

STOR 455: Extra Credit Assignment

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Team Information

Team Name: [DFBB]

Team Members:

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Prediction

Prediction: [combine 1 :766.3332 combine 2 :434.2756 combine 3 :781.1729]

Analysis

Provide the code you wrote, show output of the data you used, and show all the methods/models you considered to get to this prediction. Make sure to include any necessary explanations are given within your code comments. Your code should be clean, well-structured, and readable with clear comments.

```
#load data
bears <- read.csv("/Users/ruonan_zh/Documents/UNC/Class/2024Fall/STOR 455/Homework/Extra_credit/sportsr
lions <- read.csv("/Users/ruonan_zh/Documents/UNC/Class/2024Fall/STOR 455/Homework/Extra_credit/sportsr
giants <- read.csv("/Users/ruonan_zh/Documents/UNC/Class/2024Fall/STOR 455/Homework/Extra_credit/sportsr
cowboys <- read.csv("/Users/ruonan_zh/Documents/UNC/Class/2024Fall/STOR 455/Homework/Extra_credit/sportsr
dolphins <- read.csv("/Users/ruonan_zh/Documents/UNC/Class/2024Fall/STOR 455/Homework/Extra_credit/spor
packers <- read.csv("/Users/ruonan_zh/Documents/UNC/Class/2024Fall/STOR 455/Homework/Extra_credit/sportsr

colnames(bears) <- c(
  "Week", "Day", "Date", "x.4", "x.5", "x.6", "x.7", "Opponent", "Score_Tm", "Score_Opp", "Pass_Cmp",
  "Pass_Att", "Pass_Yds", "Pass_TD", "Pass_Int", "Pass_Sacks", "Sack_Yds", "Pass_ya", "Pass_nya",
  "Pass_Cmp_Percentage", "Pass_Rate", "Rush_Att", "Rush_Yds",
  "Rush_YA", "Rush_TD", "Field_Goals_Made", "Field_Goals_Att", "Extra_Points_Made",
  "Extra_Points_Attempted", "Punts", "Punt_Yds", "Third_Down_Conv",
  "Third_Down_Att", "Fourth_Down_Conv", "Fourth_Down_Att", "Time_of_Possession")

colnames(lions) <- c(
  "Week", "Day", "Date", "x.4", "x.5", "x.6", "x.7", "Opponent", "Score_Tm", "Score_Opp", "Pass_Cmp",
  "Pass_Att", "Pass_Yds", "Pass_TD", "Pass_Int", "Pass_Sacks", "Sack_Yds", "Pass_ya", "Pass_nya",
  "Pass_Cmp_Percentage", "Pass_Rate", "Rush_Att", "Rush_Yds",
```

```

"Rush_YA", "Rush_TD", "Field_Goals_Made", "Field_Goals_Att", "Extra_Points_Made",
"Extra_Points_Attempted", "Punts", "Punt_Yds", "Third_Down_Conv",
"Third_Down_Att", "Fourth_Down_Conv", "Fourth_Down_Att", "Time_of_Possession")

colnames(giants) <- c(
  "Week", "Day", "Date", "x.4", "x.5", "x.6", "x.7", "Opponent", "Score_Tm", "Score_Opp", "Pass_Cmp",
  "Pass_Att", "Pass_Yds", "Pass_TD", "Pass_Int", "Pass_Sacks", "Sack_Yds", "Pass_ya", "Pass_nya",
  "Pass_Cmp_Percentage", "Pass_Rate", "Rush_Att", "Rush_Yds",
  "Rush_YA", "Rush_TD", "Field_Goals_Made", "Field_Goals_Att", "Extra_Points_Made",
  "Extra_Points_Attempted", "Punts", "Punt_Yds", "Third_Down_Conv",
  "Third_Down_Att", "Fourth_Down_Conv", "Fourth_Down_Att", "Time_of_Possession")

colnames(cowboys) <- c(
  "Week", "Day", "Date", "x.4", "x.5", "x.6", "x.7", "Opponent", "Score_Tm", "Score_Opp", "Pass_Cmp",
  "Pass_Att", "Pass_Yds", "Pass_TD", "Pass_Int", "Pass_Sacks", "Sack_Yds", "Pass_ya", "Pass_nya",
  "Pass_Cmp_Percentage", "Pass_Rate", "Rush_Att", "Rush_Yds",
  "Rush_YA", "Rush_TD", "Field_Goals_Made", "Field_Goals_Att", "Extra_Points_Made",
  "Extra_Points_Attempted", "Punts", "Punt_Yds", "Third_Down_Conv",
  "Third_Down_Att", "Fourth_Down_Conv", "Fourth_Down_Att", "Time_of_Possession")

colnames(dolphins) <- c(
  "Week", "Day", "Date", "x.4", "x.5", "x.6", "x.7", "Opponent", "Score_Tm", "Score_Opp", "Pass_Cmp",
  "Pass_Att", "Pass_Yds", "Pass_TD", "Pass_Int", "Pass_Sacks", "Sack_Yds", "Pass_ya", "Pass_nya",
  "Pass_Cmp_Percentage", "Pass_Rate", "Rush_Att", "Rush_Yds",
  "Rush_YA", "Rush_TD", "Field_Goals_Made", "Field_Goals_Att", "Extra_Points_Made",
  "Extra_Points_Attempted", "Punts", "Punt_Yds", "Third_Down_Conv",
  "Third_Down_Att", "Fourth_Down_Conv", "Fourth_Down_Att", "Time_of_Possession")

colnames(packers) <- c(
  "Week", "Day", "Date", "x.4", "x.5", "x.6", "x.7", "Opponent", "Score_Tm", "Score_Opp", "Pass_Cmp",
  "Pass_Att", "Pass_Yds", "Pass_TD", "Pass_Int", "Pass_Sacks", "Sack_Yds", "Pass_ya", "Pass_nya",
  "Pass_Cmp_Percentage", "Pass_Rate", "Rush_Att", "Rush_Yds",
  "Rush_YA", "Rush_TD", "Field_Goals_Made", "Field_Goals_Att", "Extra_Points_Made",
  "Extra_Points_Attempted", "Punts", "Punt_Yds", "Third_Down_Conv",
  "Third_Down_Att", "Fourth_Down_Conv", "Fourth_Down_Att", "Time_of_Possession")

bears <- bears[-1, -c(4, 5, 6, 7)]
lions <- lions[-1, -c(4, 5, 6, 7)]
giants <- giants[-1, -c(4, 5, 6, 7)]
cowboys <- cowboys[-1, -c(4, 5, 6, 7)]
dolphins <- dolphins[-1, -c(4, 5, 6, 7)]
packers <- packers[-1, -c(4, 5, 6, 7)]

#check na value and get structure of data
#bears
sum(is.na(bears))

