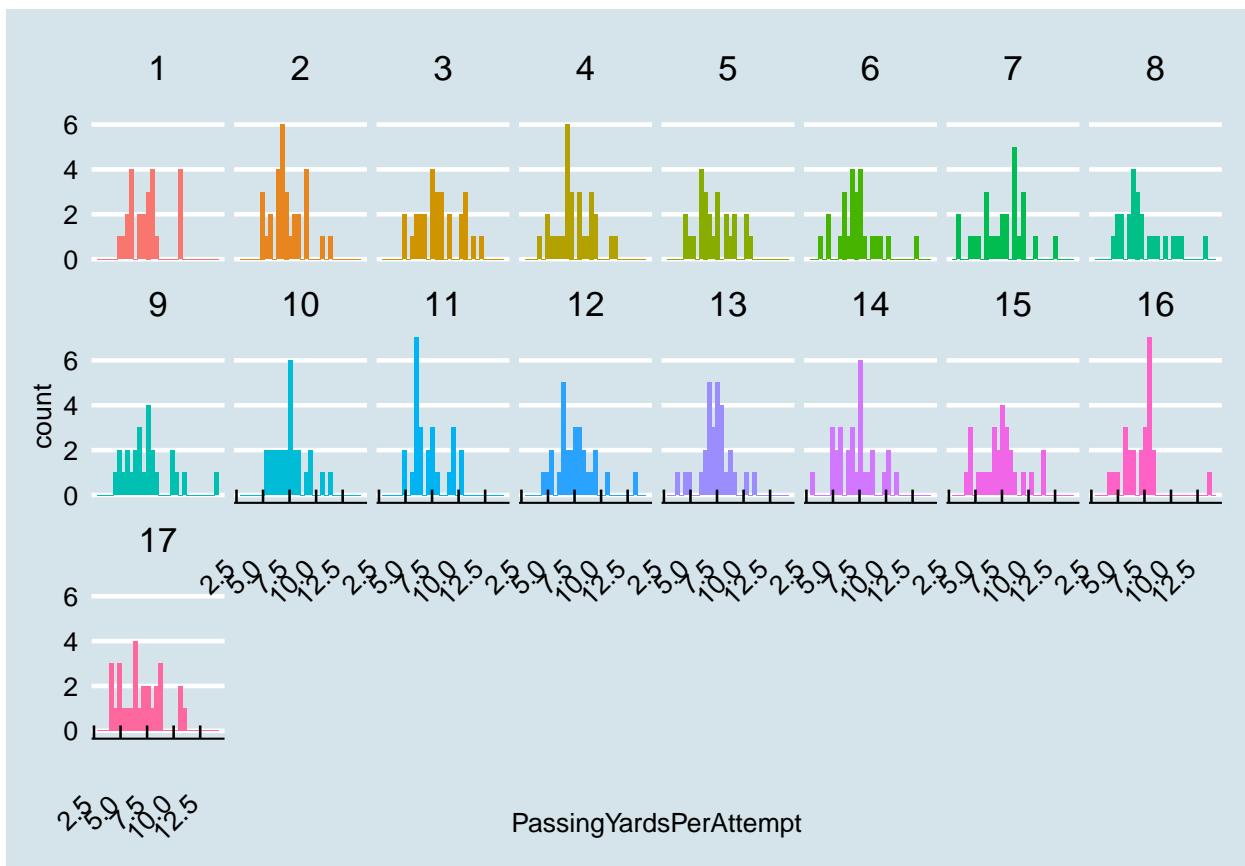
Check for skewed predictors

1.5.4 Histograms - Normality by Week

```
features_to_keep = c('PassingYards', 'PassingAttempts', 'PassingTouchdowns', 'PassingCompletions', 'PassingAttemptsRate')
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_text(angle=90))
  print(hist)
}
```







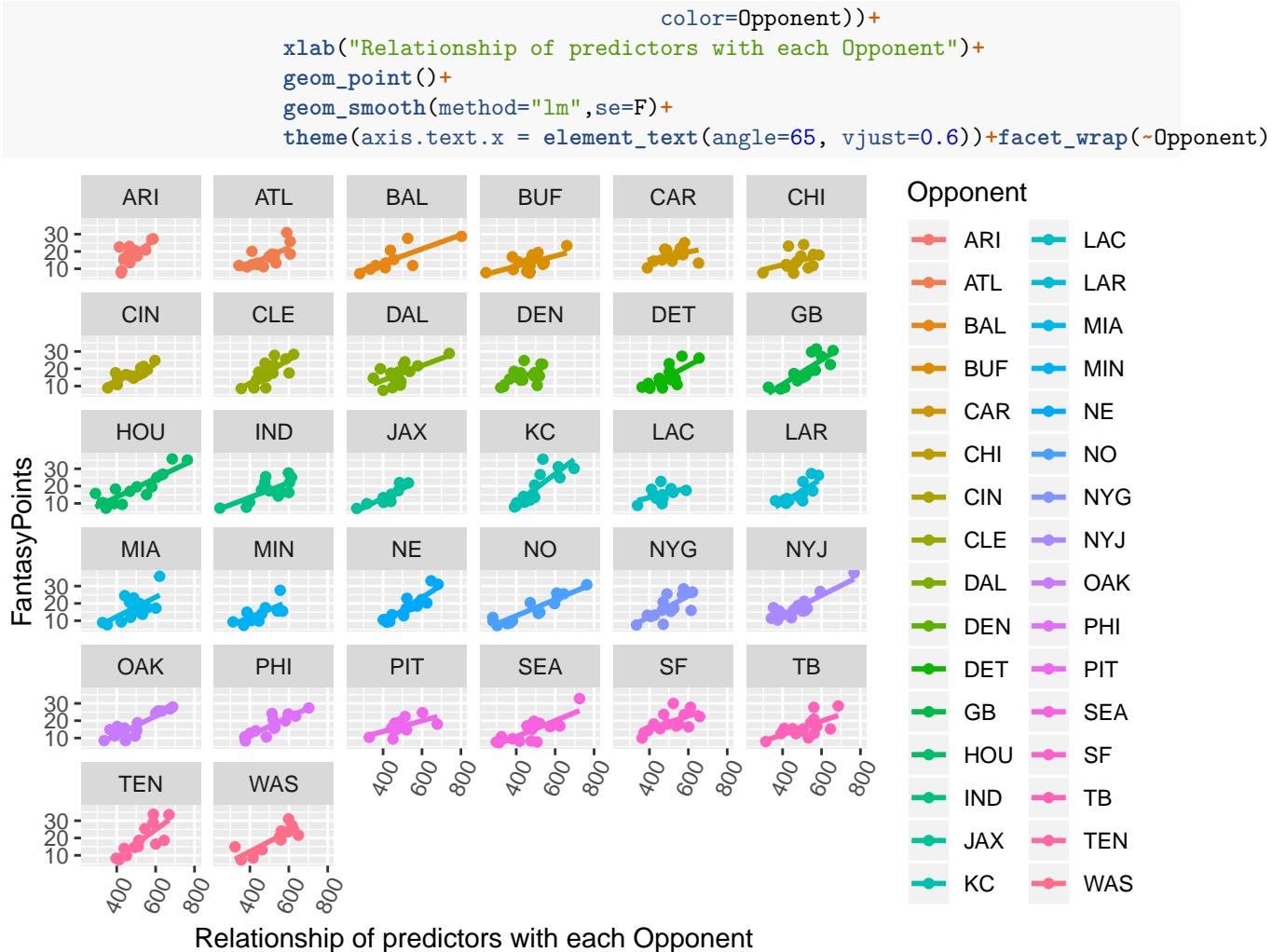
1.6: Relationships

1.6.1 Relationship between FantasyPoints 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,
```



1.6.2 Relationship between FantasyPoints 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

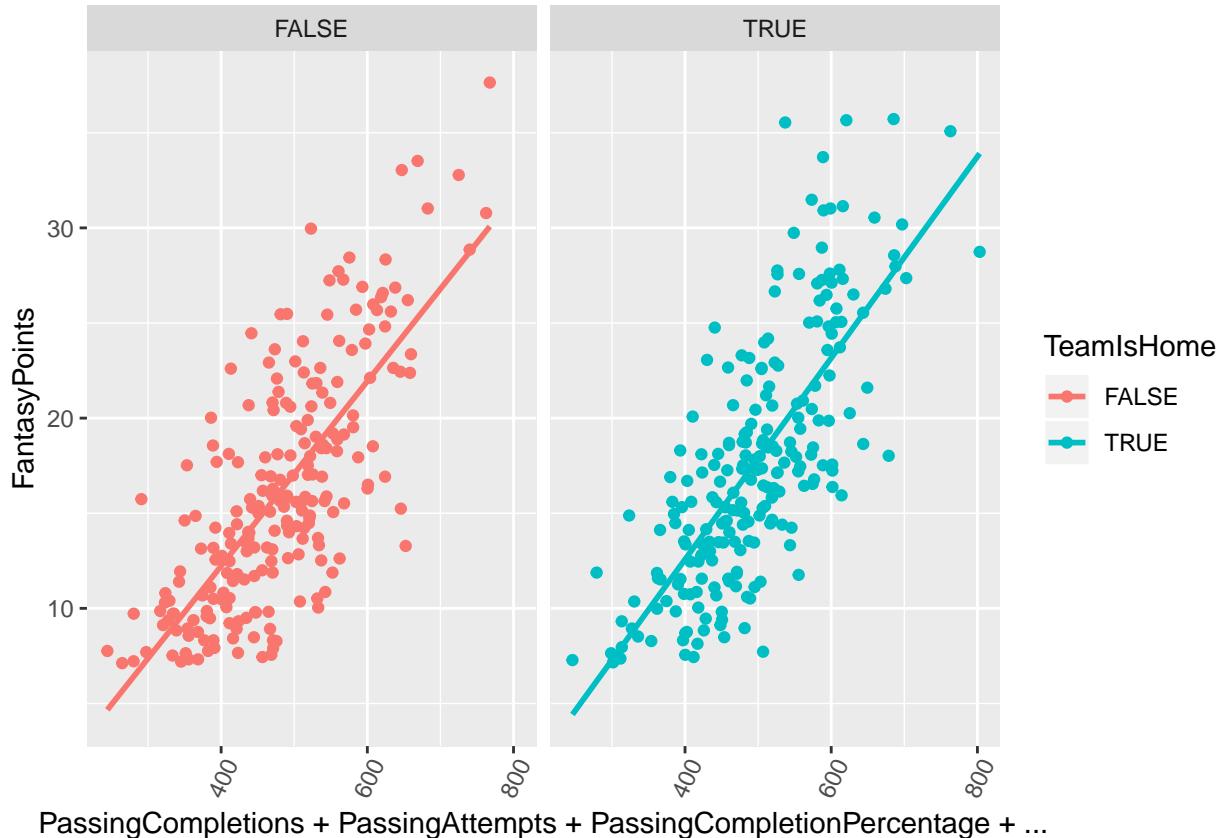
## The following objects are masked from QBCrossSectional (pos = 5):
##
## FantasyPoints, FumblesLost, GameDate, Opponent,
## PassingAttempts, PassingCompletionPercentage,
## PassingCompletions, PassingInterceptions, PassingRating,
## PassingTouchdowns, PassingYards, PassingYardsPerAttempt,

```

```

##      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

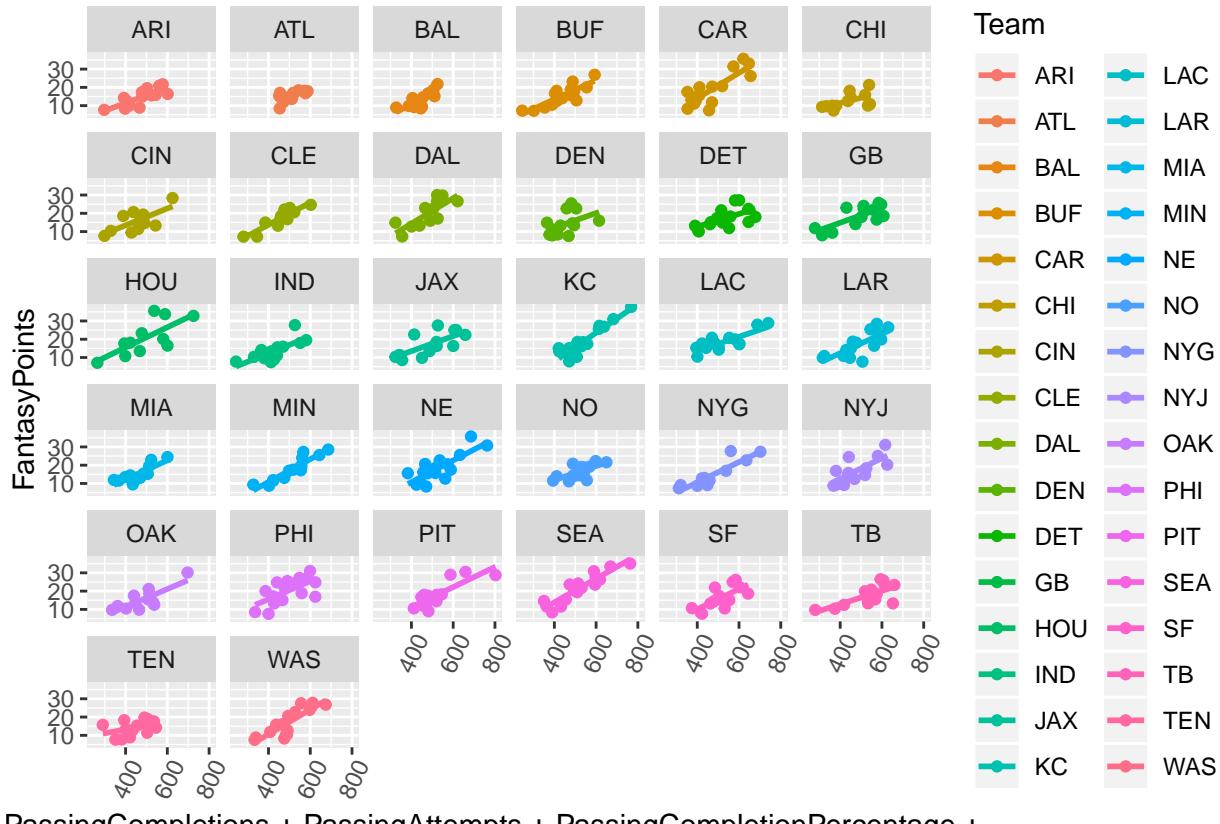
## The following objects are masked from QBCrossSectional (pos = 4):
## 
##      FantasyPoints, FumblesLost, GameDate, Opponent,
##      PassingAttempts, PassingCompletionPercentage,
##      PassingCompletions, PassingInterceptions, PassingRating,
##      PassingTouchdowns, PassingYards, PassingYardsPerAttempt,
##      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)

```

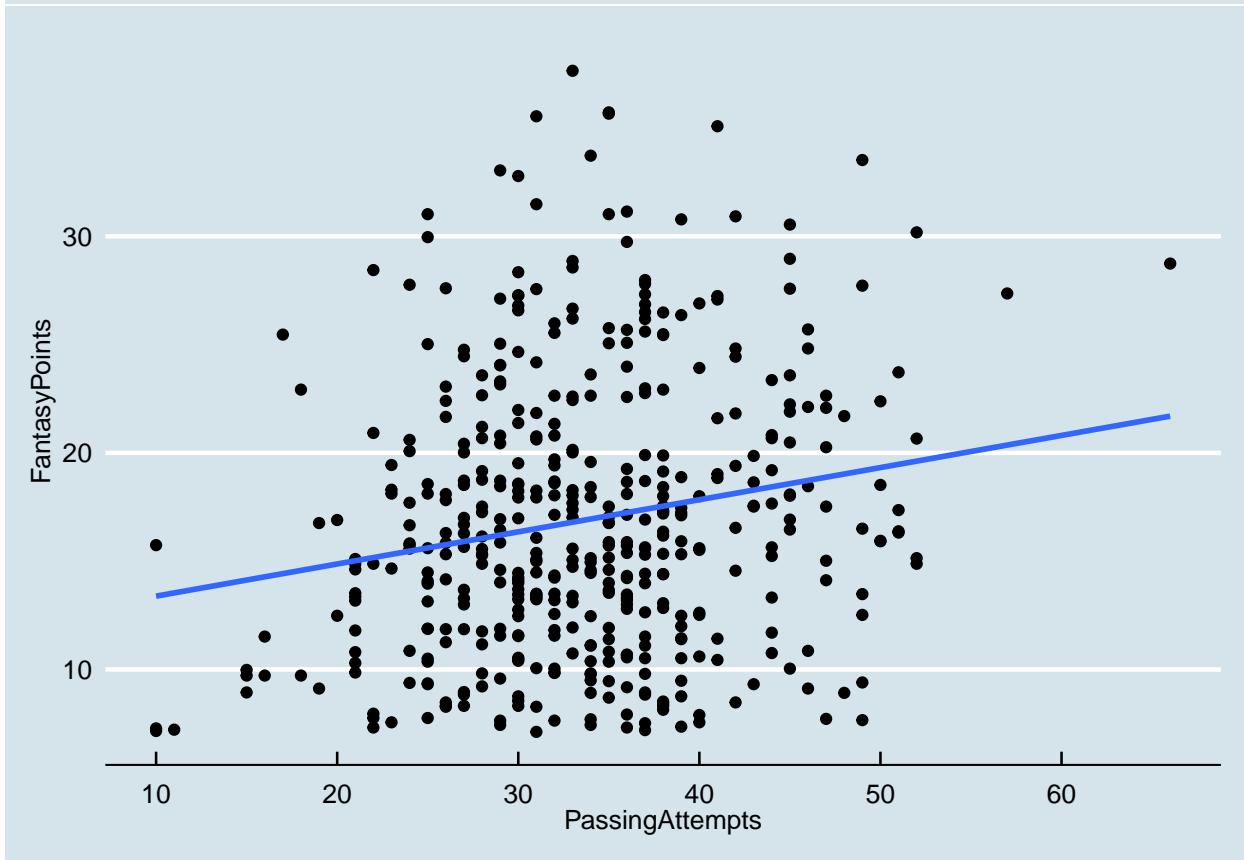
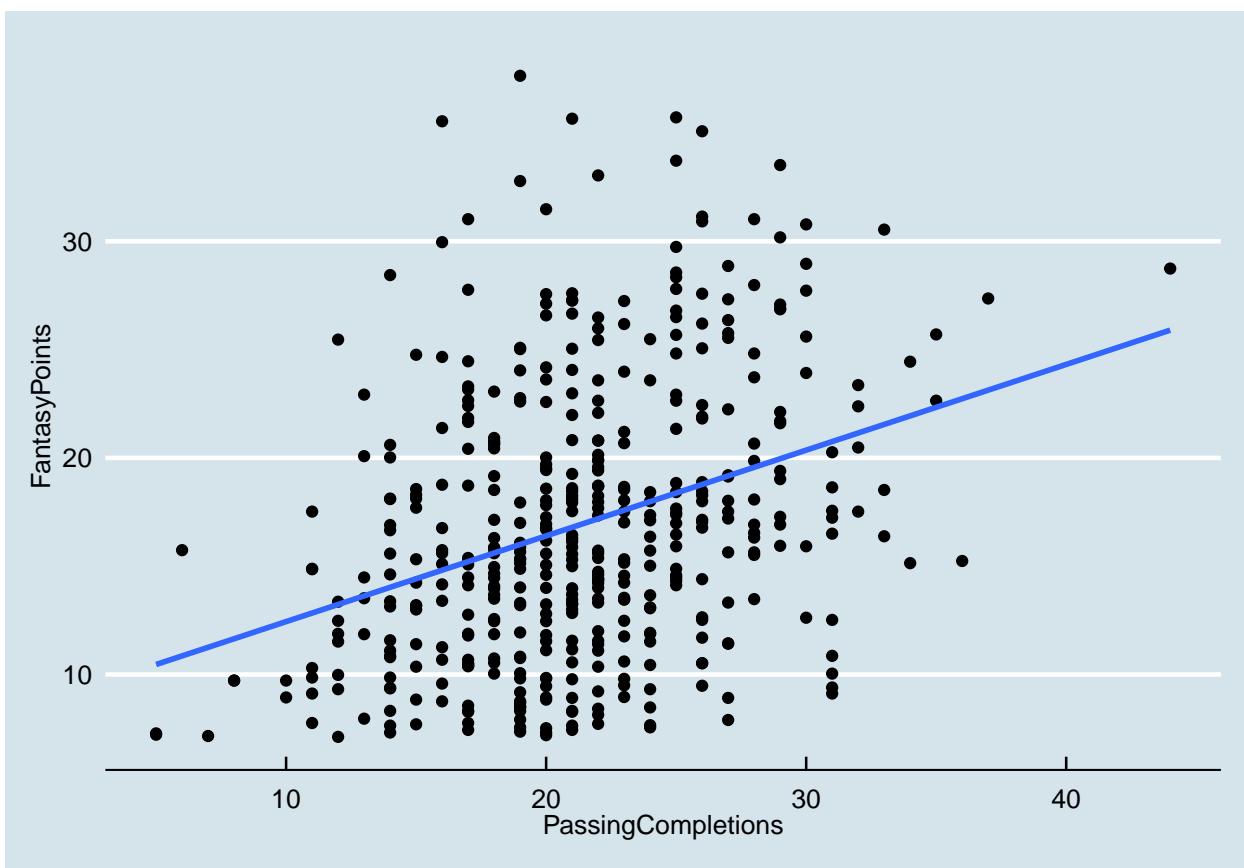


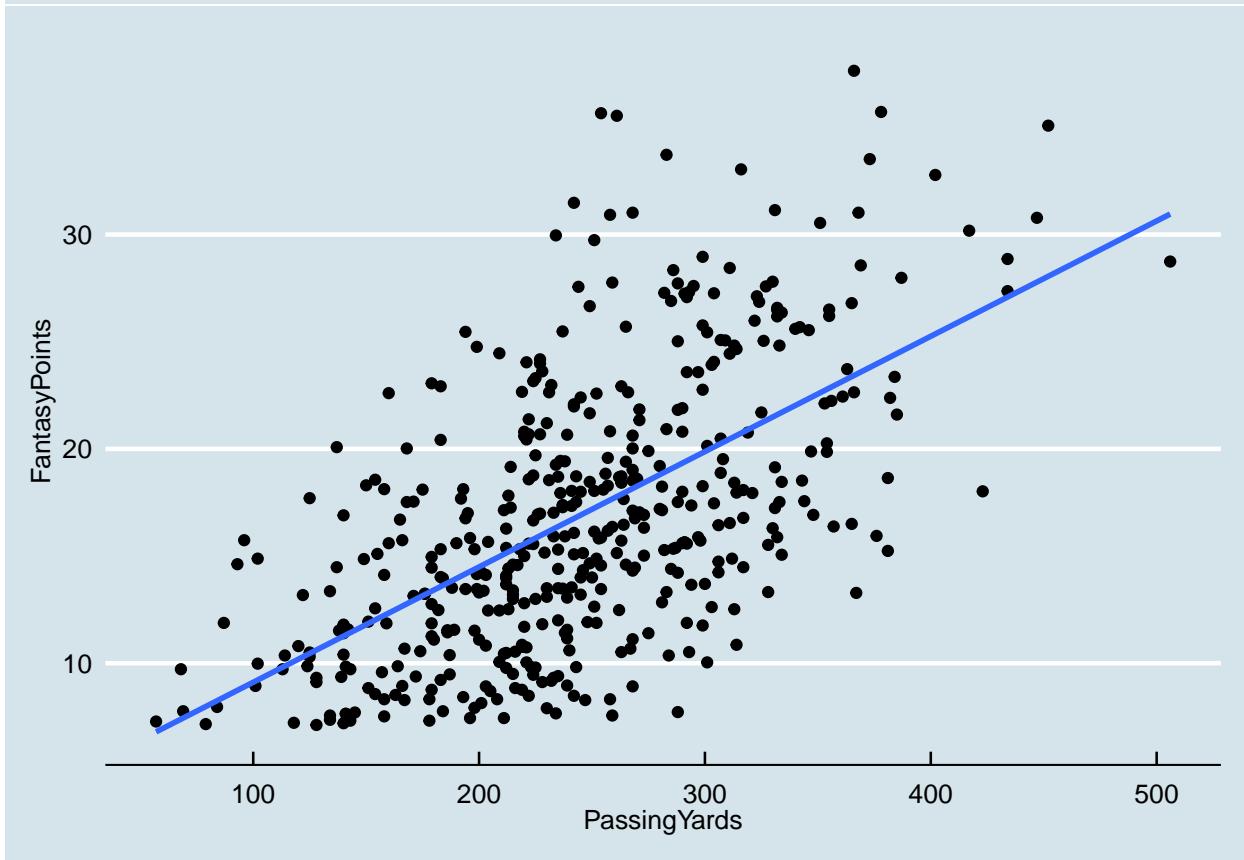
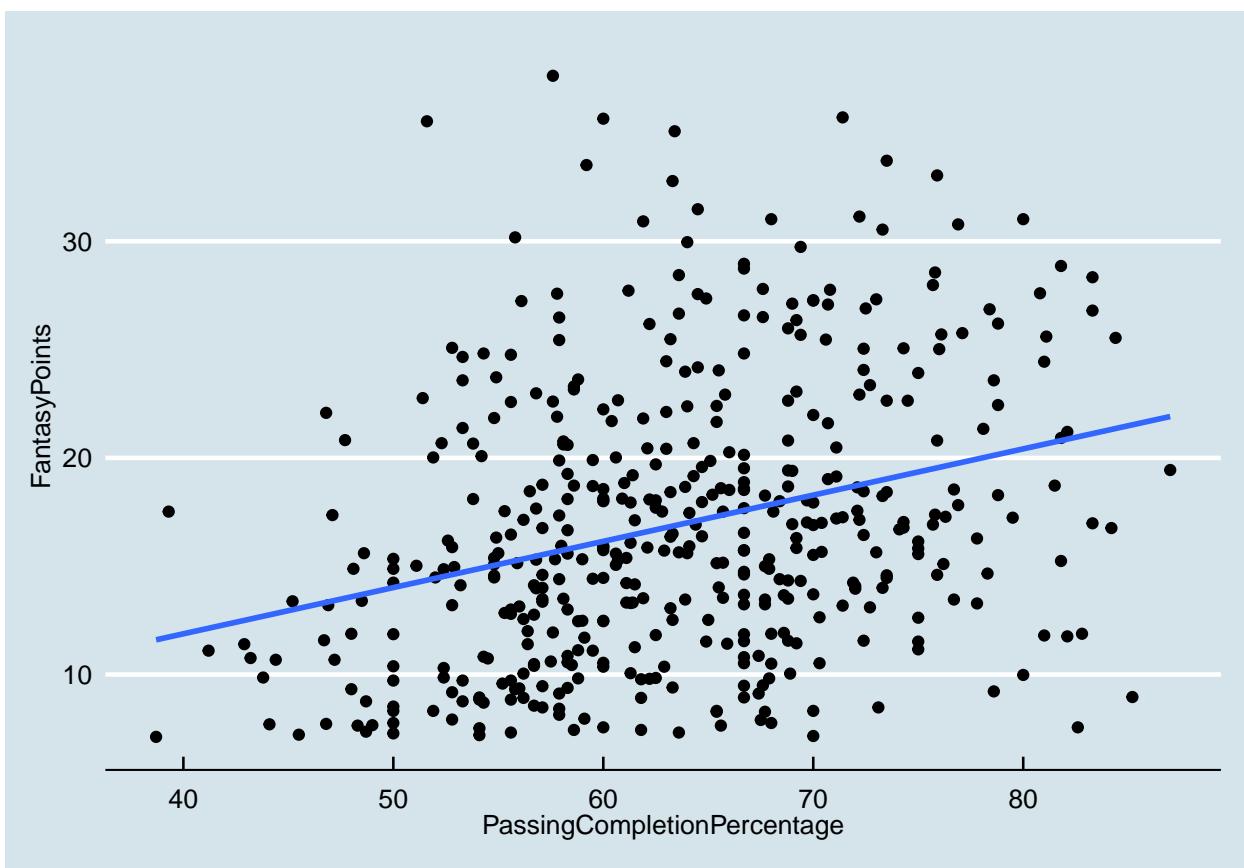
PassingCompletions + PassingAttempts + PassingCompletionPercentage + ...

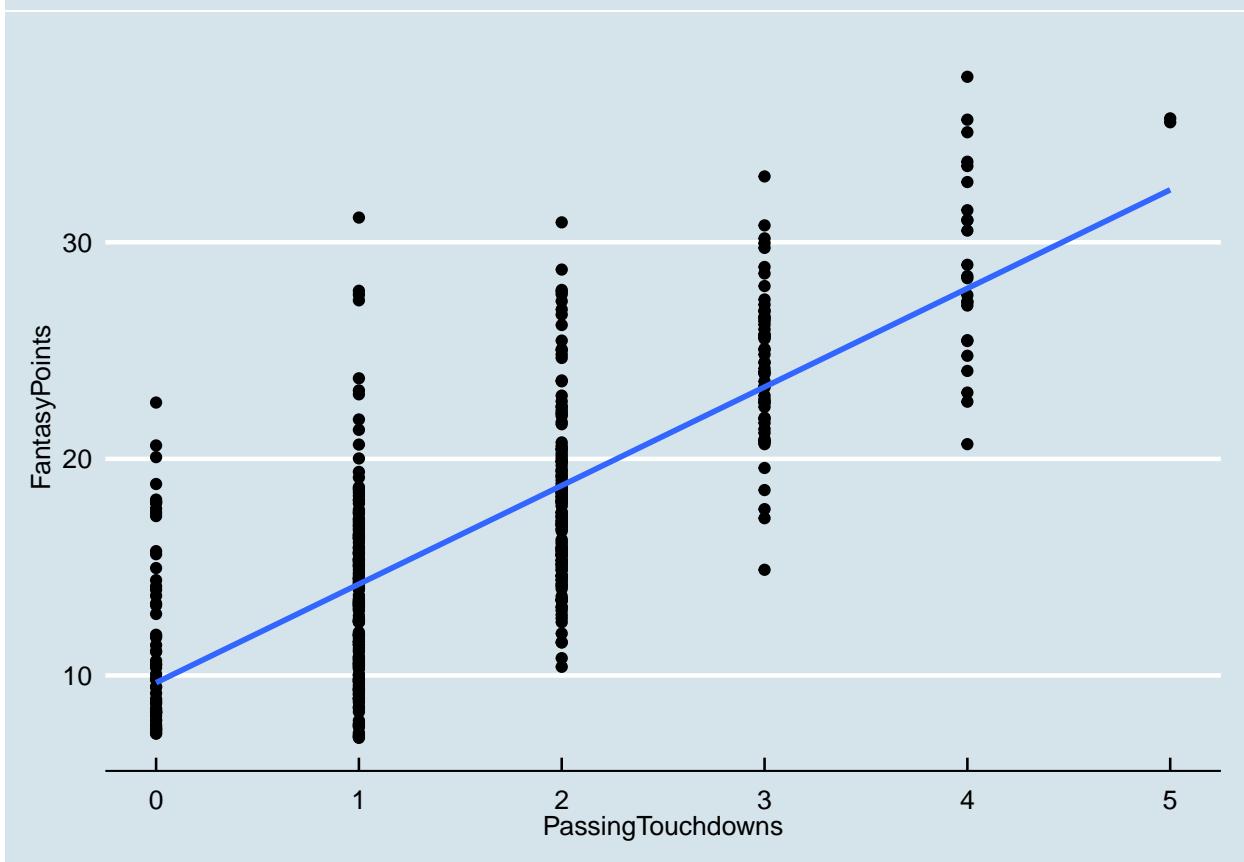
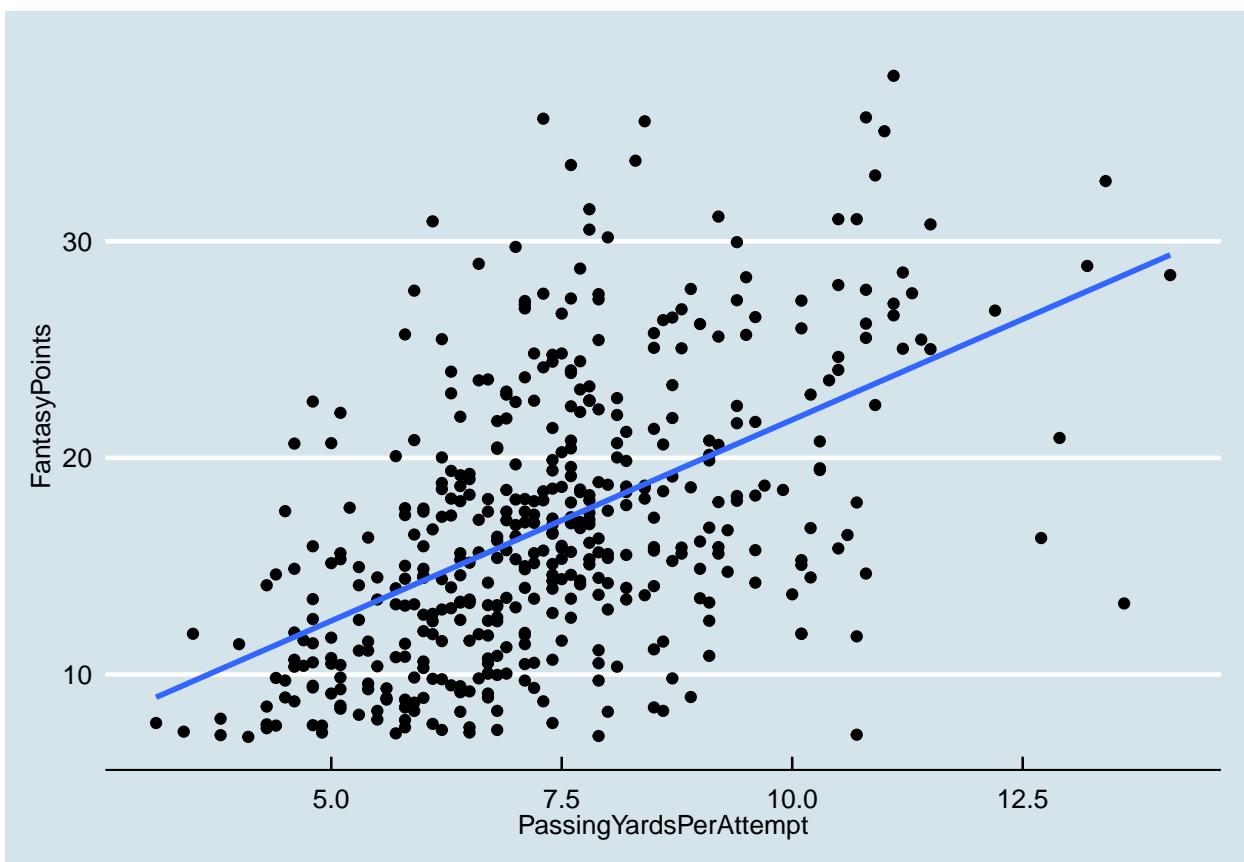
1.6.4 Relationship between FantasyPoints and Individual predictors

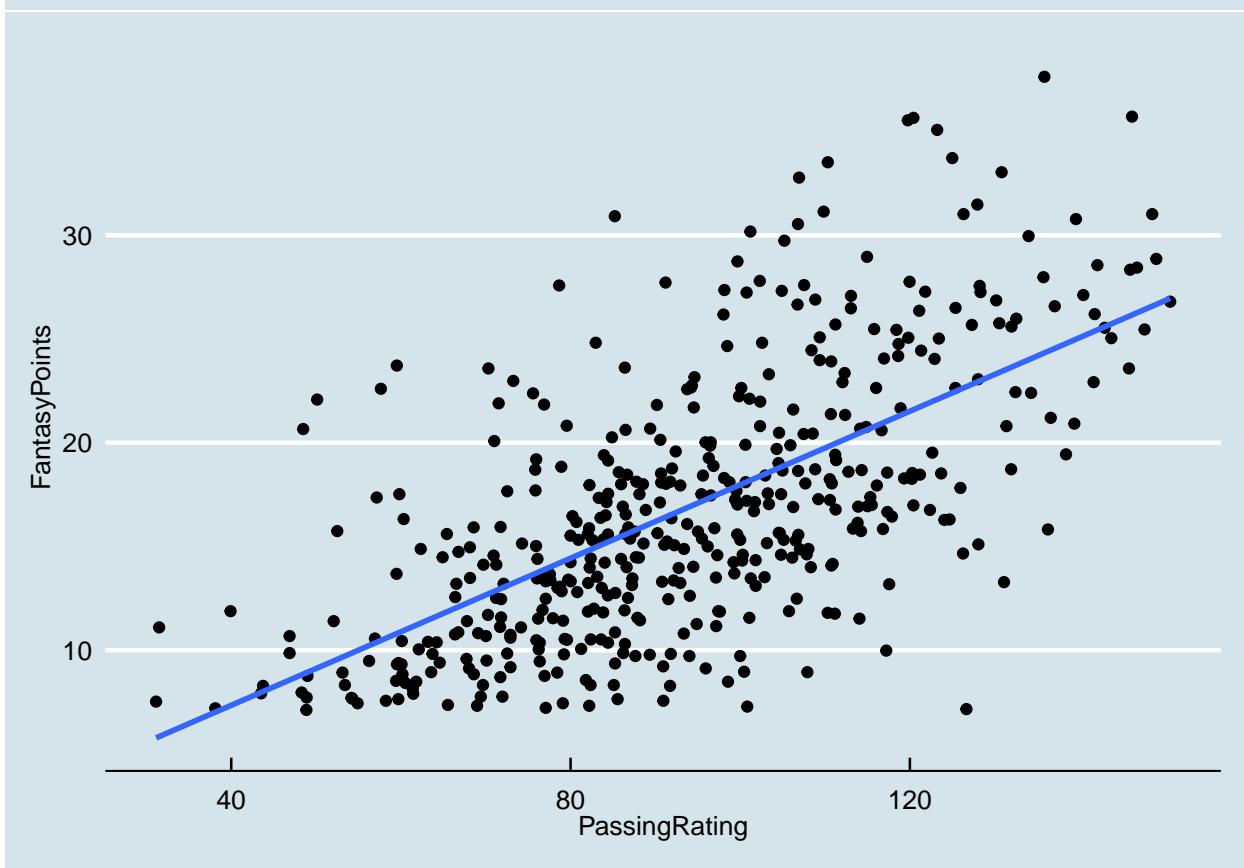
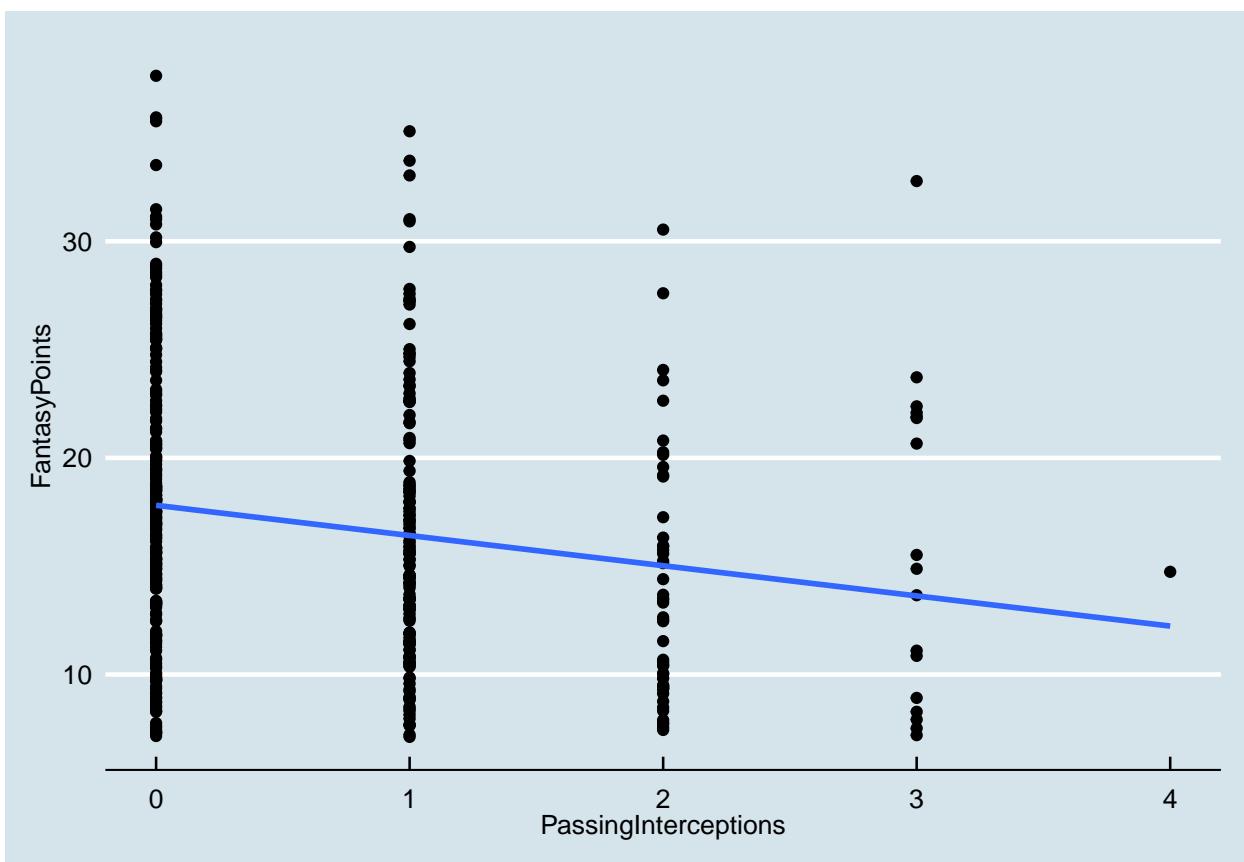
This makes sense – but we are actually trying to capture what the NEXT value for fantasy points is like week since the fantasy score is a linear combination of the predictors for any given week. We need to s

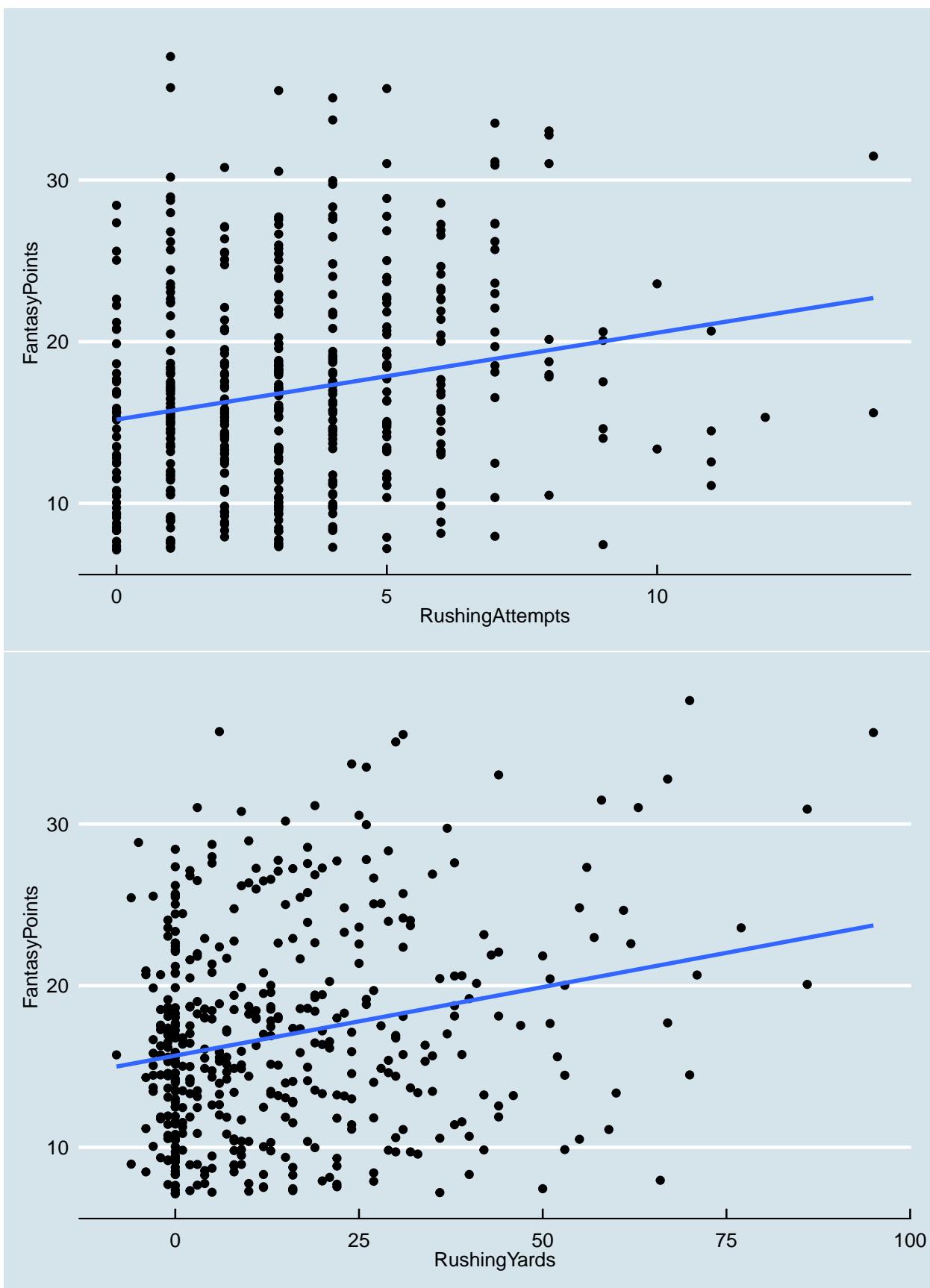
```
for (i in 7:19) {
  linear_plot <- QBCrossSectional %>%
    ggplot(aes_string(y="FantasyPoints",x=names(QBCrossSectional[i]))) +
    geom_point() + geom_smooth(method="lm", se=F) +
    theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
    theme_economist()
  print(linear_plot)
}
```