```

```
## [1] 0
```

```
colSums(is.na(bears))
```

```
##           Week           Day           Date
##           0           0           0
```

```
##           Opponent           Score_Tm           Score_Opp
##           0              0              0
##           Pass_Cmp           Pass_Att           Pass_Yds
##           0              0              0
##           Pass_TD           Pass_Int           Pass_Sacks
##           0              0              0
##           Sack_Yds           Pass_ya           Pass_nya
##           0              0              0
##           Pass_Cmp_Percentage Pass_Rate           Rush_Att
##           0              0              0
##           Rush_Yds           Rush_YA           Rush_TD
##           0              0              0
##           Field_Goals_Made     Field_Goals_Att     Extra_Points_Made
##           0              0              0
##           Extra_Points_Attempted Punts           Punt_Yds
##           0              0              0
##           Third_Down_Conv       Third_Down_Att       Fourth_Down_Conv
##           0              0              0
##           Fourth_Down_Att       Time_of_Possession
##           0              0
```

```
bears <- bears %>%
  mutate(across(5:32, as.numeric))
```

```
## Warning: There was 1 warning in 'mutate()'.
## i In argument: 'across(5:32, as.numeric)'.
## Caused by warning:
## ! NAs introduced by coercion
```

```
str(bears)
```

```
## 'data.frame':   17 obs. of  32 variables:
## $ Week          : chr  "1" "2" "3" "4" ...
## $ Day           : chr  "Sun" "Sun" "Sun" "Sun" ...
## $ Date          : chr  "8-Sep" "15-Sep" "22-Sep" "29-Sep" ...
## $ Opponent      : chr  "Tennessee Titans" "Houston Texans" "Indianapolis Colts" "Los Angeles" ...
## $ Score_Tm      : num  24 13 16 24 36 35 15 9 3 NA ...
## $ Score_Opp     : num  17 19 21 18 10 16 18 29 19 NA ...
## $ Pass_Cmp      : num  14 23 33 17 20 23 10 22 16 NA ...
## $ Pass_Att      : num  29 37 52 23 29 29 24 41 30 NA ...
## $ Pass_Yds      : num  64 134 332 133 296 221 105 172 69 NA ...
## $ Pass_TD       : num  0 0 2 1 2 4 0 0 0 NA ...
## $ Pass_Int      : num  0 2 2 0 0 1 0 0 0 NA ...
## $ Pass_Sacks    : num  2 7 4 3 1 3 3 6 9 NA ...
## $ Sack_Yds      : num  29 40 31 24 8 5 26 45 51 NA ...
## $ Pass_ya       : num  3.2 4.7 7 6.8 10.5 7.8 5.5 5.3 4 NA ...
## $ Pass_nya      : num  2.1 3 5.9 5.1 9.9 6.9 3.9 3.7 1.8 NA ...
## $ Pass_Cmp_Percentage : num  48.3 62.2 63.5 73.9 69 79.3 41.7 53.7 53.3 NA ...
## $ Pass_Rate     : num  54.8 46.5 78.4 102.3 125.1 ...
## $ Rush_Att      : num  22 22 28 28 39 29 33 23 20 NA ...
## $ Rush_Yds      : num  84 71 63 131 128 152 202 69 73 NA ...
## $ Rush_YA       : num  3.8 3.2 2.3 4.7 3.3 5.2 6.1 3 3.7 NA ...
## $ Rush_TD       : num  0 1 0 2 3 1 2 0 0 NA ...
```

```
## $ Field_Goals_Made      : num  3 2 1 1 1 0 0 3 1 NA ...
## $ Field_Goals_Att       : num  3 2 2 1 1 1 0 3 1 NA ...
## $ Extra_Points_Made     : num  1 1 1 3 3 5 1 0 0 NA ...
## $ Extra_Points_Attempted: num  1 1 1 3 4 5 1 0 0 NA ...
## $ Punts                 : num  6 6 3 5 4 2 7 4 8 NA ...
## $ Punt_Yds              : num  270 284 127 277 178 123 341 218 335 NA ...
## $ Third_Down_Conv       : num  2 6 9 3 4 5 2 3 1 NA ...
## $ Third_Down_Att        : num  13 17 21 9 11 11 12 14 14 NA ...
## $ Fourth_Down_Conv      : num  2 1 4 0 0 1 0 2 2 NA ...
## $ Fourth_Down_Att       : num  2 2 5 0 1 1 1 4 4 NA ...
## $ Time_of_Possession    : num  NA NA NA NA NA NA NA NA NA NA ...
```

```
head(bears)
```

```
## Week Day Date Opponent Score_Tm Score_Opp Pass_Cmp Pass_Att
## 2 1 Sun 8-Sep Tennessee Titans 24 17 14 29
## 3 2 Sun 15-Sep Houston Texans 13 19 23 37
## 4 3 Sun 22-Sep Indianapolis Colts 16 21 33 52
## 5 4 Sun 29-Sep Los Angeles Rams 24 18 17 23
## 6 5 Sun 6-Oct Carolina Panthers 36 10 20 29
## 7 6 Sun 13-Oct Jacksonville Jaguars 35 16 23 29
## Pass_Yds Pass_TD Pass_Int Pass_Sacks Sack_Yds Pass_ya Pass_nya
## 2 64 0 0 2 29 3.2 2.1
## 3 134 0 2 7 40 4.7 3.0
## 4 332 2 2 4 31 7.0 5.9
## 5 133 1 0 3 24 6.8 5.1
## 6 296 2 0 1 8 10.5 9.9
## 7 221 4 1 3 5 7.8 6.9
## Pass_Cmp_Percentage Pass_Rate Rush_Att Rush_Yds Rush_YA Rush_TD
## 2 48.3 54.8 22 84 3.8 0
## 3 62.2 46.5 22 71 3.2 1
## 4 63.5 78.4 28 63 2.3 0
## 5 73.9 102.3 28 131 4.7 2
## 6 69.0 125.1 39 128 3.3 3
## 7 79.3 123.6 29 152 5.2 1
## Field_Goals_Made Field_Goals_Att Extra_Points_Made Extra_Points_Attempted
## 2 3 3 1 1
## 3 2 2 1 1
## 4 1 2 1 1
## 5 1 1 3 3
## 6 1 1 3 4
## 7 0 1 5 5
## Punts Punt_Yds Third_Down_Conv Third_Down_Att Fourth_Down_Conv
## 2 6 270 2 13 2
## 3 6 284 6 17 1
## 4 3 127 9 21 4
## 5 5 277 3 9 0
## 6 4 178 4 11 0
## 7 2 123 5 11 1
## Fourth_Down_Att Time_of_Possession
## 2 2 NA
## 3 2 NA
## 4 5 NA
## 5 0 NA
```

```
## 6          1          NA
## 7          1          NA
```

```
#lions
sum(is.na(lions))
```

```
## [1] 0
```

```
colSums(is.na(lions))
```

```
##           Week           Day           Date
##           0           0           0
##      Opponent      Score_Tm      Score_Opp
##           0           0           0
##      Pass_Cmp      Pass_Att      Pass_Yds
##           0           0           0
##      Pass_TD      Pass_Int      Pass_Sacks
##           0           0           0
##      Sack_Yds      Pass_ya      Pass_nya
##           0           0           0
##      Pass_Cmp_Percentage      Pass_Rate      Rush_Att
##           0           0           0
##      Rush_Yds      Rush_YA      Rush_TD
##           0           0           0
##      Field_Goals_Made      Field_Goals_Att      Extra_Points_Made
##           0           0           0
##      Extra_Points_Attempted      Punts      Punt_Yds
##           0           0           0
##      Third_Down_Conv      Third_Down_Att      Fourth_Down_Conv
##           0           0           0
##      Fourth_Down_Att      Time_of_Possession
##           0           0
```

```
lions <- lions %>%
  mutate(across(5:32, as.numeric))
```

```
## Warning: There was 1 warning in 'mutate()'.
## i In argument: 'across(5:32, as.numeric)'.
## Caused by warning:
## ! NAs introduced by coercion
```

```
head(lions)
```

```
##   Week Day   Date      Opponent Score_Tm Score_Opp Pass_Cmp Pass_Att
## 2     1 Sun 8-Sep   Los Angeles Rams      26      20      18      28
## 3     2 Sun 15-Sep Tampa Bay Buccaneers      16      20      35      56
## 4     3 Sun 22-Sep   Arizona Cardinals      20      13      18      23
## 5     4 Mon 30-Sep   Seattle Seahawks      42      29      19      19
## 6     6 Sun 13-Oct   Dallas Cowboys      47       9      19      27
## 7     7 Sun 20-Oct   Minnesota Vikings      31      29      22      25
##   Pass_Yds Pass_TD Pass_Int Pass_Sacks Sack_Yds Pass_ya Pass_nya
```

## 2	200	1	1	2	17	7.8	6.7
## 3	324	0	2	0	0	5.8	5.8
## 4	186	2	1	2	13	8.7	7.4
## 5	273	3	0	3	26	15.7	12.4
## 6	308	3	0	3	26	12.4	10.3
## 7	247	2	0	4	33	11.2	8.5
##	Pass_Cmp_Percentage	Pass_Rate	Rush_Att	Rush_Yds	Rush_YA	Rush_TD	
## 2		64.3	82.4	31	163	5.3	2
## 3		62.5	63.4	27	139	5.1	1
## 4		78.3	111.2	43	187	4.3	1
## 5		100.0	158.3	28	116	4.1	3
## 6		70.4	145.3	36	184	5.1	2
## 7		88.0	134.5	27	144	5.3	2
##	Field_Goals_Made	Field_Goals_Att	Extra_Points_Made	Extra_Points_Attempted			
## 2		2	2		2		2
## 3		3	3		1		1
## 4		0	0		2		3
## 5		0	0		6		6
## 6		4	4		5		5
## 7		1	1		4		4
##	Punts	Punt_Yds	Third_Down_Conv	Third_Down_Att	Fourth_Down_Conv		
## 2	4	230	6	13		1	
## 3	2	67	7	17		3	
## 4	5	247	6	12		0	
## 5	3	140	3	6		0	
## 6	0	0	4	10		1	
## 7	4	219	4	10		0	
##	Fourth_Down_Att	Time_of_Possession					
## 2		1	NA				
## 3		5	NA				
## 4		1	NA				
## 5		0	NA				
## 6		2	NA				
## 7		1	NA				

```
#giants
sum(is.na(giants))
```

```
## [1] 0
```

```
colSums(is.na(giants))
```