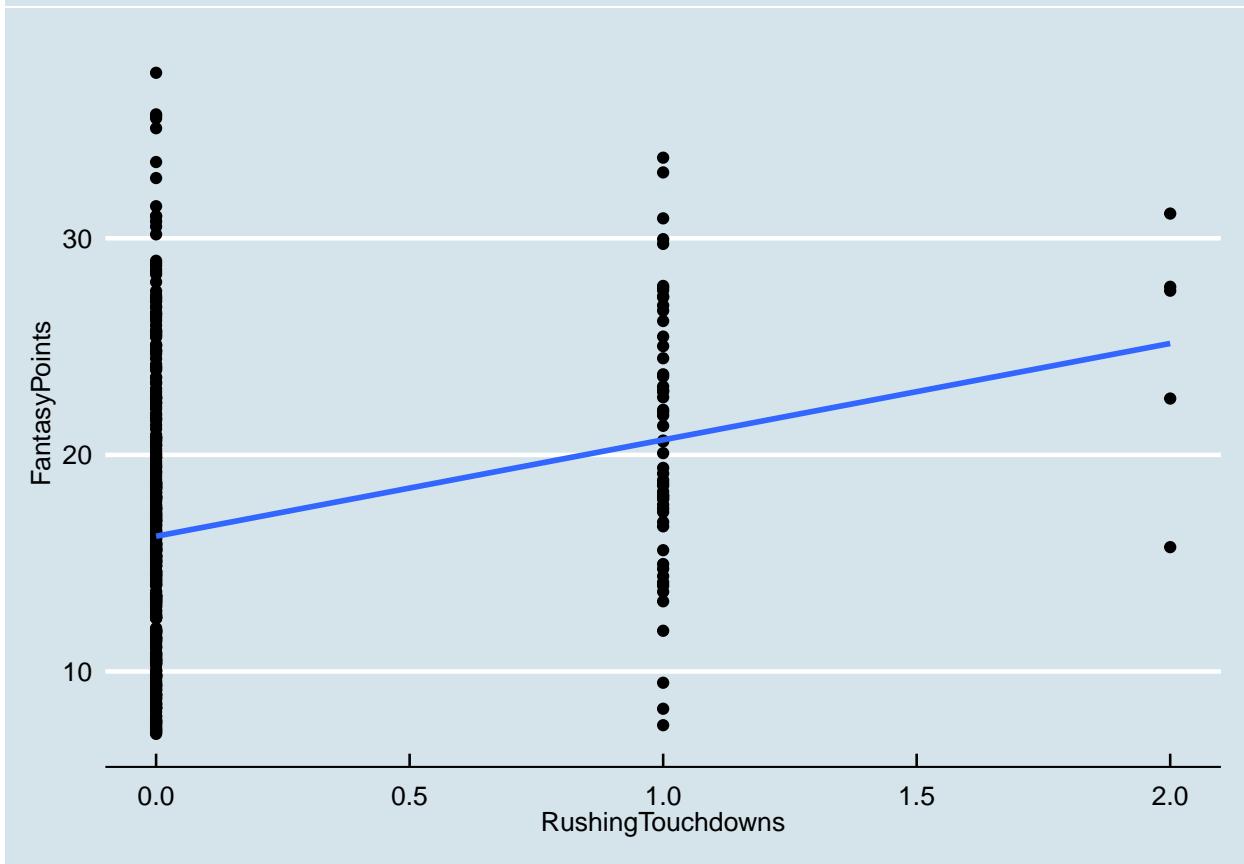
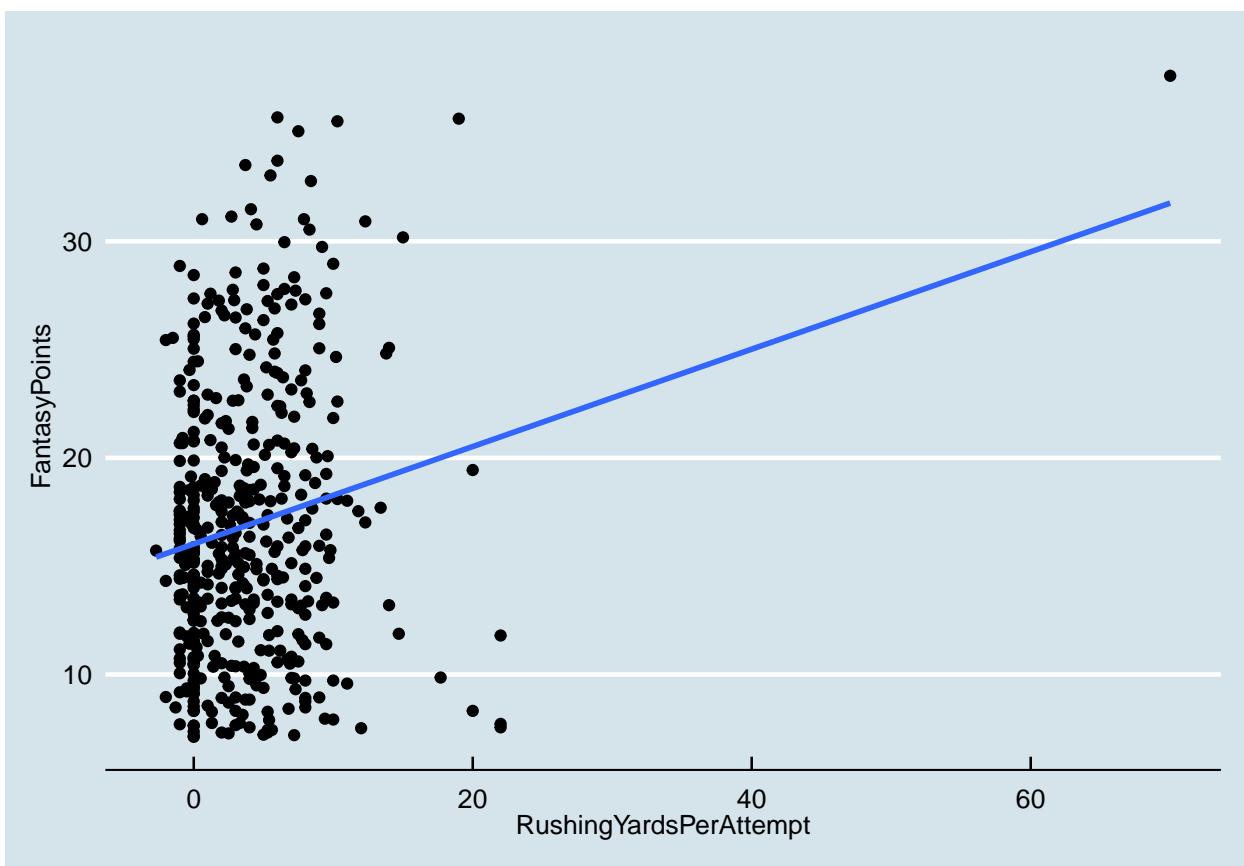


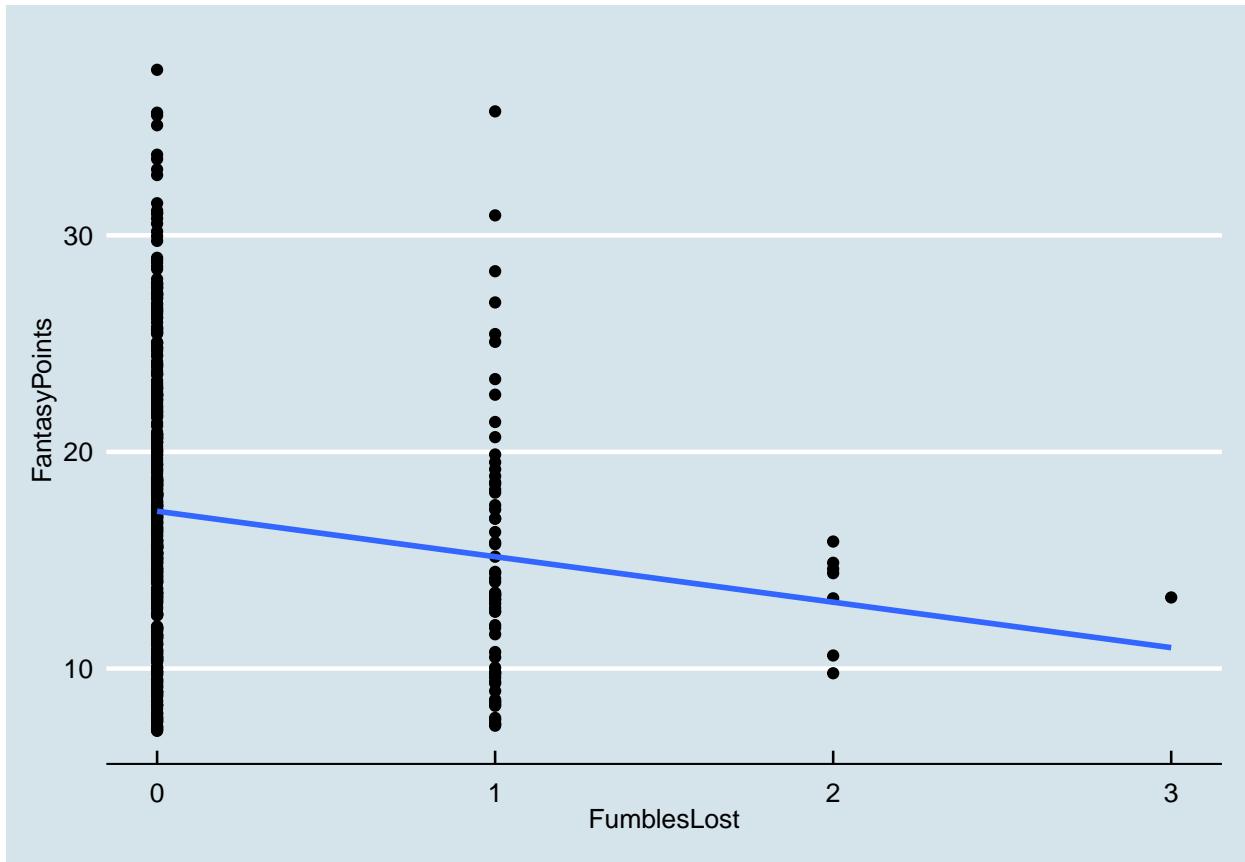












Drop rushing yards per attempt

1.7 Defensive stats

1.7.1 Player Defensive Stats

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

1.7.2 Team Defensive Stats

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

Defensive Players and team defense by week

```
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', 'FantasyPoints')

team_defense = team_defense %>% select(defensive_columns) %>% rename('DefensiveFantasyPoints'='FantasyPoints')
  mutate(WeeklyRank = dense_rank(DefensiveFantasyPoints))
#  mutate(HostName = paste(FirstName, " ", LastName))
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', 'Week'='Week'))
```

1.7.3 Add some lag data for QB

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

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

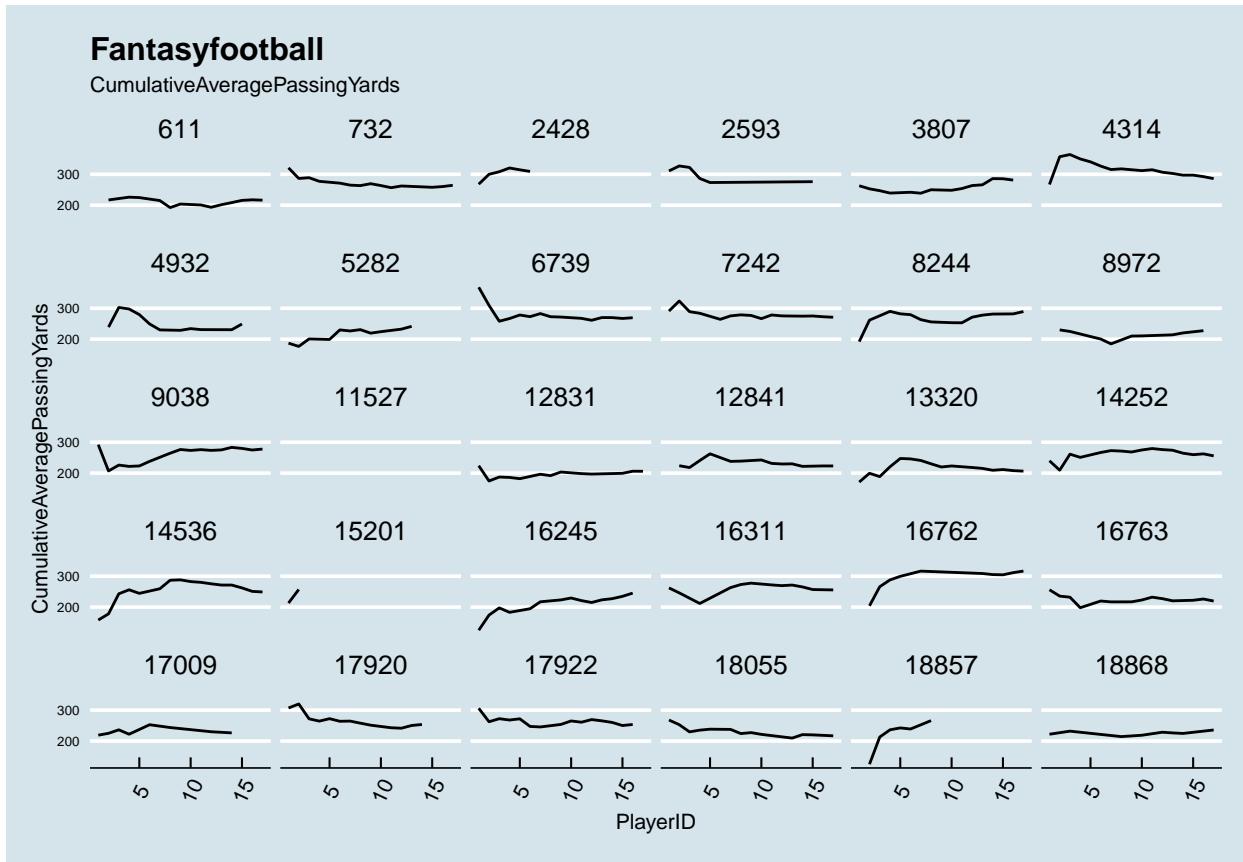
QBCrossSectionalDefensiveOverlayCumulativePassYards %>% filter(PlayerID == 6739) %>% write.csv('alex_smith_2017.csv')
final_ds <- QBCrossSectionalDefensiveOverlayCumulativePassYards
```

1.7.4 Individuals Line plots for cumulative averages by week

```
for(p in 37:51){
  #print(paste("violin plots for ",names(players_ds[p])))
  for (player in seq(1,length(unique(final_ds$PlayerID)),by=30)){
    a_size <- player + 29
    players_ds <- final_ds %>% filter(PlayerID %in% unique(final_ds$PlayerID)[player:a_size])

    line_plot <- players_ds %>%
      ggplot(aes_string(x="as.numeric(Week)",y=names(players_ds[p]))) +
      ggtitle(names(players_ds[p])) +
      geom_line(show.legend = FALSE) +
      xlab("PlayerID") +
      ylab(names(players_ds[p])) +
      labs(title="Fantasyfootball",
           subtitle=names(players_ds[p]),
           caption="Source: Fantasyfootball") +
      theme_economist(base_size=8) +
      theme(axis.text.y = element_text(size=5)) +
      theme(axis.text.x = element_text(angle=65, vjust=0.6)) +
      facet_wrap(~PlayerID)
    suppressWarnings(print(line_plot))
  }
}

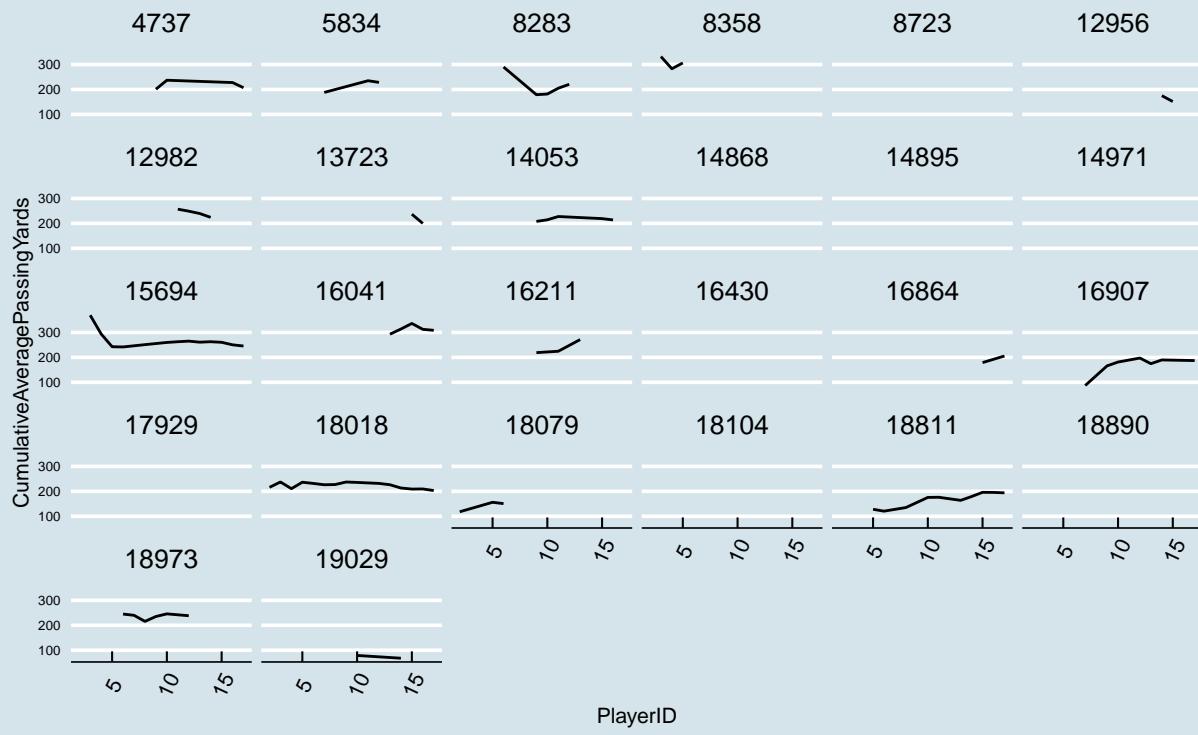
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



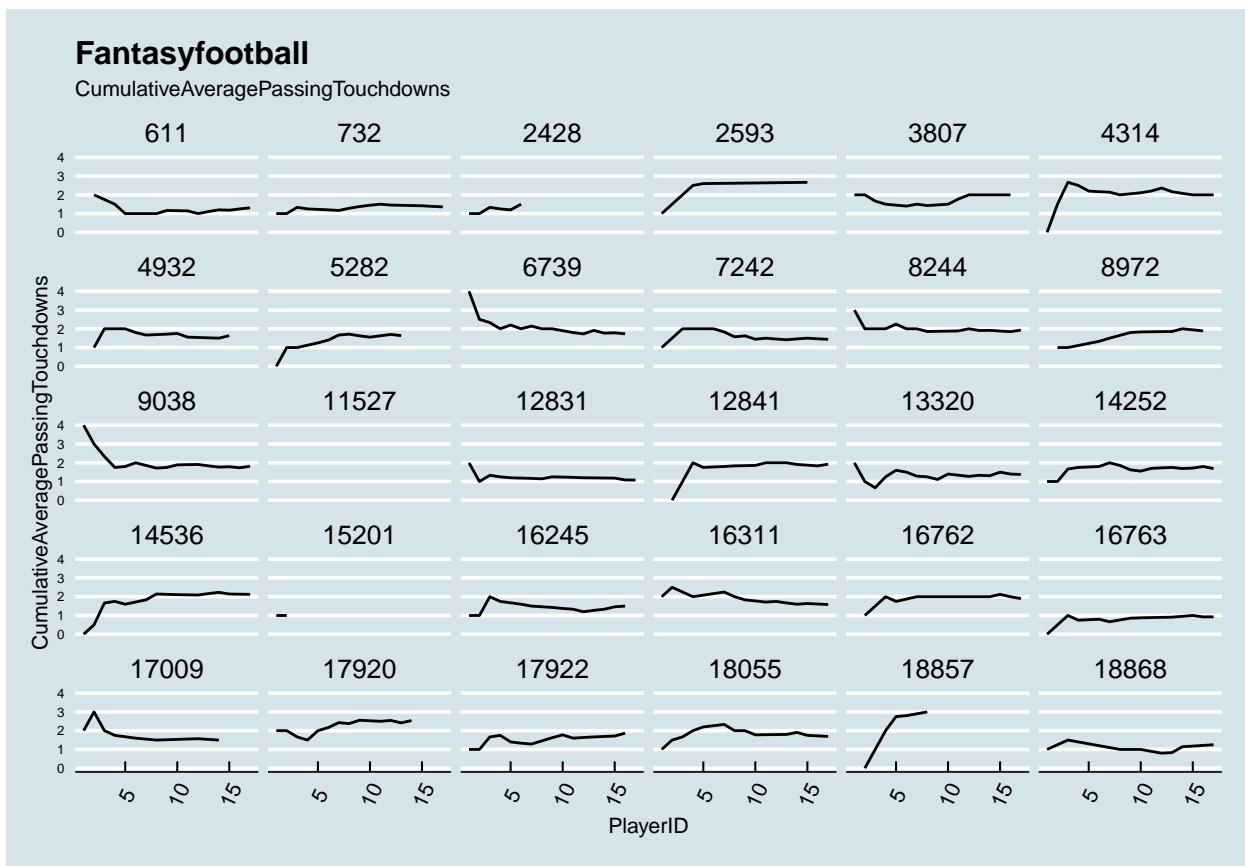
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```

Fantasyfootball

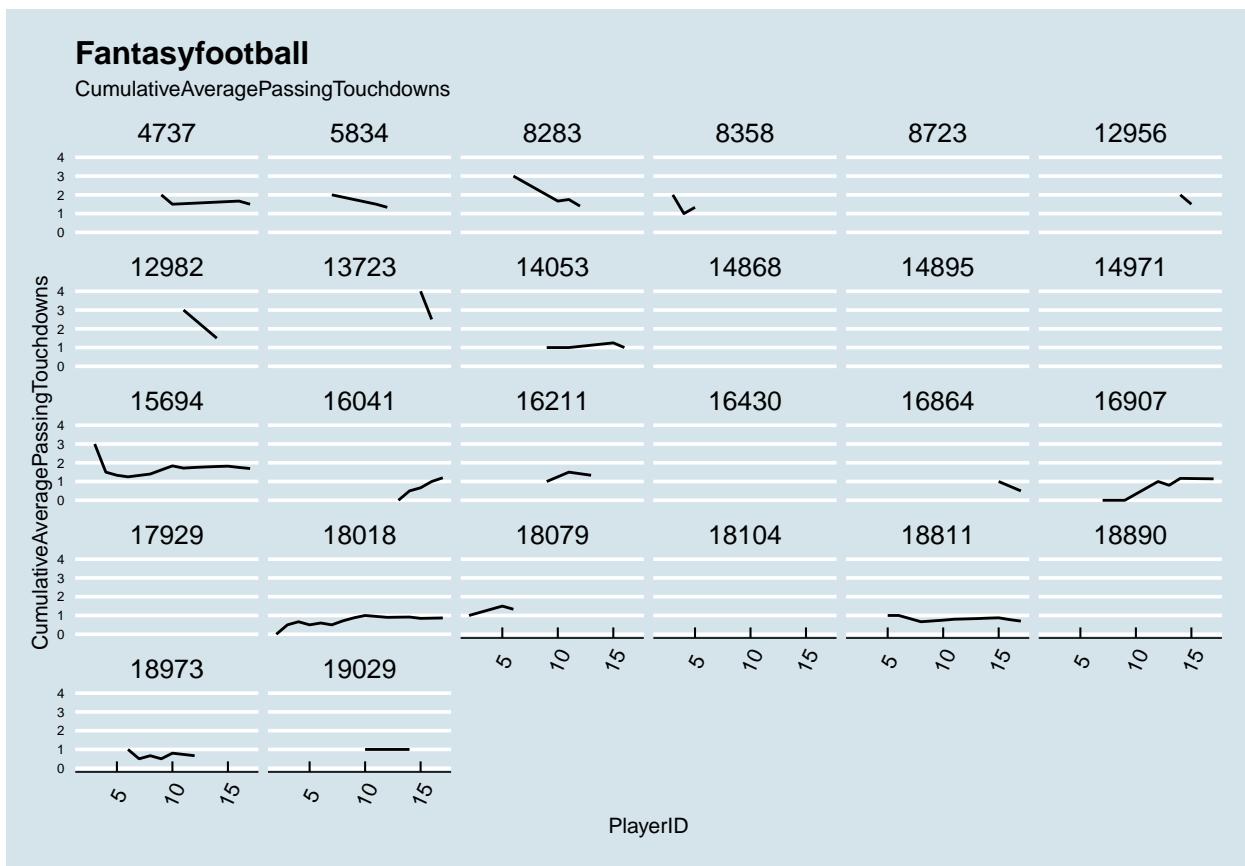
CumulativeAveragePassingYards



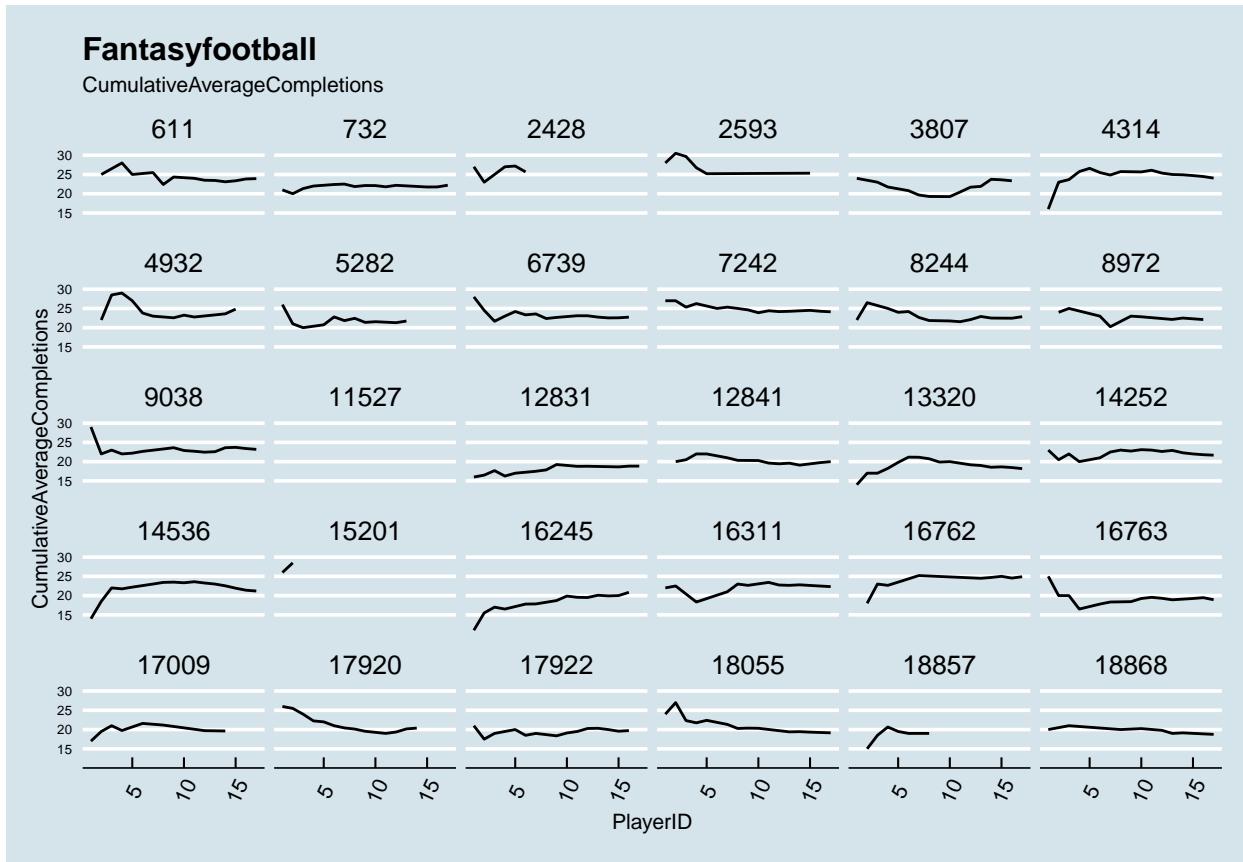
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



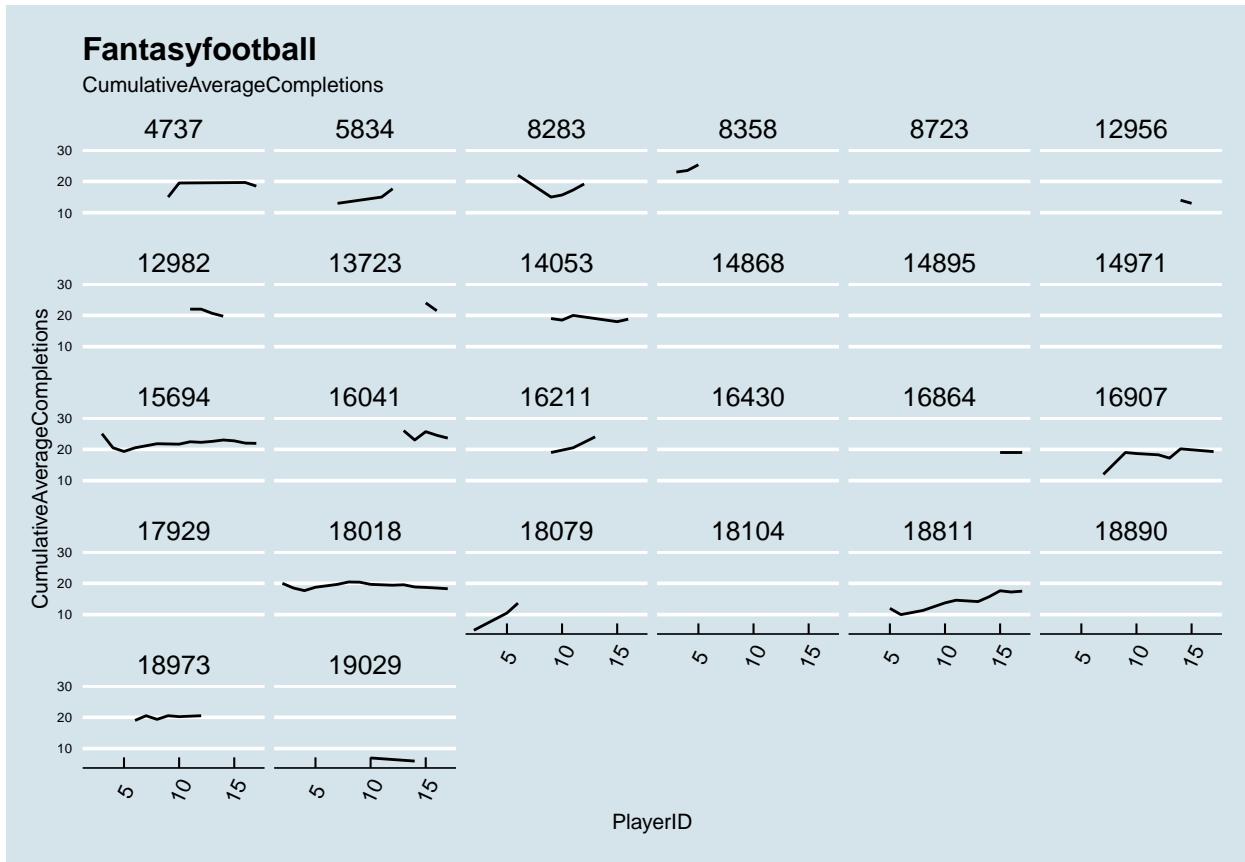
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



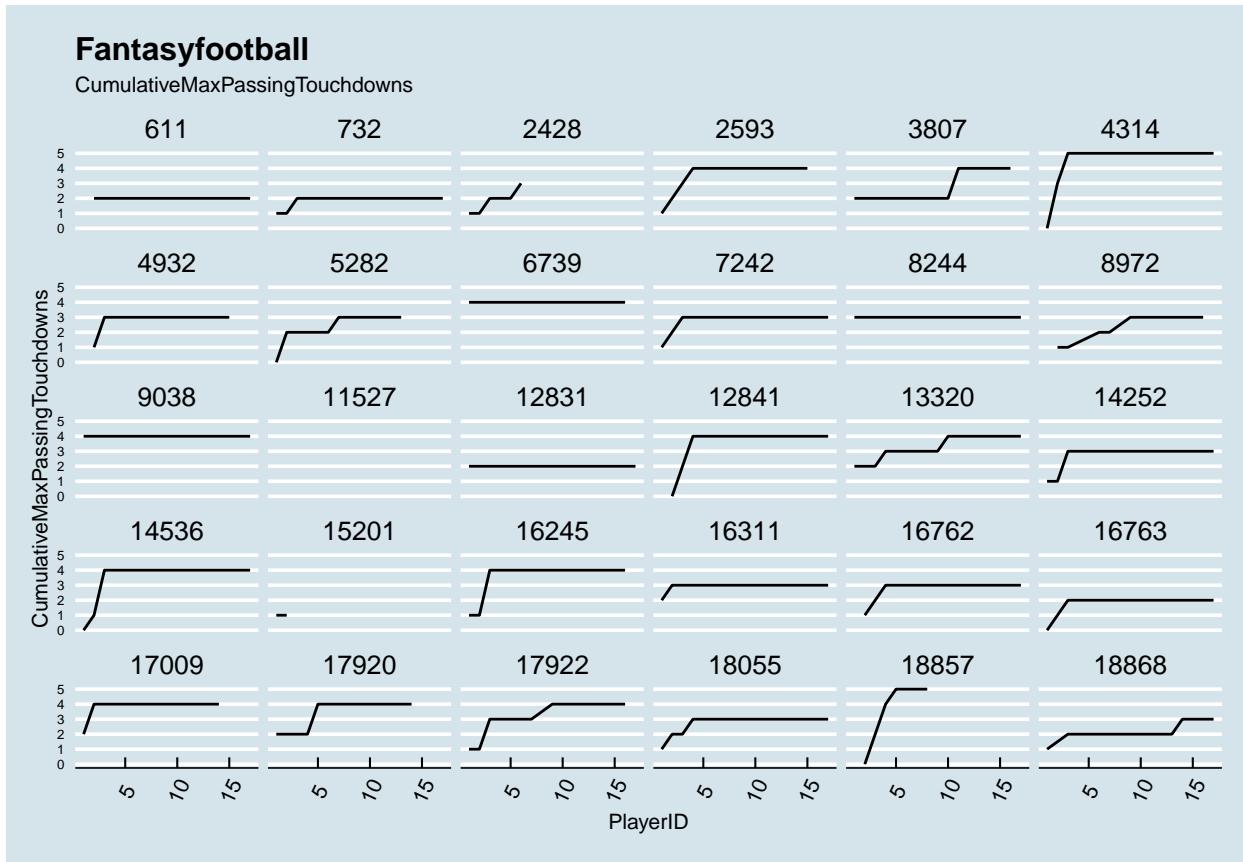
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



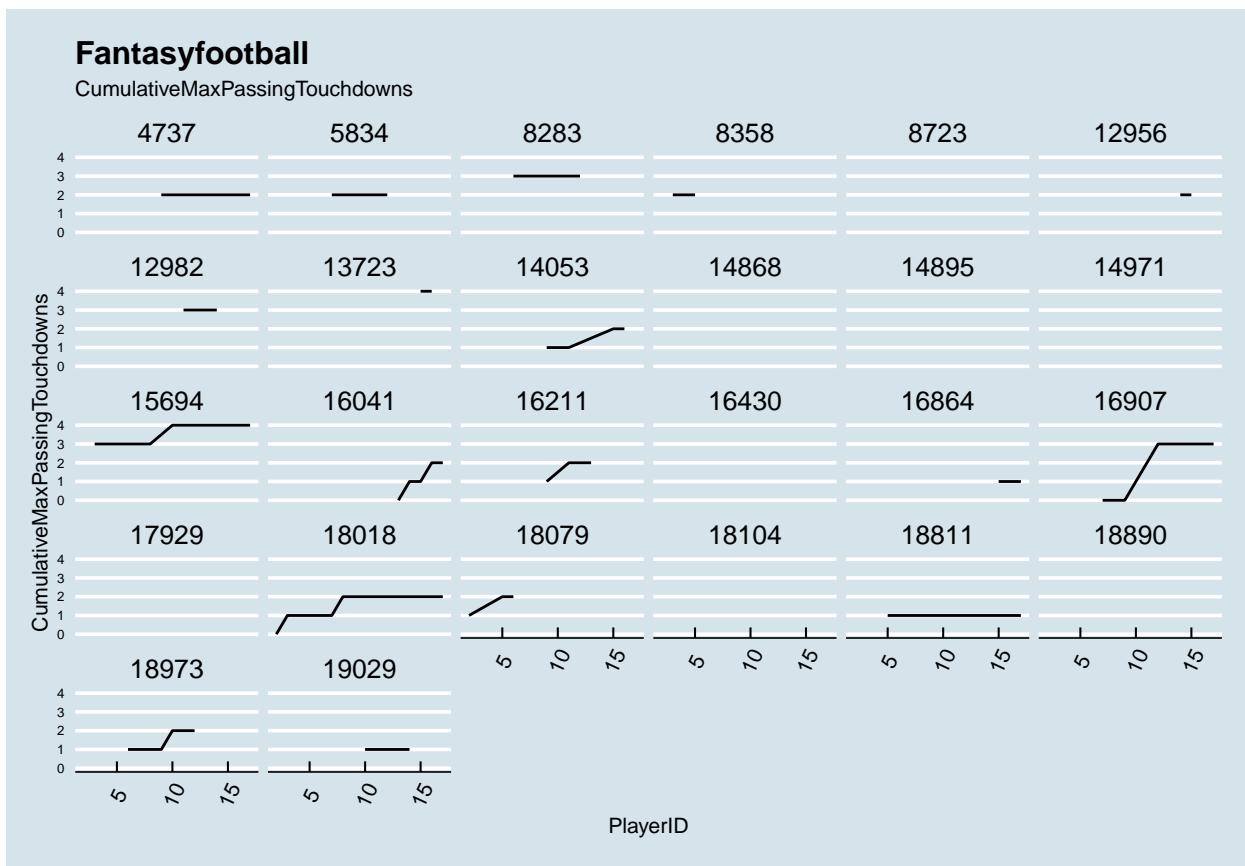
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



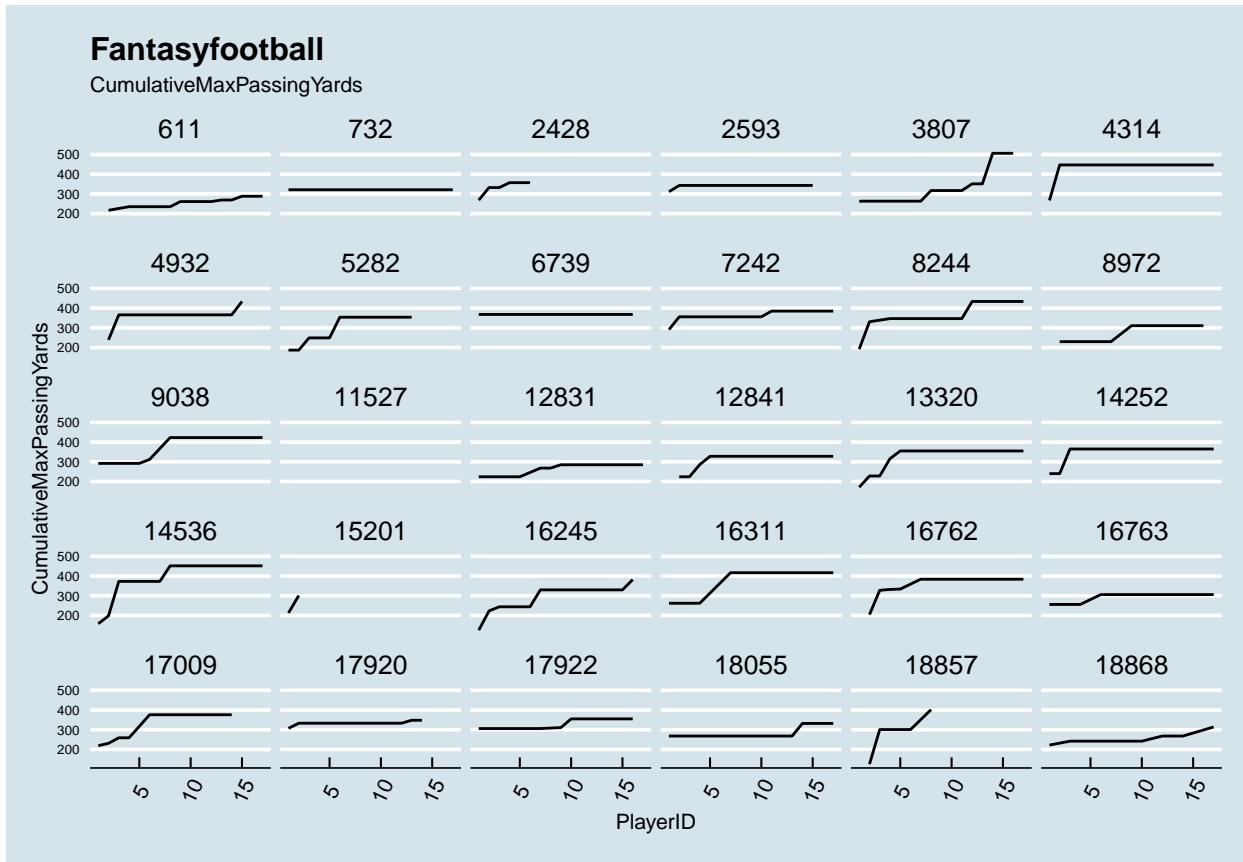
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



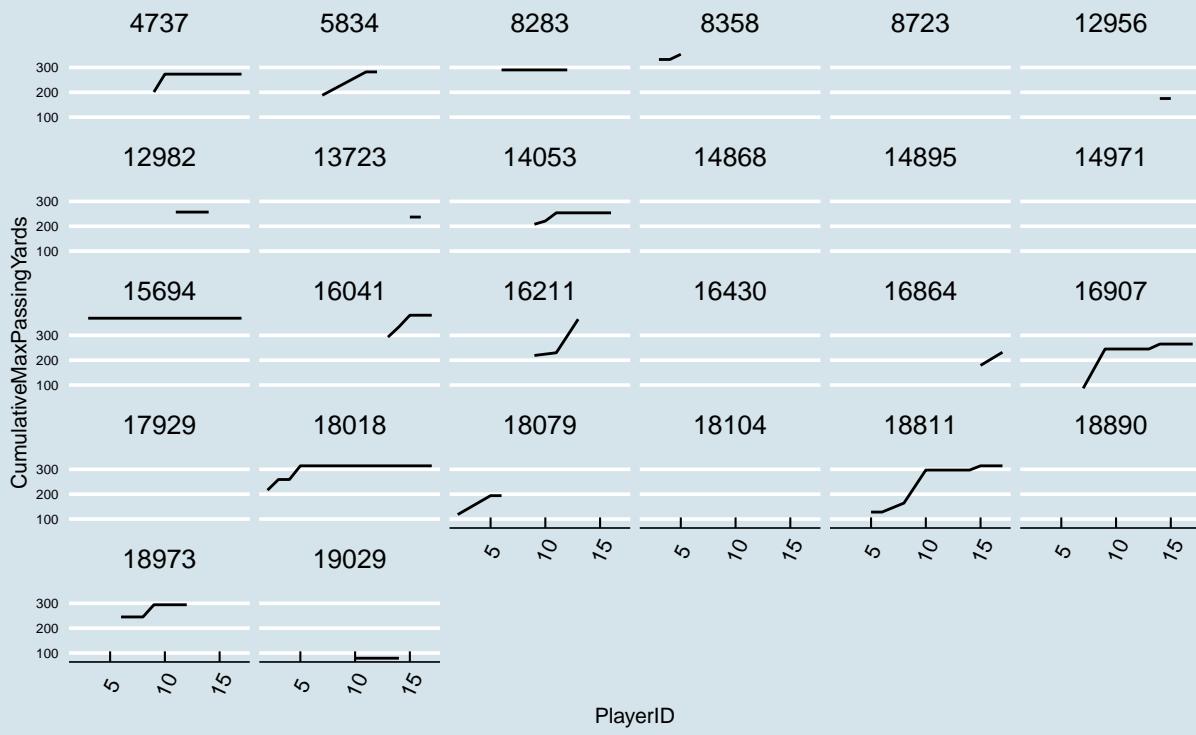
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



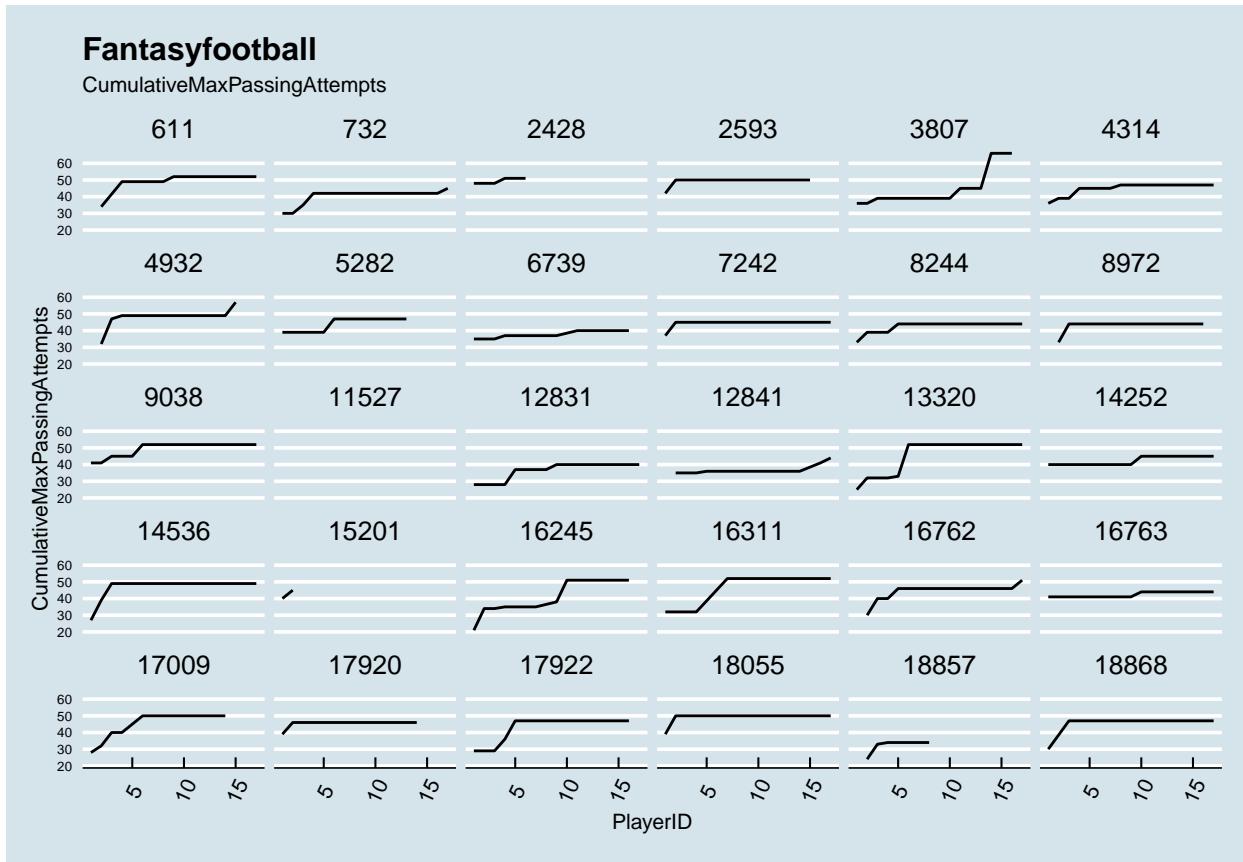
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```