##	Week	Day	Date
##	0	0	0
##	Opponent	Score_Tm	Score_Opp
##	0	0	0
##	Pass_Cmp	Pass_Att	Pass_Yds
##	0	0	0
##	Pass_TD	Pass_Int	Pass_Sacks
##	0	0	0
##	Sack_Yds	Pass_ya	Pass_nya
##	0	0	0
##	Pass_Cmp_Percentage	Pass_Rate	Rush_Att

```
##           0           0           0
##           Rush_Yds           Rush_YA           Rush_TD
##           0           0           0
##           Field_Goals_Made           Field_Goals_Att           Extra_Points_Made
##           0           0           0
## Extra_Points_Attempted           Punts           Punt_Yds
##           0           0           0
##           Third_Down_Conv           Third_Down_Att           Fourth_Down_Conv
##           0           0           0
##           Fourth_Down_Att           Time_of_Possession
##           0           0
```

```
giants <- giants %>%
  mutate(across(5:32, as.numeric))
```

```
## Warning: There was 1 warning in 'mutate()'.
## i In argument: 'across(5:32, as.numeric)'.
## Caused by warning:
## ! NAs introduced by coercion
```

```
head(giants)
```

```
##   Week Day   Date           Opponent Score_Tm Score_Opp Pass_Cmp Pass_Att
## 2     1 Sun  8-Sep      Minnesota Vikings         6         28         22         42
## 3     2 Sun 15-Sep Washington Commanders        18         21         16         28
## 4     3 Sun 22-Sep      Cleveland Browns         21         15         24         35
## 5     4 Thu 26-Sep           Dallas Cowboys         15         20         29         40
## 6     5 Sun  6-Oct      Seattle Seahawks         29         20         23         34
## 7     6 Sun 13-Oct      Cincinnati Bengals         7         17         22         41
##   Pass_Yds Pass_TD Pass_Int Pass_Sacks Sack_Yds Pass_ya Pass_nya
## 2       166         0         2         5        20      4.4      3.5
## 3       175         2         0         1         3      6.4      6.0
## 4       228         2         0         2         8      6.7      6.2
## 5       277         0         1         1         4      7.0      6.8
## 6       245         2         0         3        12      7.6      6.6
## 7       190         0         1         2        15      5.0      4.4
##   Pass_Cmp_Percentage Pass_Rate Rush_Att Rush_Yds Rush_YA Rush_TD
## 2                52.4      42.4        21       74      3.5         0
## 3                57.1      99.6        22      129      5.9         1
## 4                68.6     105.4        32      112      3.5         1
## 5                72.5      80.9        24       26      1.1         0
## 6                67.6     108.1        34      175      5.1         0
## 7                53.7      55.9        31      119      3.8         1
##   Field_Goals_Made Field_Goals_Att Extra_Points_Made Extra_Points_Attempted
## 2                 2                 2                 0                 0
## 3                 0                 0                 0                 1
## 4                 0                 1                 3                 3
## 5                 5                 5                 0                 0
## 6                 3                 3                 2                 2
## 7                 0                 2                 1                 1
##   Punts Punt_Yds Third_Down_Conv Third_Down_Att Fourth_Down_Conv
## 2      6      277                7          18                1
## 3      2       87                4           8                1
```

```
## 4      7      361      4      14      1
## 5      1      44      5      16      3
## 6      4     186      7      16      0
## 7      4     187      5      15      3
##   Fourth_Down_Att Time_of_Possession
## 2              3              NA
## 3              2              NA
## 4              1              NA
## 5              4              NA
## 6              1              NA
## 7              5              NA
```

```
#cowboys
sum(is.na(cowboys))
```

```
## [1] 0
```

```
colSums(is.na(cowboys))
```

```
##           Week           Day           Date
##           0           0           0
##      Opponent      Score_Tm      Score_Opp
##           0           0           0
##      Pass_Cmp      Pass_Att      Pass_Yds
##           0           0           0
##      Pass_TD      Pass_Int      Pass_Sacks
##           0           0           0
##      Sack_Yds      Pass_ya      Pass_nya
##           0           0           0
## Pass_Cmp_Percentage      Pass_Rate      Rush_Att
##           0           0           0
##      Rush_Yds      Rush_YA      Rush_TD
##           0           0           0
##      Field_Goals_Made      Field_Goals_Att      Extra_Points_Made
##           0           0           0
## Extra_Points_Attempted      Punts      Punt_Yds
##           0           0           0
##      Third_Down_Conv      Third_Down_Att      Fourth_Down_Conv
##           0           0           0
##      Fourth_Down_Att      Time_of_Possession
##           0           0
```

```
cowboys <- cowboys %>%
  mutate(across(5:32, as.numeric))
```

```
## Warning: There was 1 warning in 'mutate()'.
## i In argument: 'across(5:32, as.numeric)'.
## Caused by warning:
## ! NAs introduced by coercion
```



```
head(cowboys)
```

```
##   Week Day   Date      Opponent Score_Tm Score_Opp Pass_Cmp Pass_Att
## 2     1 Sun  8-Sep   Cleveland Browns      33      17      19      32
## 3     2 Sun 15-Sep   New Orleans Saints      19      44      28      42
## 4     3 Sun 22-Sep   Baltimore Ravens      25      28      28      51
## 5     4 Thu 26-Sep   New York Giants      20      15      22      27
## 6     5 Sun  6-Oct Pittsburgh Steelers      20      17      29      42
## 7     6 Sun 13-Oct      Detroit Lions       9      47      25      44
##   Pass_Yds Pass_TD Pass_Int Pass_Sacks Sack_Yds Pass_ya Pass_nya
## 2      163      1      0          3      16      5.6      4.7
## 3      285      1      2          3      14      7.1      6.3
## 4      361      2      0          3      18      7.4      6.7
## 5      213      2      0          1       8      8.2      7.6
## 6      336      2      2          2      16      8.4      7.6
## 7      198      0      3          4      26      5.1      4.1
##   Pass_Cmp_Percentage Pass_Rate Rush_Att Rush_Yds Rush_YA Rush_TD
## 2              59.4      83.2      25      102      4.1      1
## 3              66.7      74.0      21       68      3.2      0
## 4              54.9      90.4      16       51      3.2      1
## 5              81.5     124.2      23       80      3.5      0
## 6              69.0      89.0      31      109      3.5      0
## 7              56.8      39.8      17       53      3.1      0
##   Field_Goals_Made Field_Goals_Att Extra_Points_Made Extra_Points_Attempted
## 2              4              4              3              3
## 3              4              4              1              1
## 4              2              2              1              1
## 5              2              3              2              2
## 6              2              3              2              2
## 7              3              3              0              0
##   Punts Punt_Yds Third_Down_Conv Third_Down_Att Fourth_Down_Conv
## 2     6     294              4              14              0
## 3     1      53              6              13              1
## 4     4     209              7              13              0
## 5     3     165              3              10              1
## 6     1      45              9              15              1
## 7     2      93              3              13              1
##   Fourth_Down_Att Time_of_Possession
## 2              0              NA
## 3              3              NA
## 4              1              NA
## 5              1              NA
## 6              1              NA
## 7              4              NA
```

```
#dolphins
sum(is.na(dolphins))
```

```
## [1] 0
```

```
colSums(is.na(dolphins))
```

```
##           Week           Day           Date
##           0             0             0
##           Opponent       Score_Tm       Score_Opp
##           0             0             0
##           Pass_Cmp       Pass_Att       Pass_Yds
##           0             0             0
##           Pass_TD       Pass_Int       Pass_Sacks
##           0             0             0
##           Sack_Yds       Pass_ya       Pass_nya
##           0             0             0
##           Pass_Cmp_Percentage Pass_Rate Rush_Att
##           0             0             0
##           Rush_Yds       Rush_YA       Rush_TD
##           0             0             0
##           Field_Goals_Made Field_Goals_Att Extra_Points_Made
##           0             0             0
##           Extra_Points_Attempted Punts Punt_Yds
##           0             0             0
##           Third_Down_Conv Third_Down_Att Fourth_Down_Conv
##           0             0             0
##           Fourth_Down_Att Time_of_Possession
##           0             0
```

```
dolphins <- dolphins %>%
  mutate(across(5:32, as.numeric))
```

```
## Warning: There was 1 warning in 'mutate()'.
## i In argument: 'across(5:32, as.numeric)'.
## Caused by warning:
## ! NAs introduced by coercion
```

```
head(dolphins)
```

```
##   Week Day   Date      Opponent Score_Tm Score_Opp Pass_Cmp Pass_Att
## 2     1 Sun  8-Sep Jacksonville Jaguars      20      17      23      37
## 3     2 Thu 12-Sep      Buffalo Bills      10      31      25      39
## 4     3 Sun 22-Sep      Seattle Seahawks      3      24      20      32
## 5     4 Mon 30-Sep      Tennessee Titans     12      31      14      22
## 6     5 Sun  6-Oct New England Patriots     15      10      18      31
## 7     7 Sun 20-Oct Indianapolis Colts      10      16      15      26
##   Pass_Yds Pass_TD Pass_Int Pass_Sacks Sack_Yds Pass_ya Pass_nya
## 2        319      1      0          3      19      9.1      8.0
## 3        212      1      3          2      13      5.8      5.2
## 4        140      0      0          6      46      5.8      3.7
## 5         78      0      0          2      18      4.4      3.3
## 6        179      0      1          3      15      6.3      5.3
## 7        149      1      0          2      12      6.2      5.3
##   Pass_Cmp_Percentage Pass_Rate Rush_Att Rush_Yds Rush_YA Rush_TD
## 2                62.2     98.8      25      81      3.2      1
## 3                64.1     54.6      34     139      4.1      0
## 4                62.5     72.4      18      65      3.6      0
## 5                63.6     69.9      30     106      3.5      1
## 6                58.1     61.1      41     193      4.7      1
```

```
## 7          57.7      86.9      40      188      4.7      0
##   Field_Goals_Made Field_Goals_Att Extra_Points_Made Extra_Points_Attempted
## 2          2          3          2          2
## 3          1          1          1          1
## 4          1          2          0          0
## 5          2          2          0          0
## 6          3          4          0          0
## 7          1          2          1          1
##   Punts Punt_Yds Third_Down_Conv Third_Down_Att Fourth_Down_Conv
## 2     4     198          8          16          0
## 3     1     48          7          15          1
## 4     6    277          1          12          0
## 5     5    238          2          12          1
## 6     3     88          2          11          0
## 7     6    286          6          15          0
##   Fourth_Down_Att Time_of_Possession
## 2          2          NA
## 3          5          NA
## 4          3          NA
## 5          3          NA
## 6          1          NA
## 7          1          NA
```

```
#packers
sum(is.na(packers))
```

```
## [1] 0
```

```
colSums(is.na(packers))
```

```
##          Week          Day          Date
##          0          0          0
##      Opponent      Score_Tm      Score_Opp
##          0          0          0
##      Pass_Cmp      Pass_Att      Pass_Yds
##          0          0          0
##      Pass_TD      Pass_Int      Pass_Sacks
##          0          0          0
##      Sack_Yds      Pass_ya      Pass_nya
##          0          0          0
##      Pass_Cmp_Percentage      Pass_Rate      Rush_Att
##          0          0          0
##      Rush_Yds      Rush_YA      Rush_TD
##          0          0          0
##      Field_Goals_Made      Field_Goals_Att      Extra_Points_Made
##          0          0          0
##      Extra_Points_Attempted      Punts      Punt_Yds
##          0          0          0
##      Third_Down_Conv      Third_Down_Att      Fourth_Down_Conv
##          0          0          0
##      Fourth_Down_Att      Time_of_Possession
##          0          0
```

```
packers <- packers %>%
  mutate(across(5:32, as.numeric))
```