Fantasyfootball

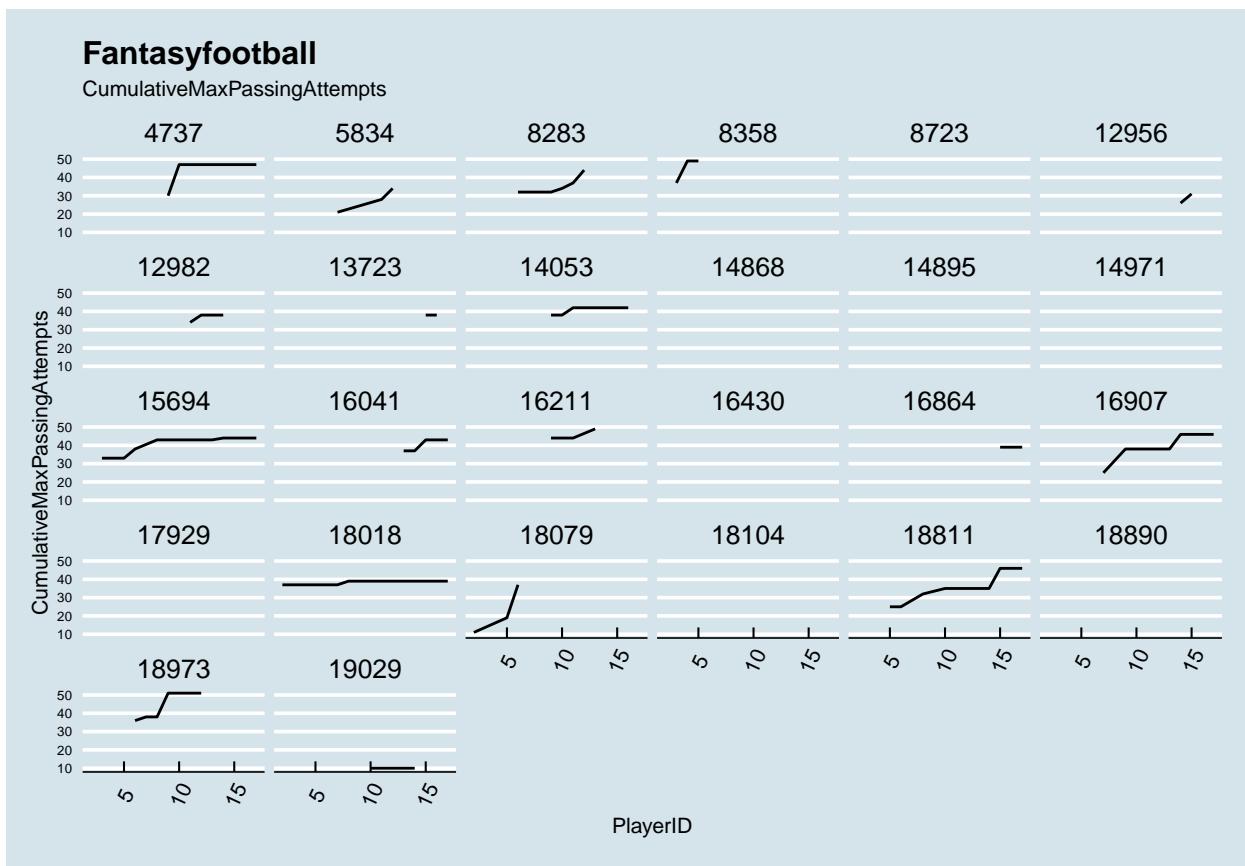
CumulativeMaxPassingYards



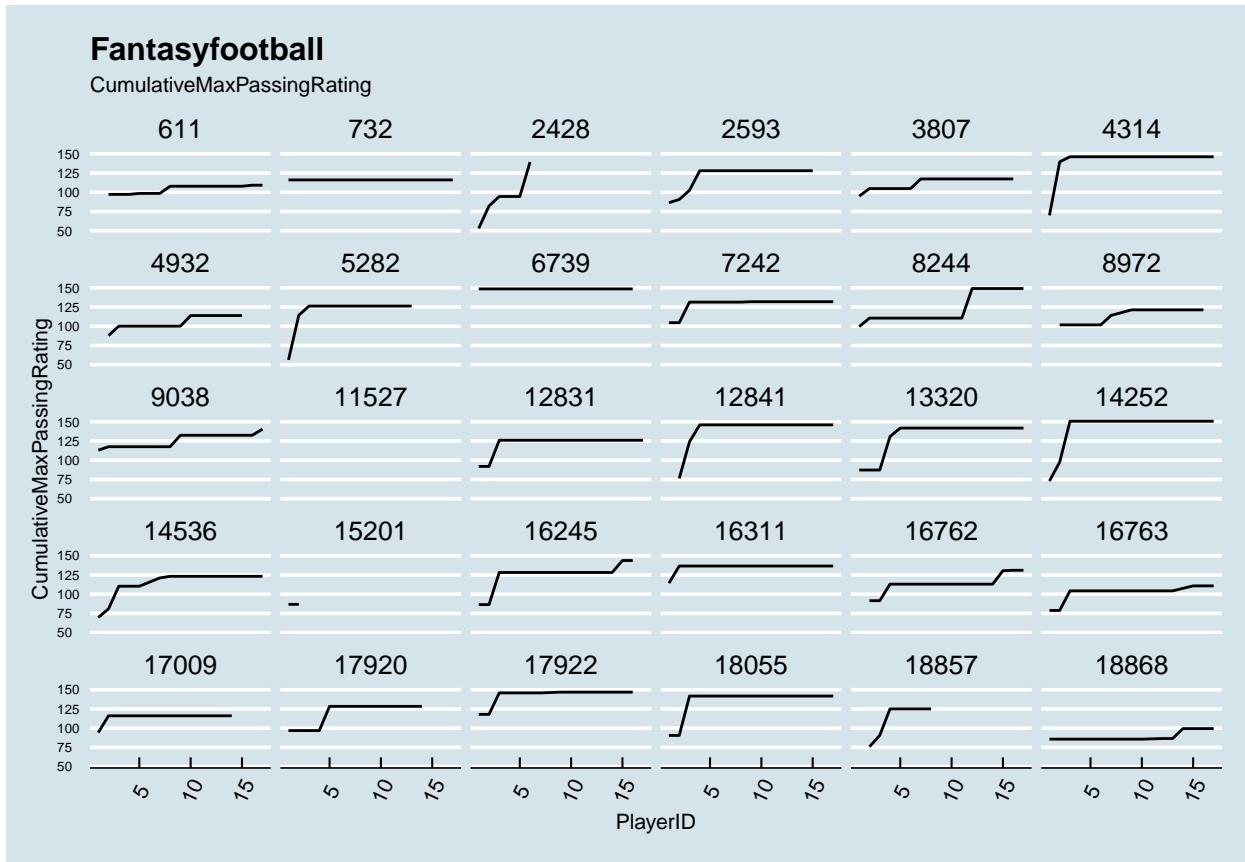
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## adjust the group aesthetic?
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## adjust the group aesthetic?
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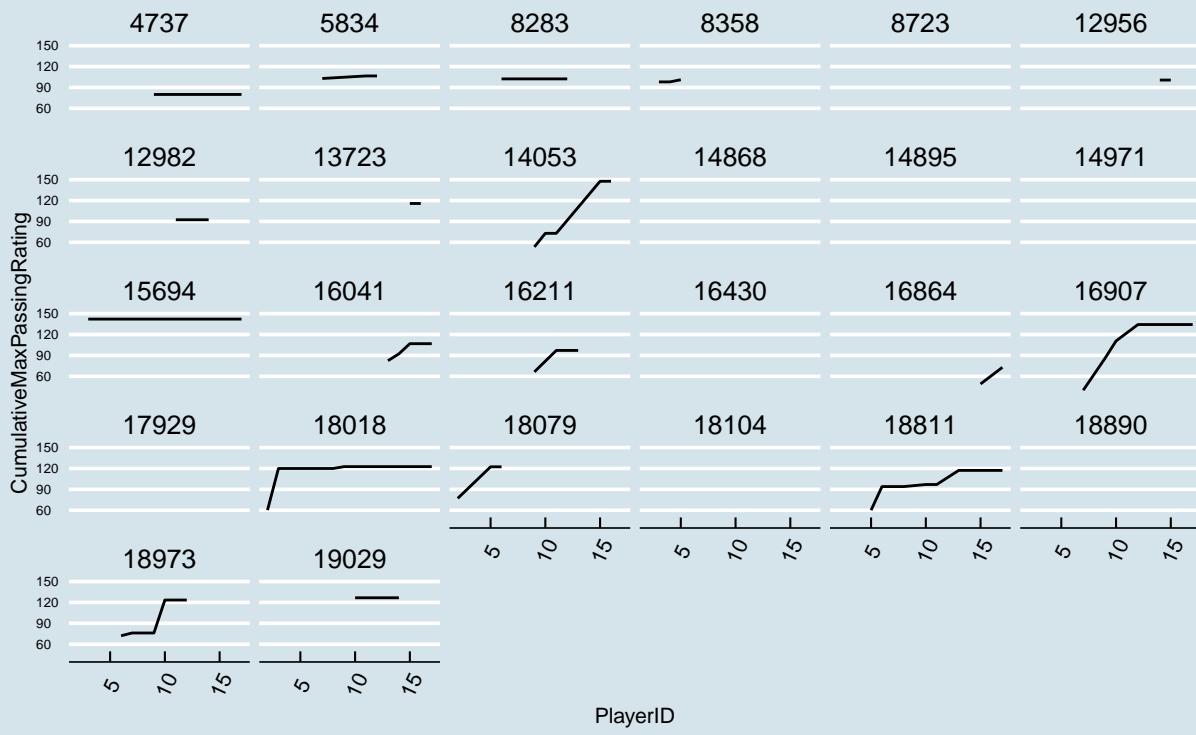
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



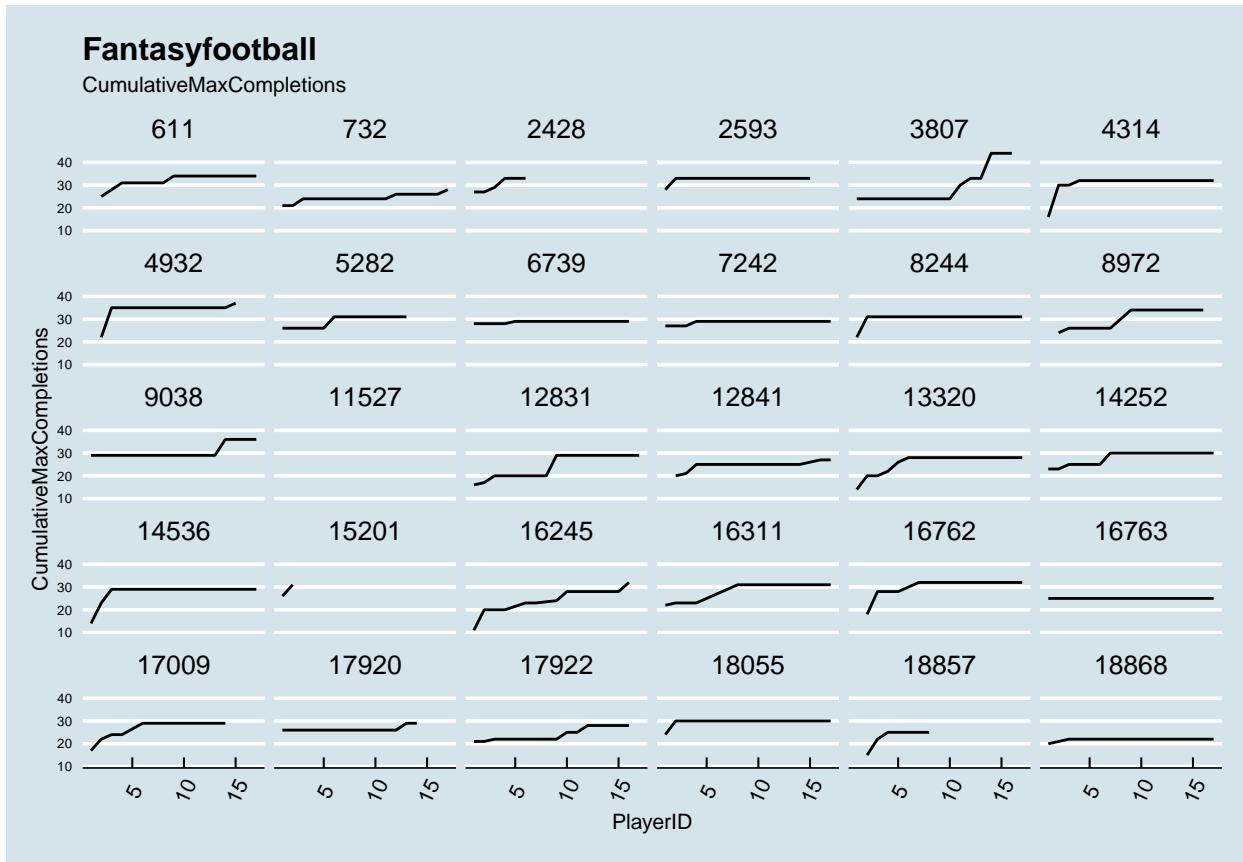
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```

Fantasyfootball

CumulativeMaxPassingRating



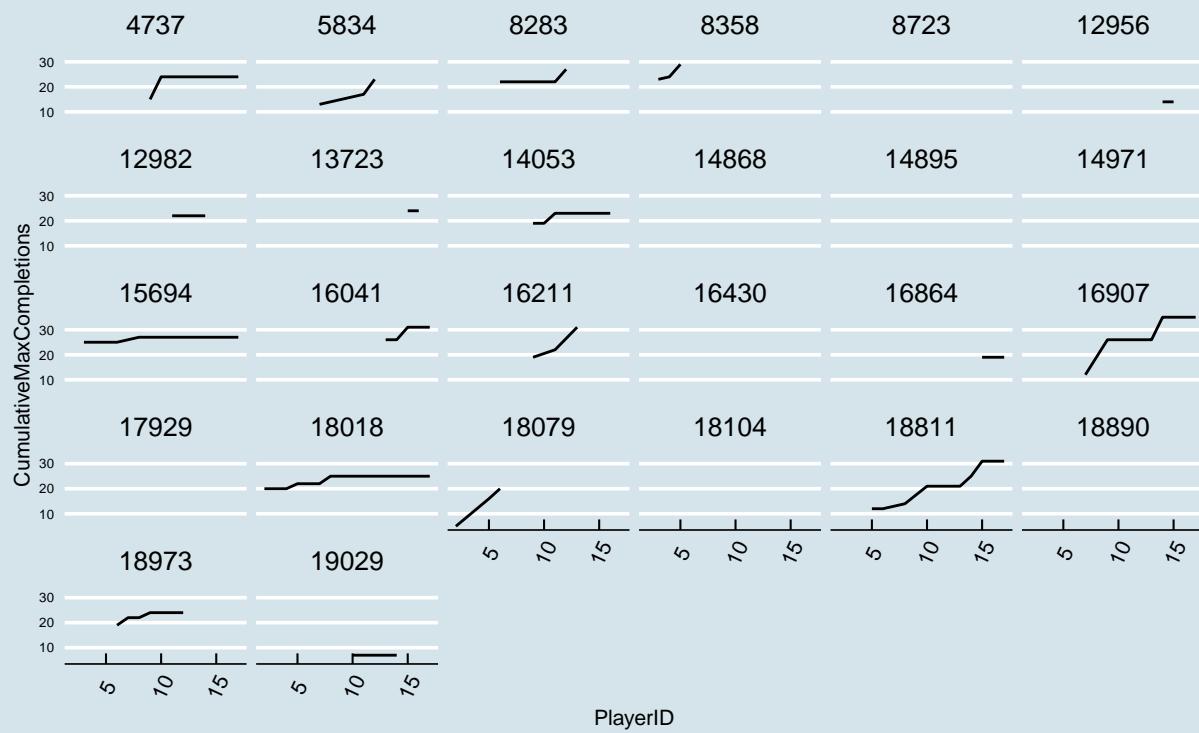
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



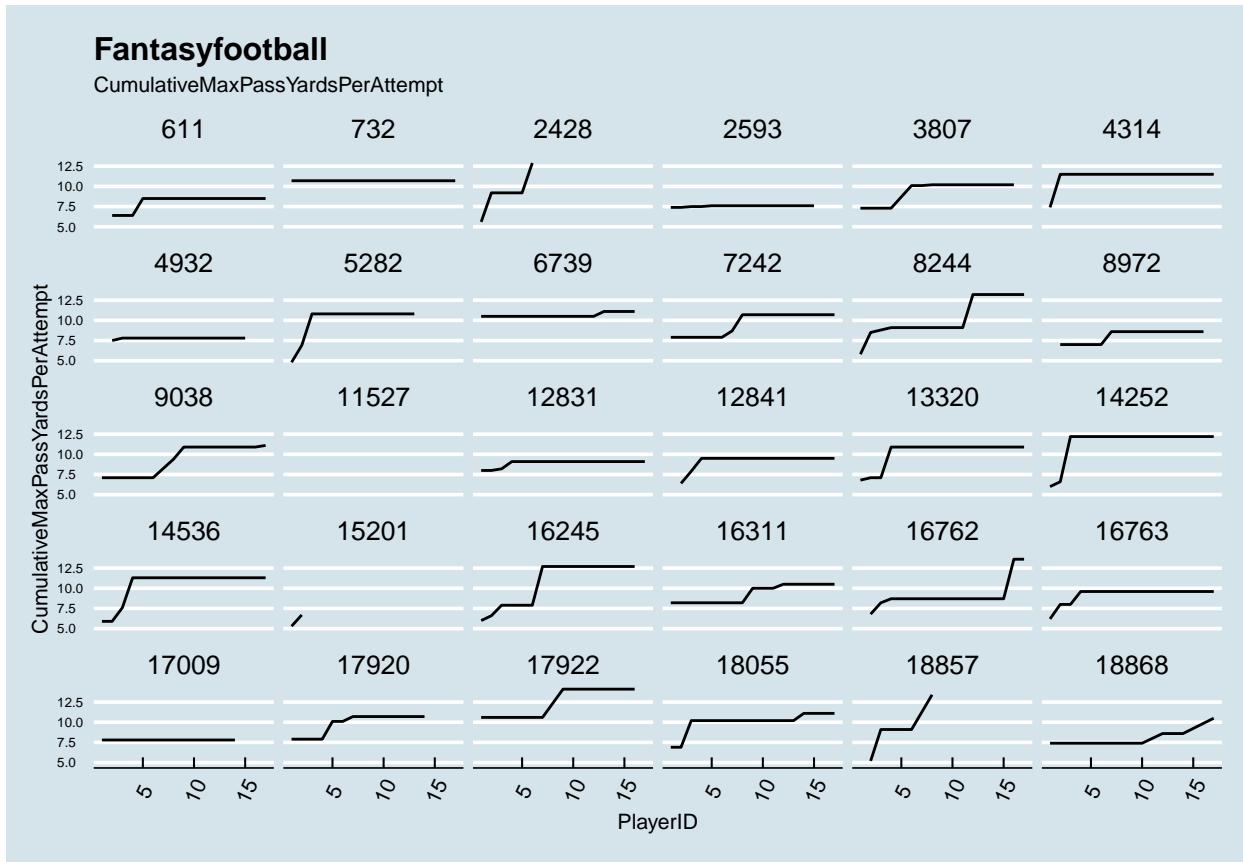
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## adjust the group aesthetic?
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## adjust the group aesthetic?
```

Fantasyfootball

CumulativeMaxCompletions



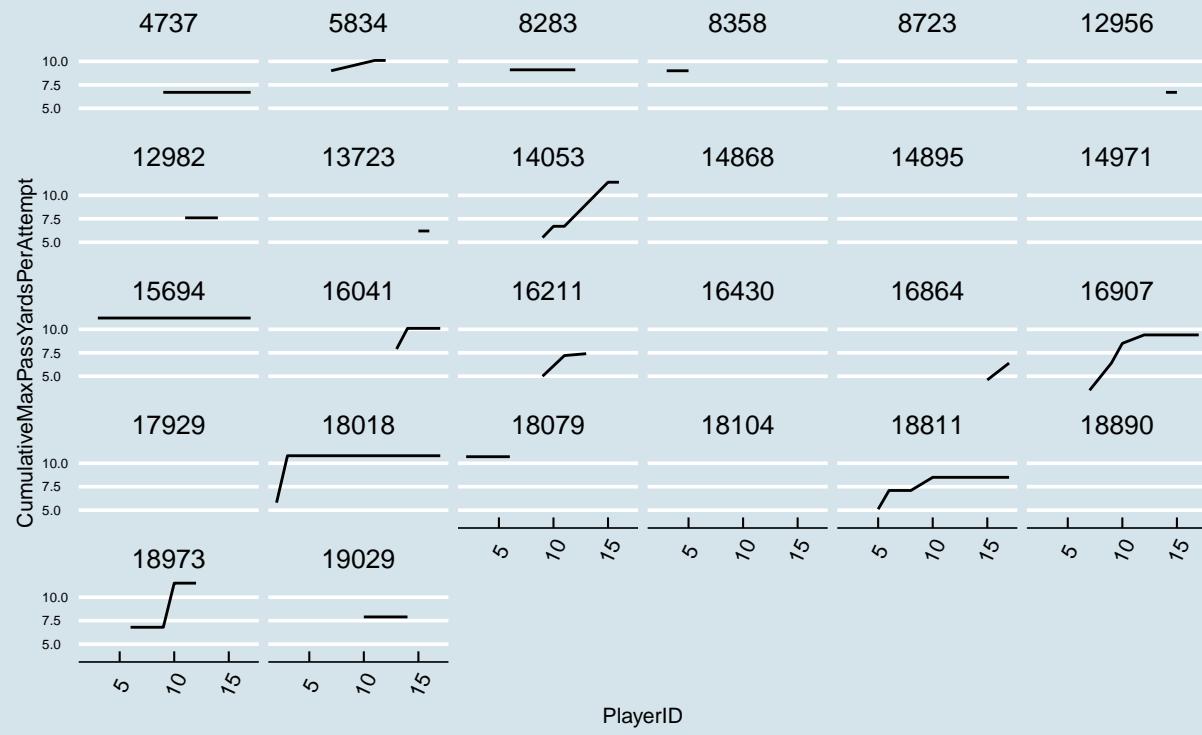
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



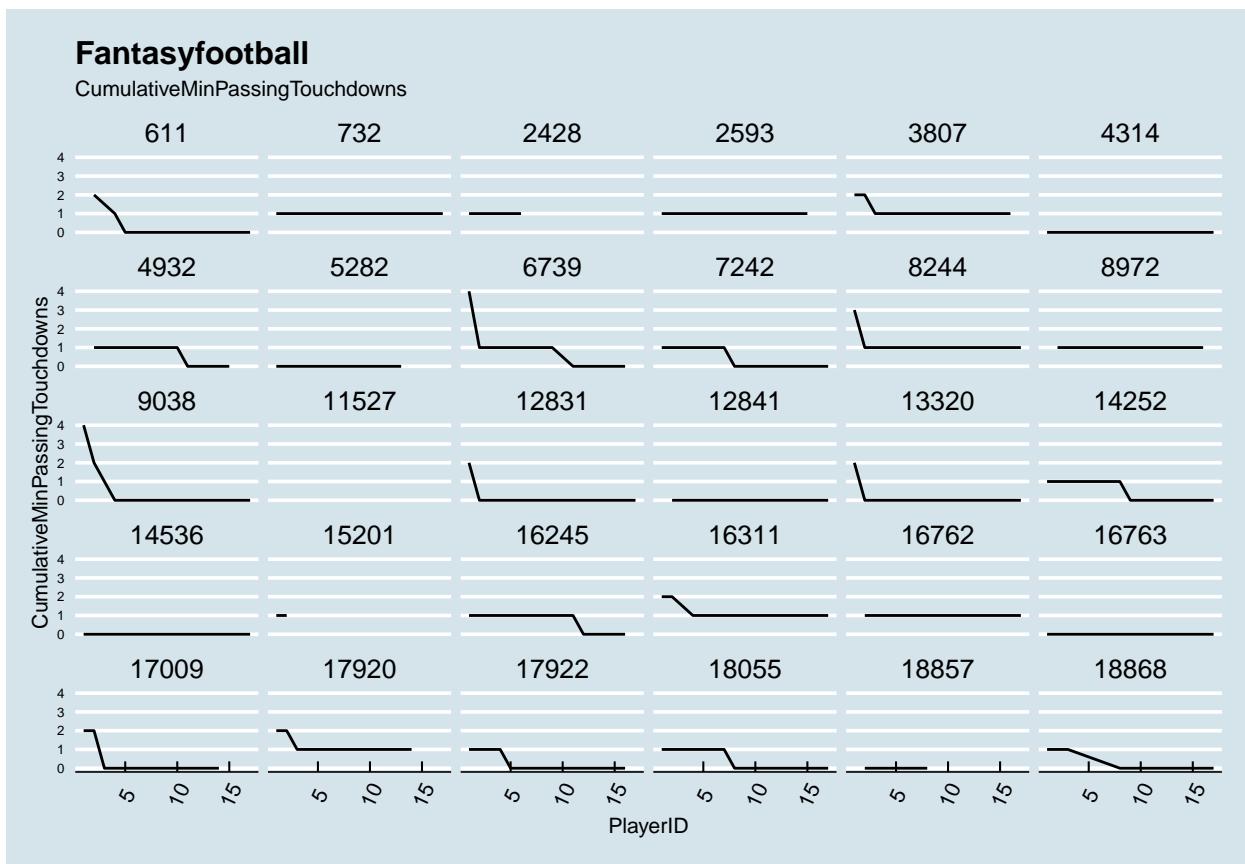
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```

Fantasyfootball

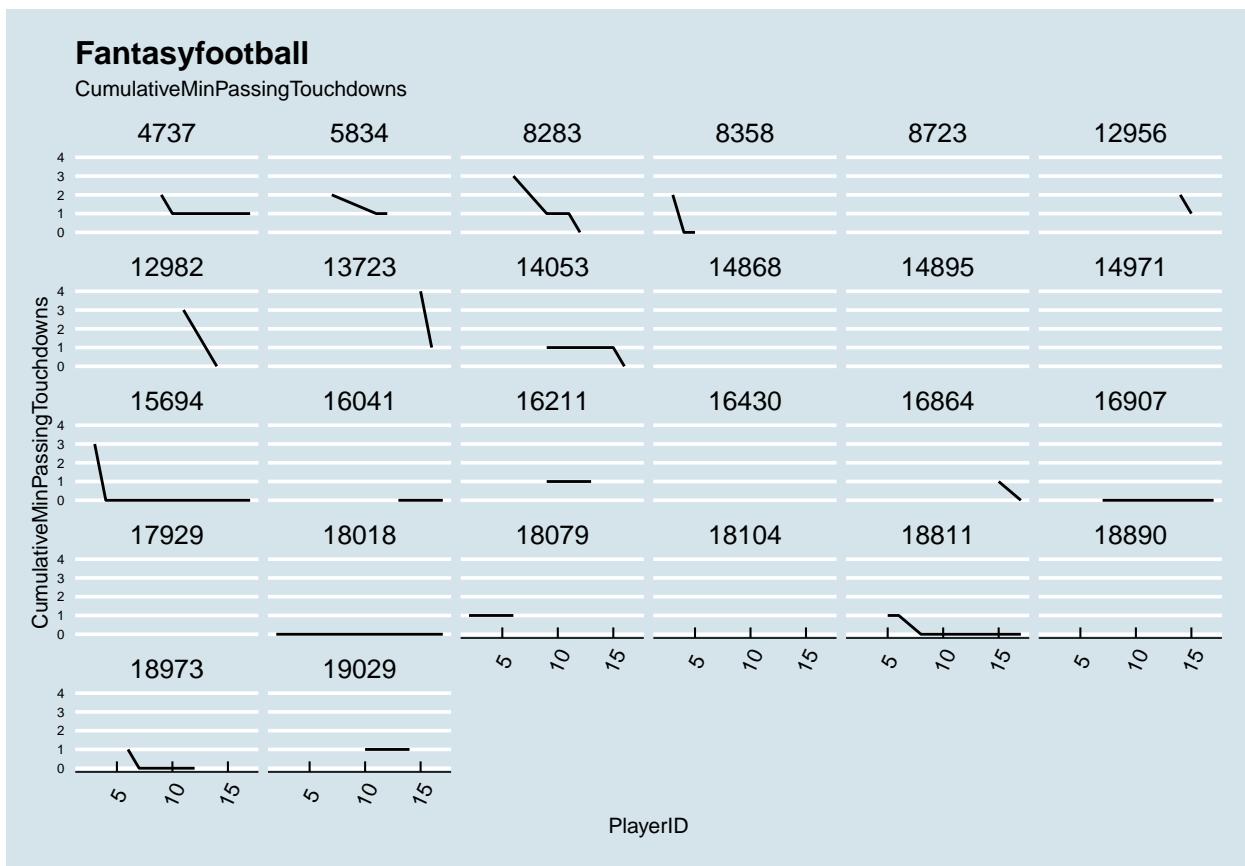
CumulativeMaxPassYardsPerAttempt



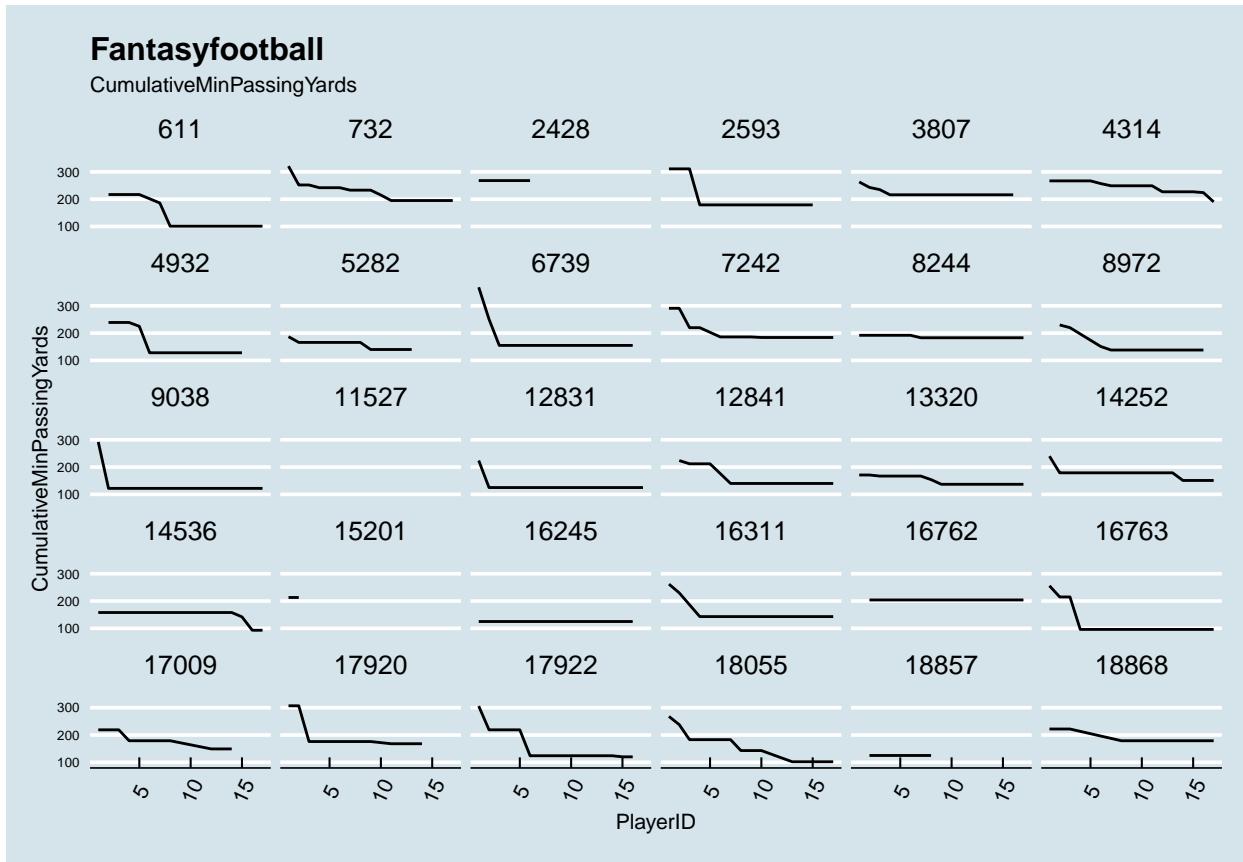
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



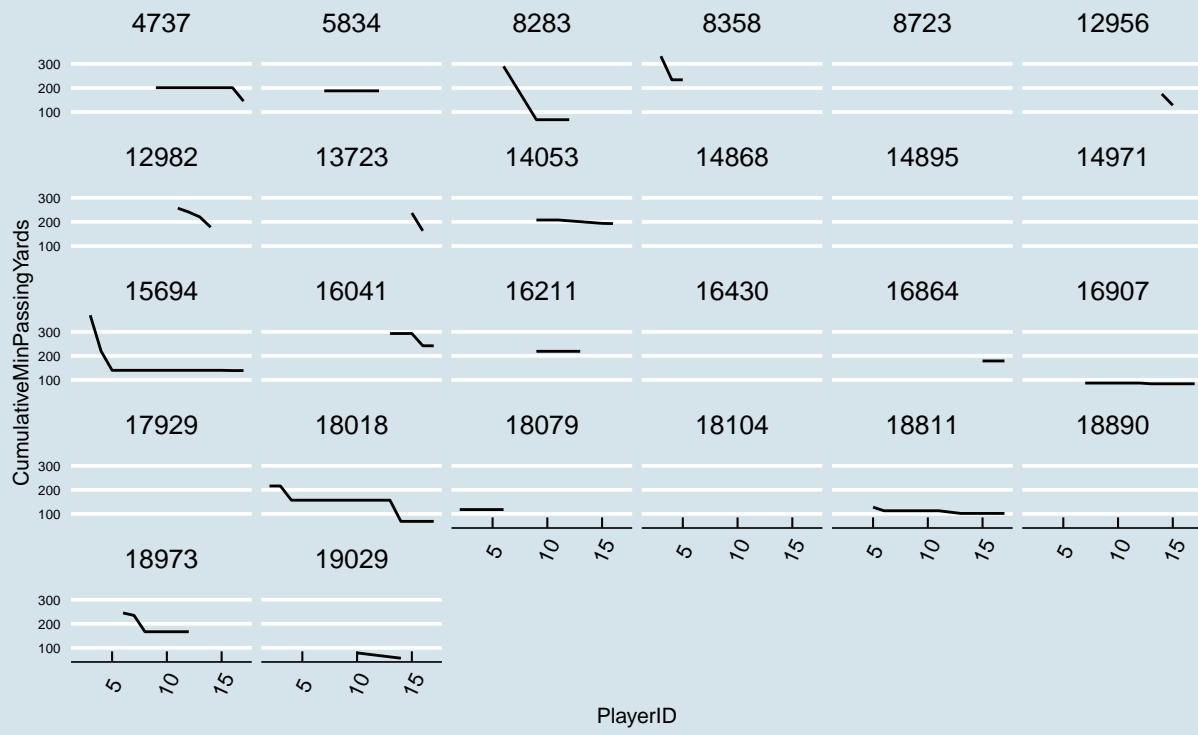
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



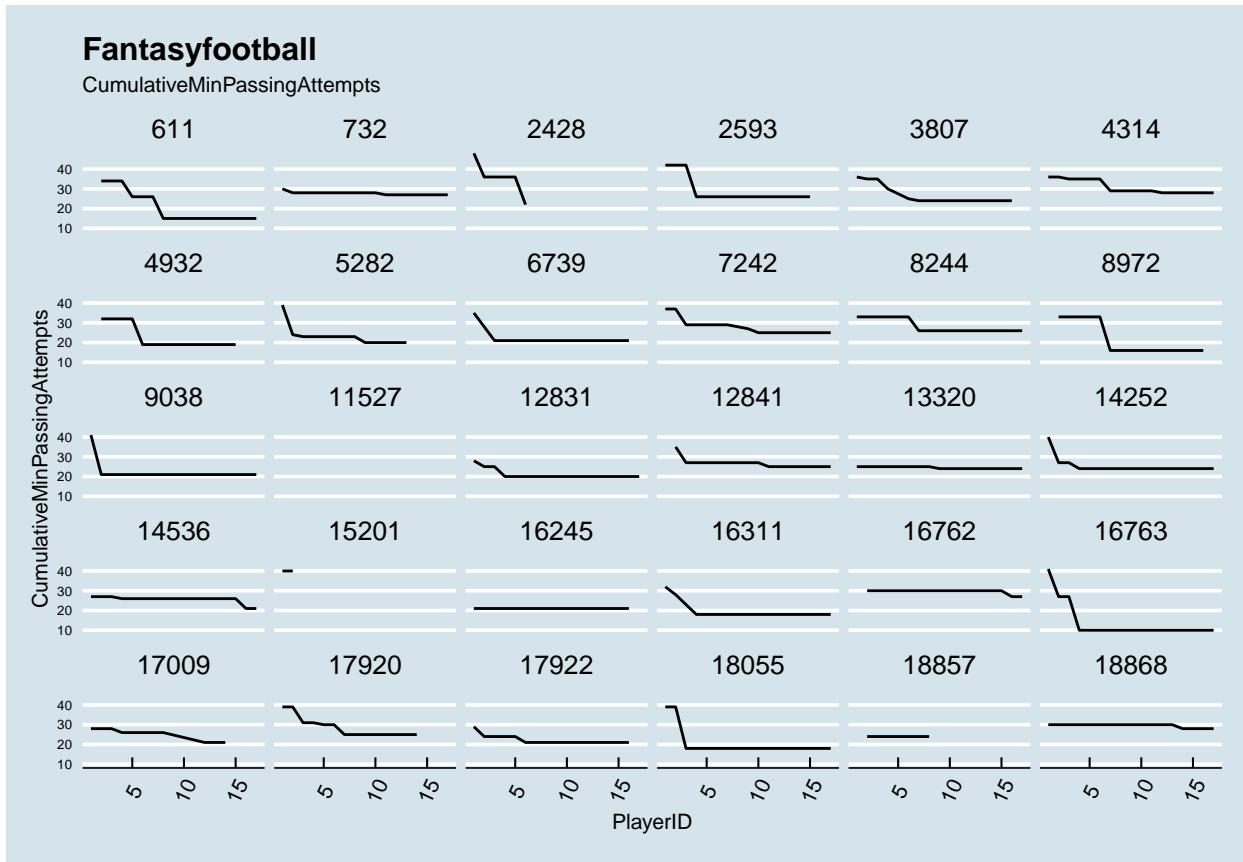
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
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## adjust the group aesthetic?
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## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```

Fantasyfootball

CumulativeMinPassingYards



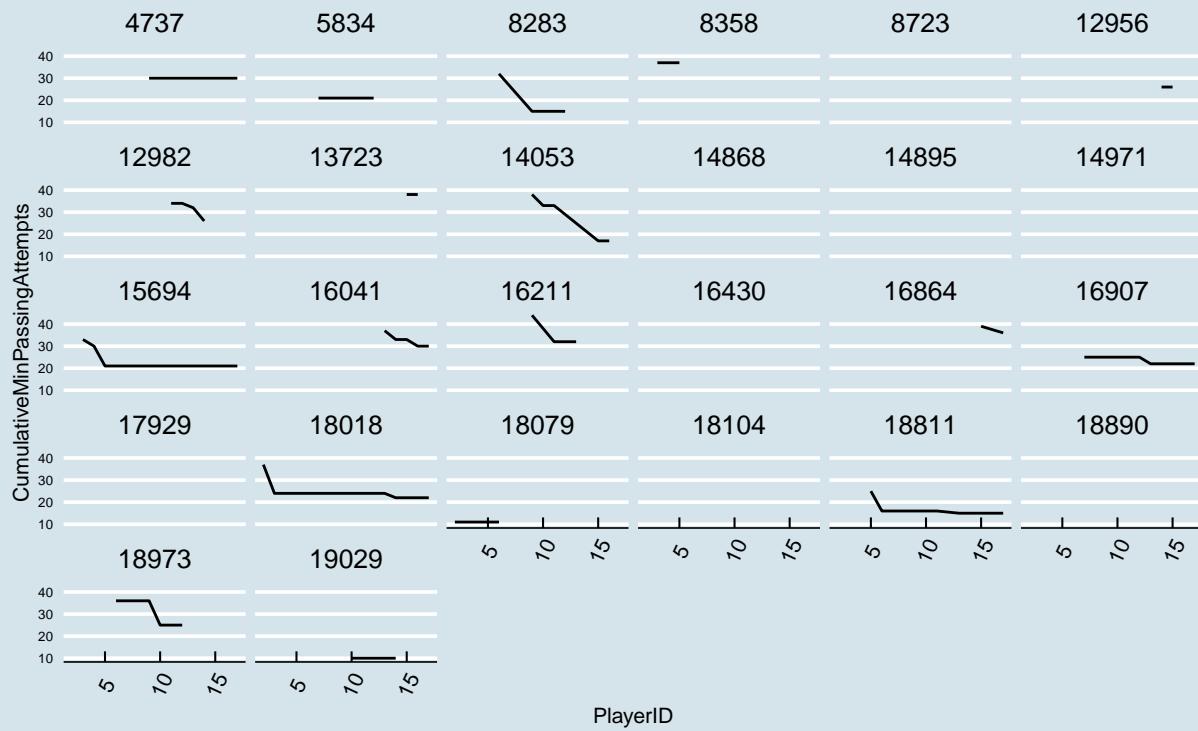
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



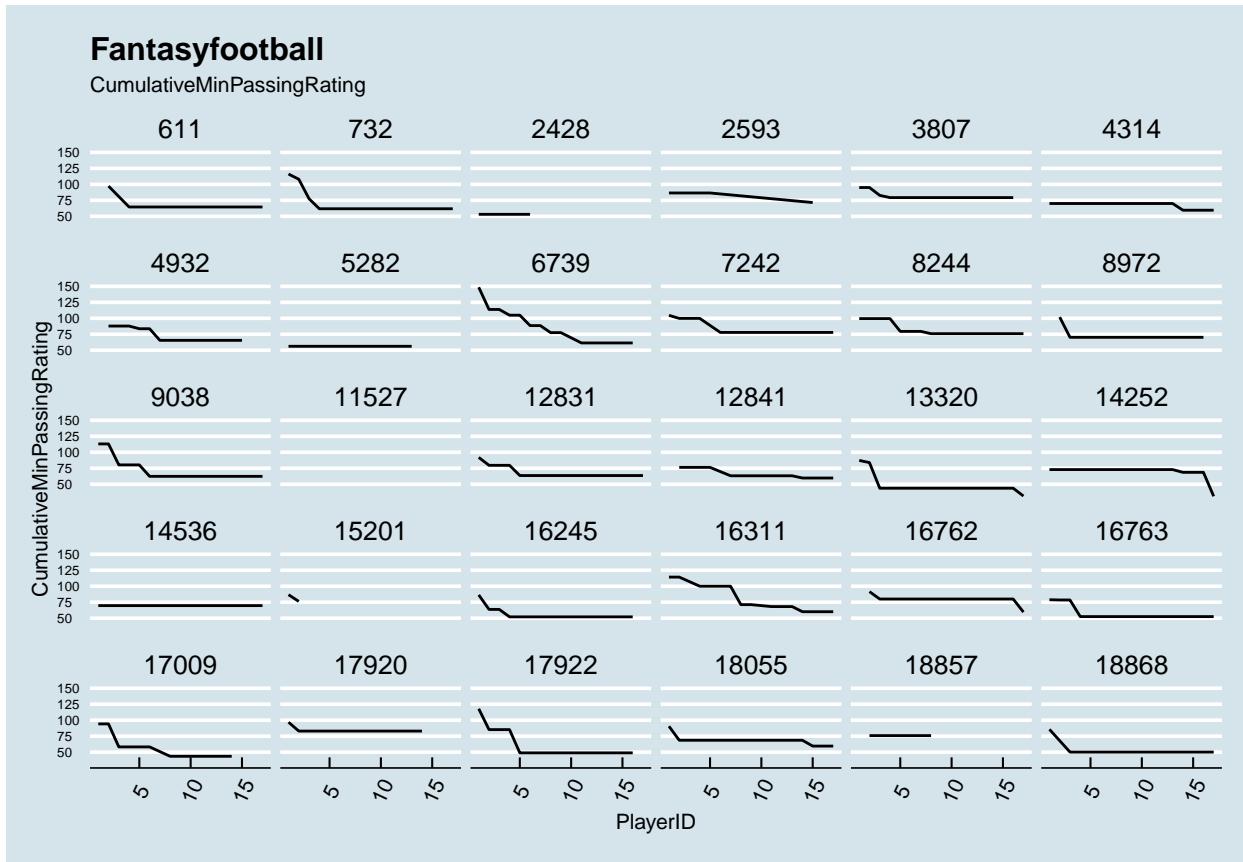
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
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## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```

Fantasyfootball

CumulativeMinPassingAttempts



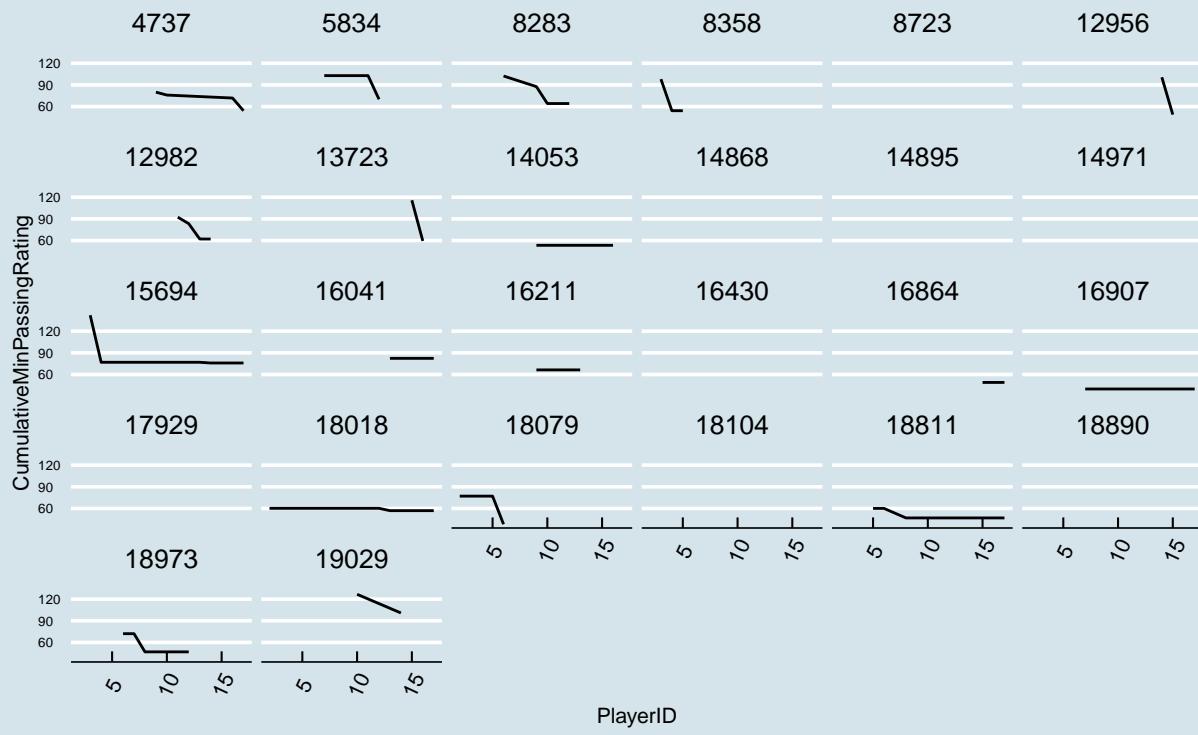
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



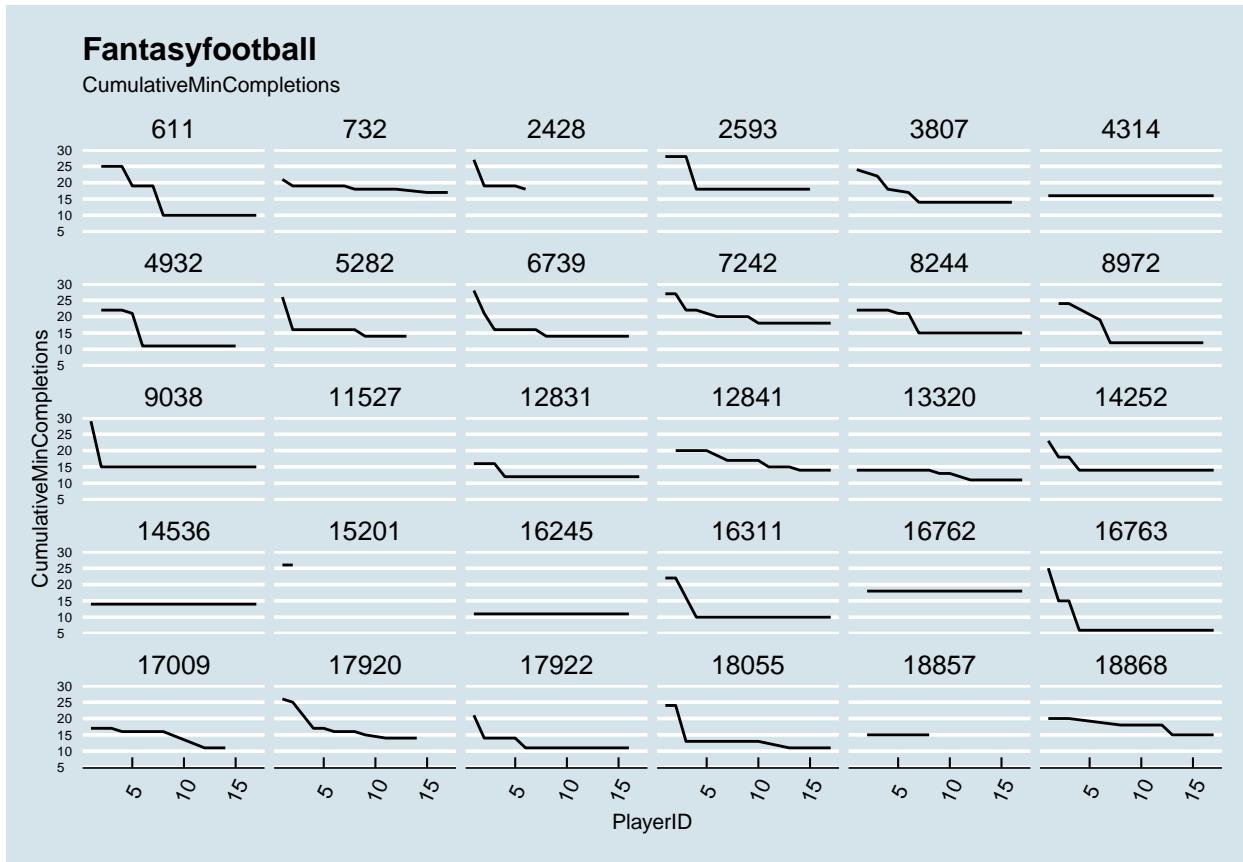
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
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## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```

Fantasyfootball

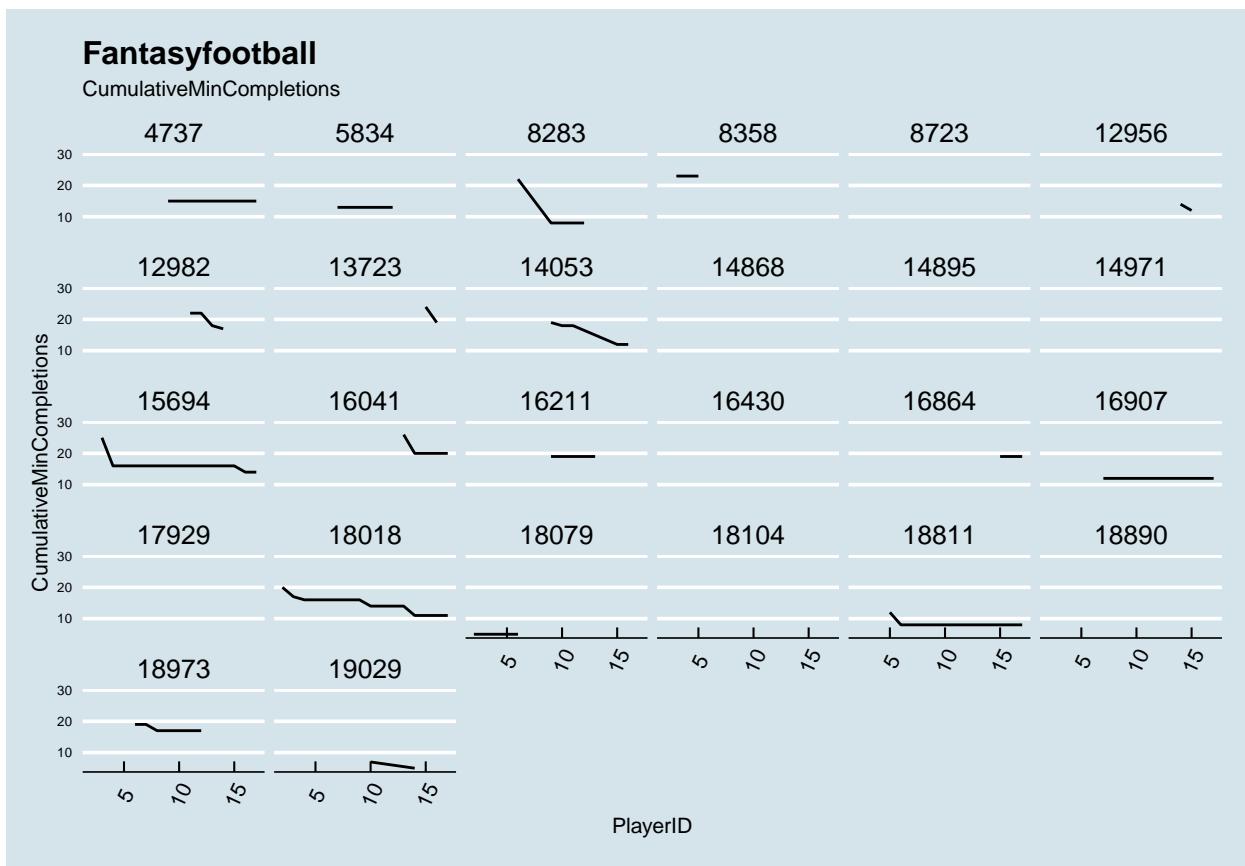
CumulativeMinPassingRating



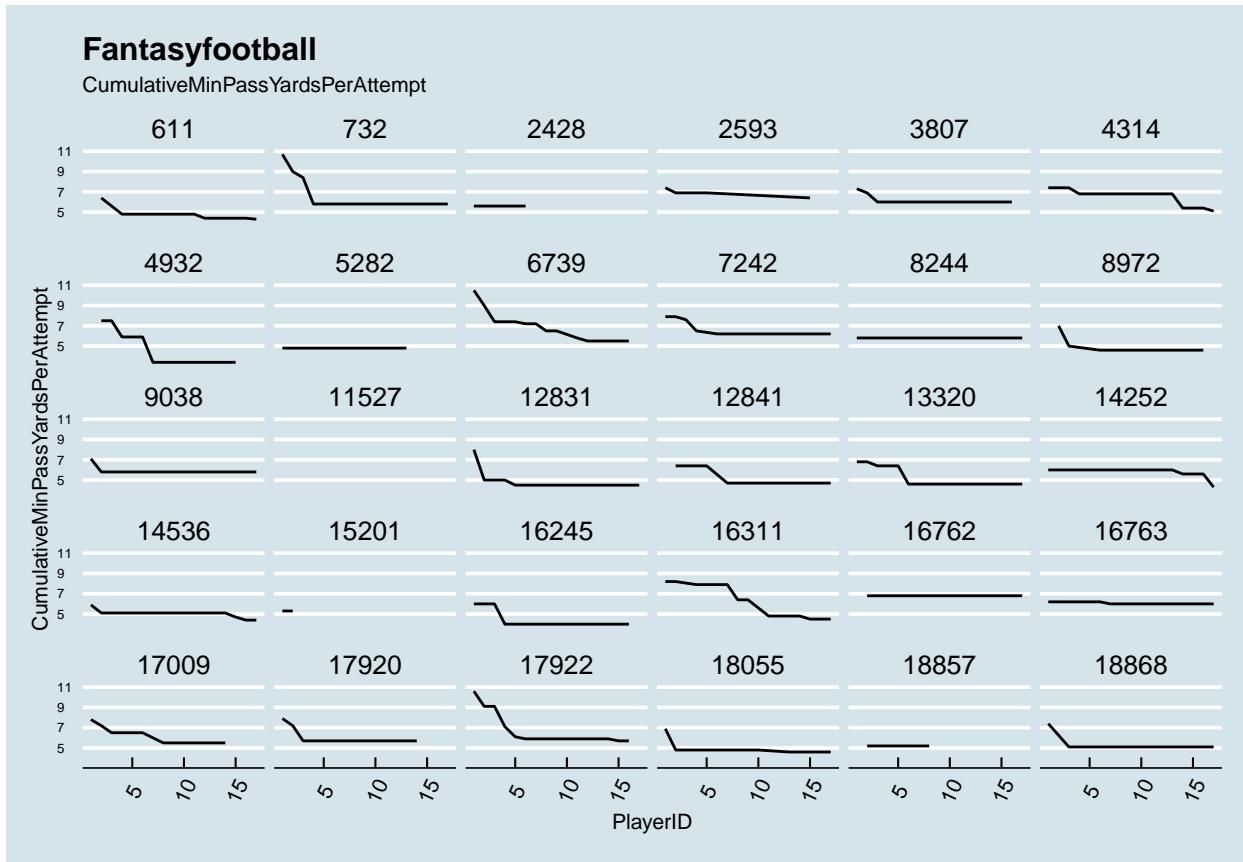
```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```