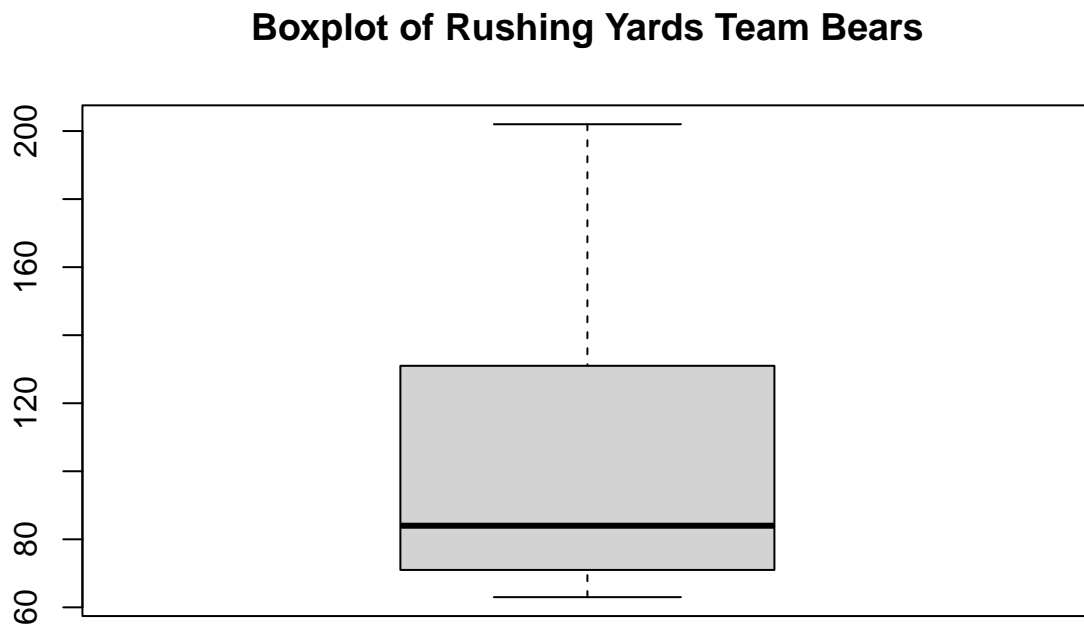
```
## Warning: There was 1 warning in 'mutate()'.
## i In argument: 'across(5:32, as.numeric)'.
## Caused by warning:
## ! NAs introduced by coercion
```

```
head(packers)
```

```
##   Week Day   Date      Opponent Score_Tm Score_Opp Pass_Cmp Pass_Att
## 2    1 Fri  6-Sep Philadelphia Eagles      29      34      17      35
## 3    2 Sun 15-Sep Indianapolis Colts      16      10      12      14
## 4    3 Sun 22-Sep Tennessee Titans      30      14      13      19
## 5    4 Sun 29-Sep Minnesota Vikings      29      31      32      54
## 6    5 Sun  6-Oct Los Angeles Rams      24      19      15      26
## 7    6 Sun 13-Oct Arizona Cardinals      34      13      22      32
##   Pass_Yds Pass_TD Pass_Int Pass_Sacks Sack_Yds Pass_ya Pass_nya
## 2      251      2      1      2      9      7.4      6.8
## 3      122      1      0      0      0      8.7      8.7
## 4      190      1      0      3     12     10.6      8.6
## 5      379      4      3      1     10      7.2      6.9
## 6      202      2      1      2     22      8.6      7.2
## 7      258      4      1      0      0      8.1      8.1
##   Pass_Cmp_Percentage Pass_Rate Rush_Att Rush_Yds Rush_YA Rush_TD
## 2              48.6      79.6      21     163      7.8      1
## 3              85.7     126.8      53     261      4.9      0
## 4              68.4     118.3      37     188      5.1      1
## 5              59.3      82.3      19      86      4.5      0
## 6              57.7      92.1      30     126      4.2      1
## 7              68.8     119.5      38     179      4.7      0
##   Field_Goals_Made Field_Goals_Att Extra_Points_Made Extra_Points_Attempted
## 2              3              4              2              2
## 3              3              4              1              1
## 4              3              3              3              3
## 5              0              2              3              3
## 6              1              1              3              3
## 7              2              3              4              4
##   Punts Punt_Yds Third_Down_Conv Third_Down_Att Fourth_Down_Conv
## 2     2      74              3      11              1
## 3     3     139              10      17              0
## 4     5     244              5      14              0
## 5     3     180              4      12              0
## 6     5     186              1      8              0
## 7     1      46              7     12              1
##   Fourth_Down_Att Time_of_Possession
## 2              1              NA
## 3              0              NA
## 4              0              NA
## 5              2              NA
## 6              0              NA
## 7              1              NA
```