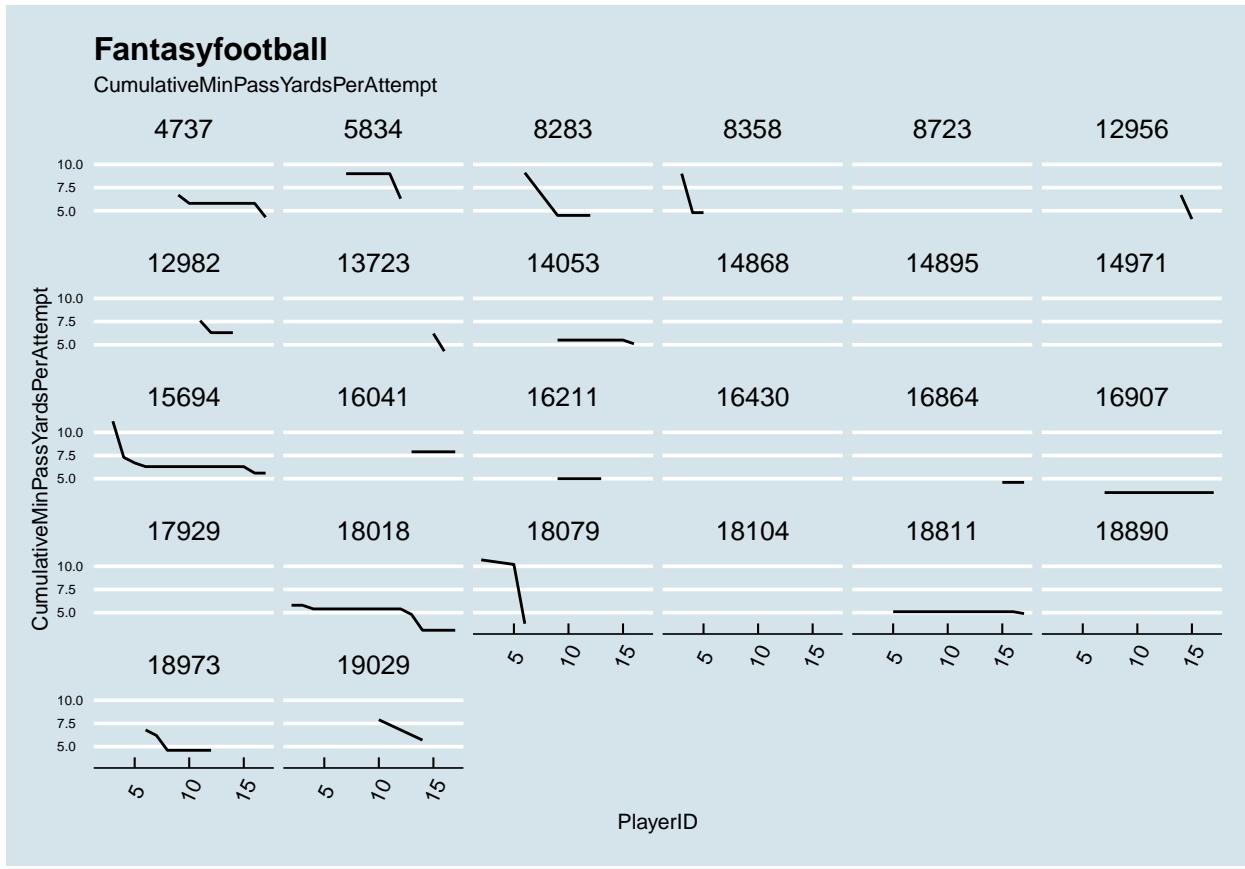


```
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



```

## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
## geom_path: Each group consists of only one observation. Do you need to
## adjust the group aesthetic?
```



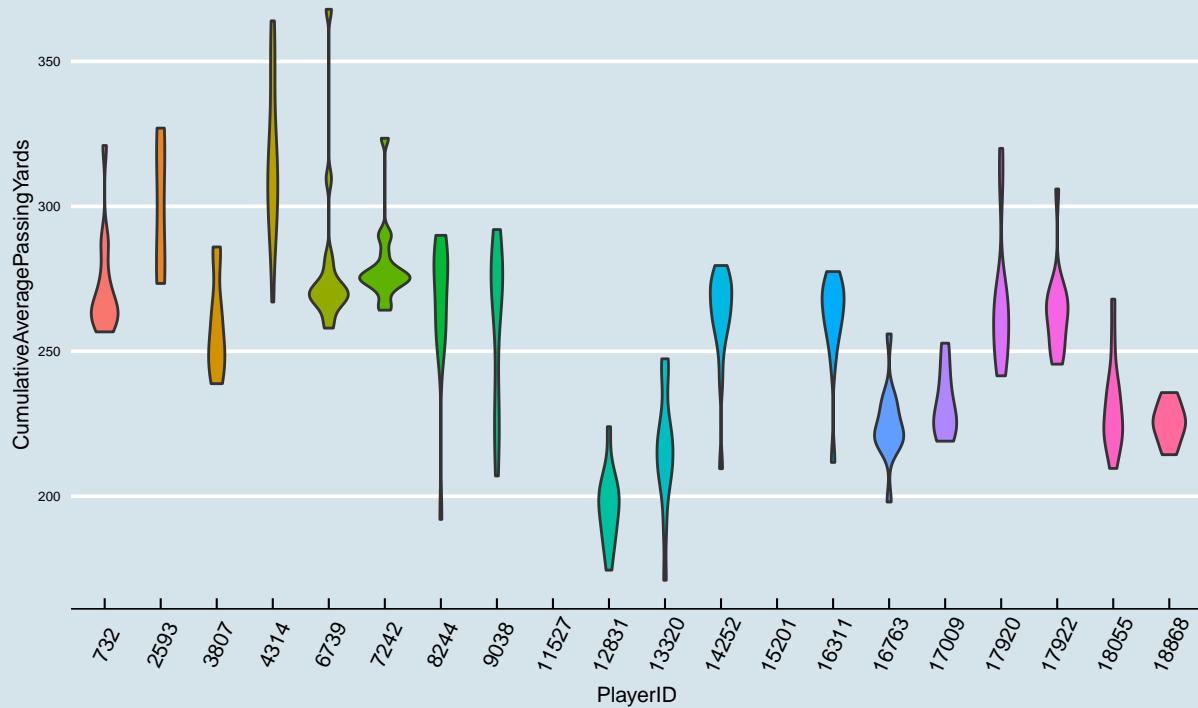
1.7.5 Individuals Violin plots for cumulative averages

```
for(p in 37:51){
  #print(paste("violin plots for ",names(players_ds[p])))
  for (player in seq(1,length(unique(final_ds$PlayerID)),by=20)){
    a_size <- player + 19
    players_ds <- final_ds %>% filter(PlayerID %in% unique(final_ds$PlayerID)[player:a_size])

    v_plot <- players_ds %>%
      ggplot(aes_string(x="as.factor(PlayerID)",y=names(players_ds[p]),fill="as.factor(Play
      gtitle(names(players_ds[p]))+
      geom_violin(show.legend = FALSE)+
      xlab("PlayerID")+
      ylab(names(players_ds[p]))+
      labs(title="Fantasyfootball",
           subtitle=names(players_ds[p]),
           caption="Source: Fantasyfootball")+
      theme_economist(base_size=8)+theme(axis.text.y = element_text(size=5))+
      theme(axis.text.x = element_text(angle=65, vjust=0.6))
    print(v_plot)
  }
}
```

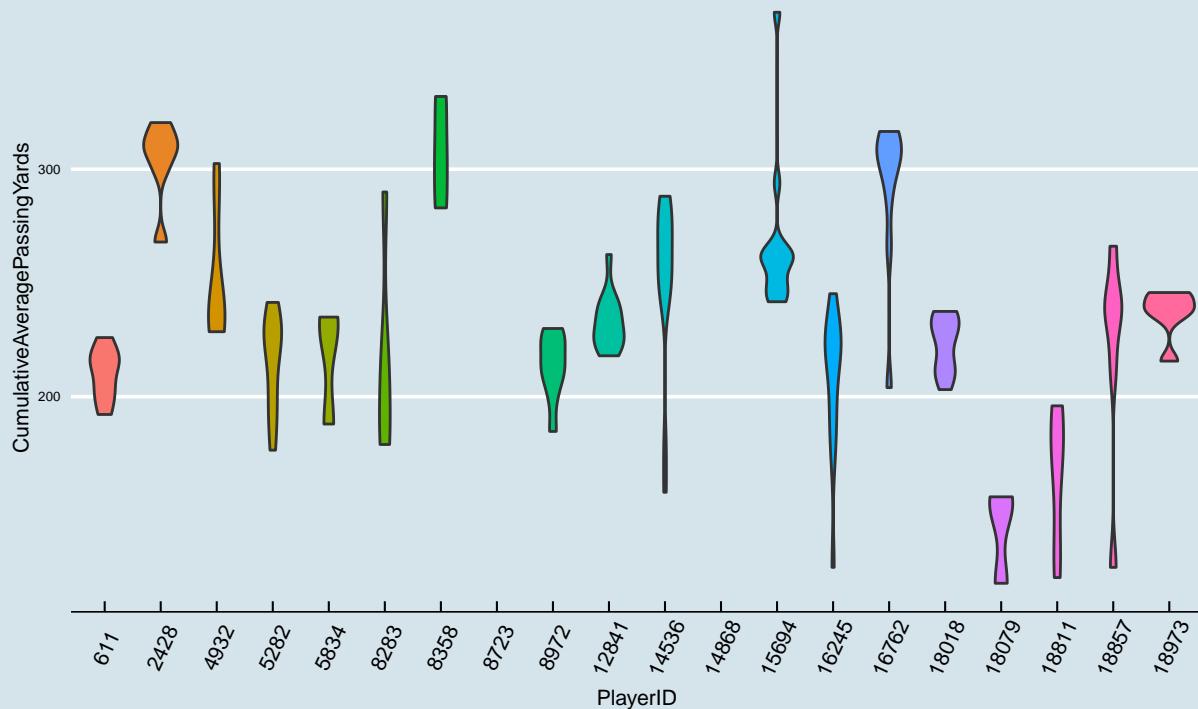
Fantasyfootball

CumulativeAveragePassingYards



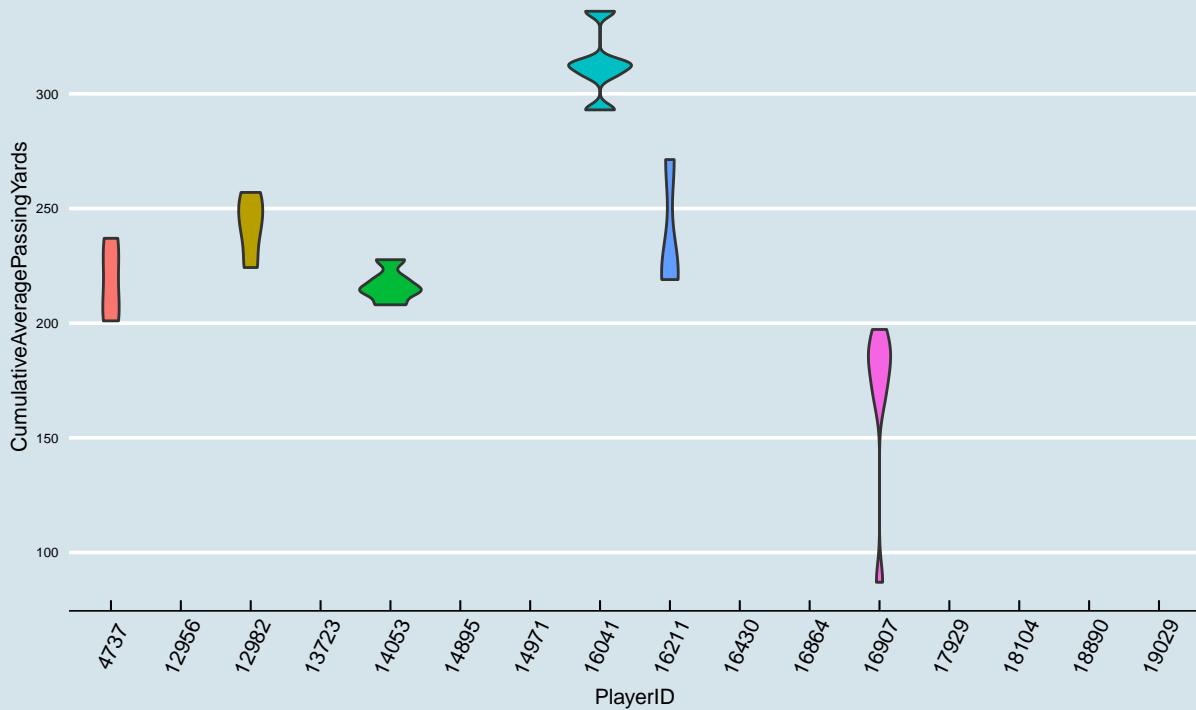
Fantasyfootball

CumulativeAveragePassingYards



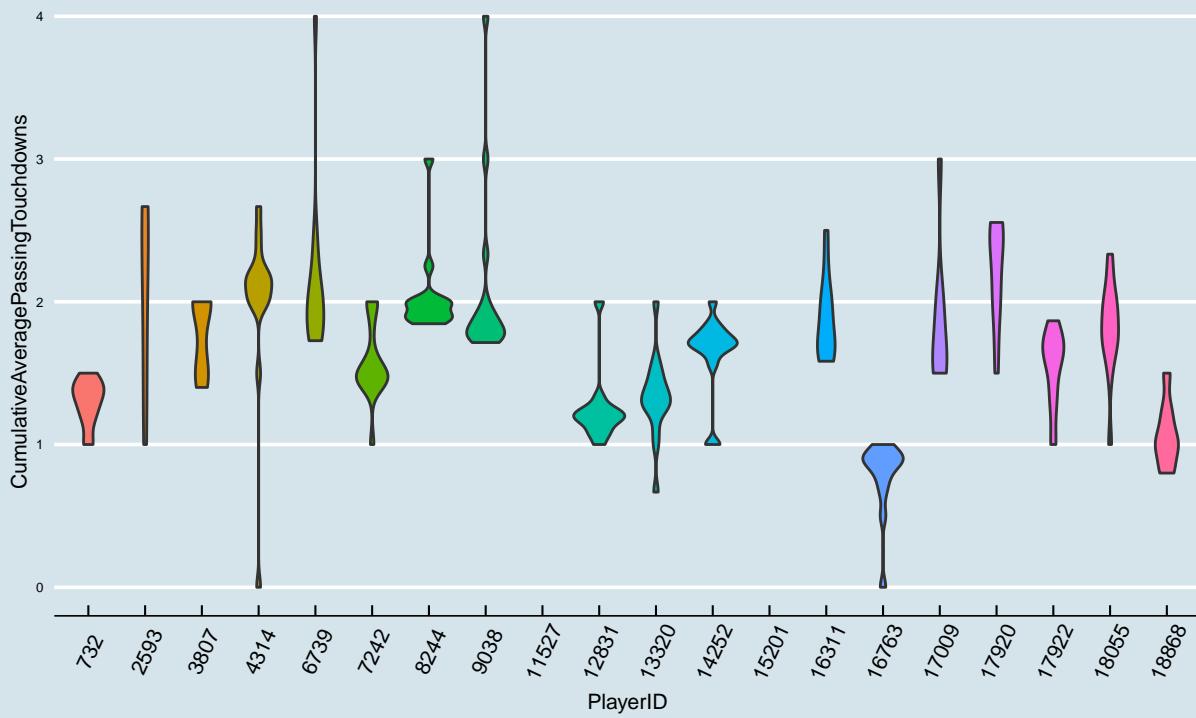
Fantasyfootball

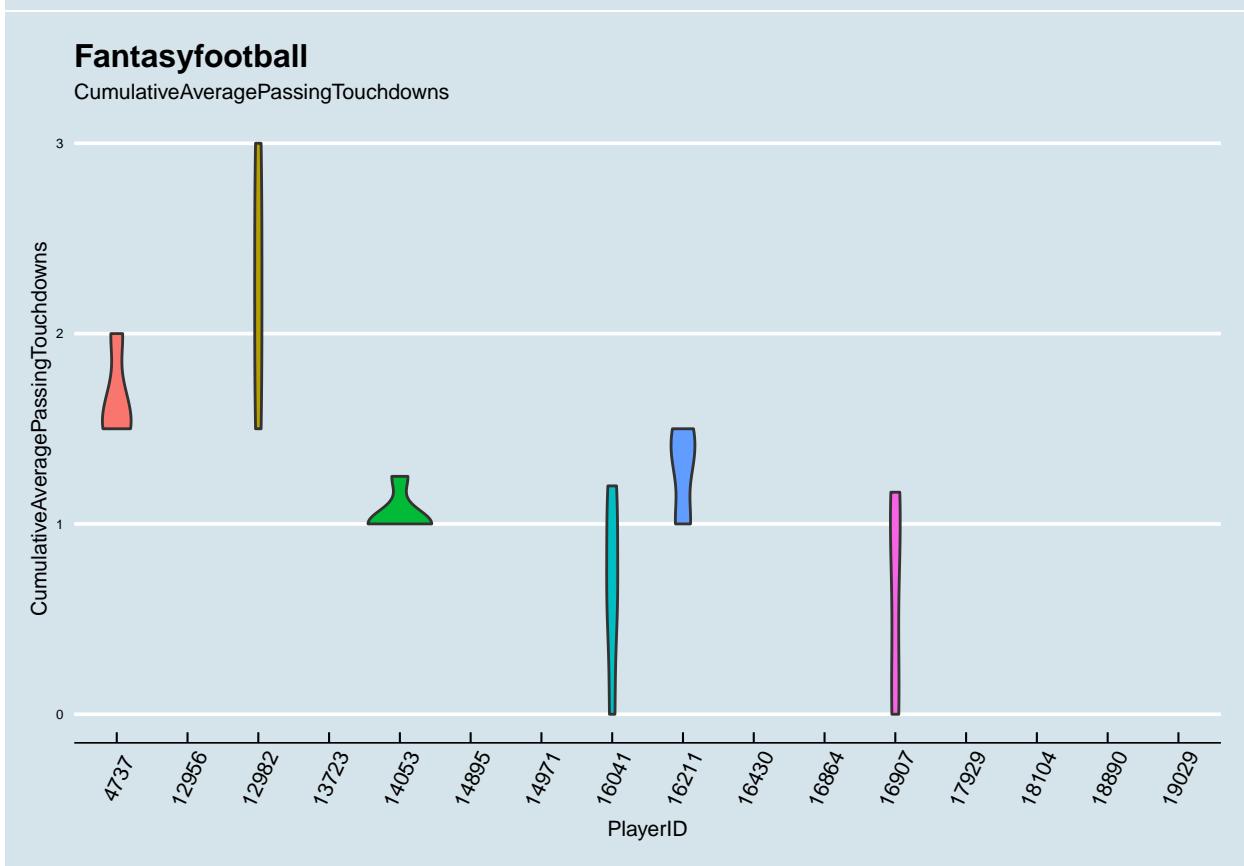
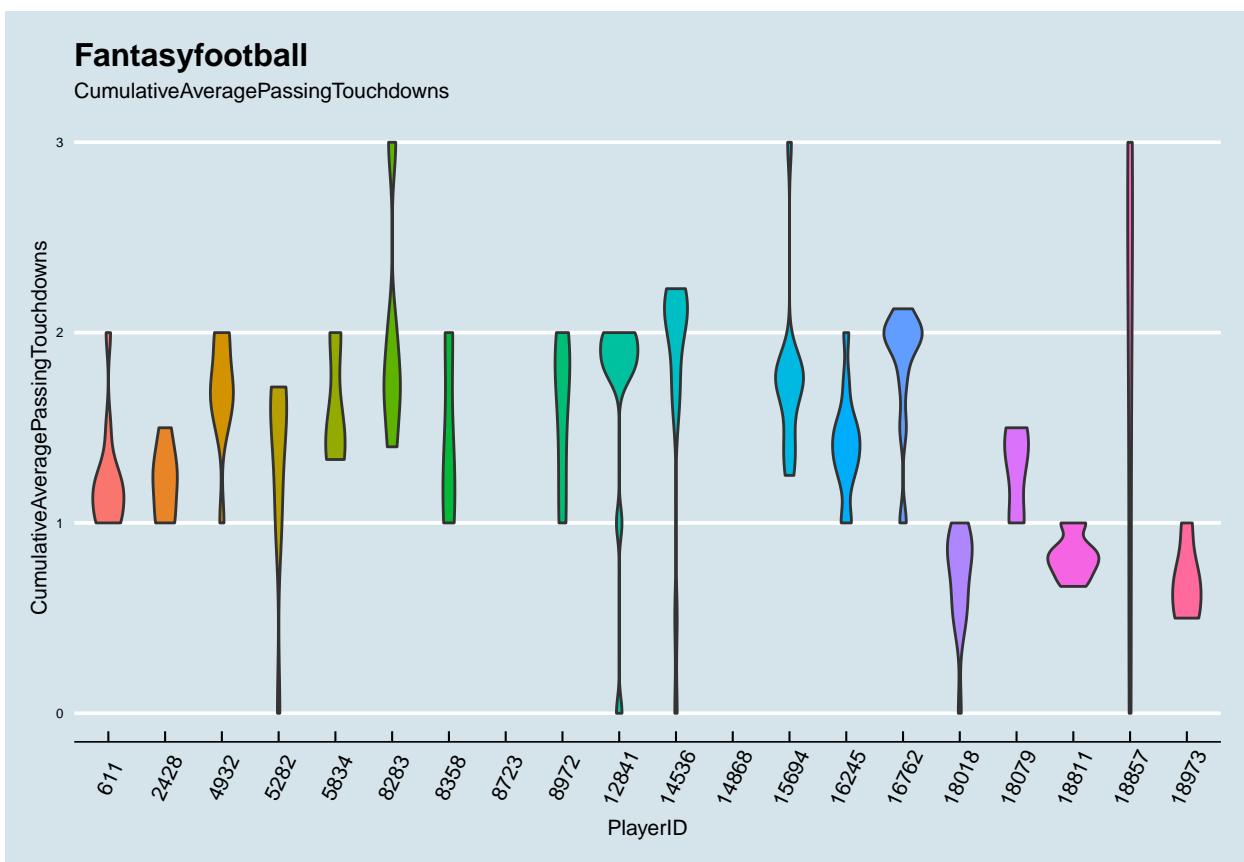
CumulativeAveragePassingYards



Fantasyfootball

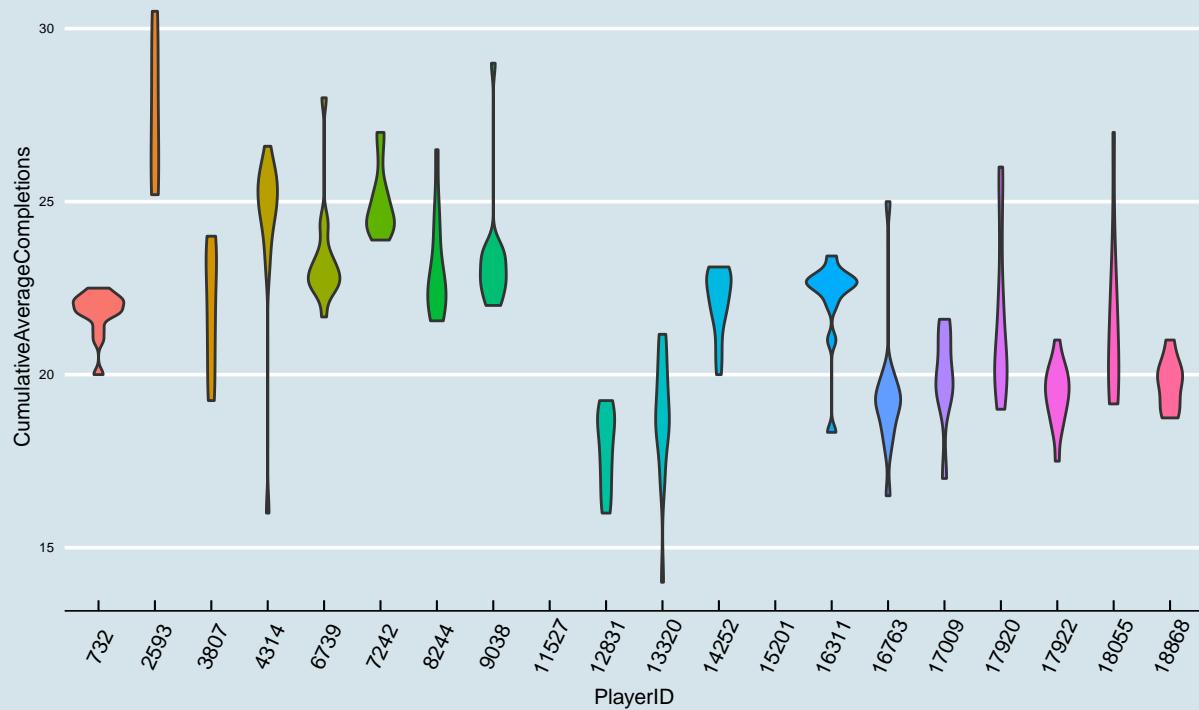
CumulativeAveragePassingTouchdowns





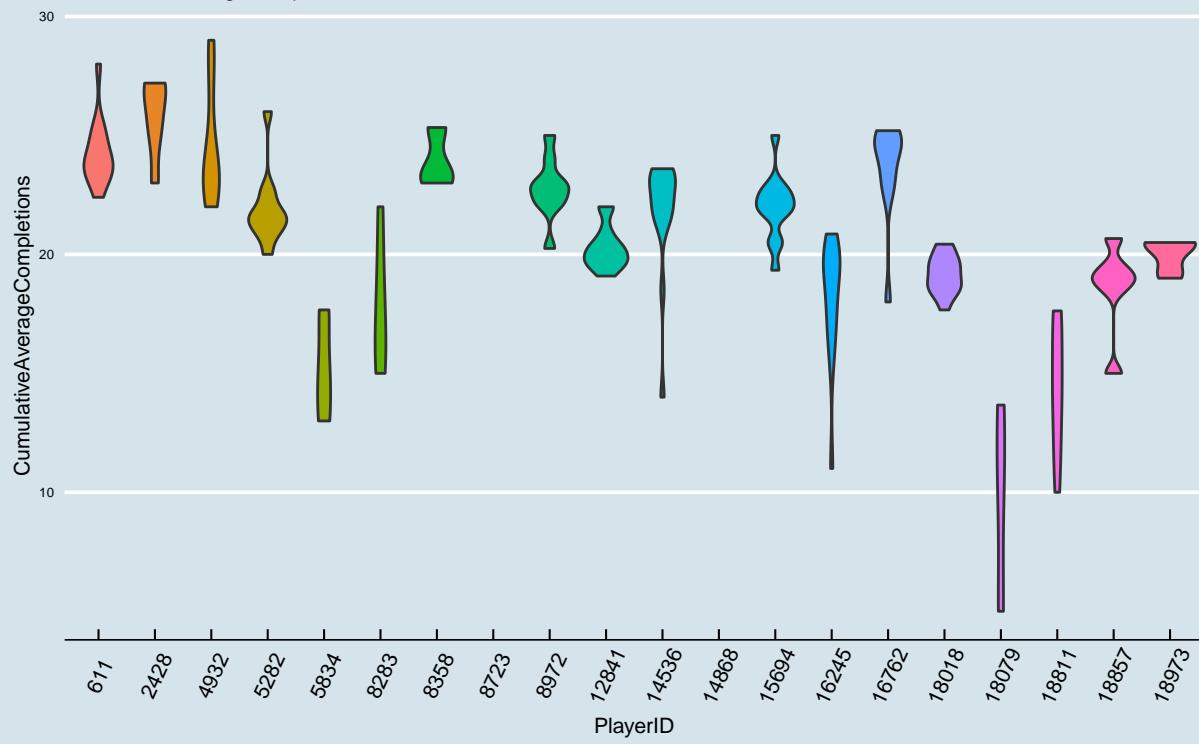
Fantasyfootball

CumulativeAverageCompletions



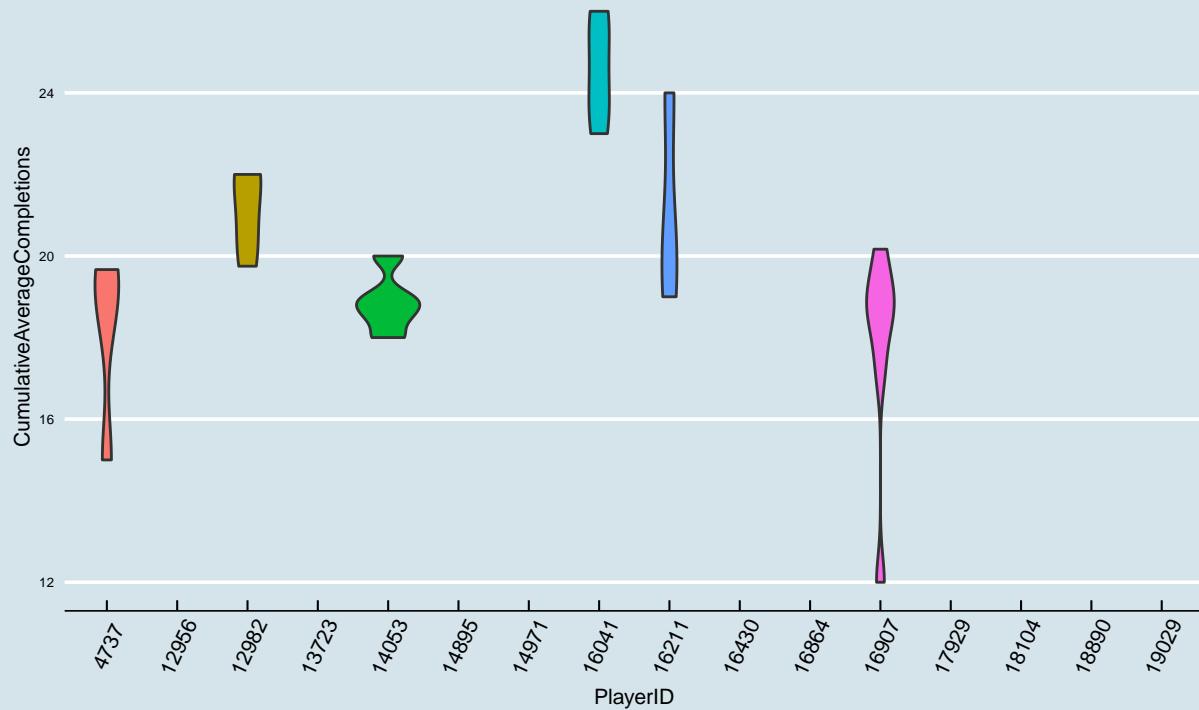
Fantasyfootball

CumulativeAverageCompletions



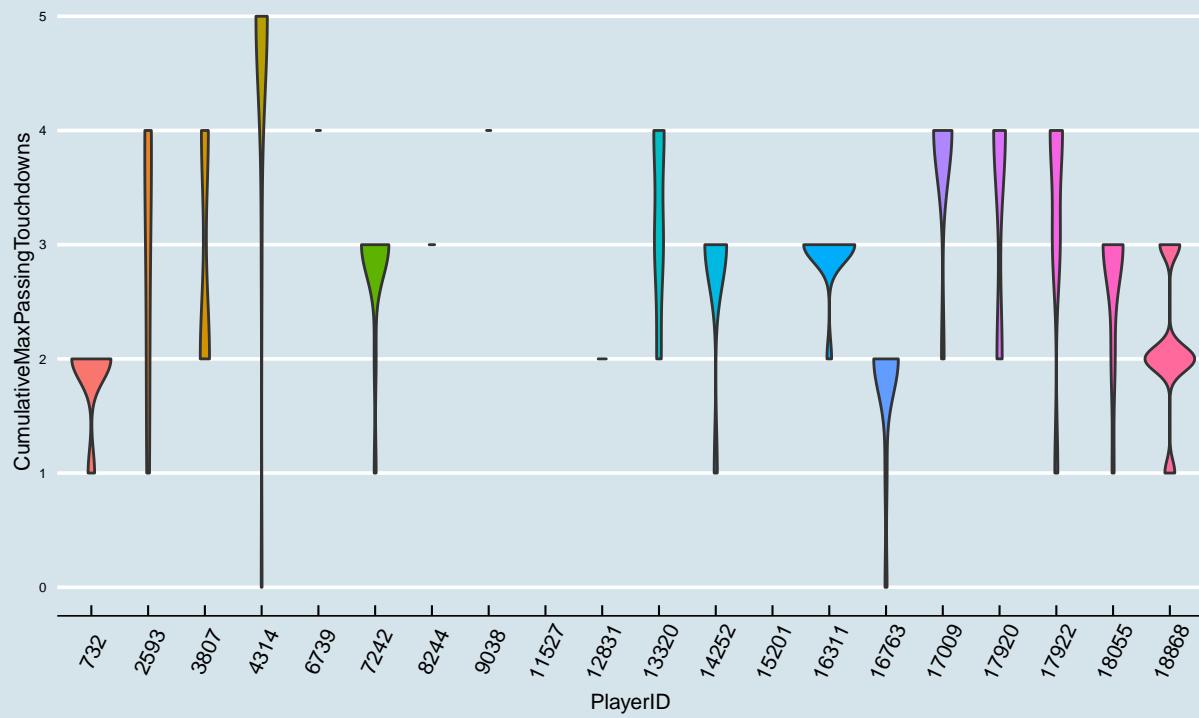
Fantasyfootball

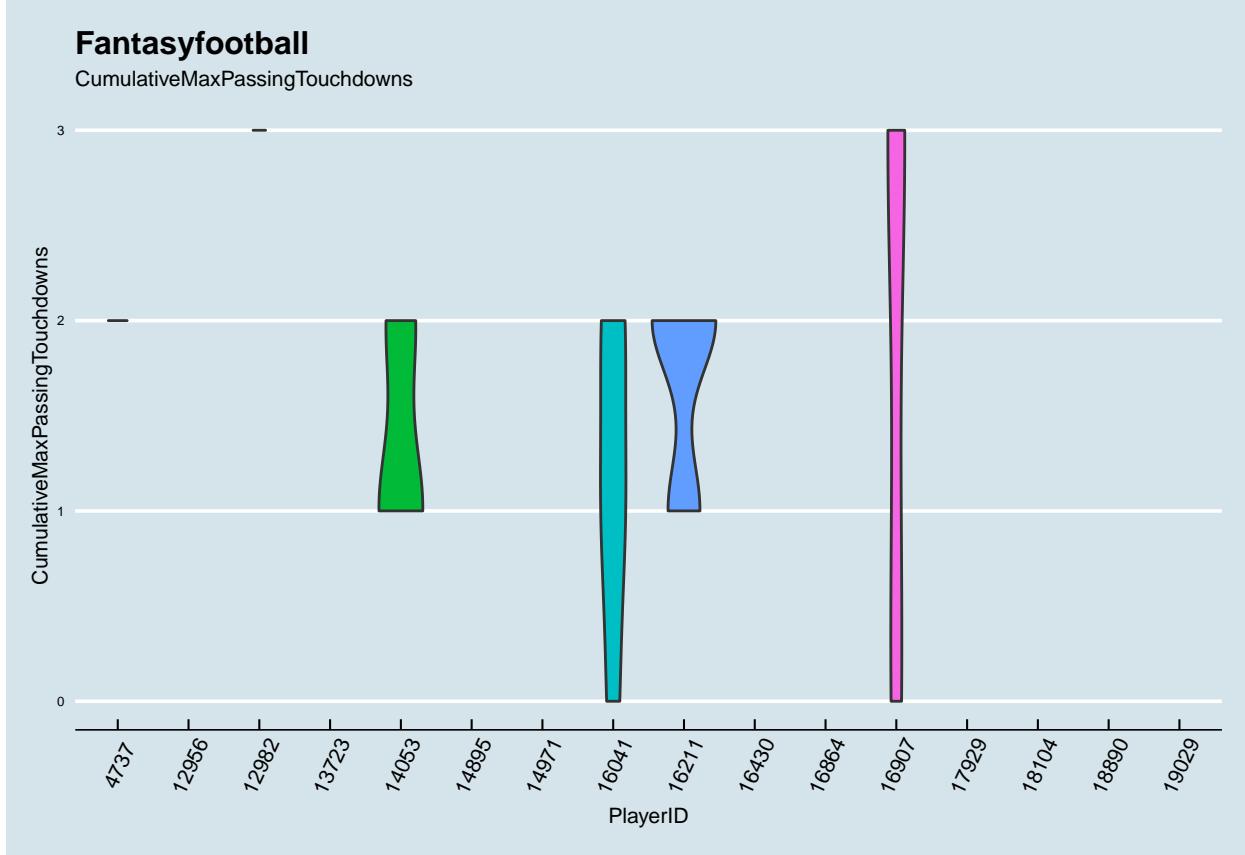
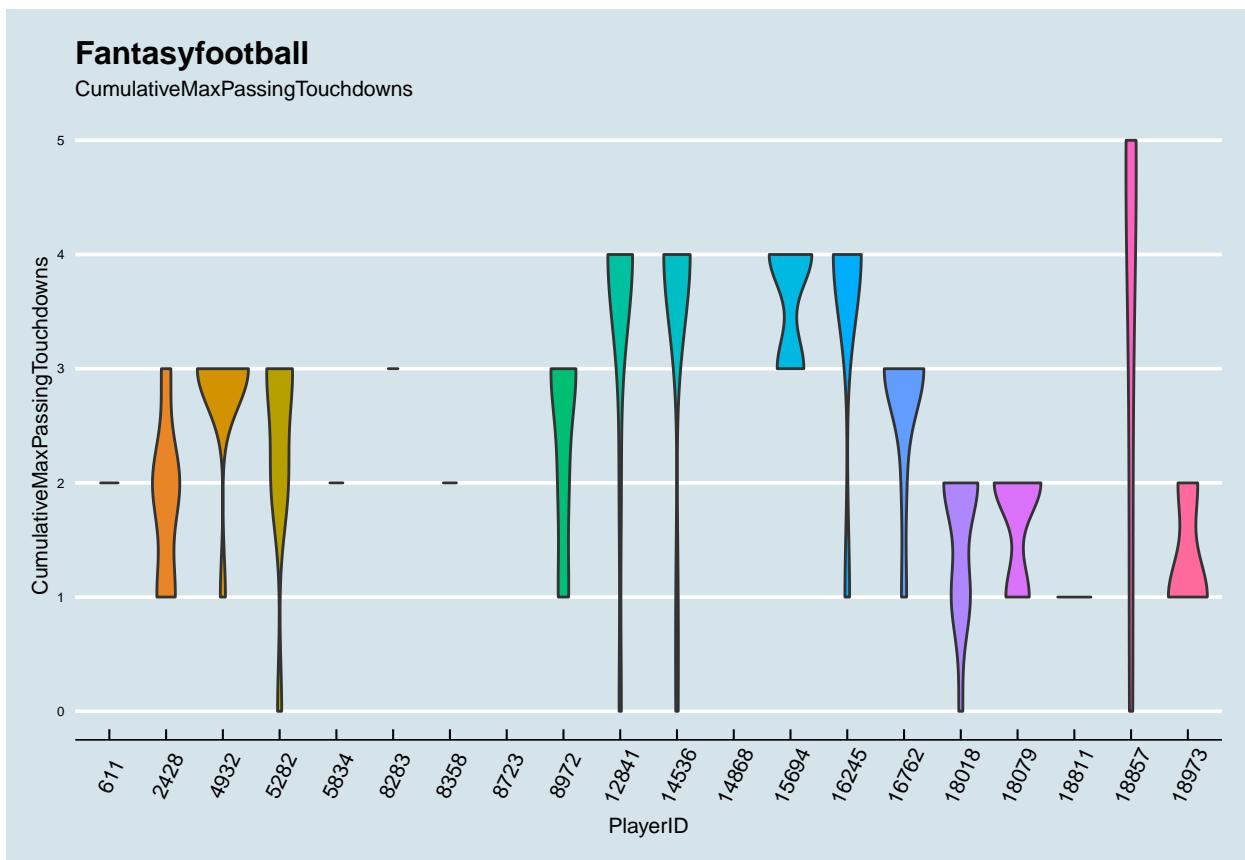
CumulativeAverageCompletions



Fantasyfootball

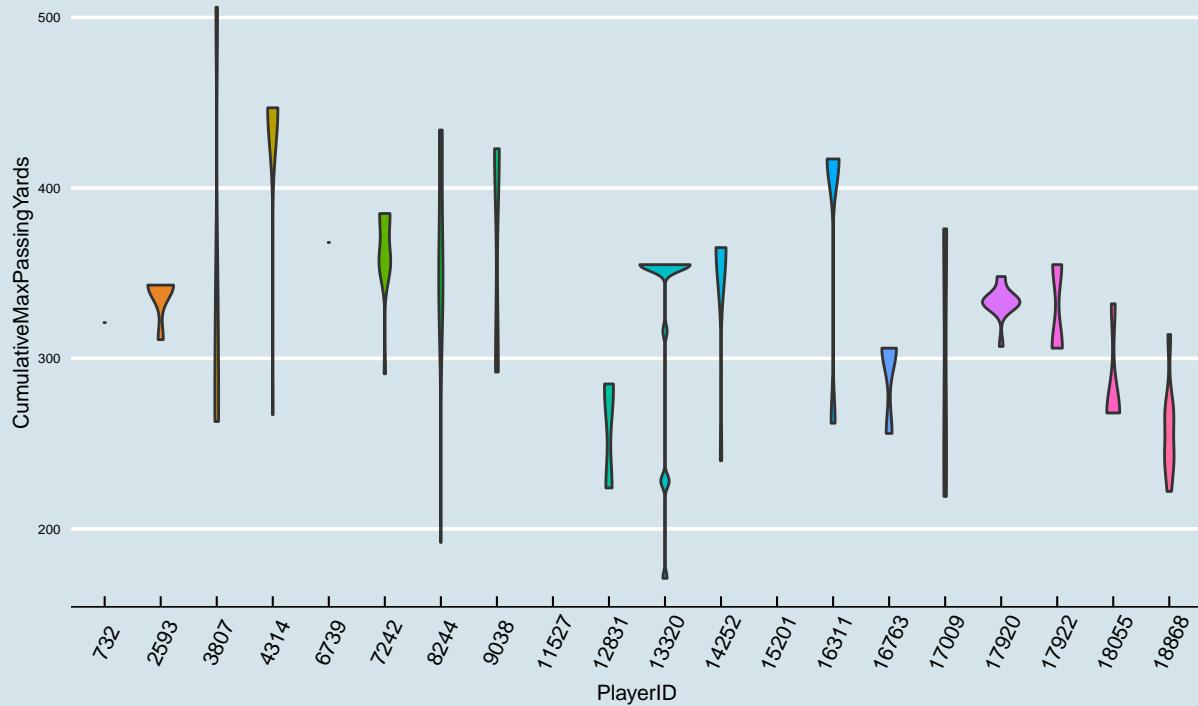
CumulativeMaxPassingTouchdowns





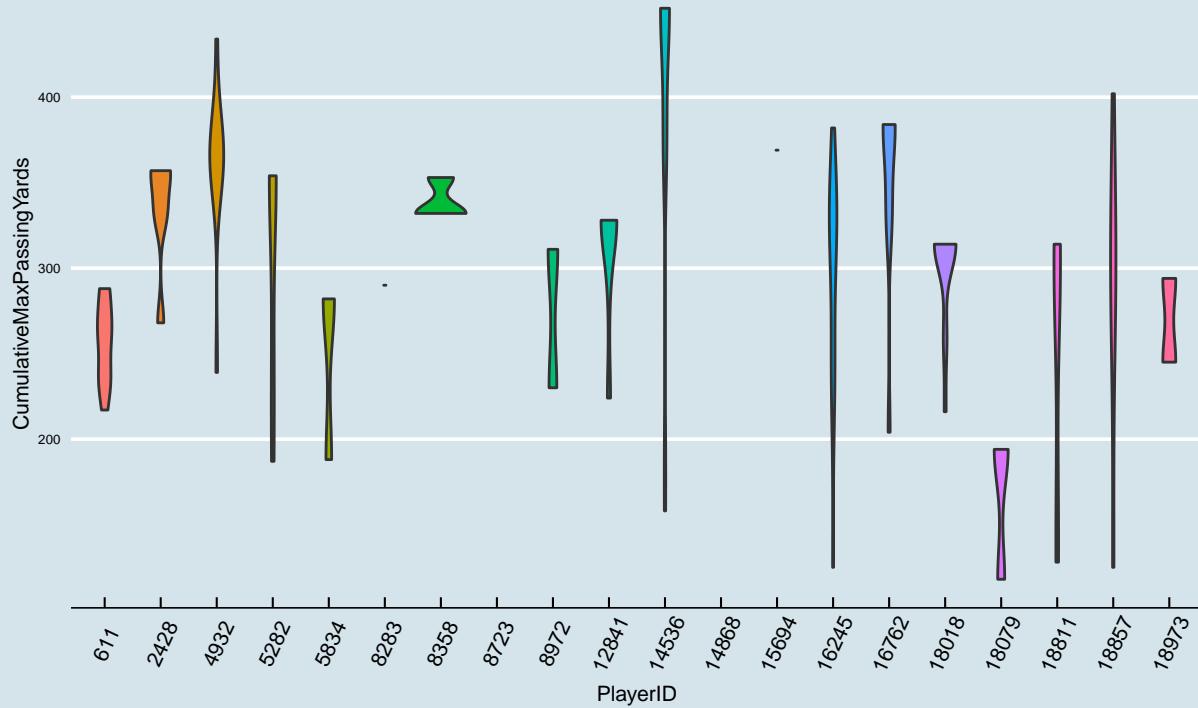
Fantasyfootball

CumulativeMaxPassingYards



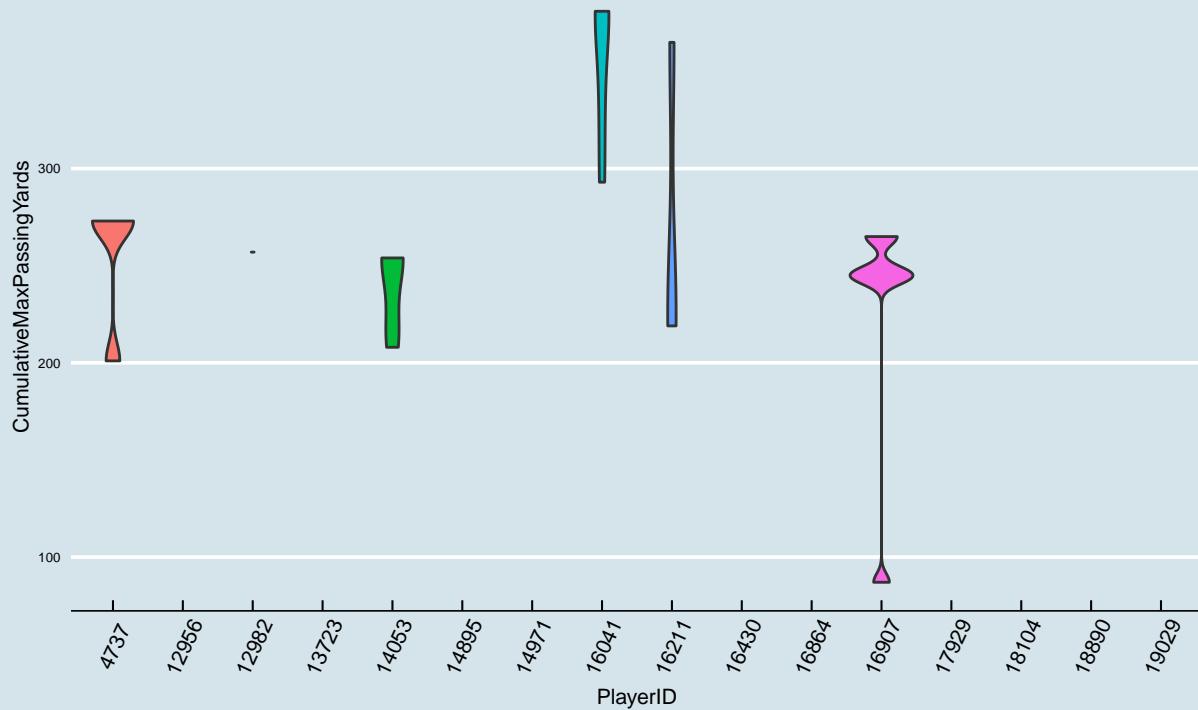
Fantasyfootball

CumulativeMaxPassingYards



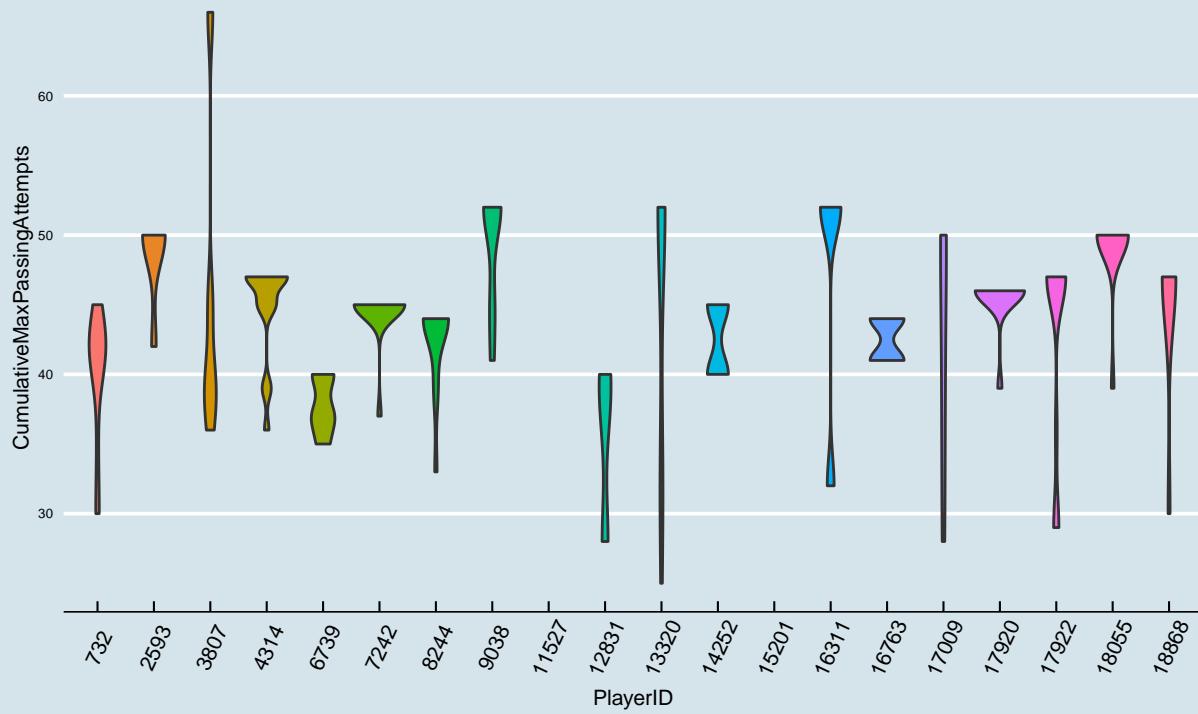
Fantasyfootball

CumulativeMaxPassingYards



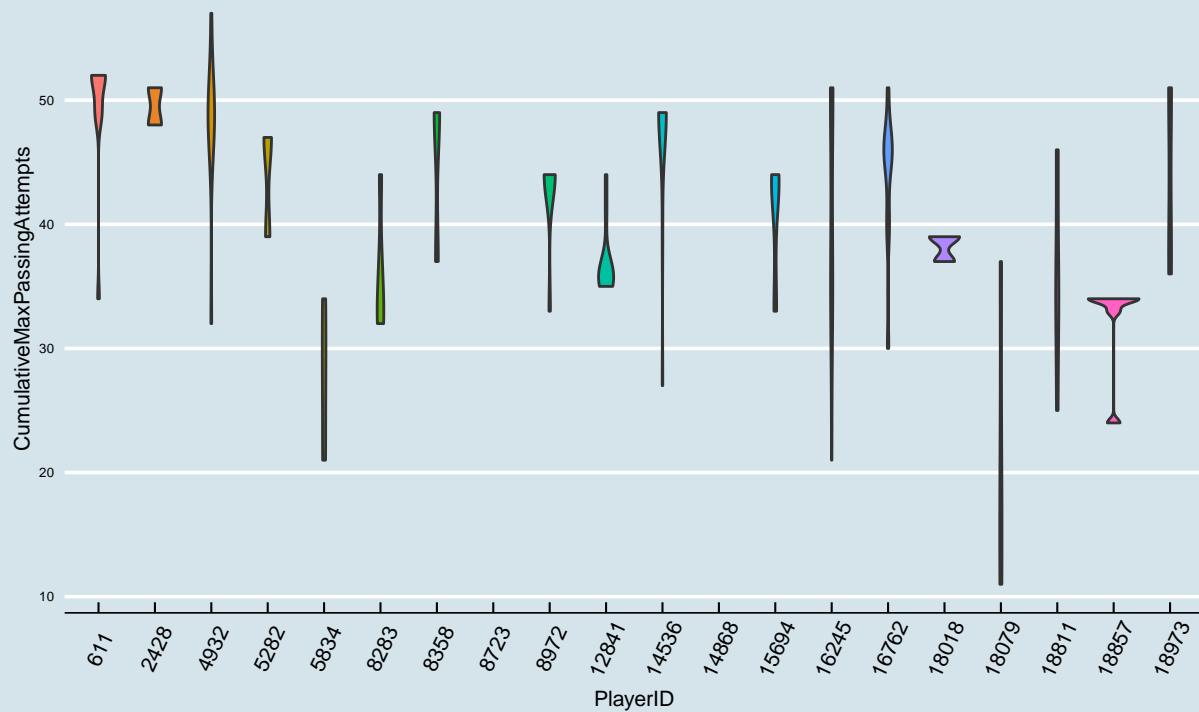
Fantasyfootball

CumulativeMaxPassingAttempts



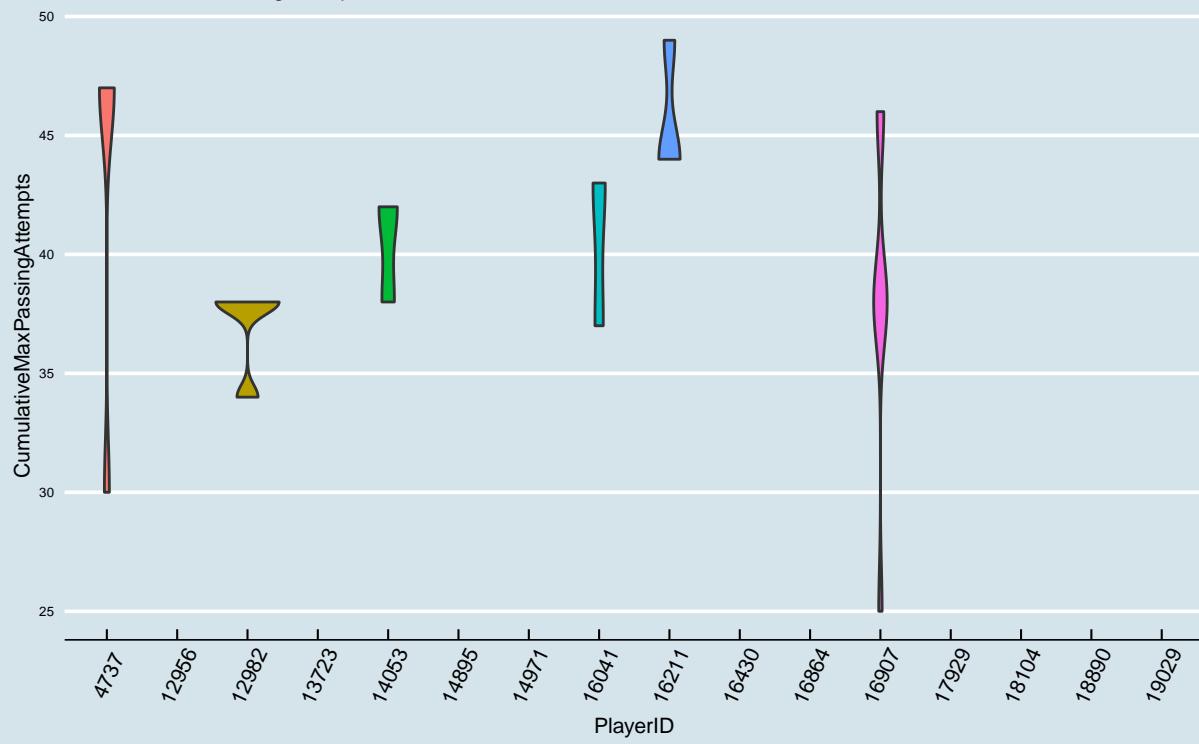
Fantasyfootball

CumulativeMaxPassingAttempts



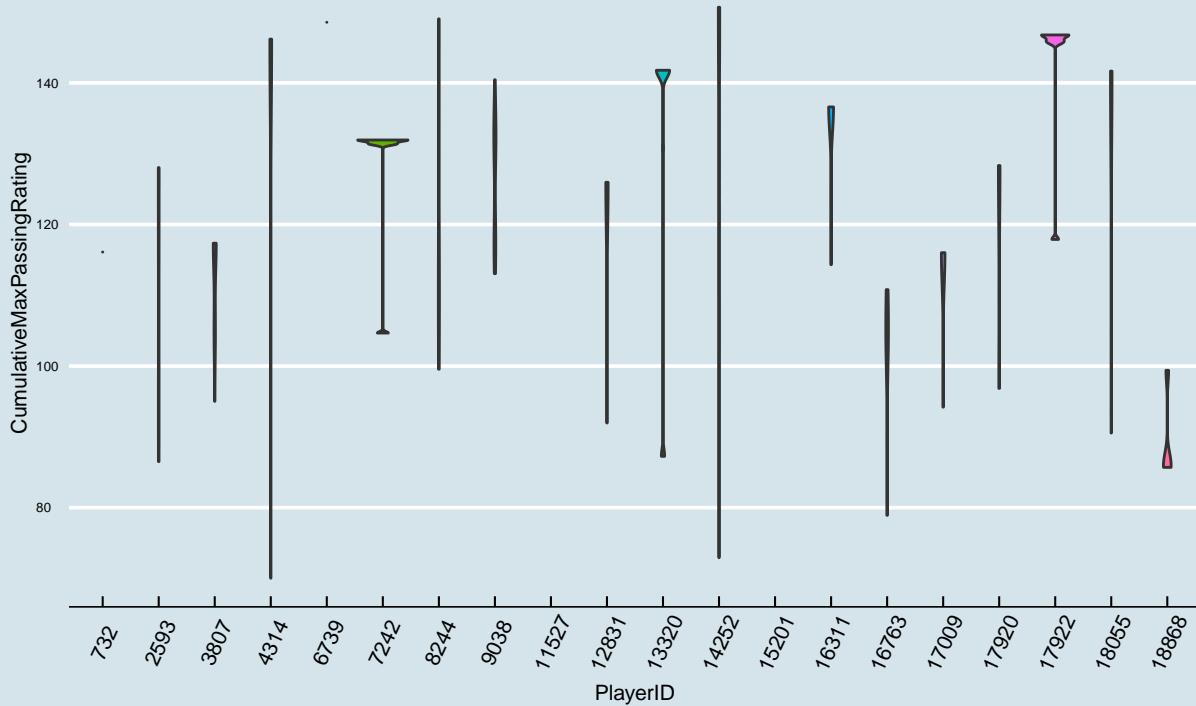
Fantasyfootball

CumulativeMaxPassingAttempts



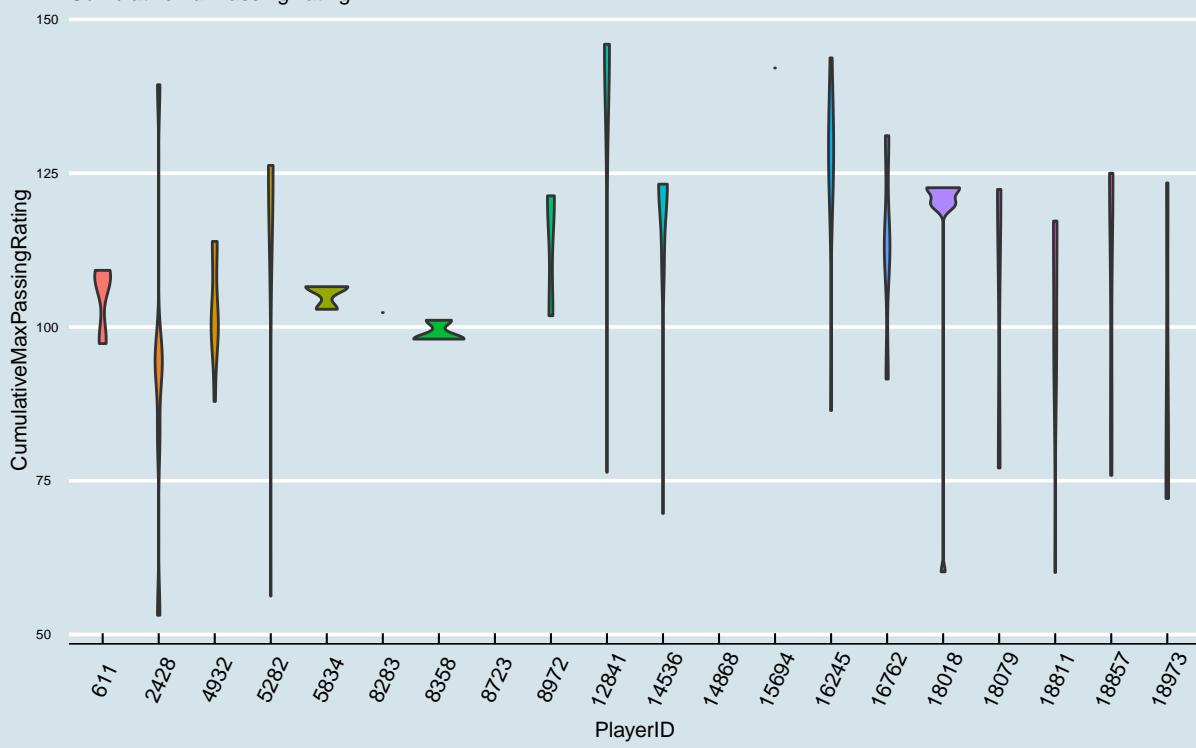
Fantasyfootball

CumulativeMaxPassingRating



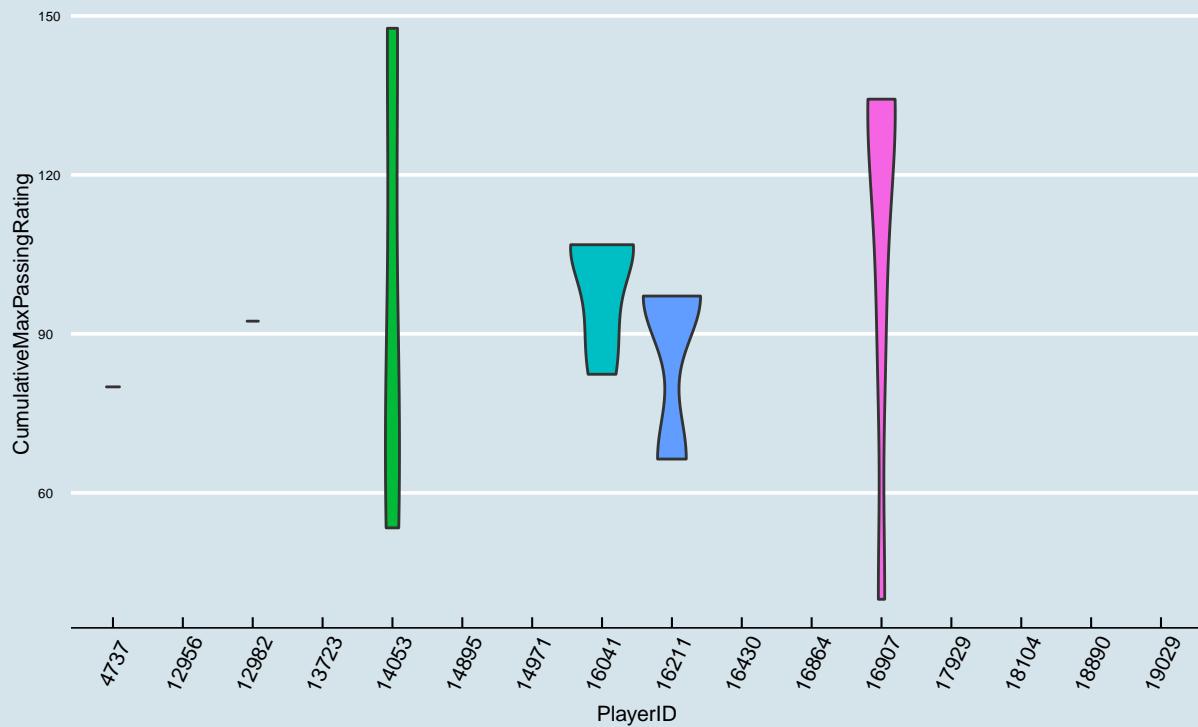
Fantasyfootball

CumulativeMaxPassingRating



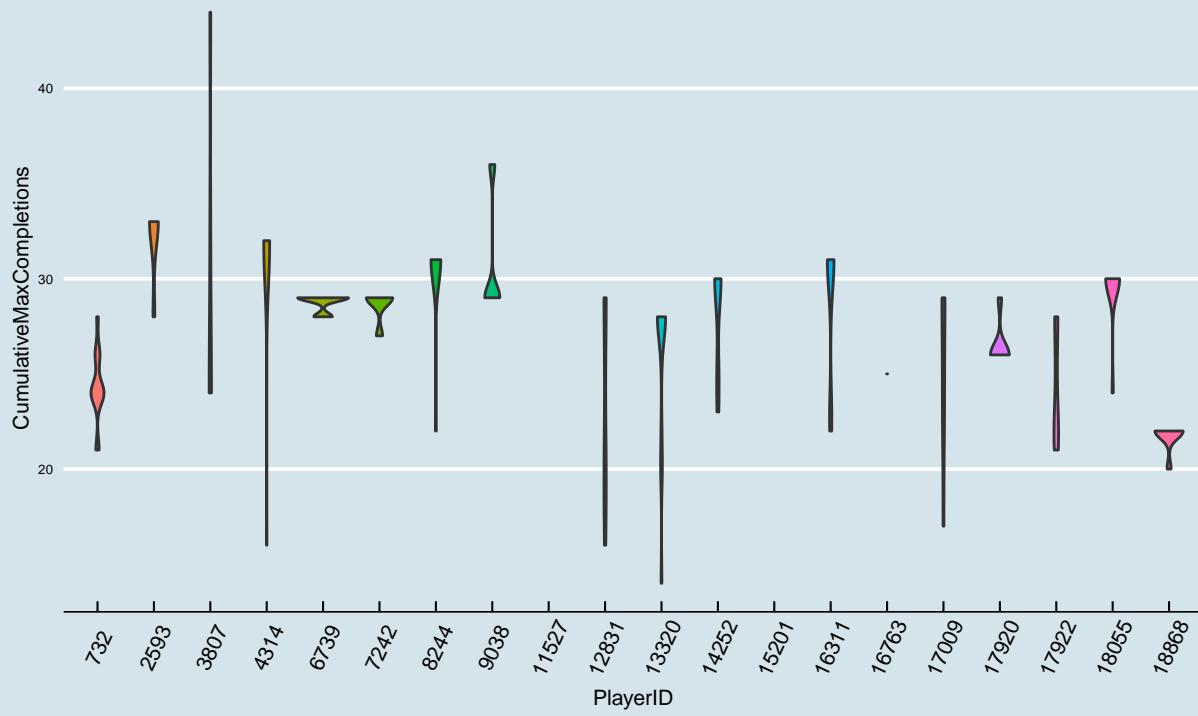
Fantasyfootball

CumulativeMaxPassingRating



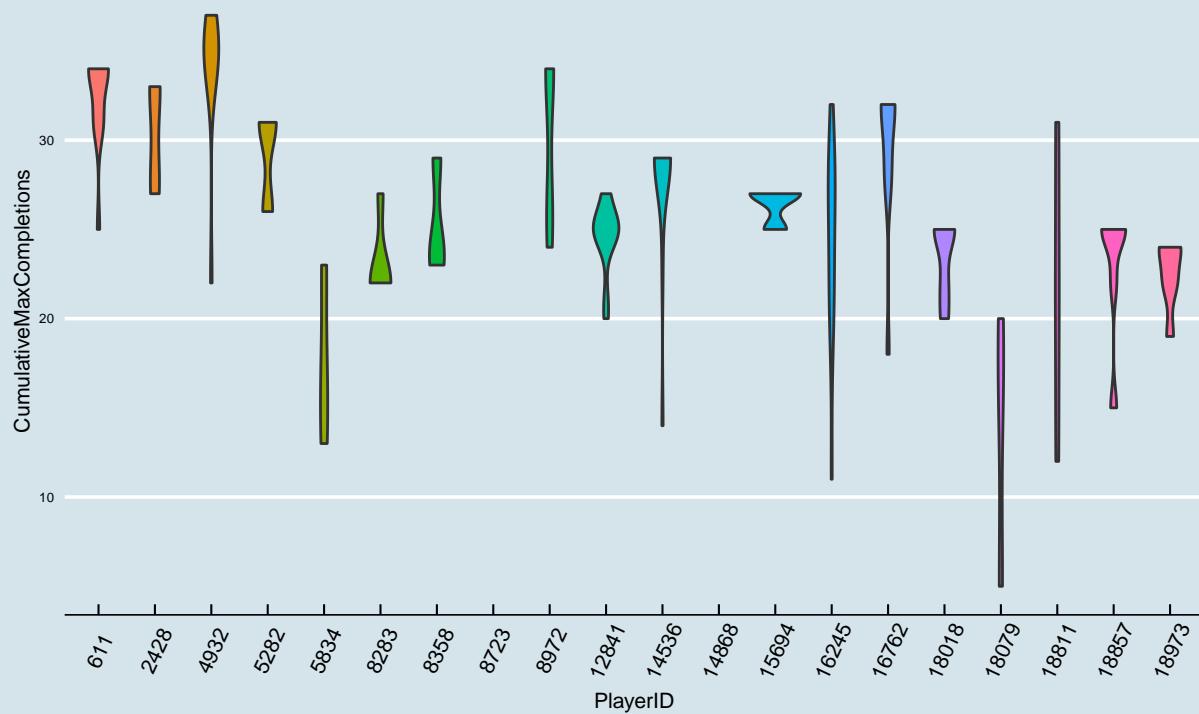
Fantasyfootball

CumulativeMaxCompletions



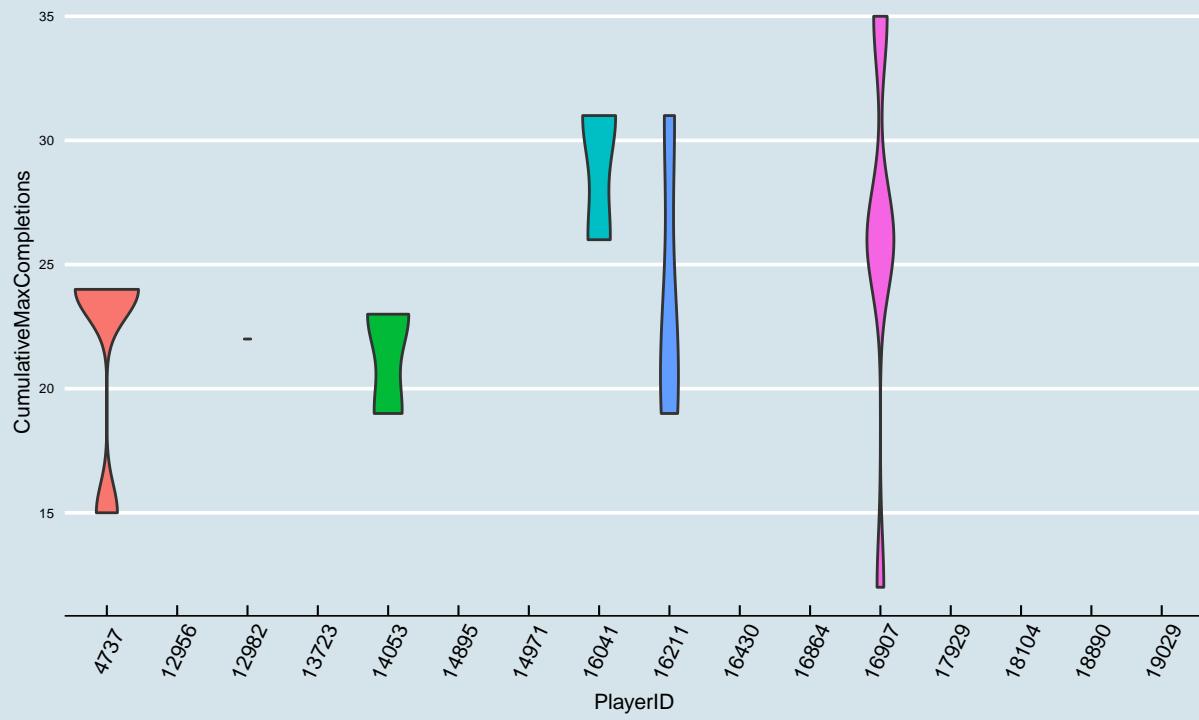
Fantasyfootball

CumulativeMaxCompletions



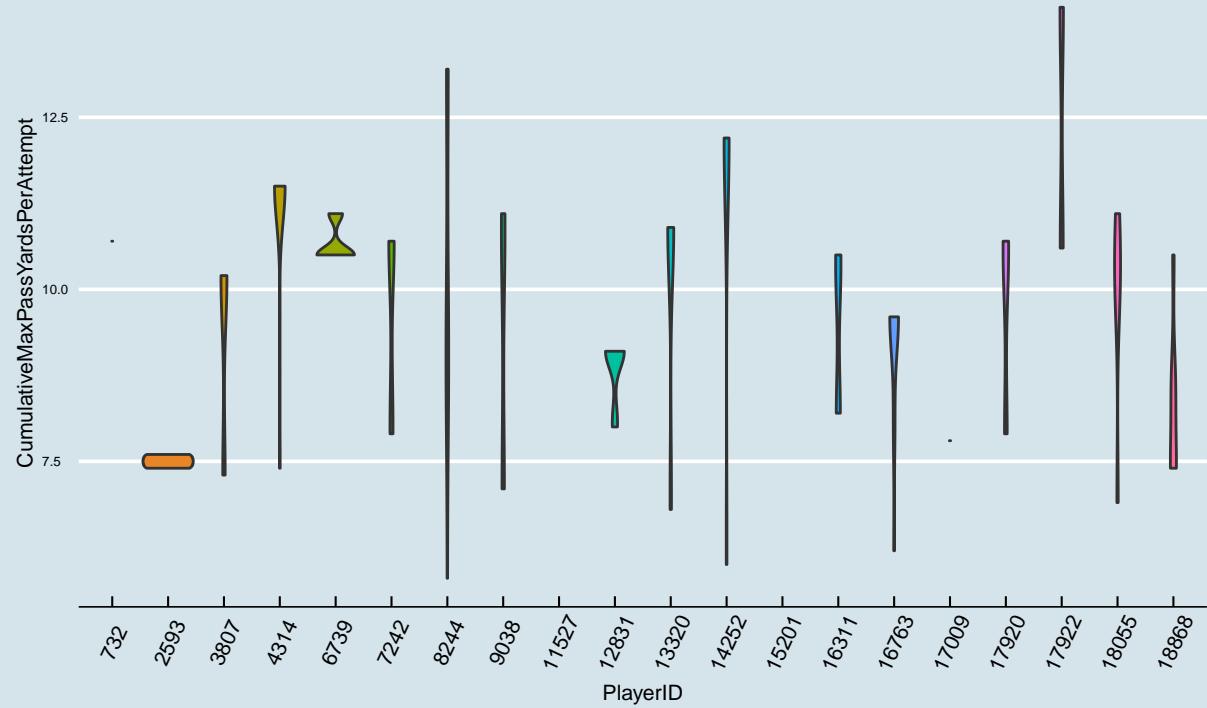
Fantasyfootball

CumulativeMaxCompletions



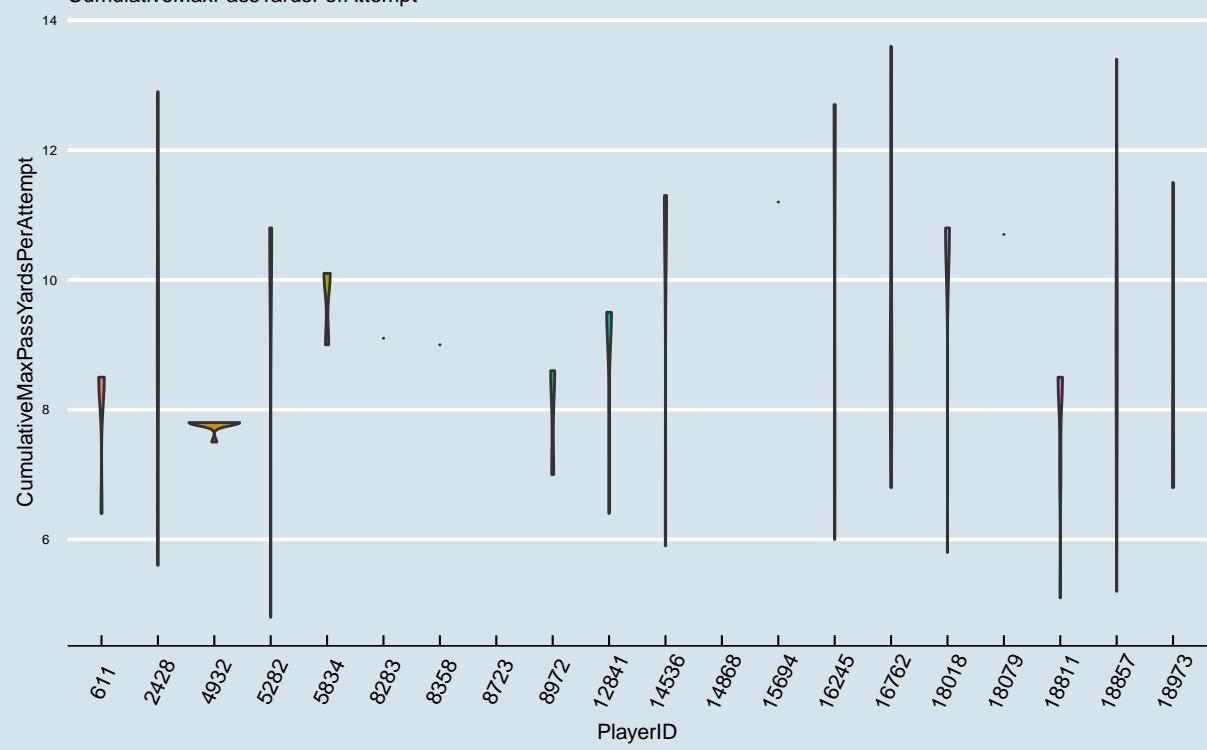
Fantasyfootball

CumulativeMaxPassYardsPerAttempt



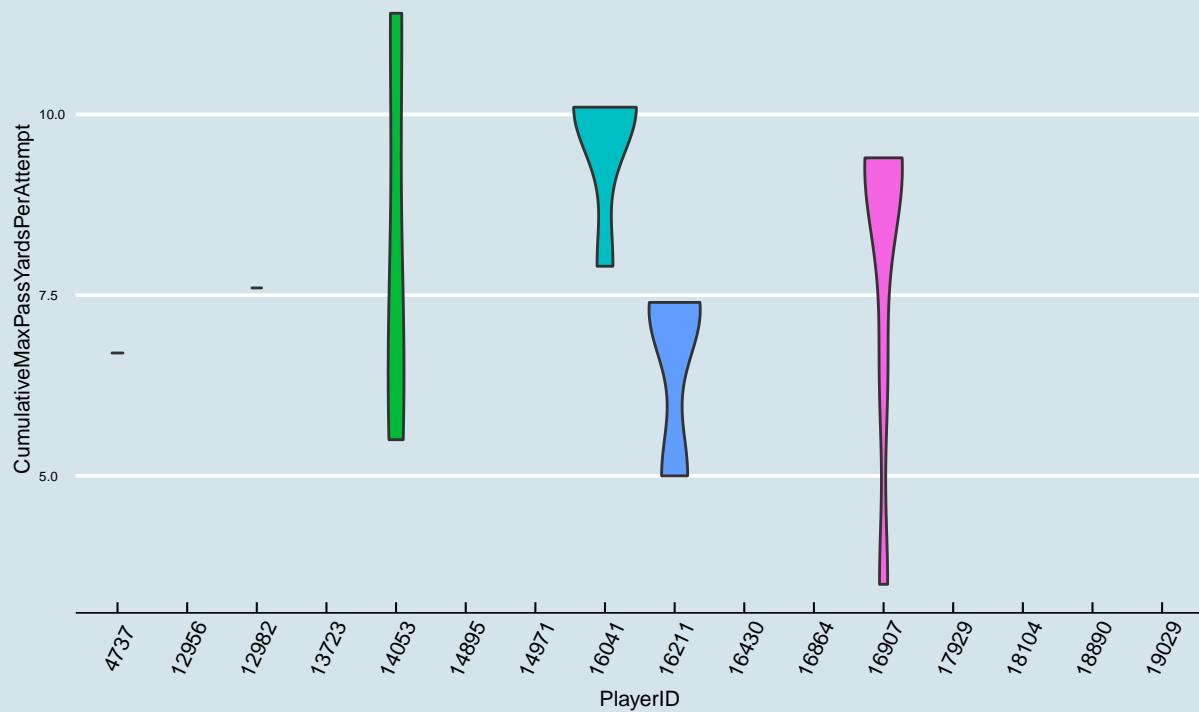
Fantasyfootball

CumulativeMaxPassYardsPerAttempt



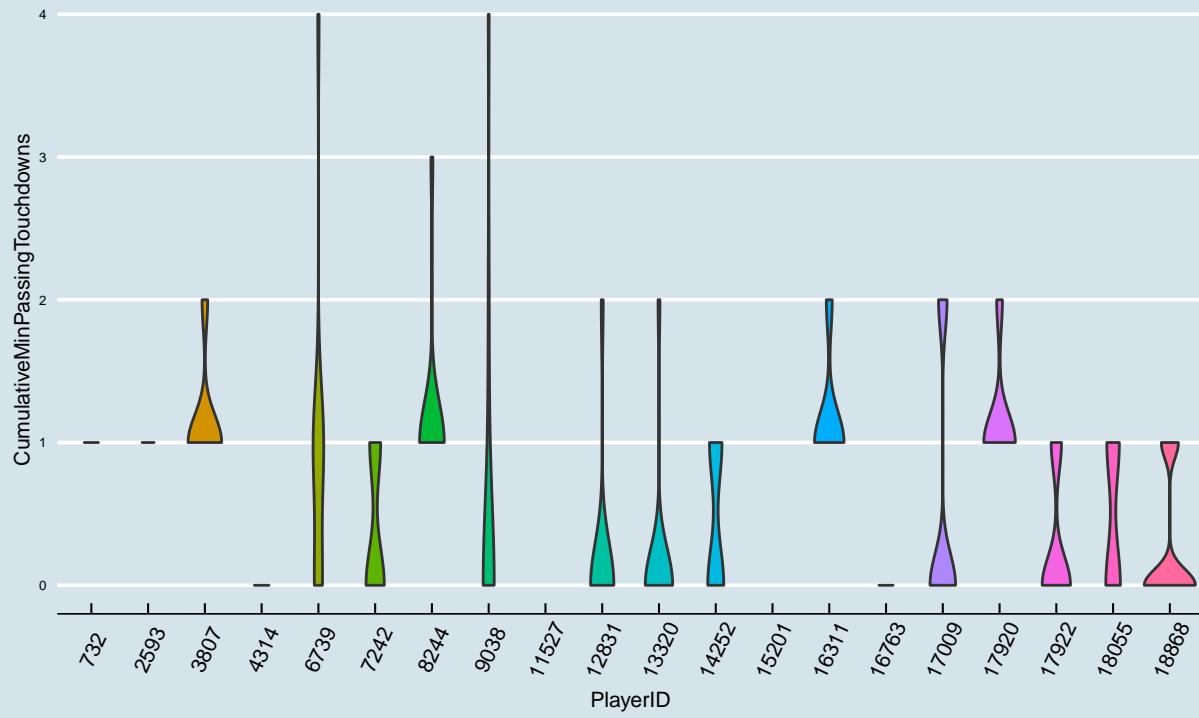
Fantasyfootball

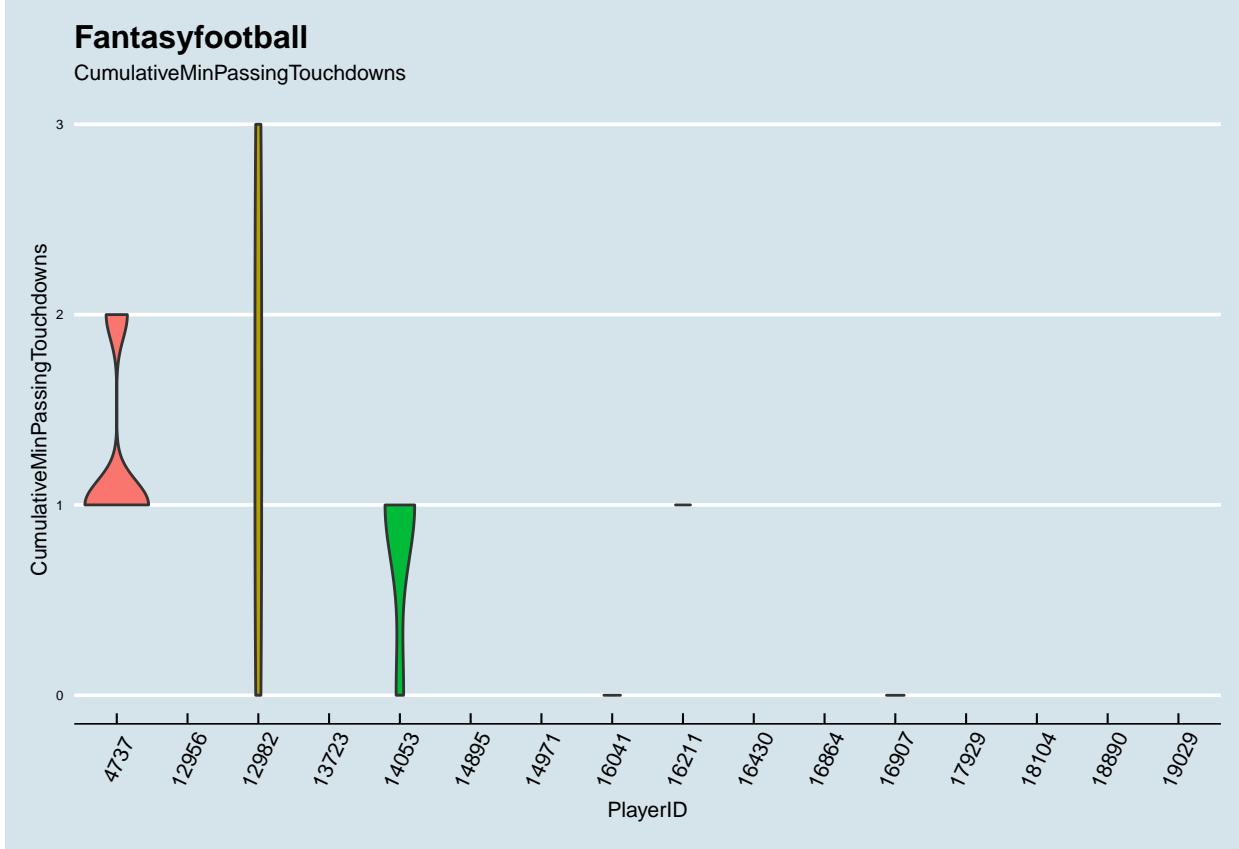
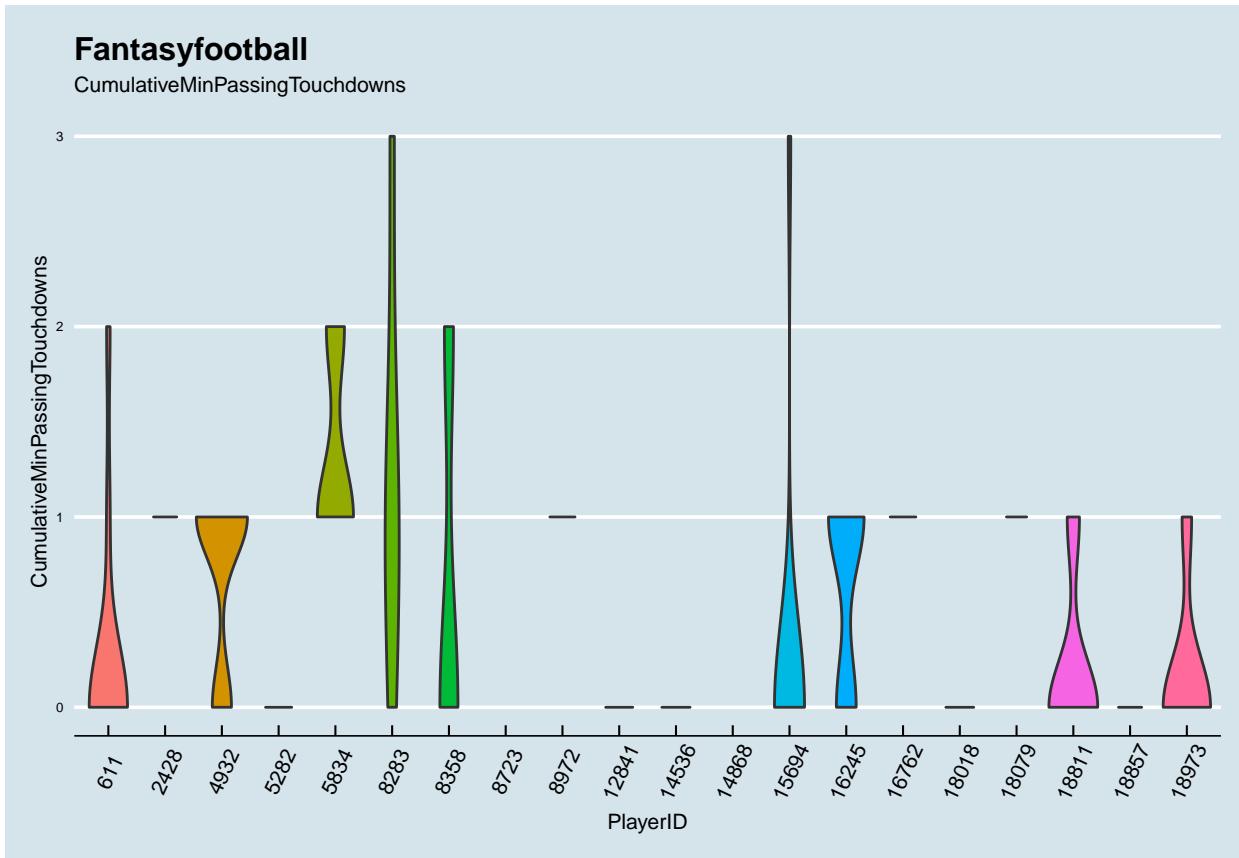
CumulativeMaxPassYardsPerAttempt



Fantasyfootball

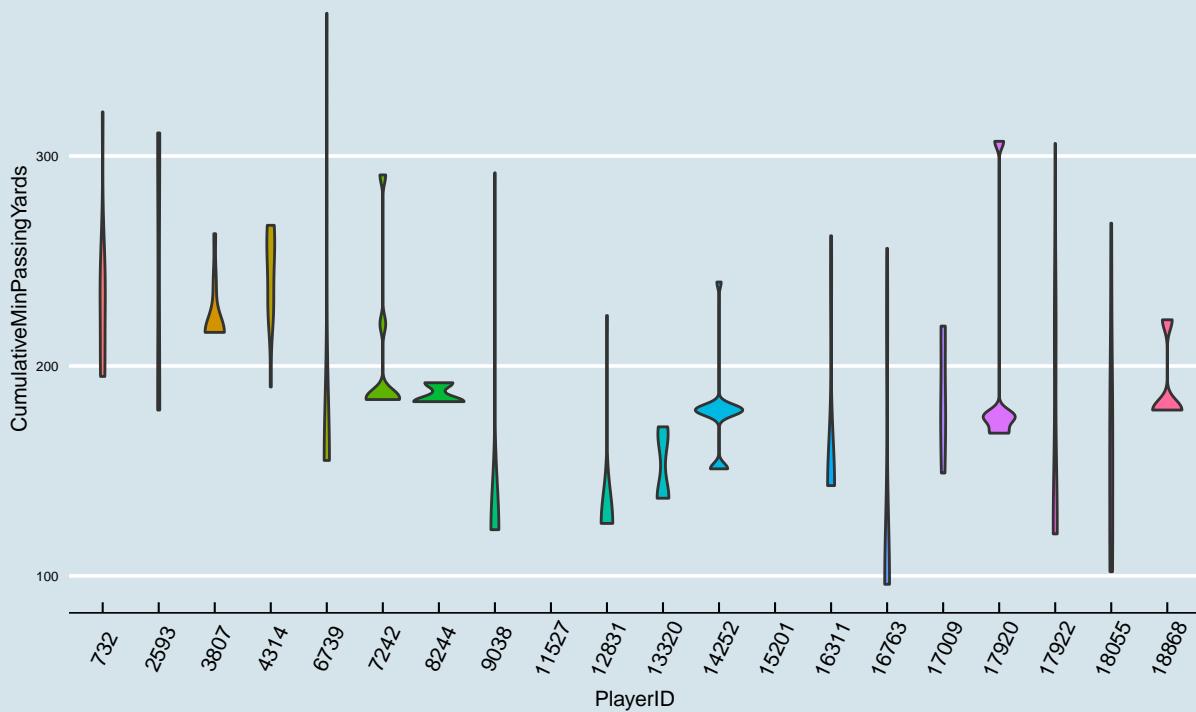
CumulativeMinPassingTouchdowns





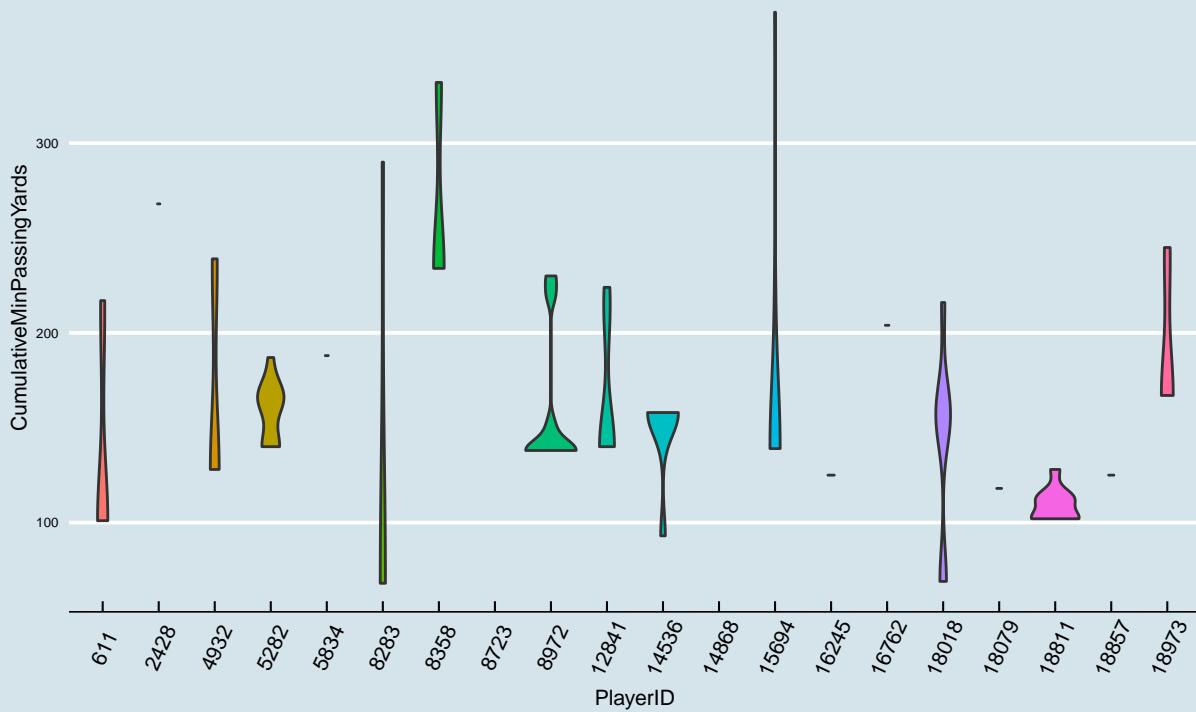
Fantasyfootball

CumulativeMinPassingYards



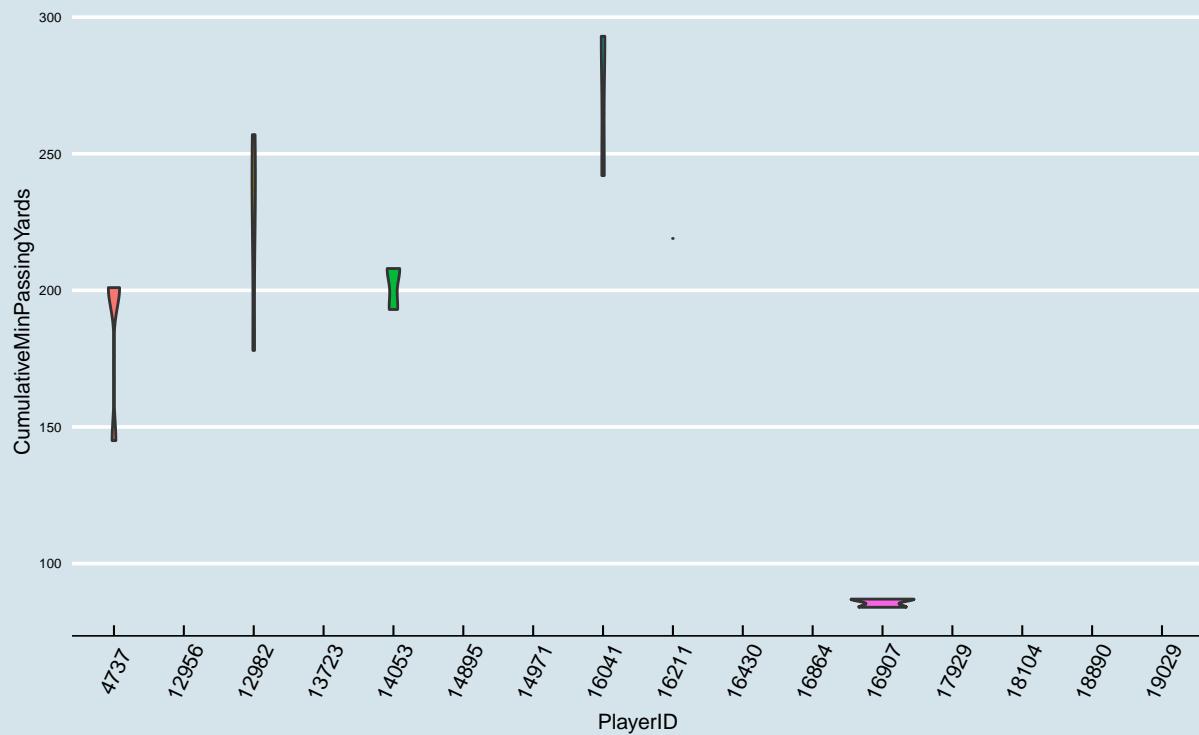
Fantasyfootball

CumulativeMinPassingYards



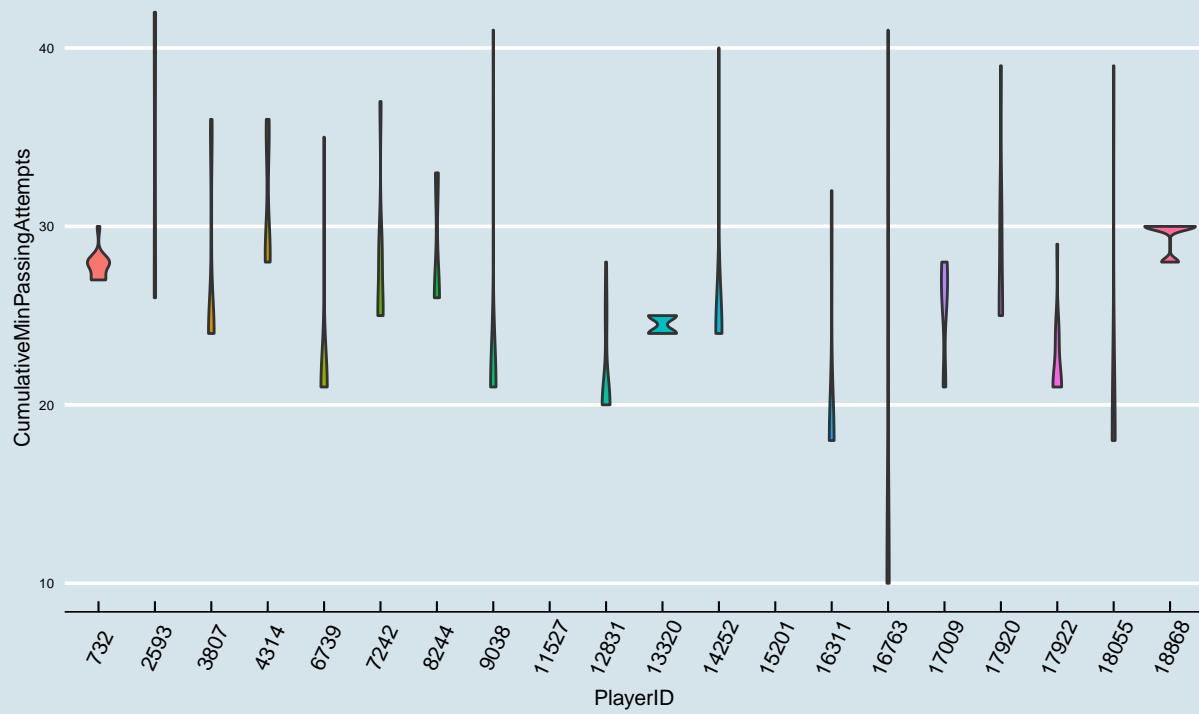
Fantasyfootball

CumulativeMinPassingYards



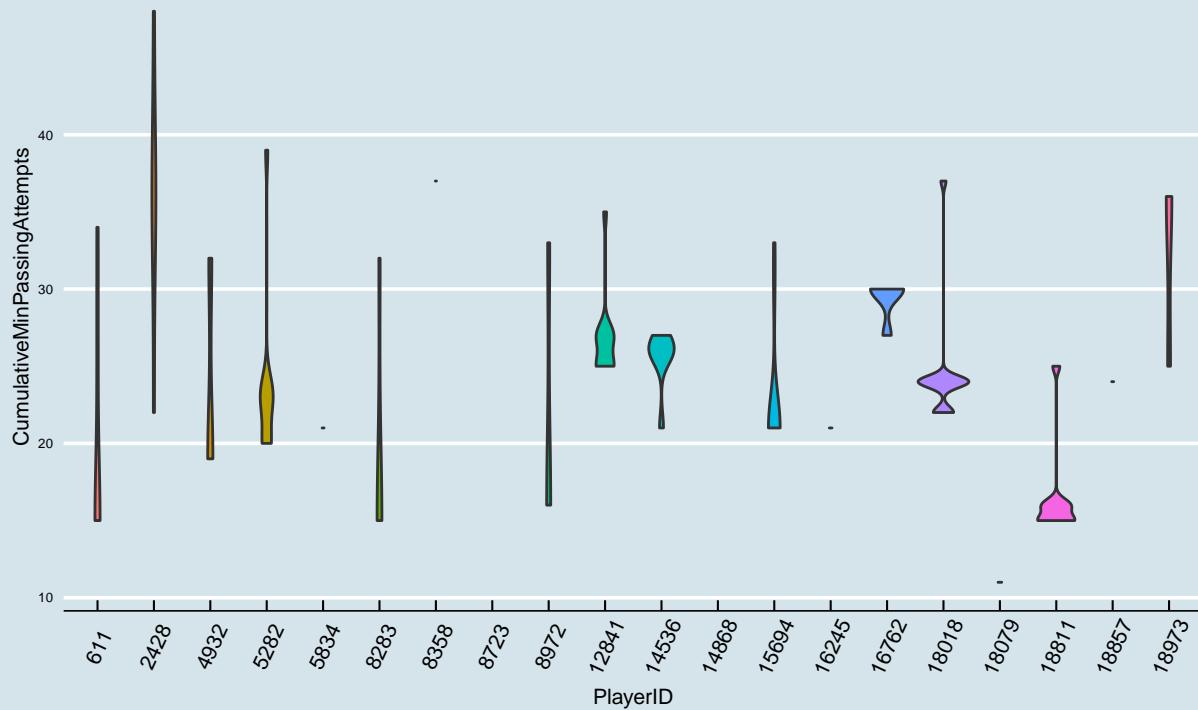
Fantasyfootball

CumulativeMinPassingAttempts



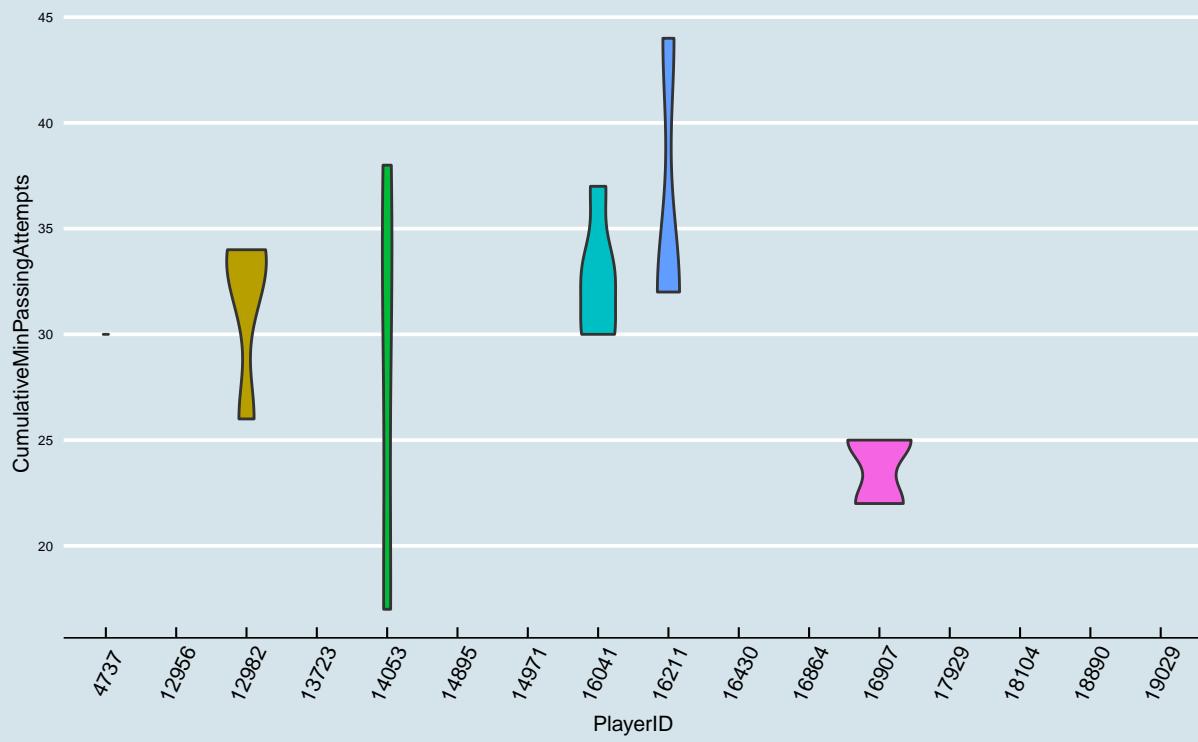
Fantasyfootball

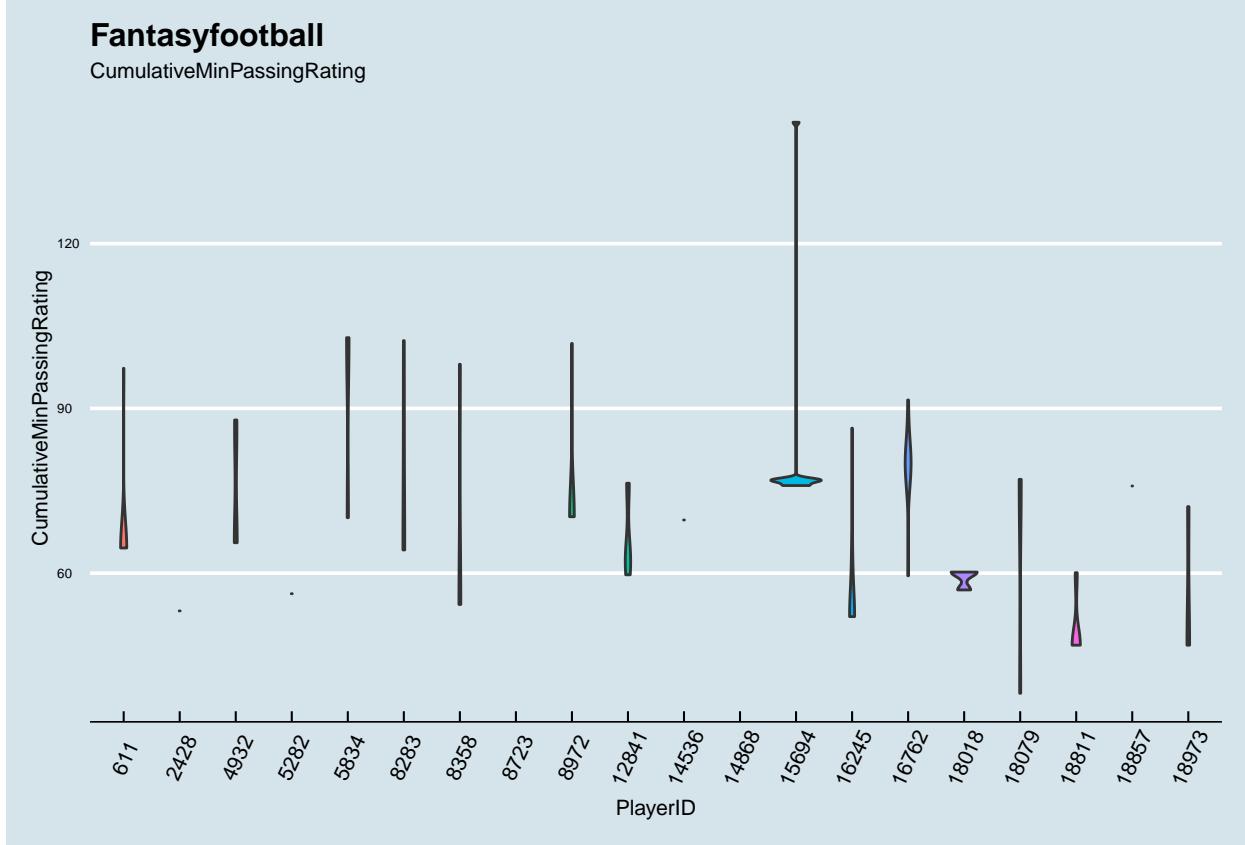
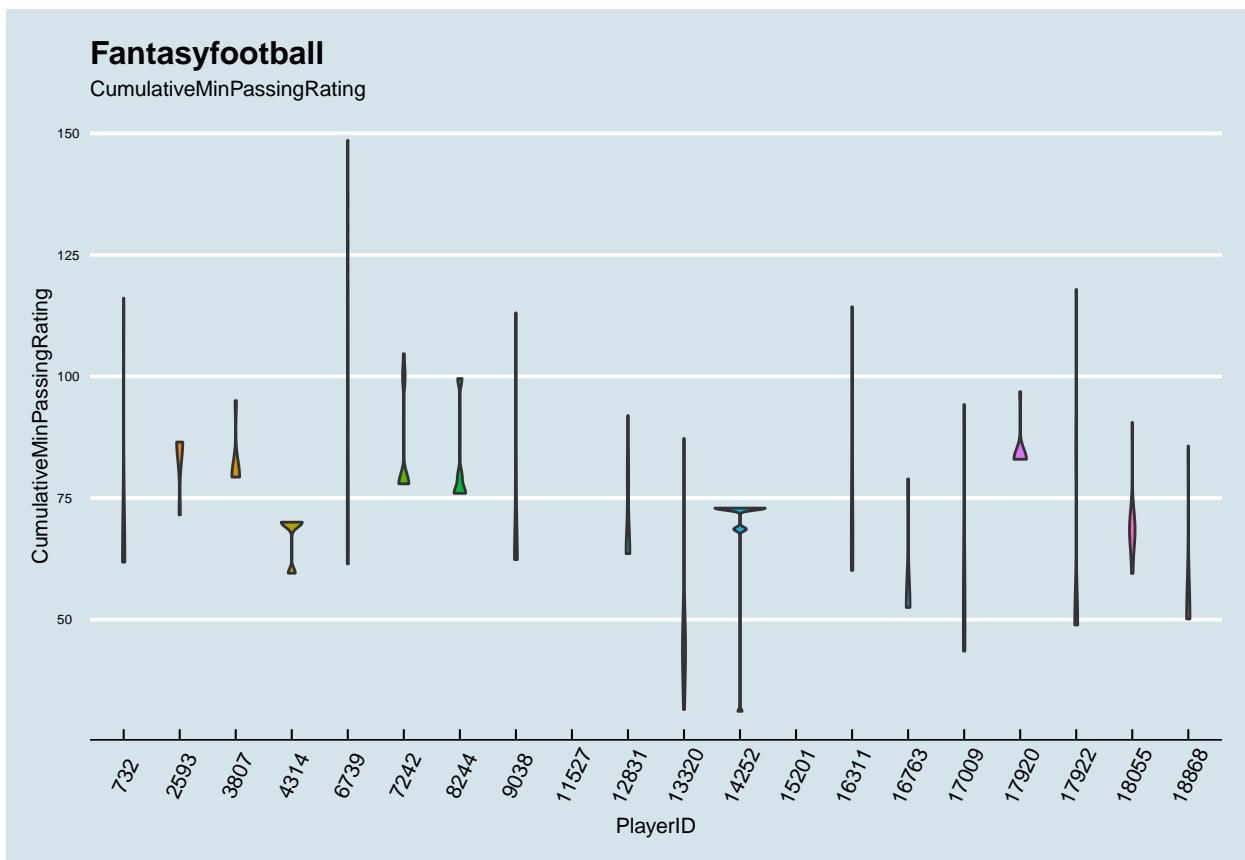
CumulativeMinPassingAttempts



Fantasyfootball

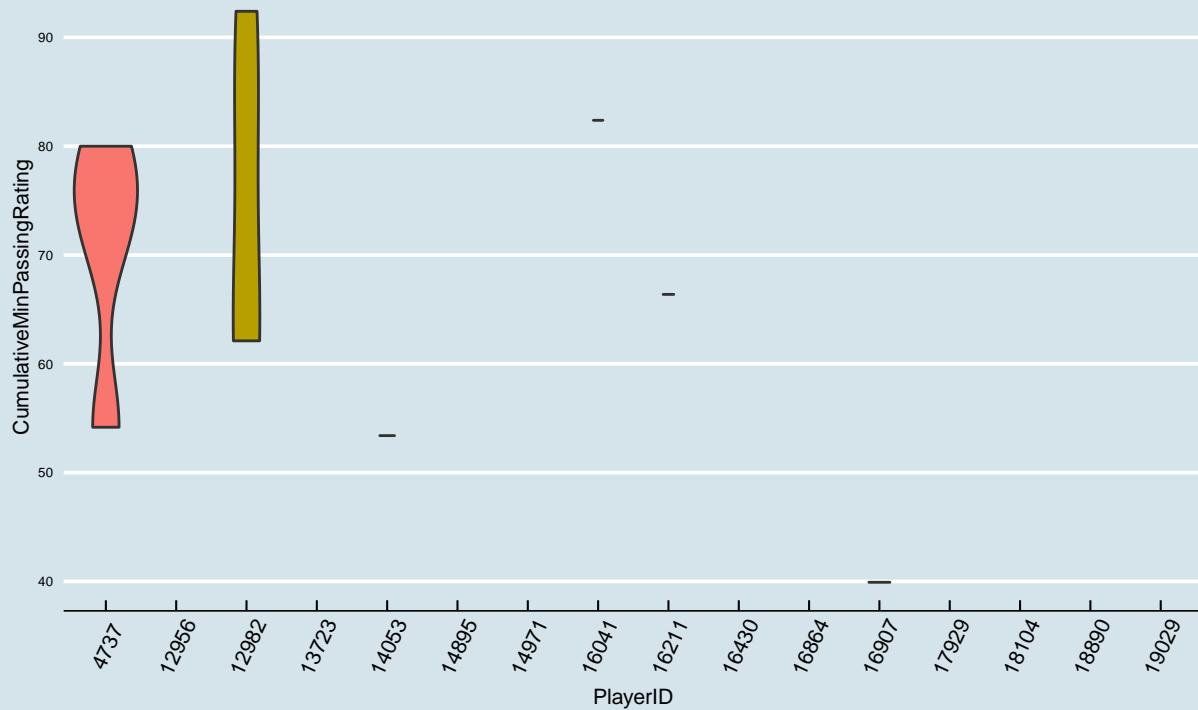
CumulativeMinPassingAttempts





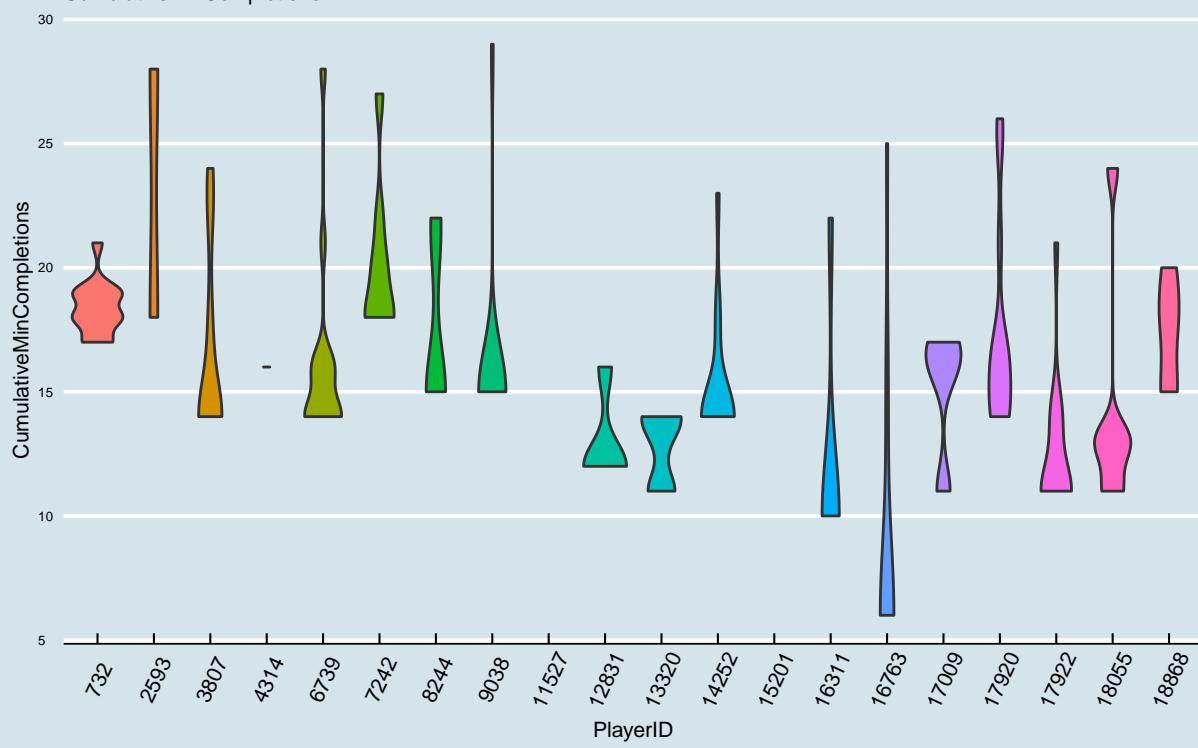
Fantasyfootball

CumulativeMinPassingRating



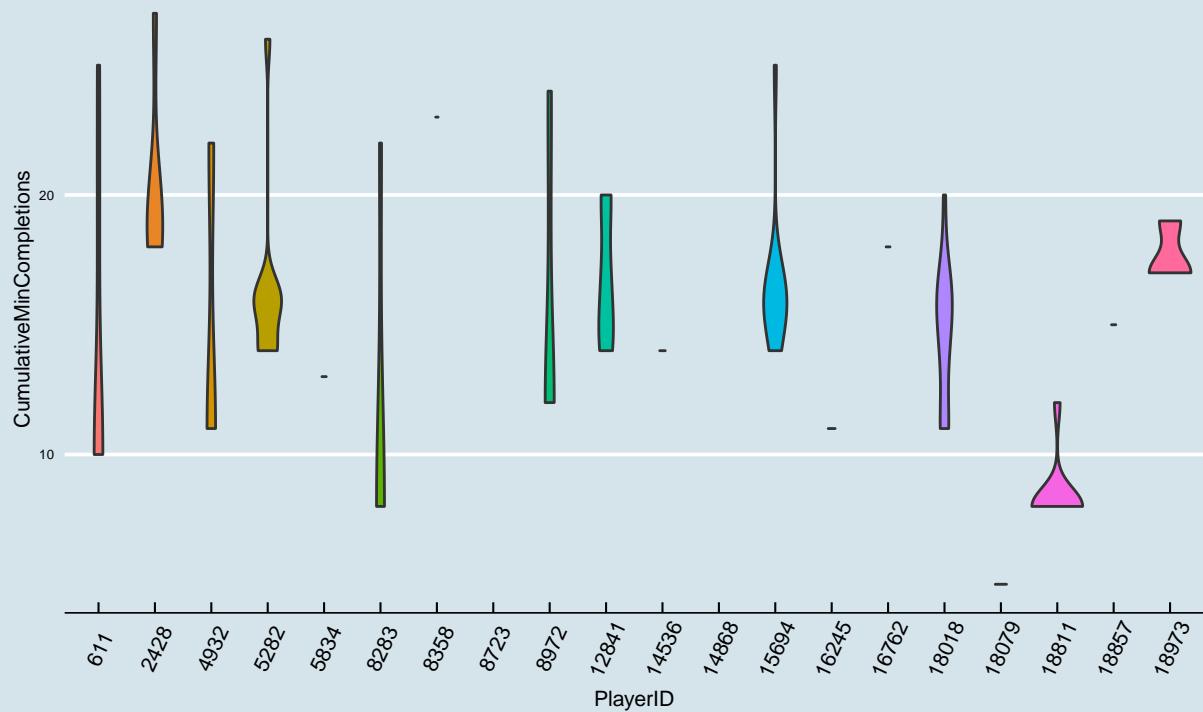
Fantasyfootball

CumulativeMinCompletions



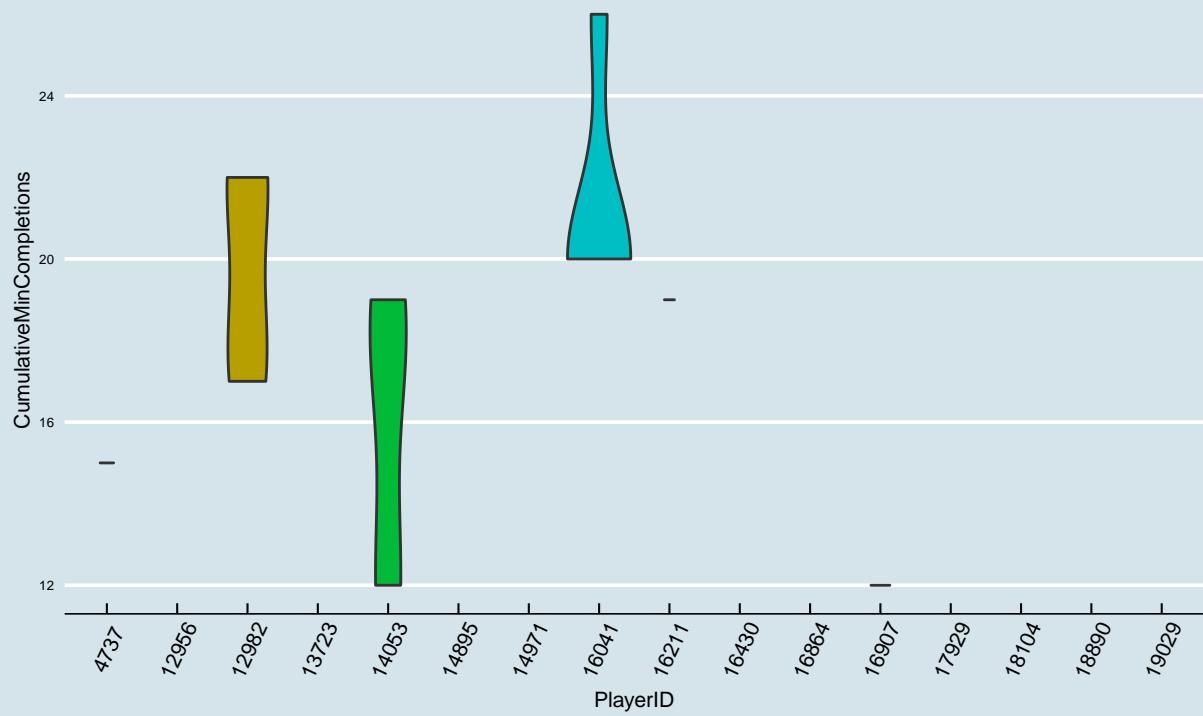
Fantasyfootball

CumulativeMinCompletions



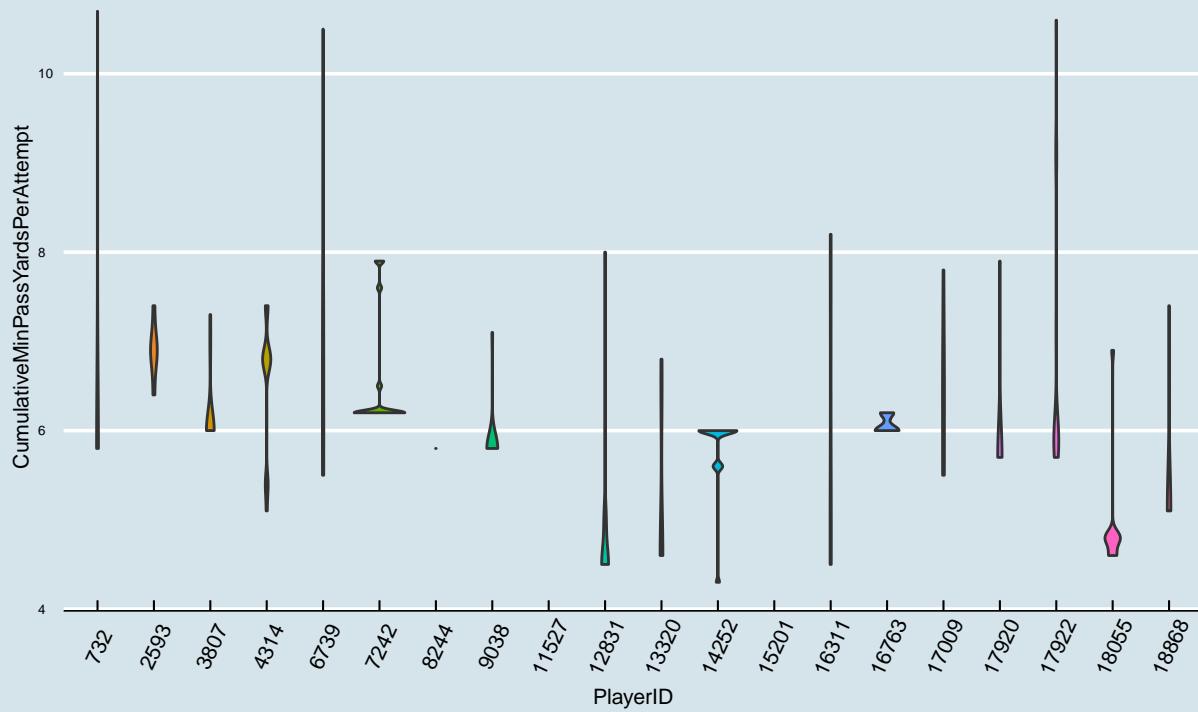
Fantasyfootball

CumulativeMinCompletions



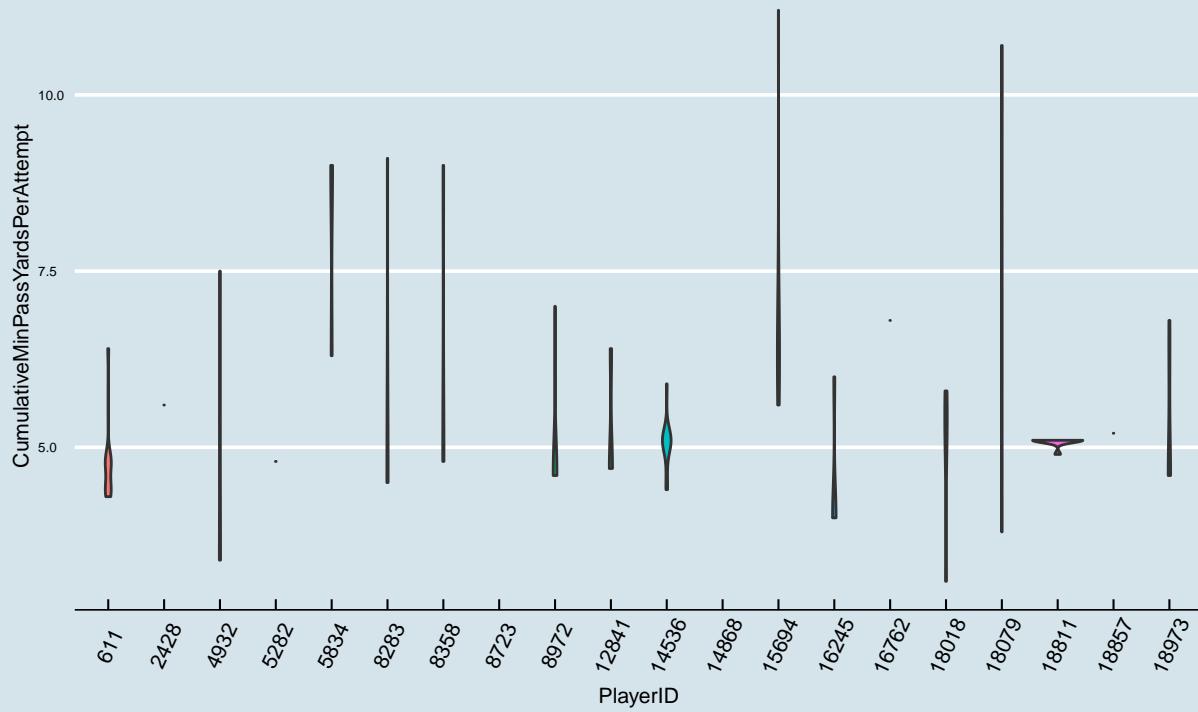
Fantasyfootball

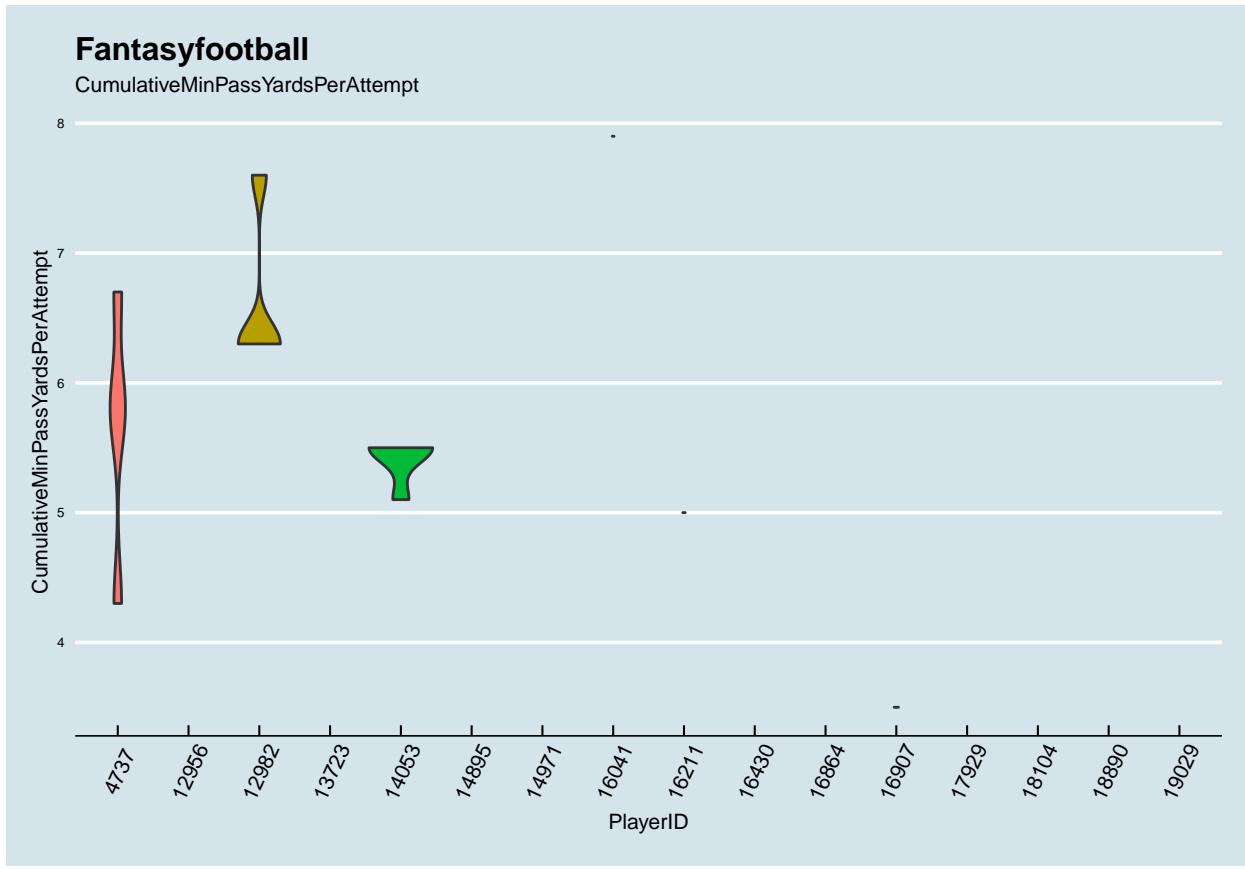
CumulativeMinPassYardsPerAttempt



Fantasyfootball

CumulativeMinPassYardsPerAttempt

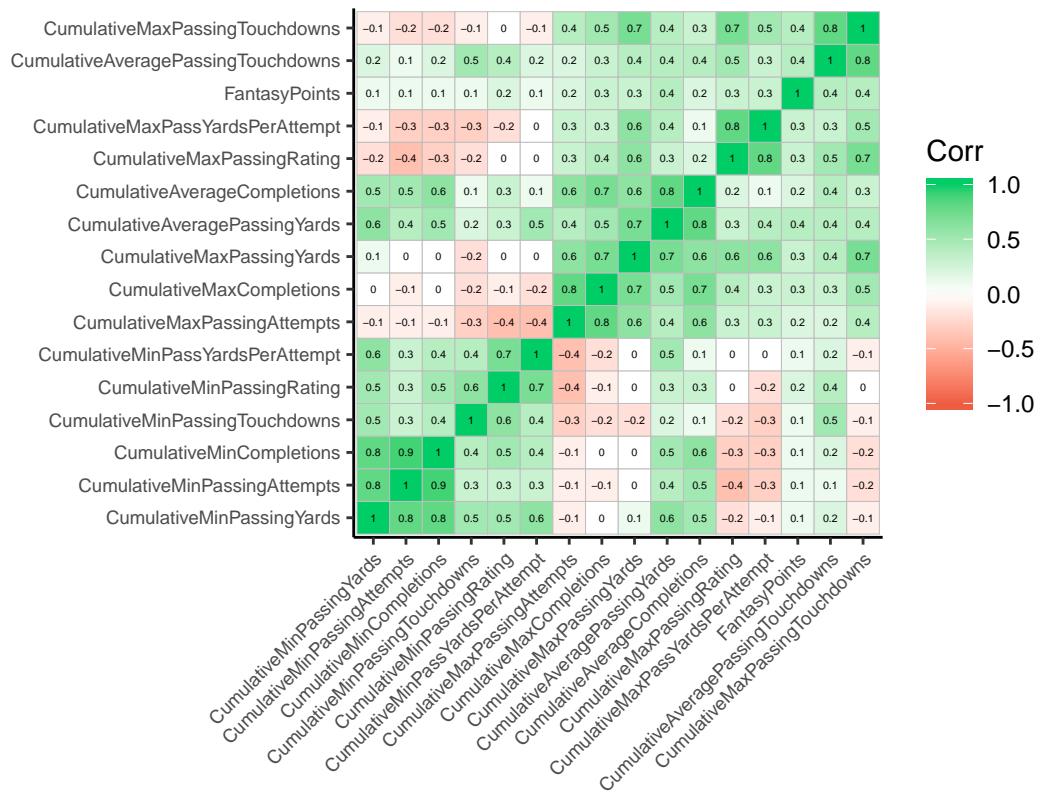




1.7.6 Correlogram for Cumulative Averages