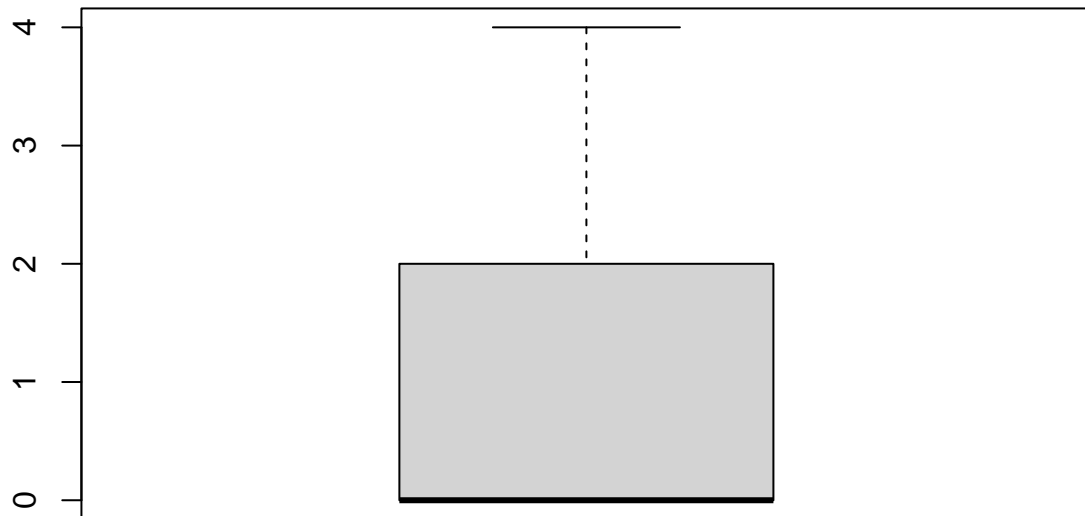
```
#check outliers
```

```
boxplot(bears$Rush_Yds, main = "Boxplot of Rushing Yards Team Bears")
```