```
final_cor_ds <- final_ds %>% select(PlayerID,FantasyPoints,names(final_ds[37:51]))
corr <- round(cor(final_cor_ds[-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 Cumulative Averages", tl.cex = 7,pch=2,pch.col =3,show.diag = T,
           ggtheme=theme_classic)
```

Correlogram of Cumulative Averages

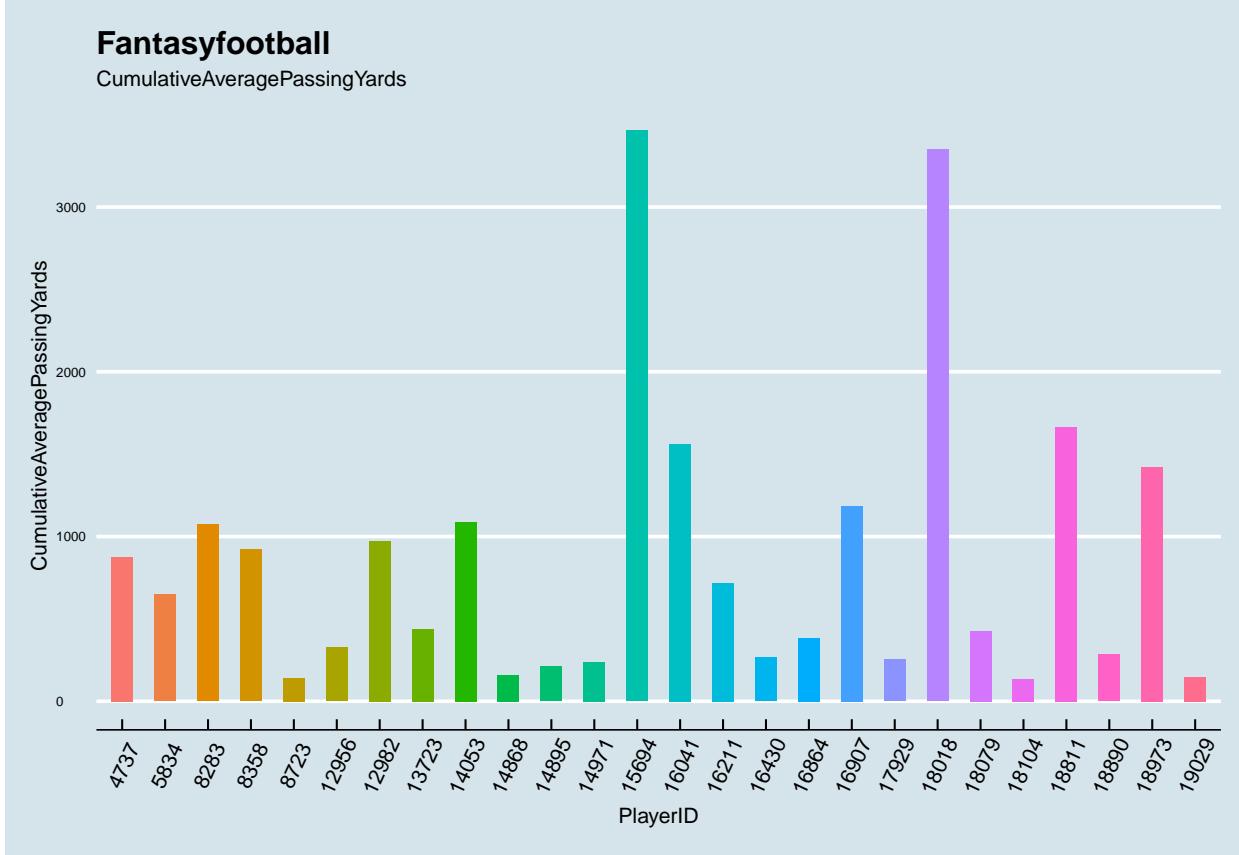
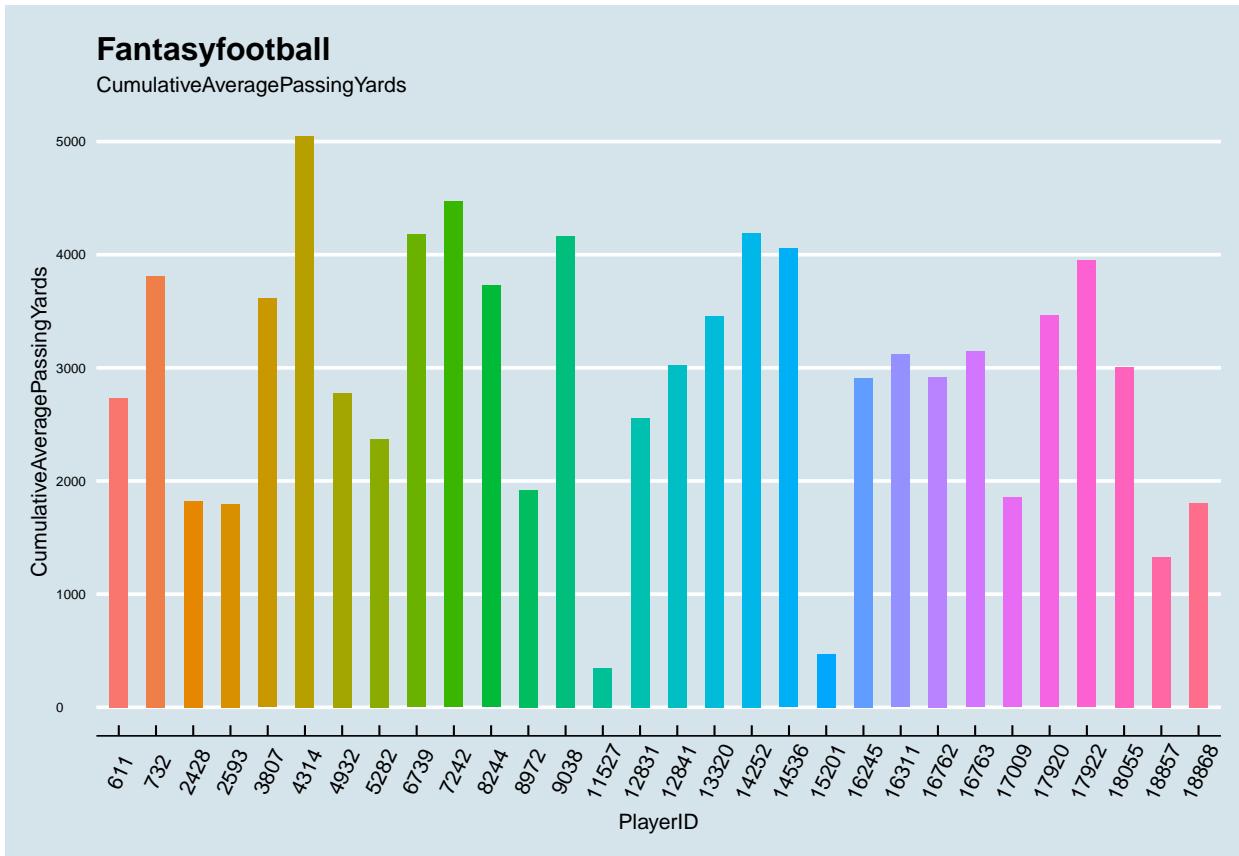


1.7.7 Individuals Bar plots for cumulative averages

```

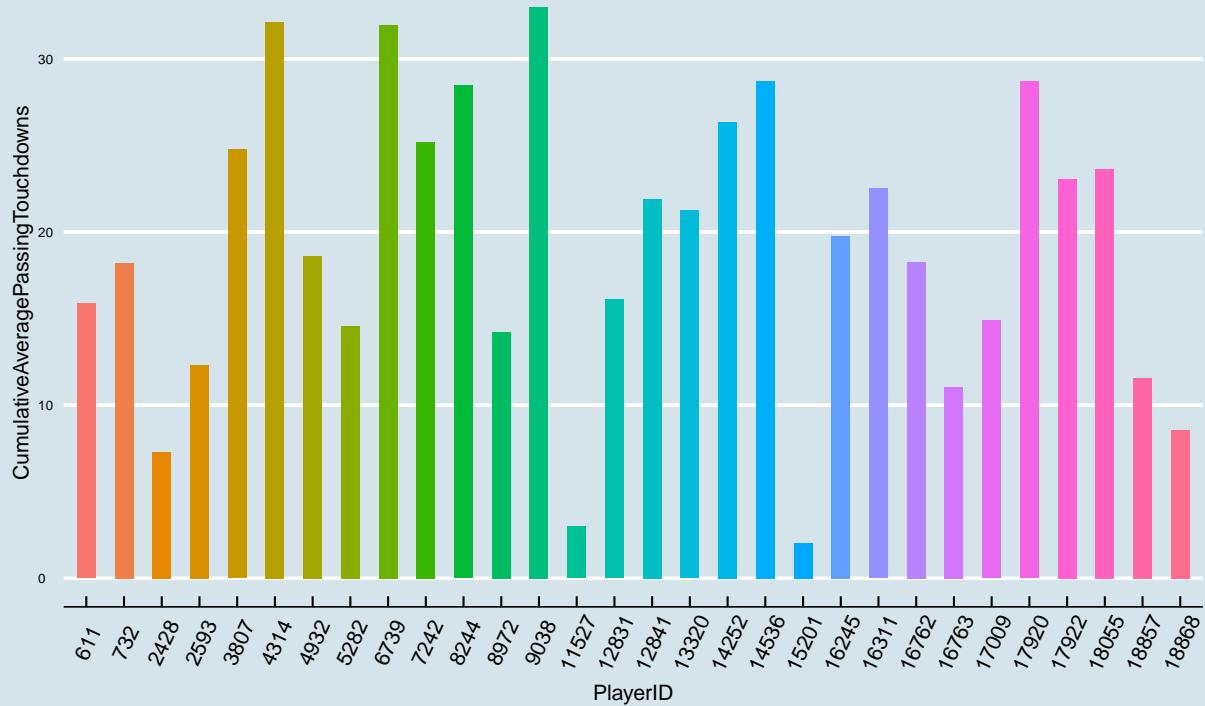
for(p in 37:51){
  for (player in seq(1,length(unique(final_ds$PlayerID)),by=30)){
    a_size <- player + 29
    players_ds <- final_ds %>% filter(PlayerID %in% unique(final_ds$PlayerID)[player:a_size])