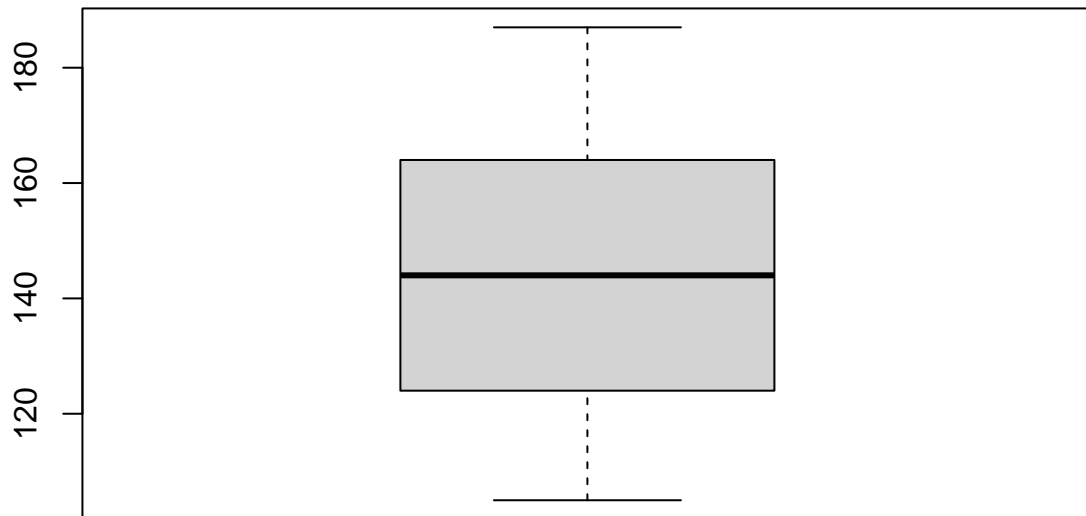
```
boxplot(bears$Pass_TD, main = "Boxplot of Passing Touchdowns Team Bears")
```

Boxplot of Passing Touchdowns Team Bears



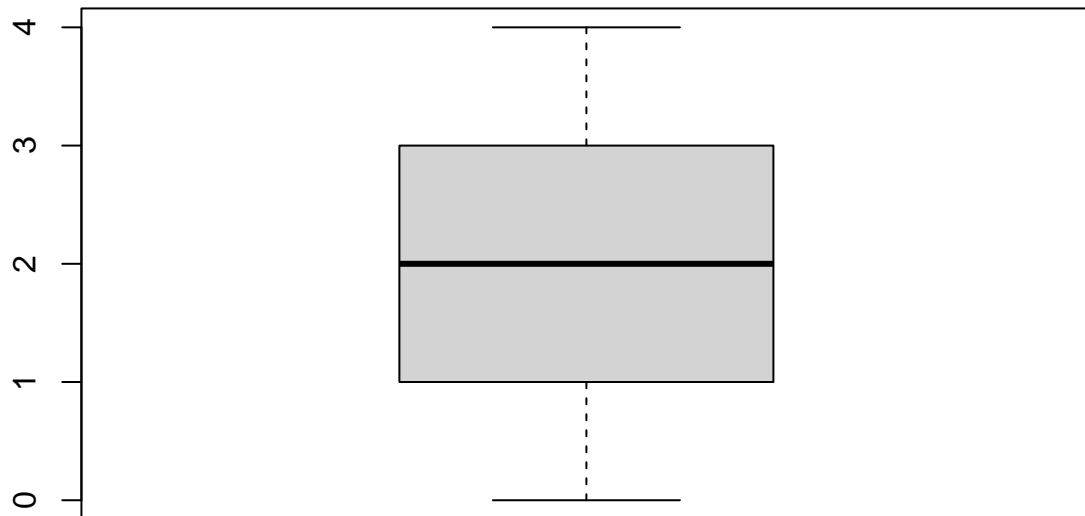
```
boxplot(lions$Rush_Yds, main = "Boxplot of Rushing Yards Team Lions")
```

Boxplot of Rushing Yards Team Lions



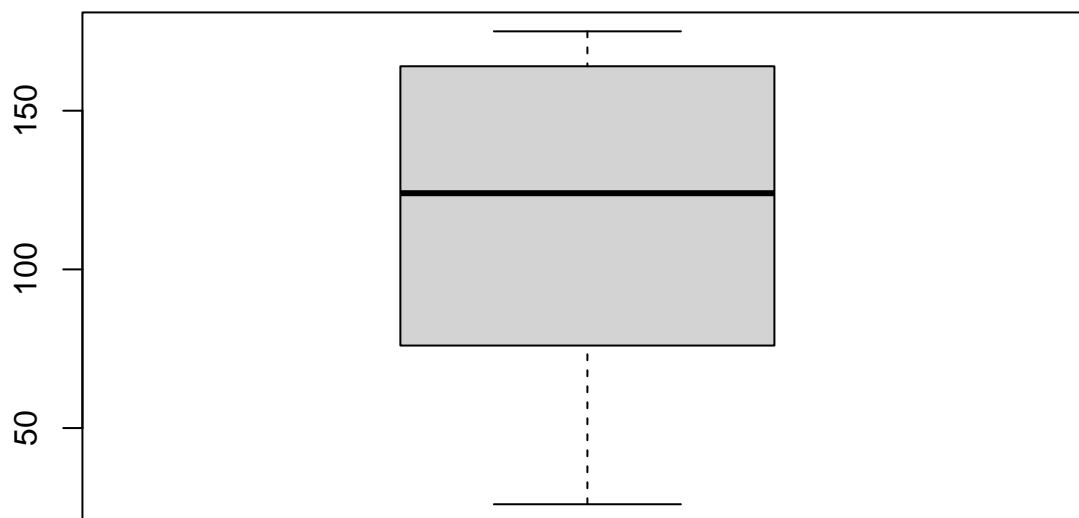
```
boxplot(lions$Pass_TD, main = "Boxplot of Passing Touchdowns Team Lions")
```