    bar_plot  <-  players_ds %>%
      ggplot(aes_string(x="as.factor(PlayerID"),y=names(players_ds[p]),fill="as.factor(PlayerID"))
      ggtile(names(players_ds[p]))+
      geom_bar(stat="identity", width=.5, show.legend = FALSE)+
      xlab("PlayerID")+
      ylab(names(players_ds[p]))+
      labs(title="Fantasyfootball",
           subtitle=names(players_ds[p]),
           aption="Source: Fantasyfootball")+
      theme_economist(base_size=8)+theme(axis.text.y = element_text(size=5))+ 
      theme(axis.text.x = element_text(angle=65, vjust=0.6))
    print(bar_plot)
  }
}
  
```



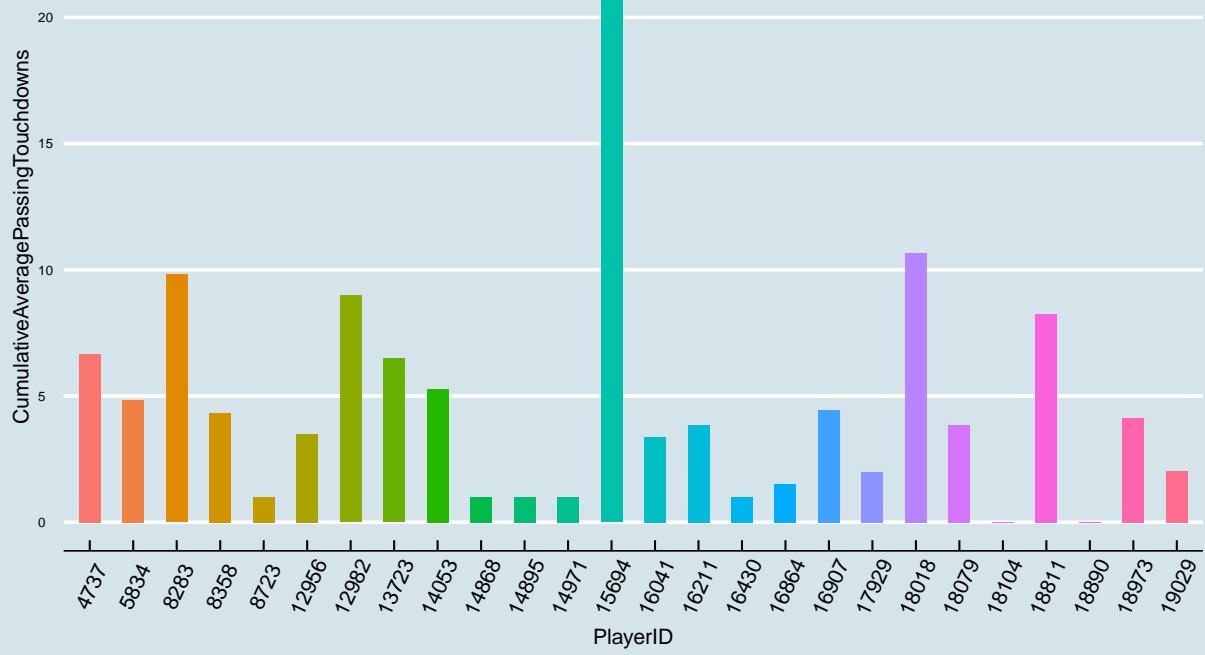
Fantasyfootball

CumulativeAveragePassingTouchdowns



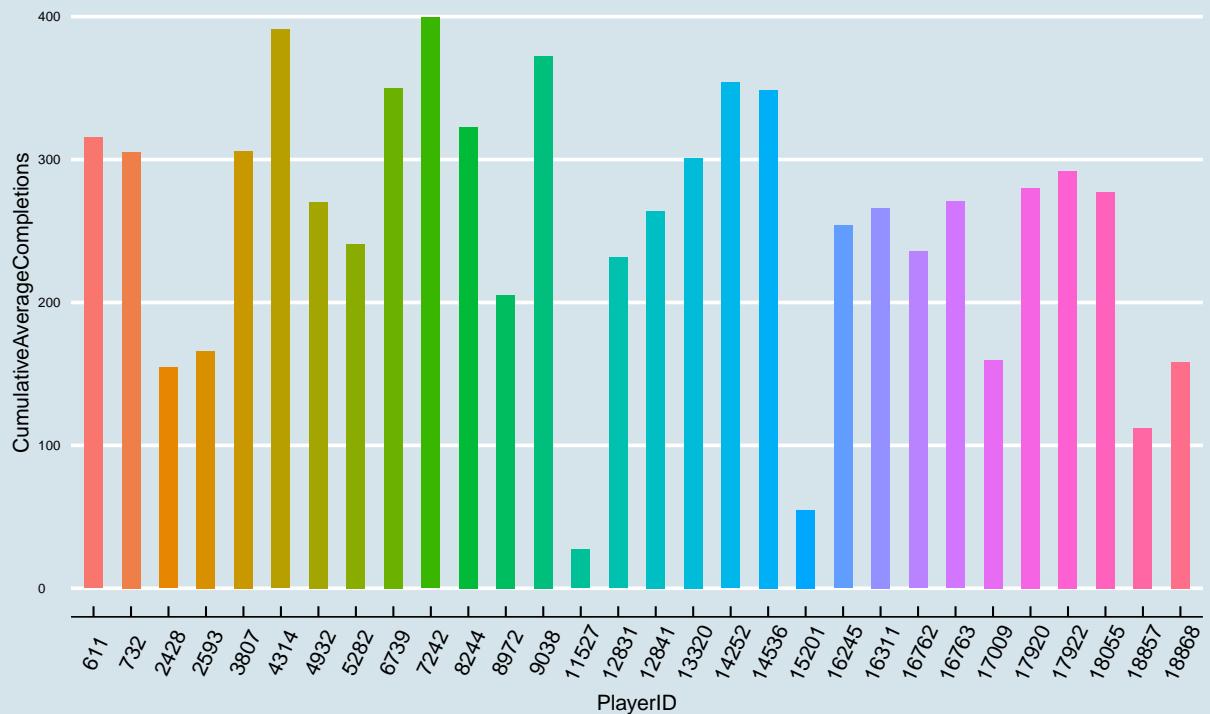
Fantasyfootball

CumulativeAveragePassingTouchdowns



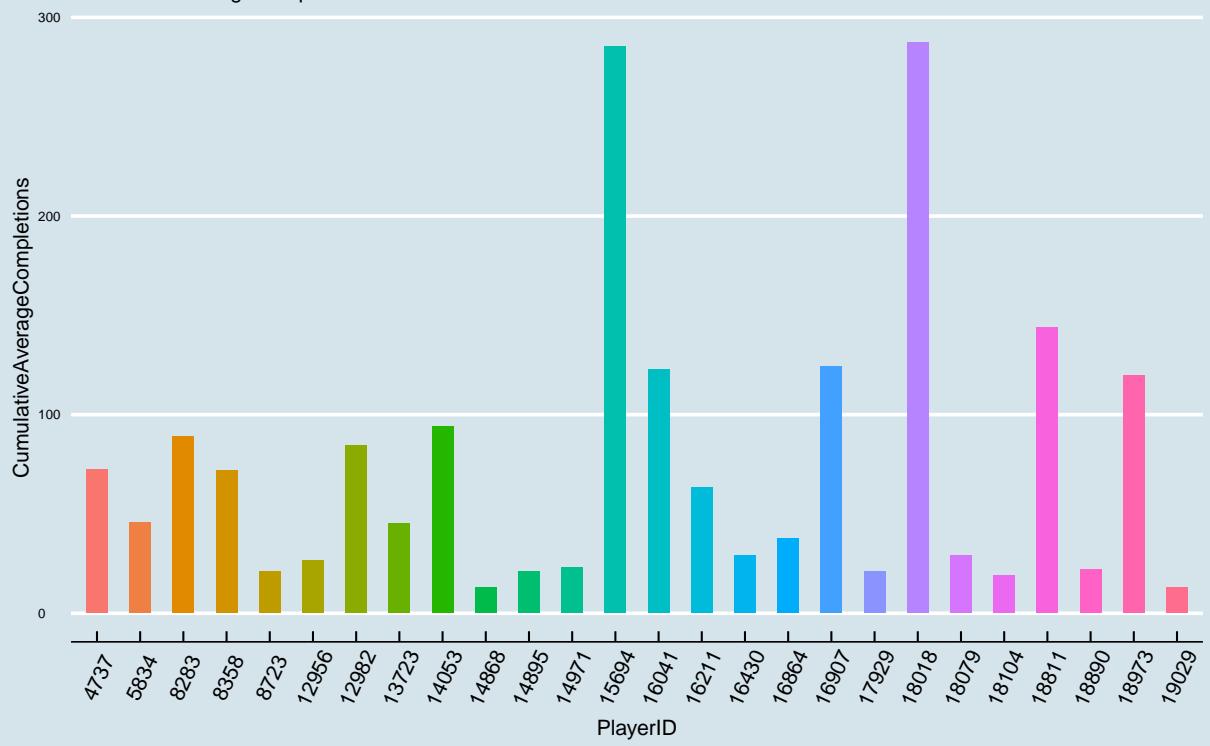
Fantasyfootball

CumulativeAverageCompletions



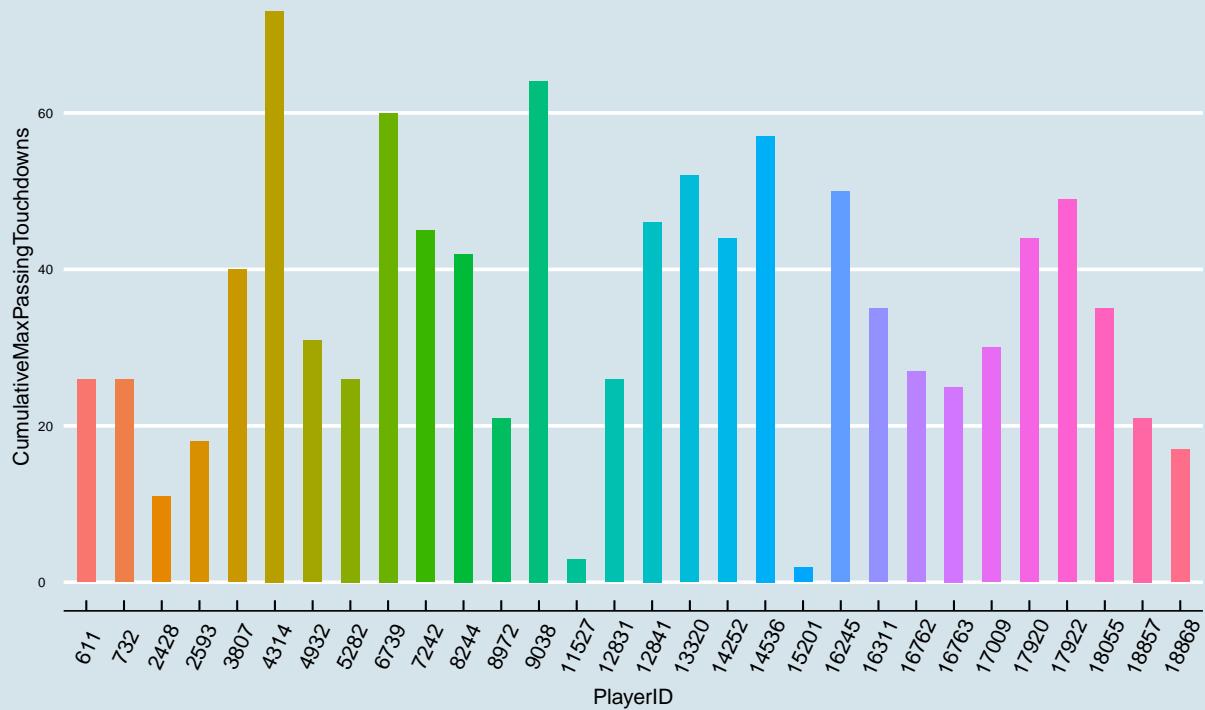
Fantasyfootball

CumulativeAverageCompletions



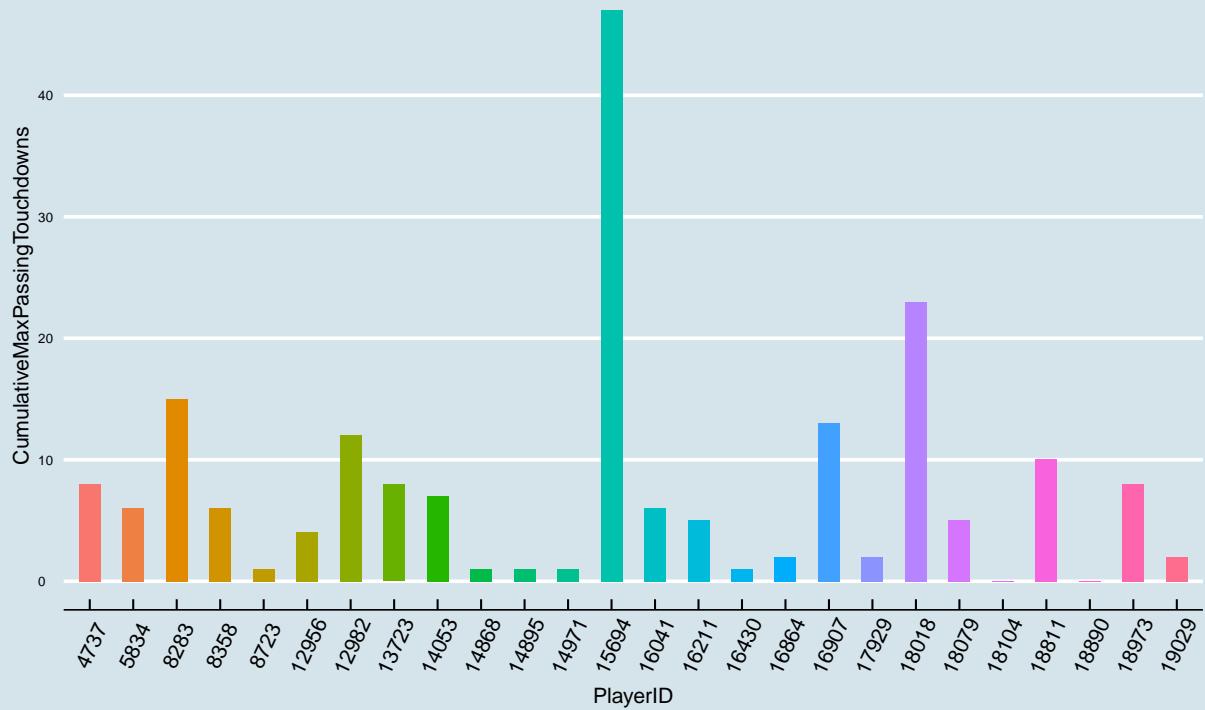
Fantasyfootball

CumulativeMaxPassingTouchdowns



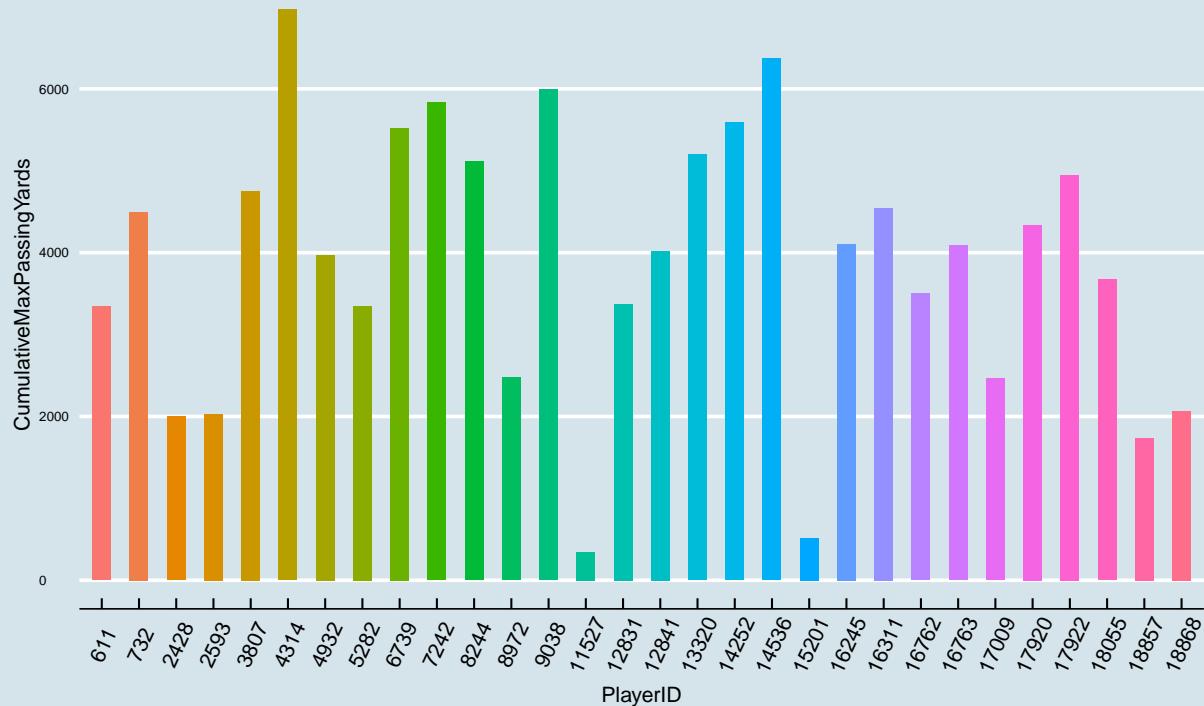
Fantasyfootball

CumulativeMaxPassingTouchdowns



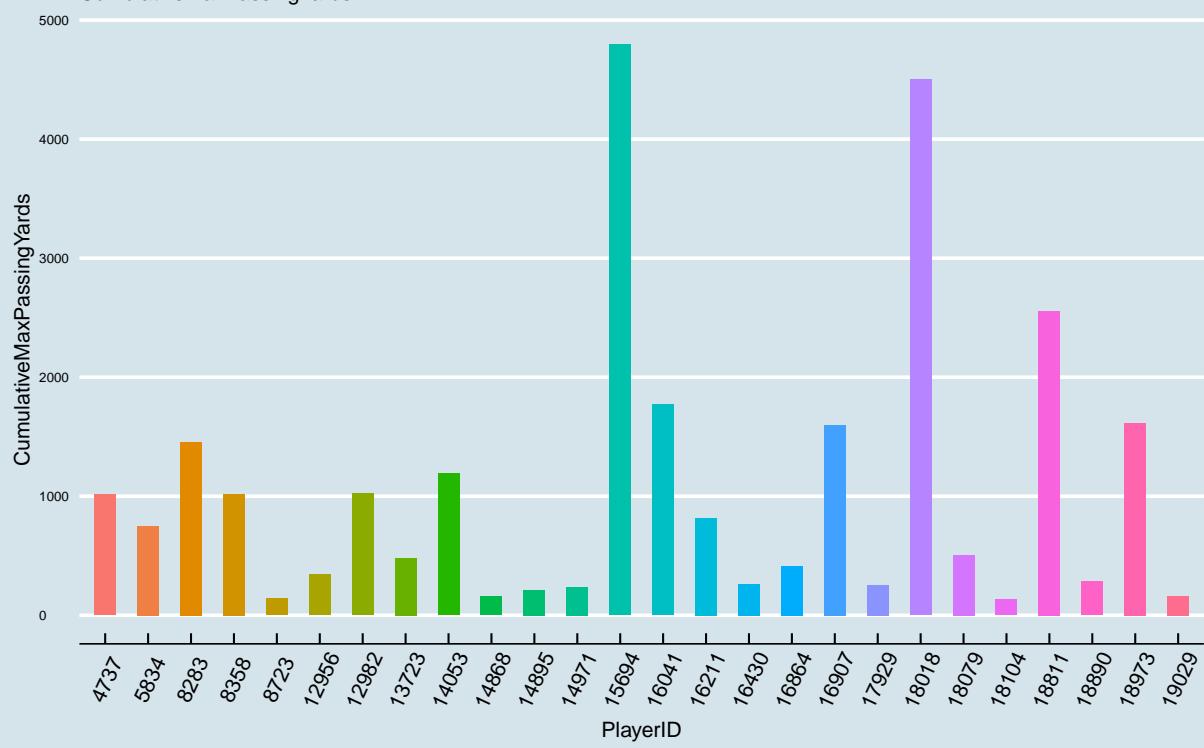
Fantasyfootball

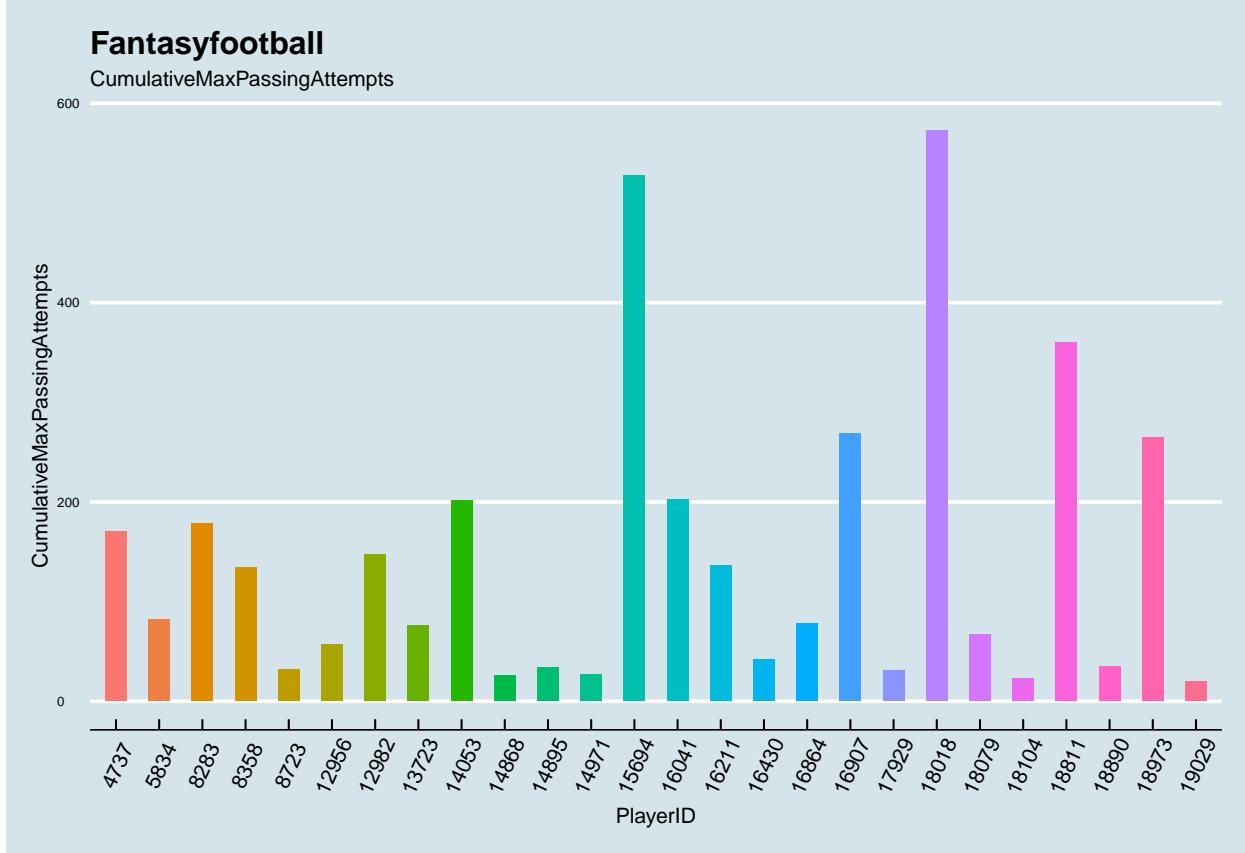
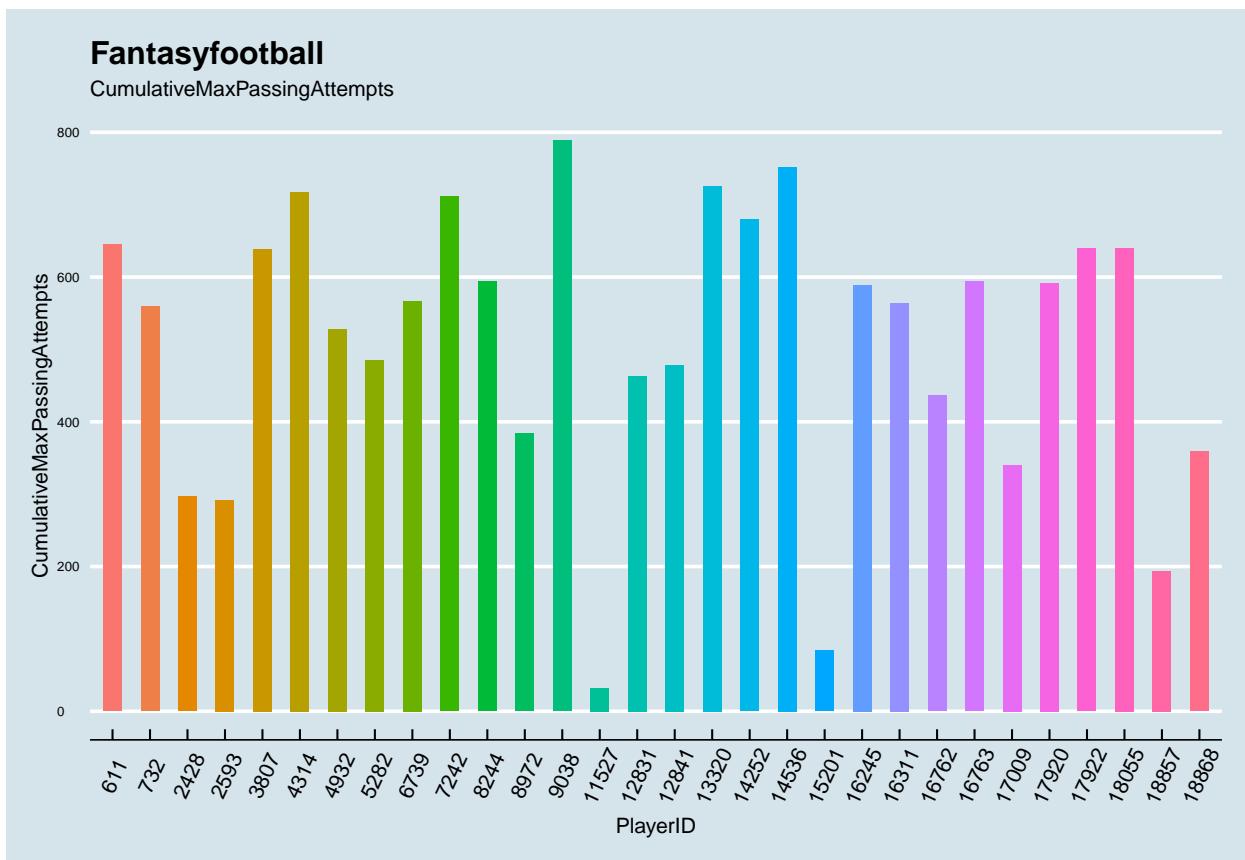
CumulativeMaxPassingYards

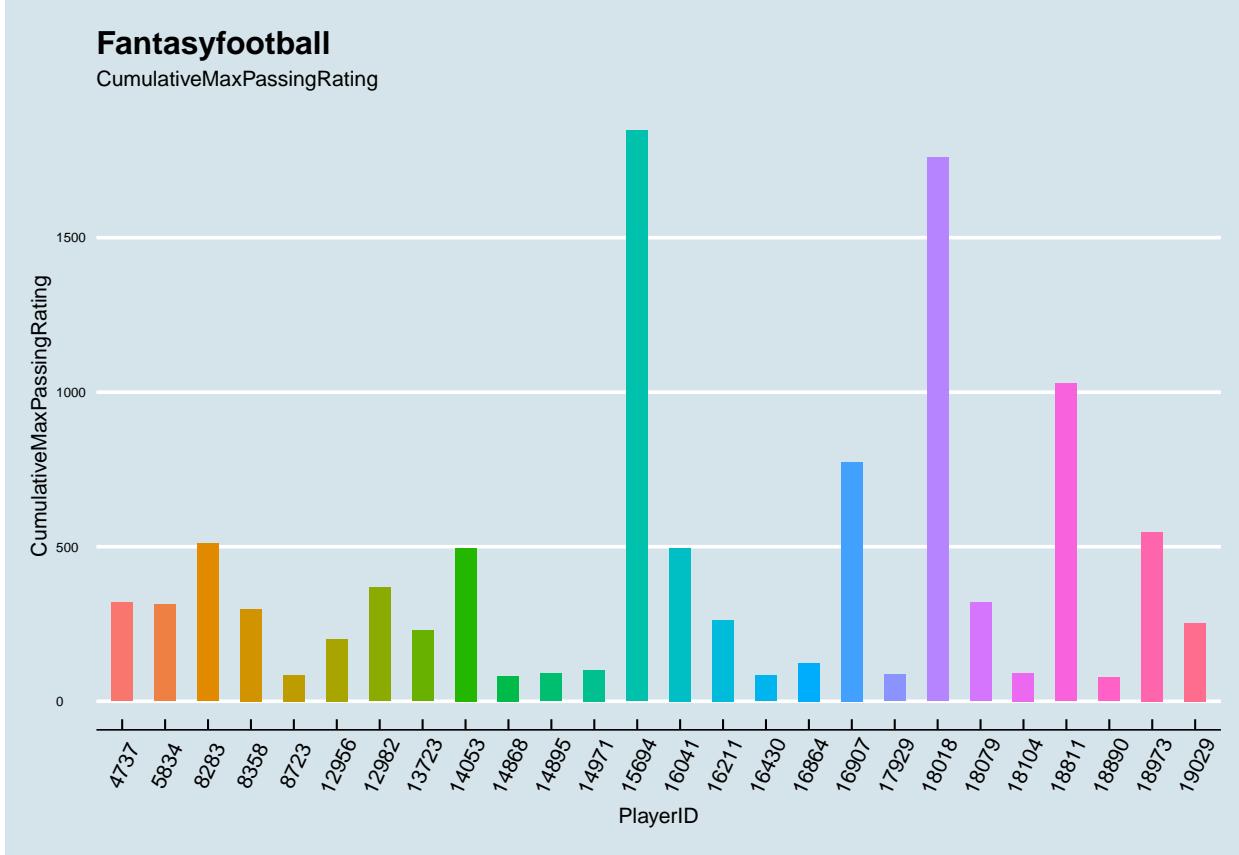
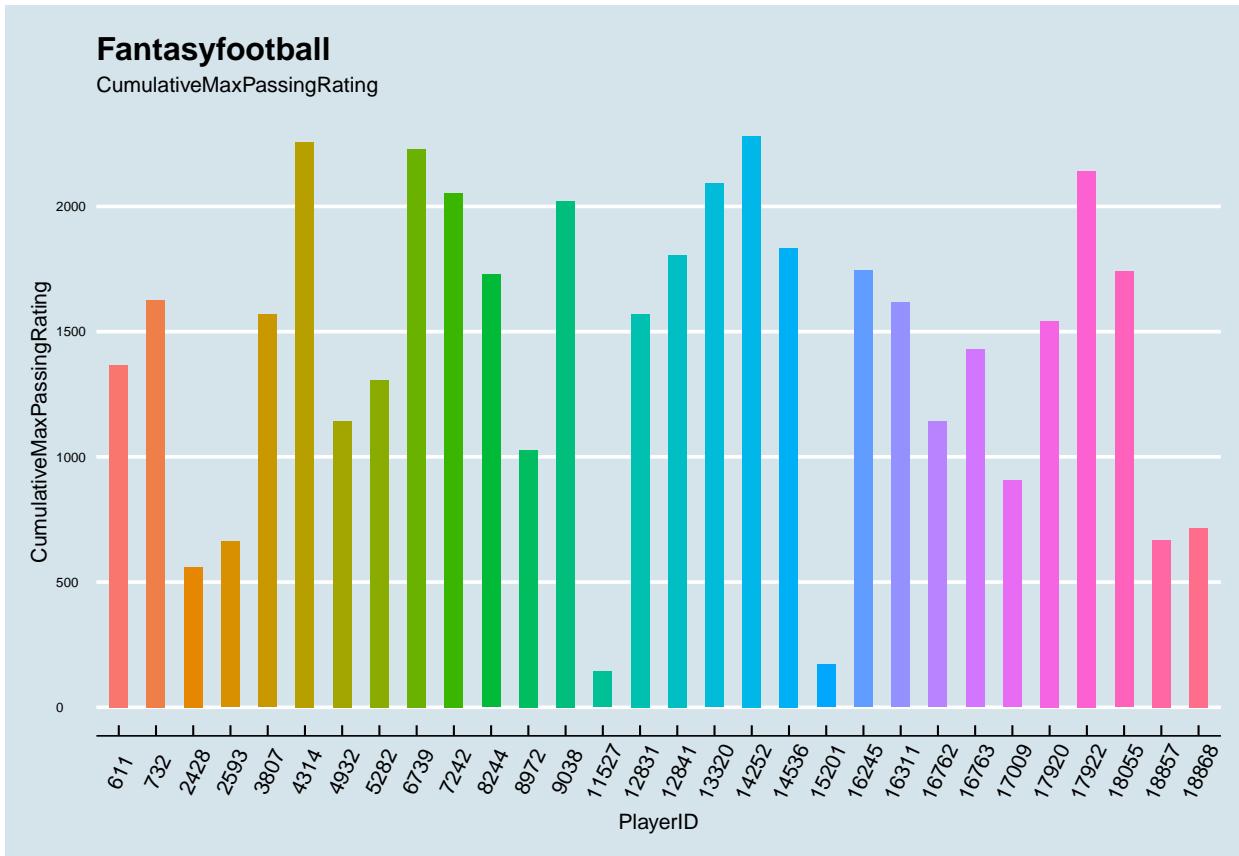


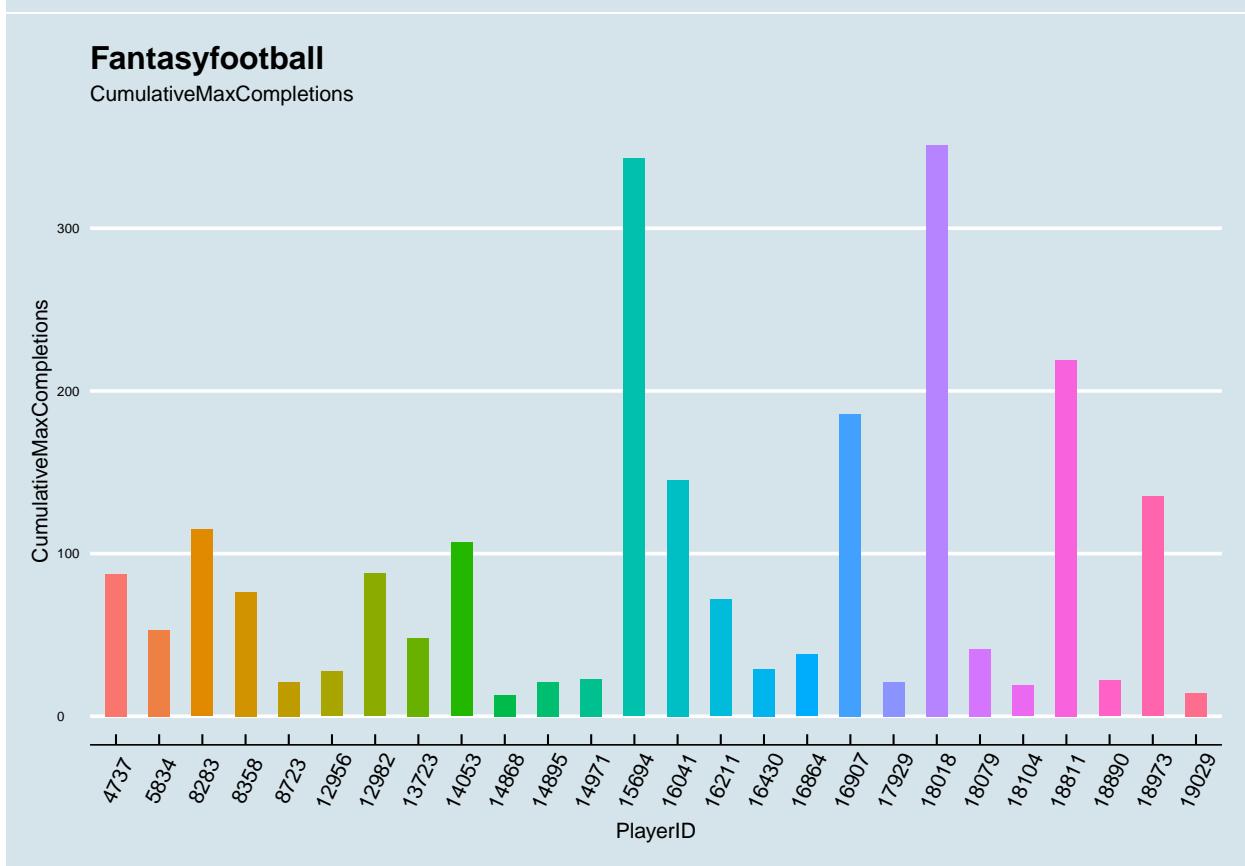
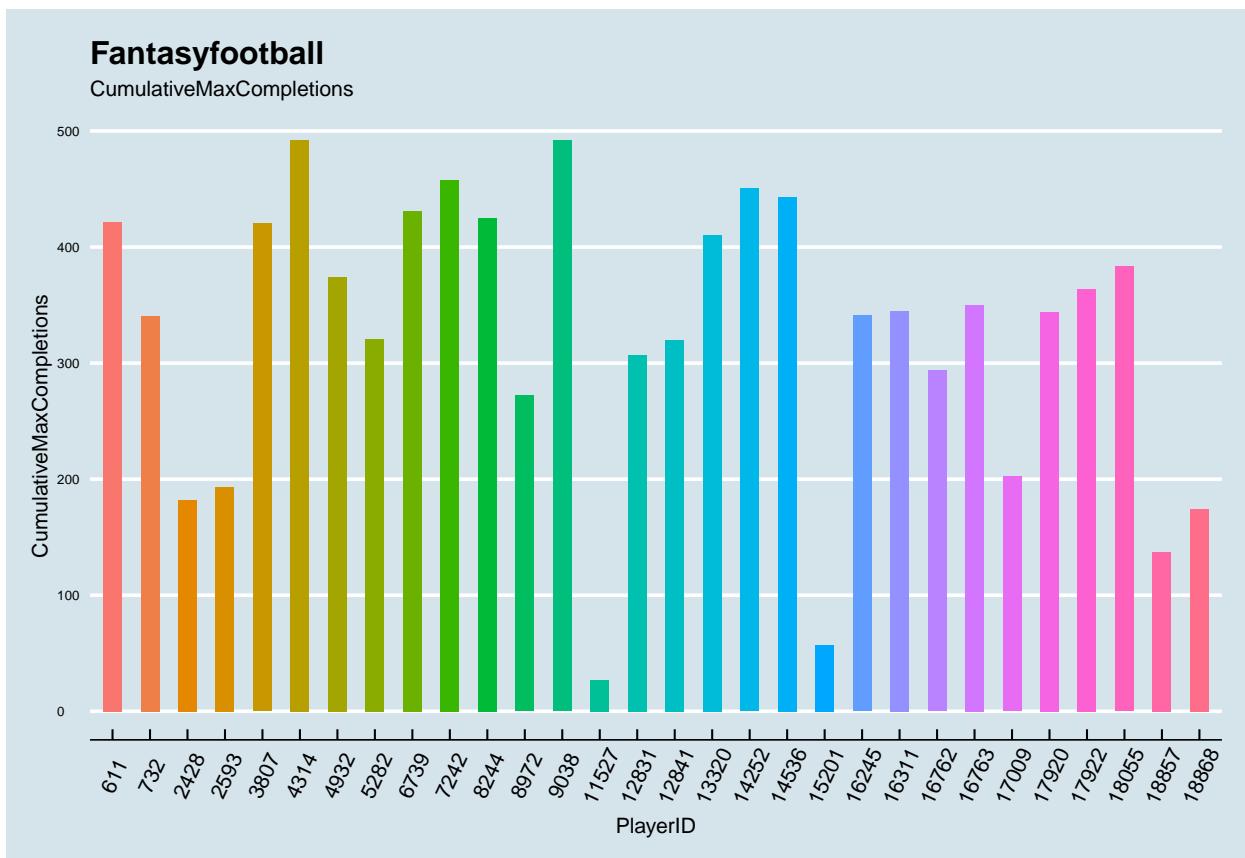
Fantasyfootball

CumulativeMaxPassingYards



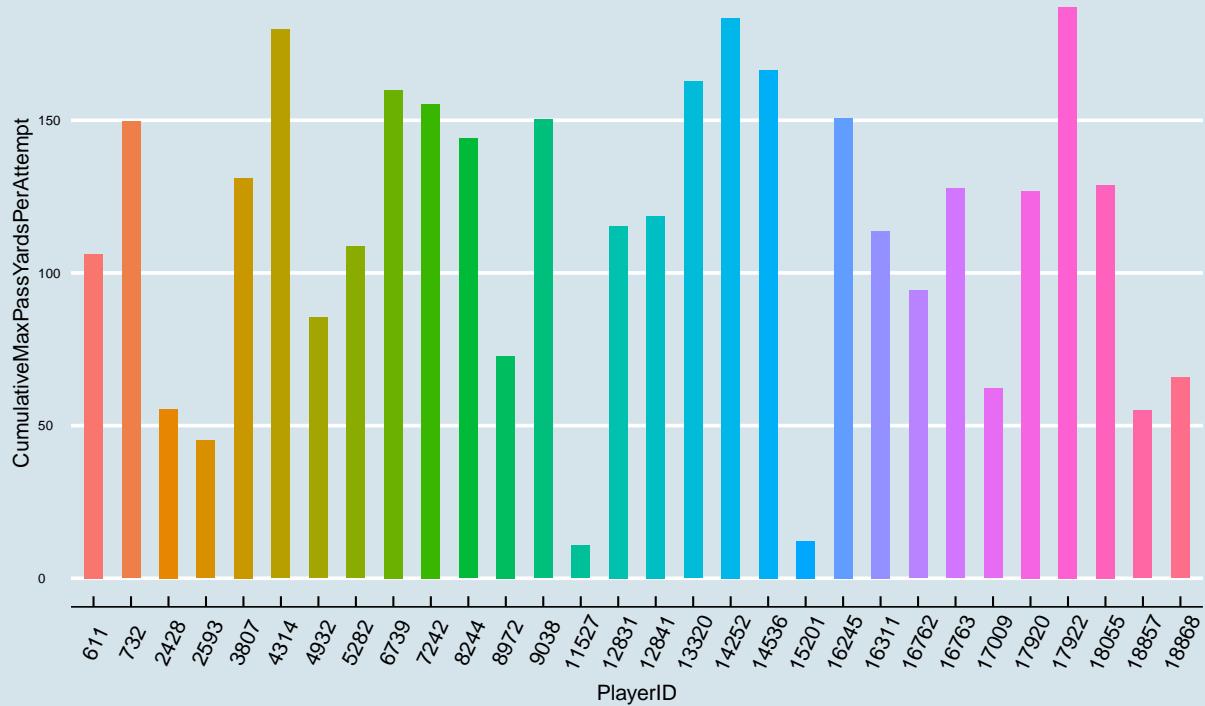






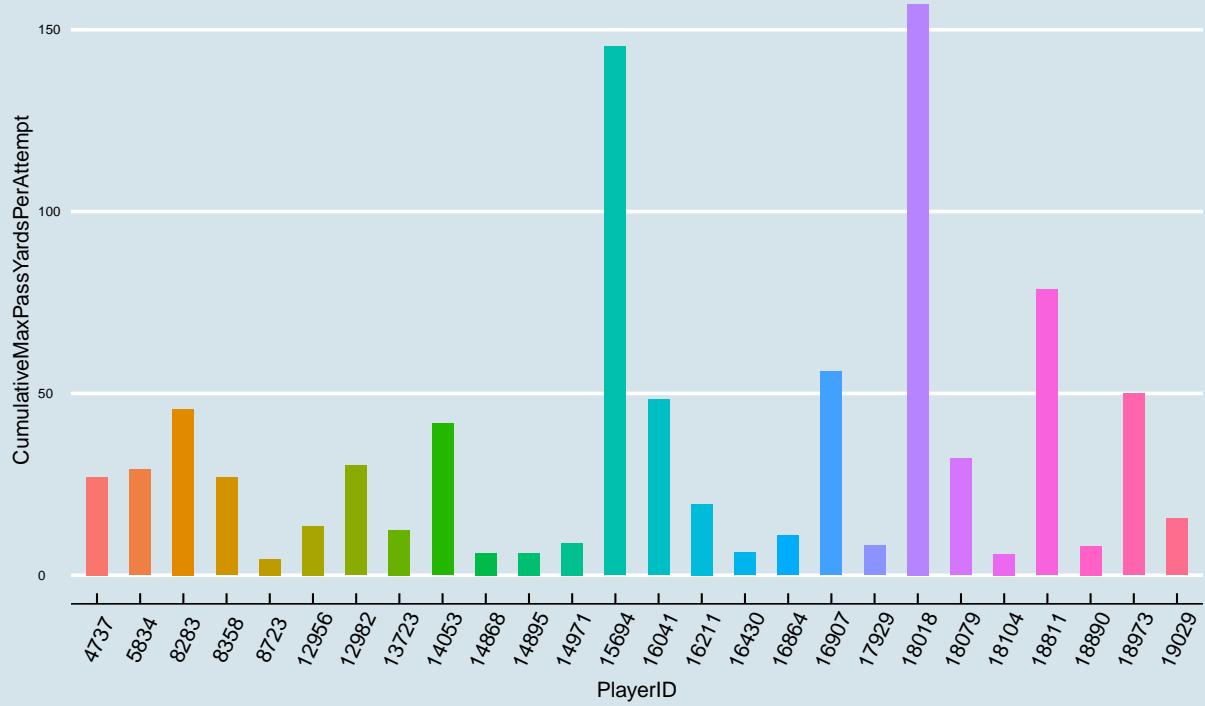
Fantasyfootball

CumulativeMaxPassYardsPerAttempt



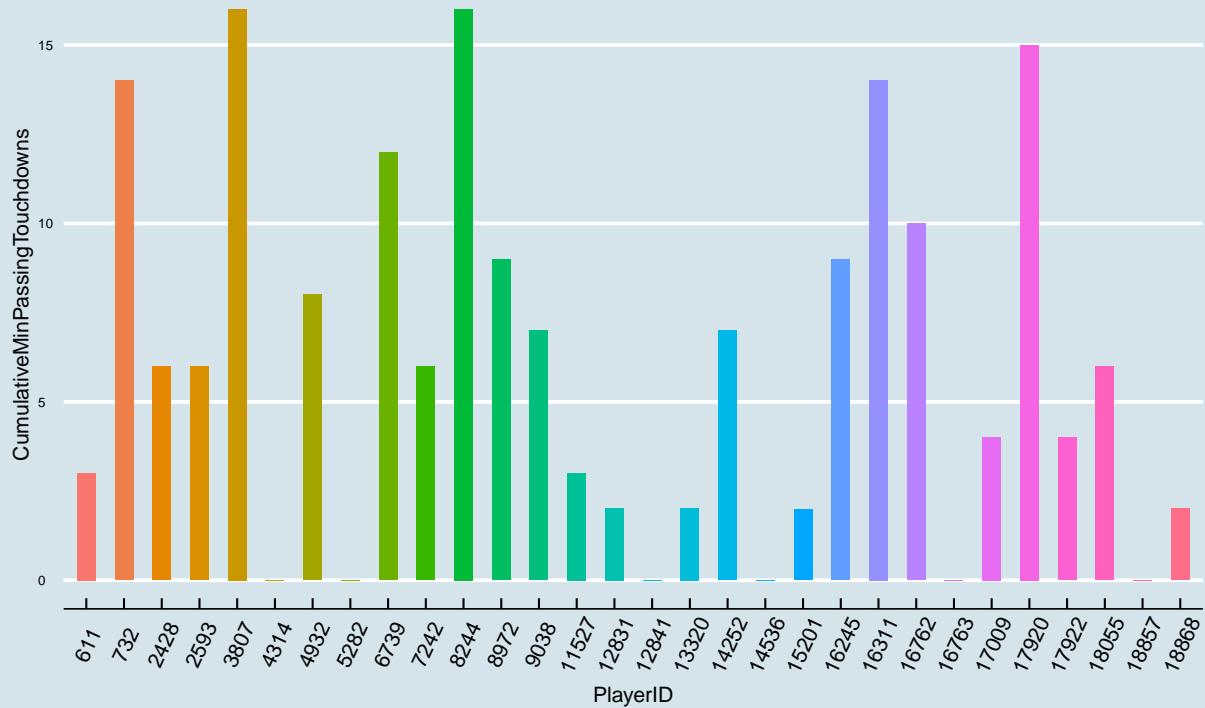
Fantasyfootball

CumulativeMaxPassYardsPerAttempt



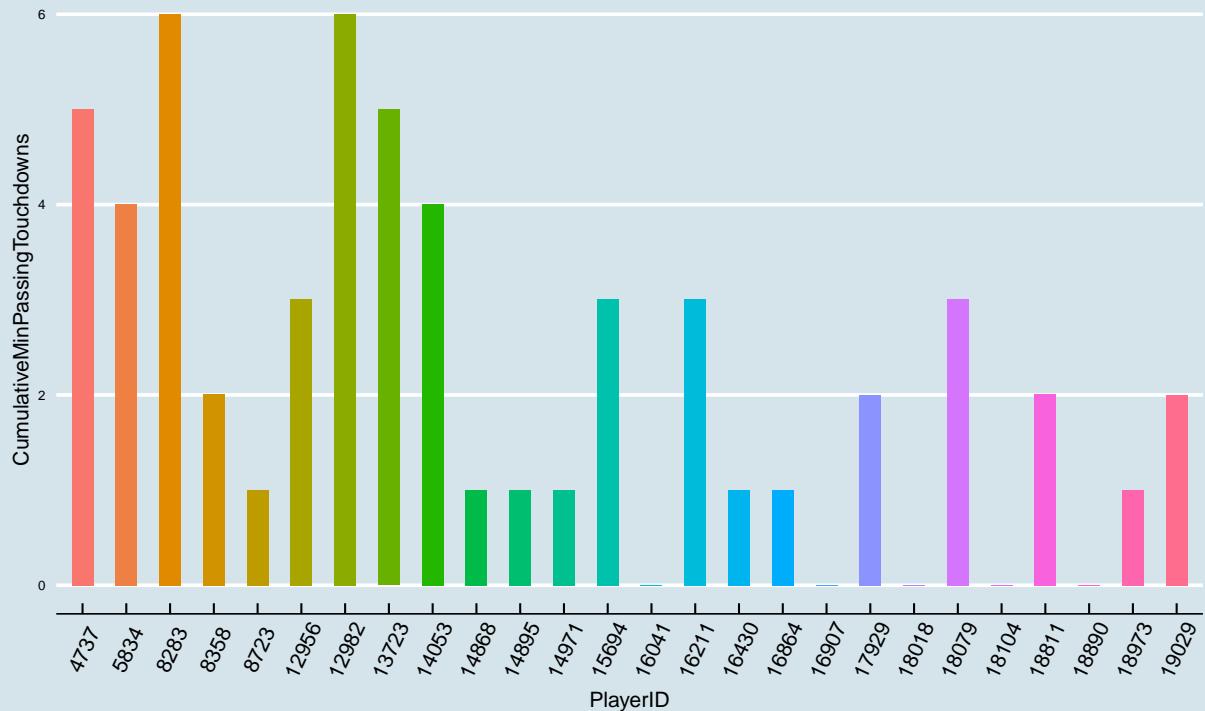
Fantasyfootball

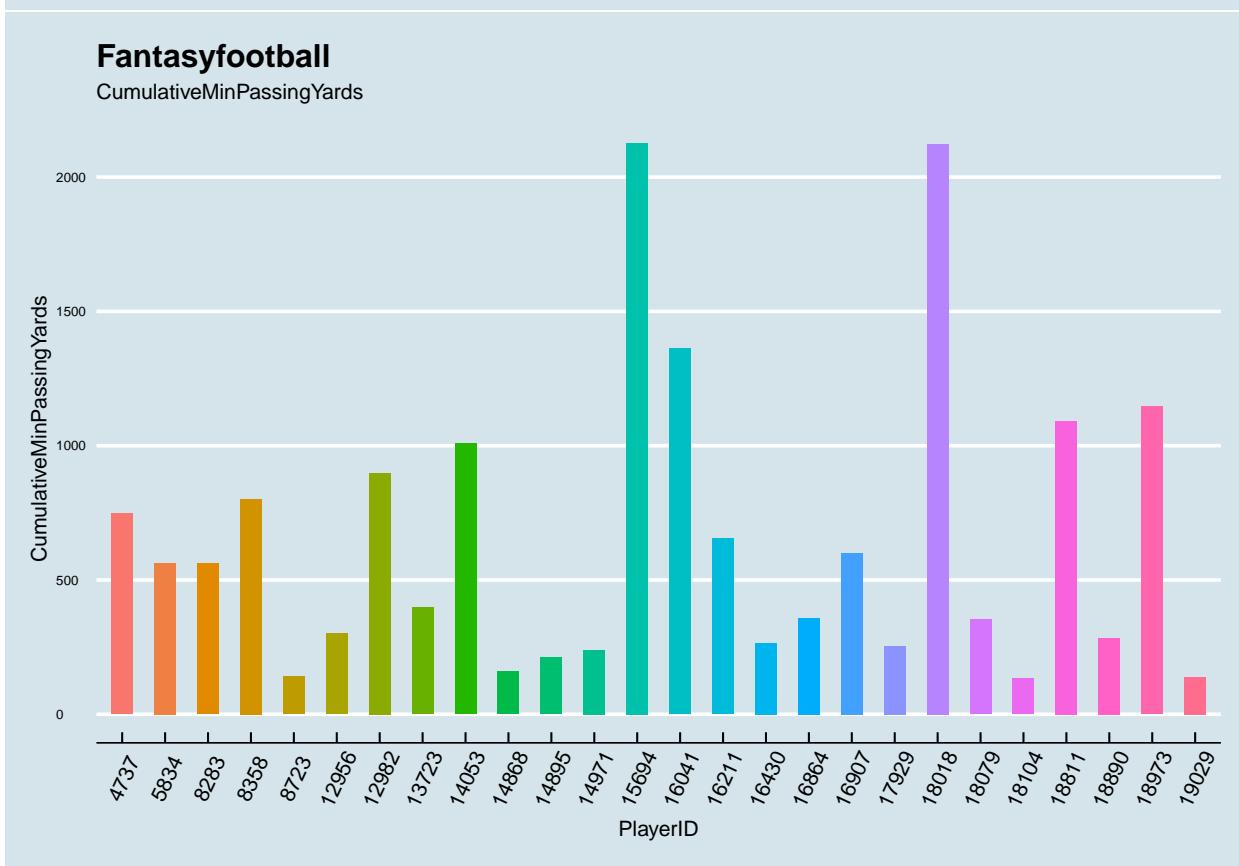
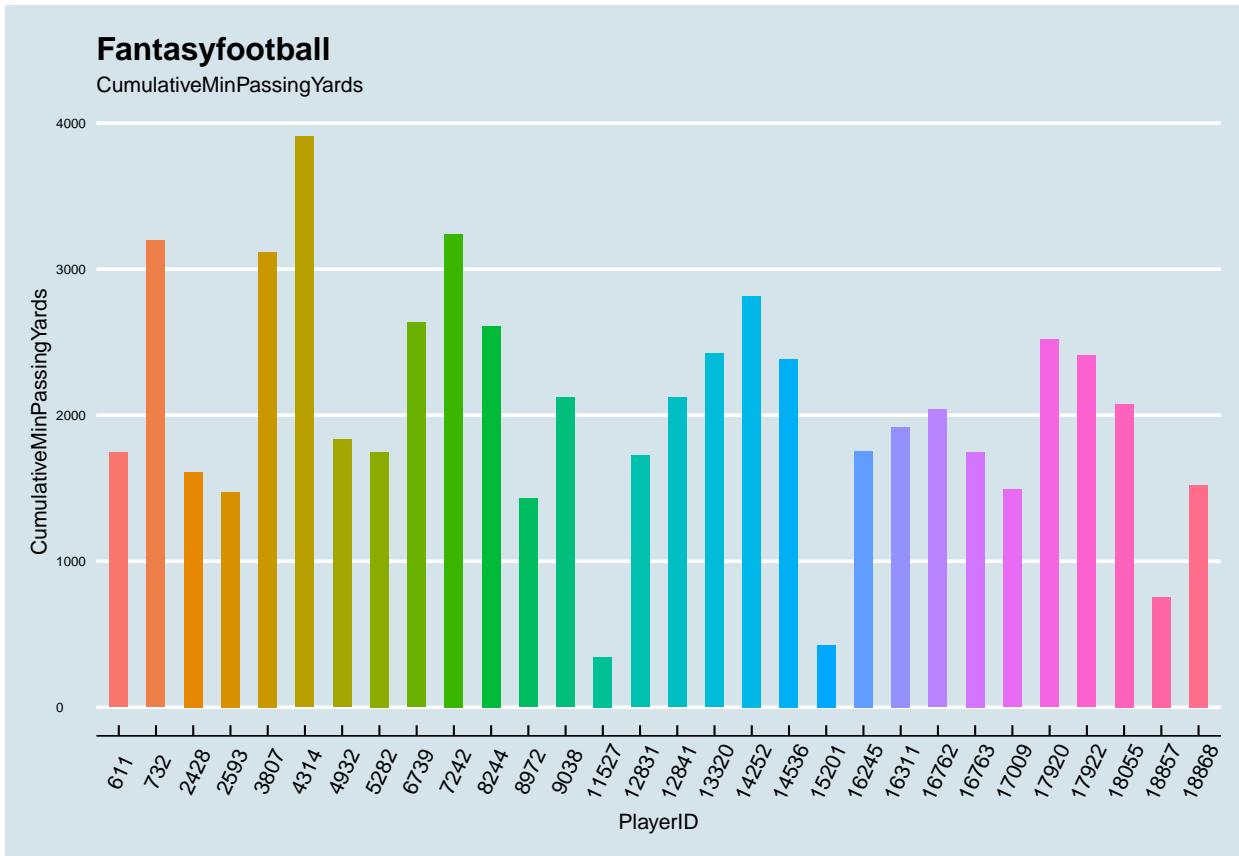
CumulativeMinPassingTouchdowns



Fantasyfootball

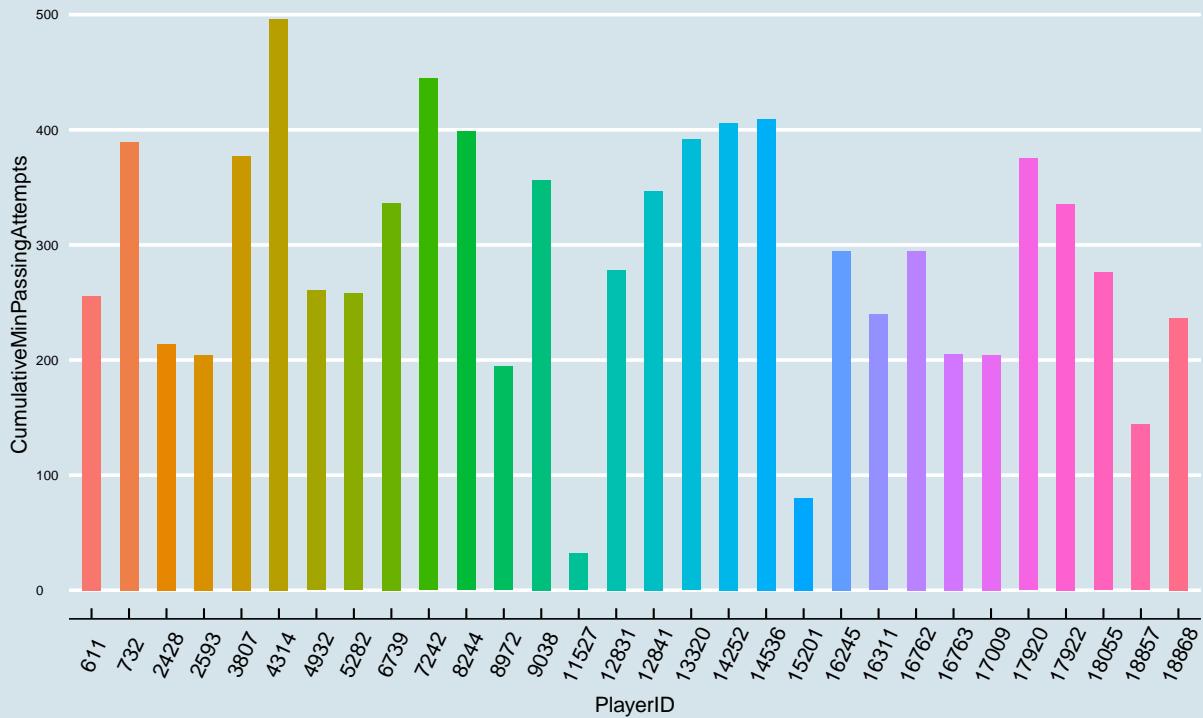
CumulativeMinPassingTouchdowns





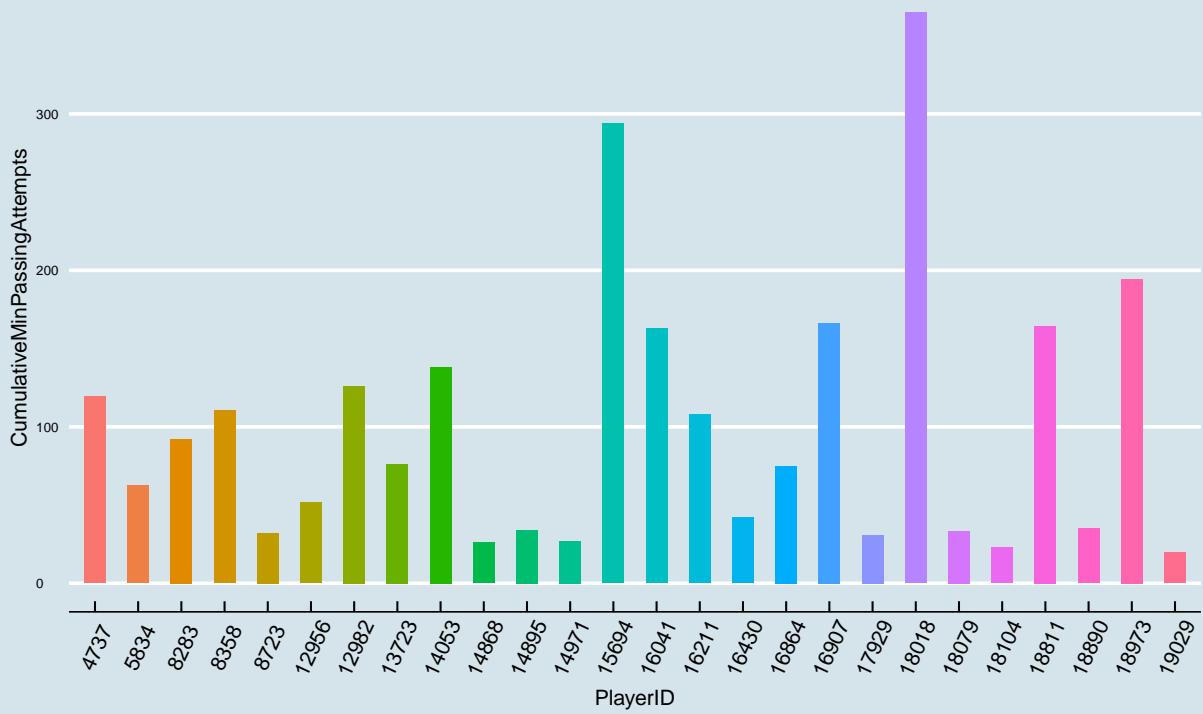
Fantasyfootball

CumulativeMinPassingAttempts



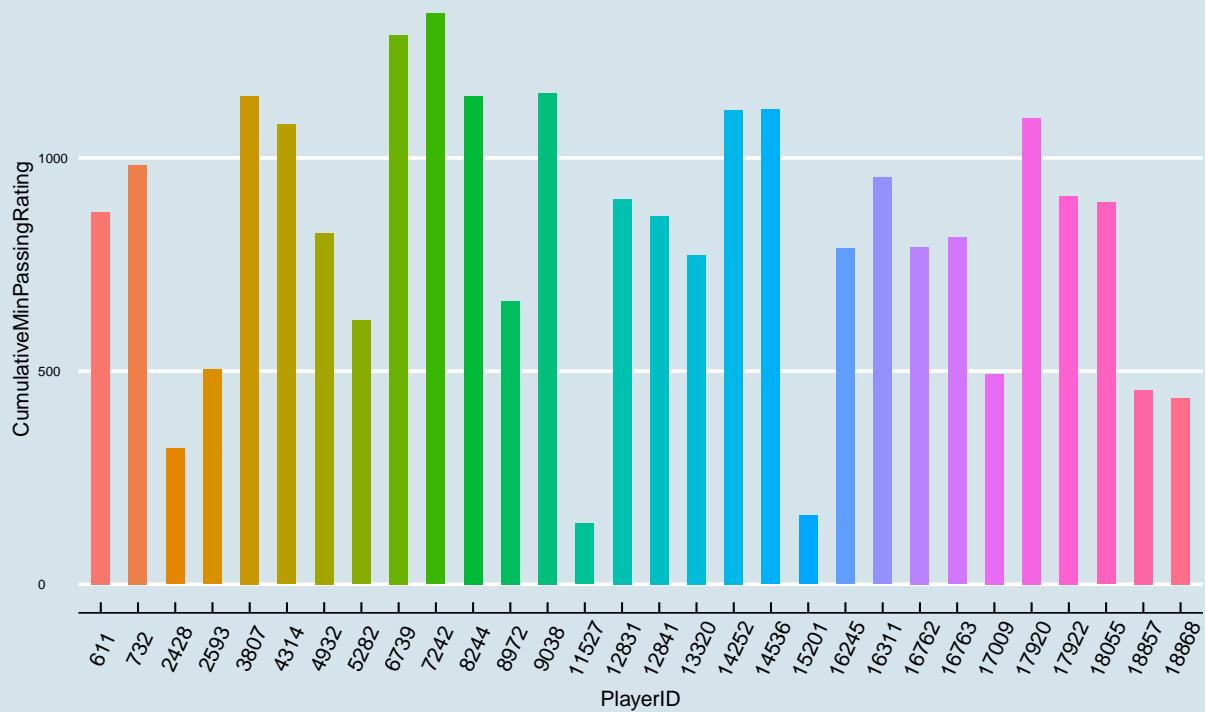
Fantasyfootball

CumulativeMinPassingAttempts



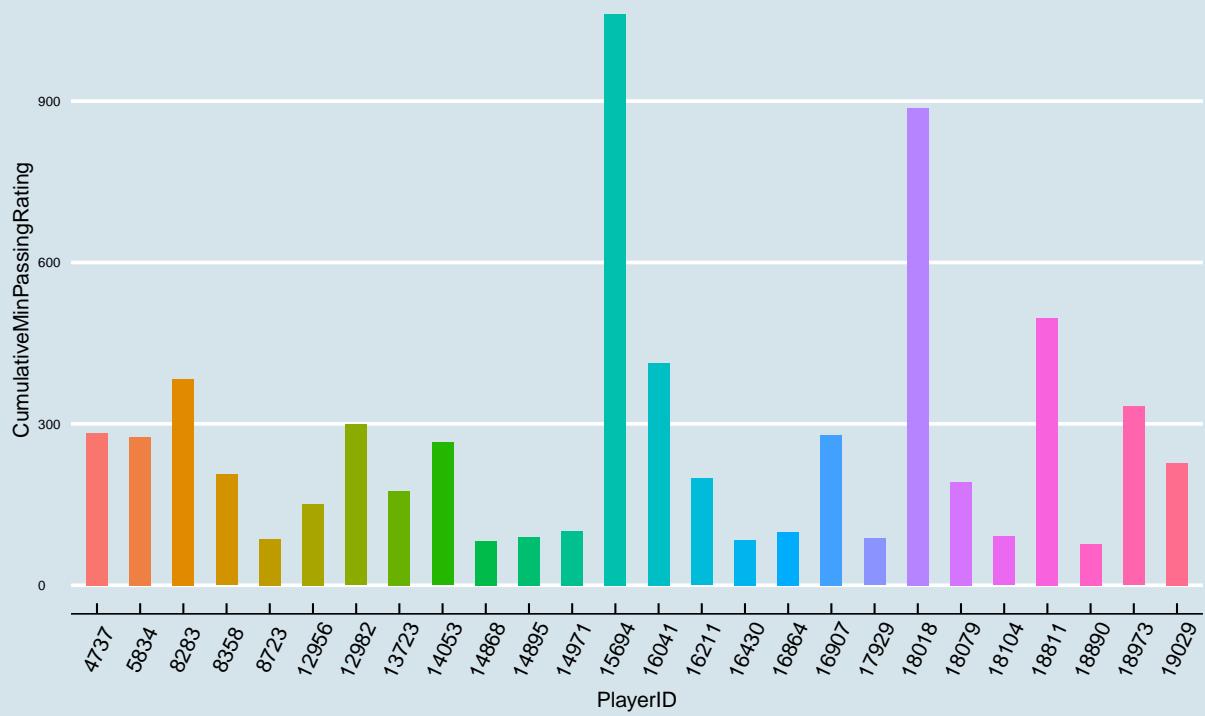
Fantasyfootball

CumulativeMinPassingRating



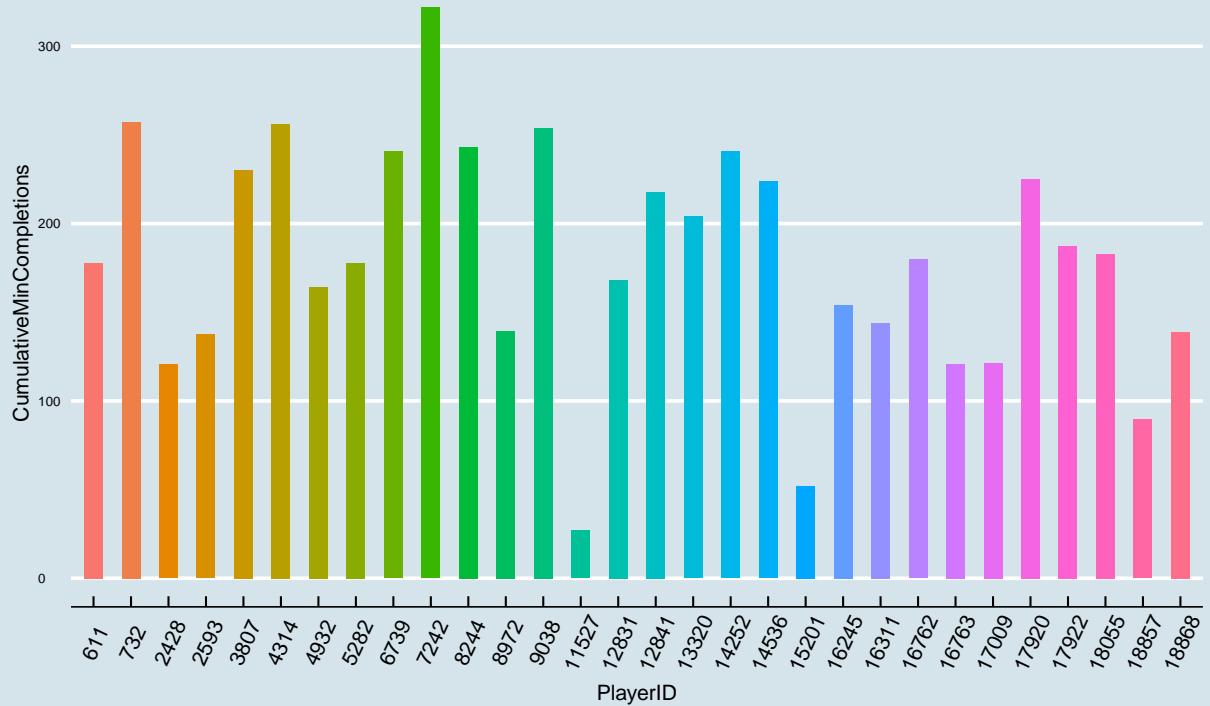
Fantasyfootball

CumulativeMinPassingRating



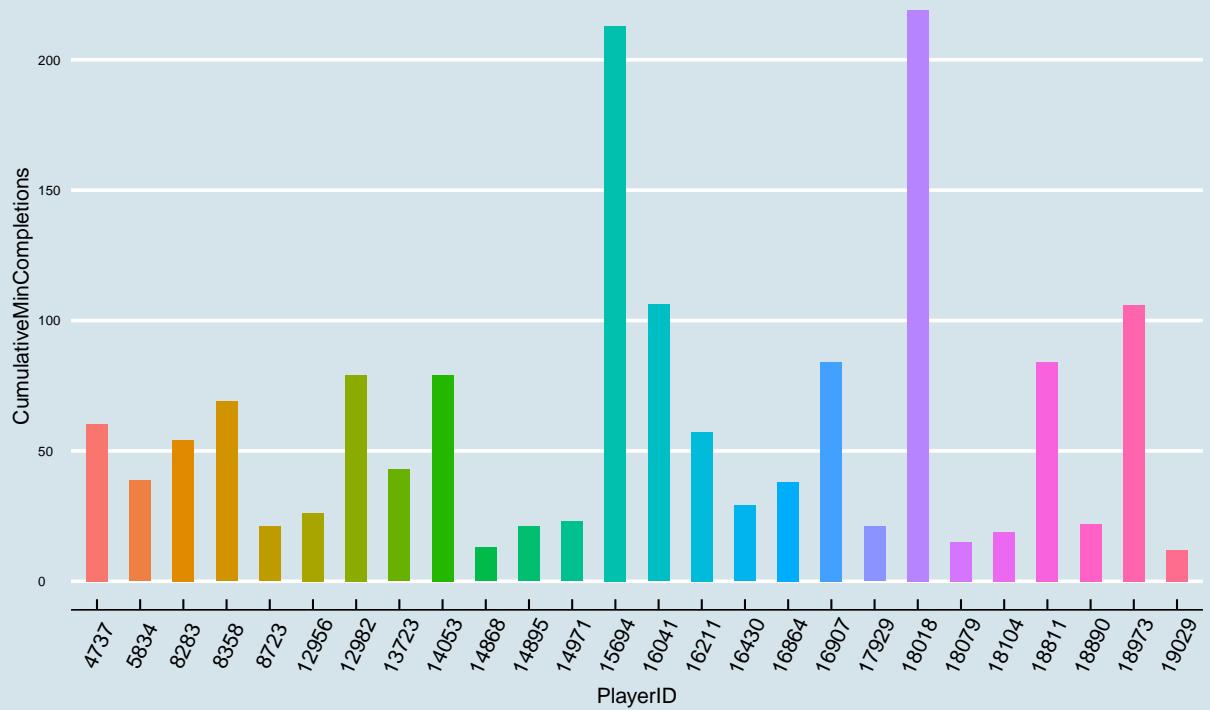
Fantasyfootball

CumulativeMinCompletions



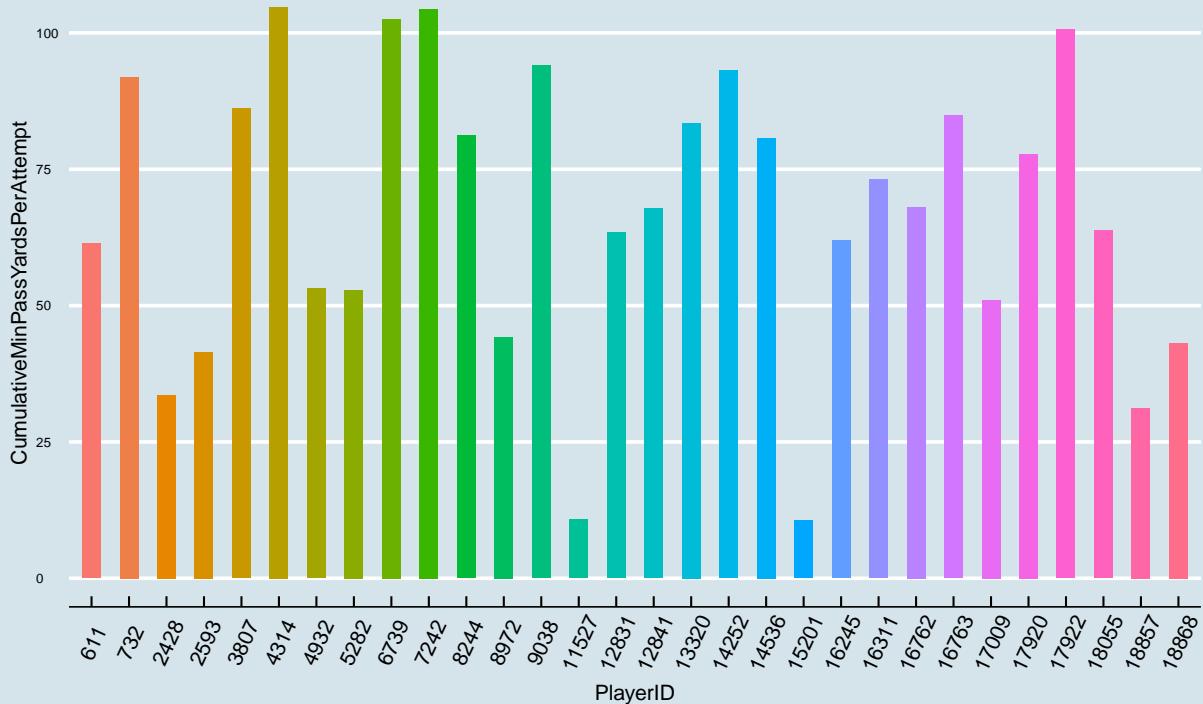
Fantasyfootball

CumulativeMinCompletions



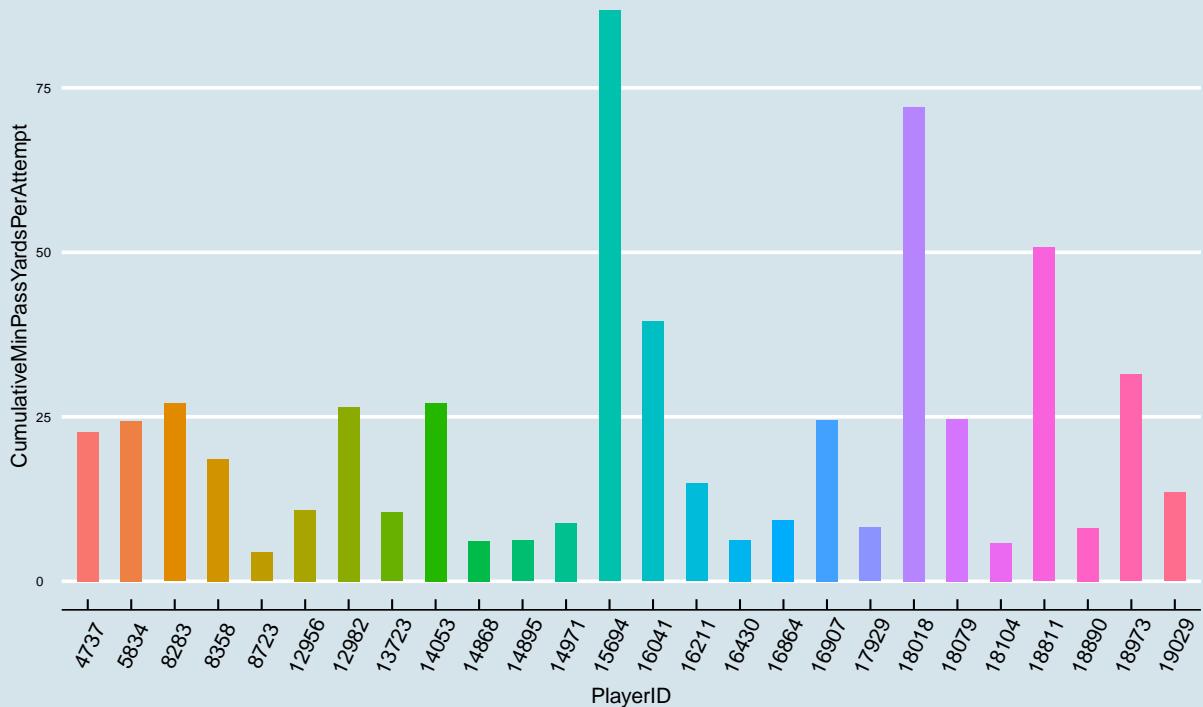
Fantasyfootball

CumulativeMinPassYardsPerAttempt



Fantasyfootball

CumulativeMinPassYardsPerAttempt



1.7.8 Linear plots for cumulative averages

```

for (i in 37:51) {
  linear_cum_plot <- final_ds %>%
    ggplot(aes_string(y="FantasyPoints",x=names(final_ds[i]),color="Week")) +
    geom_point() +
    geom_smooth(method="lm",se=F) +
    xlab(names(final_ds[i])) +
    ylab("FantasyPoints") +
    labs(title="Fantasyfootball",
         subtitle=names(players_ds[p]),
         caption="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(linear_cum_plot)
}

```