Boxplot of Passing Touchdowns Team Lions



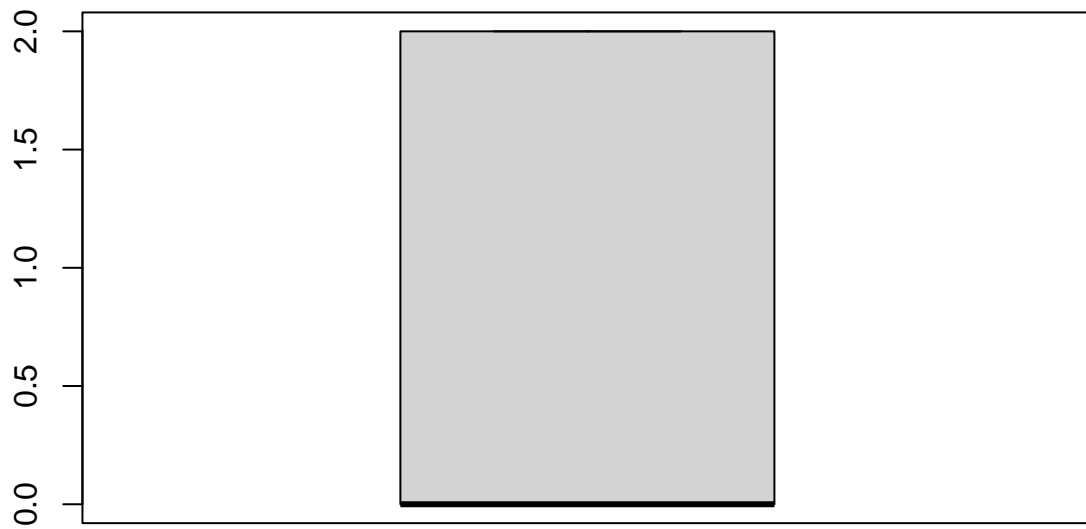
```
boxplot(giants$Rush_Yds, main = "Boxplot of Rushing Yards Team Giants")
```


Boxplot of Rushing Yards Team Giants



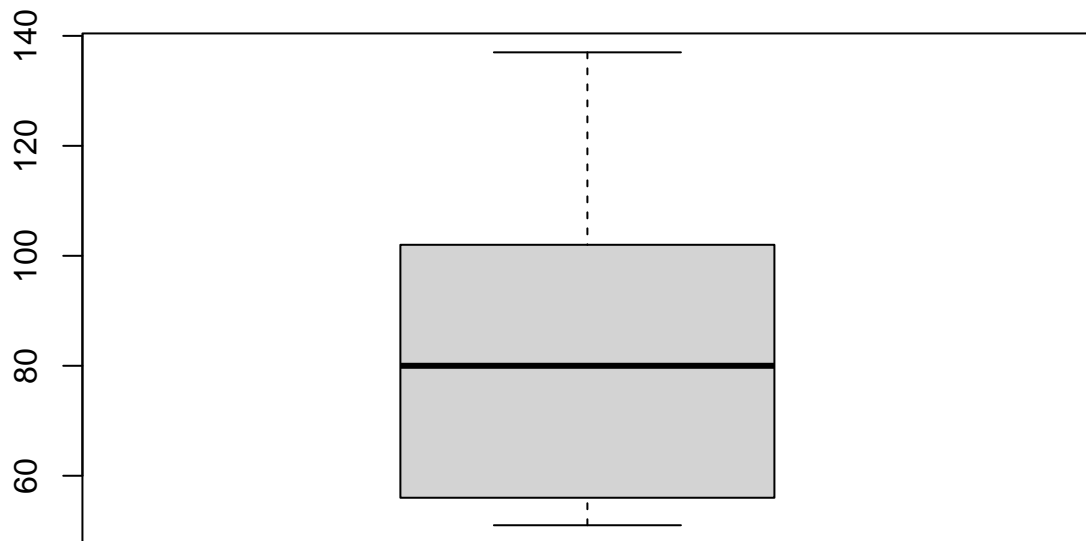
```
boxplot(giants$Pass_TD, main = "Boxplot of Passing Touchdowns Team Giants")
```

Boxplot of Passing Touchdowns Team Giants



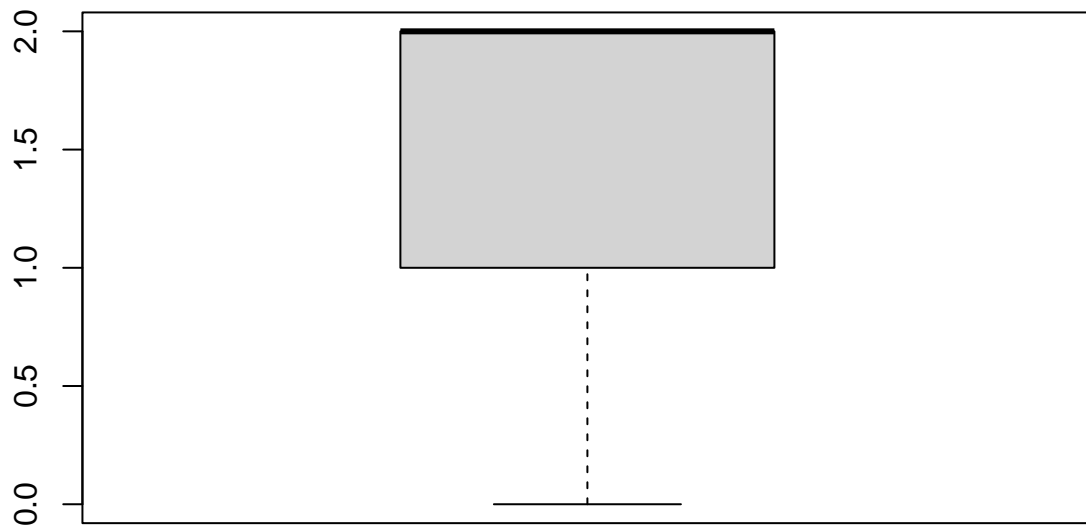
```
boxplot(cowboys$Rush_Yds, main = "Boxplot of Rushing Yards Team Cowboys")
```

Boxplot of Rushing Yards Team Cowboys



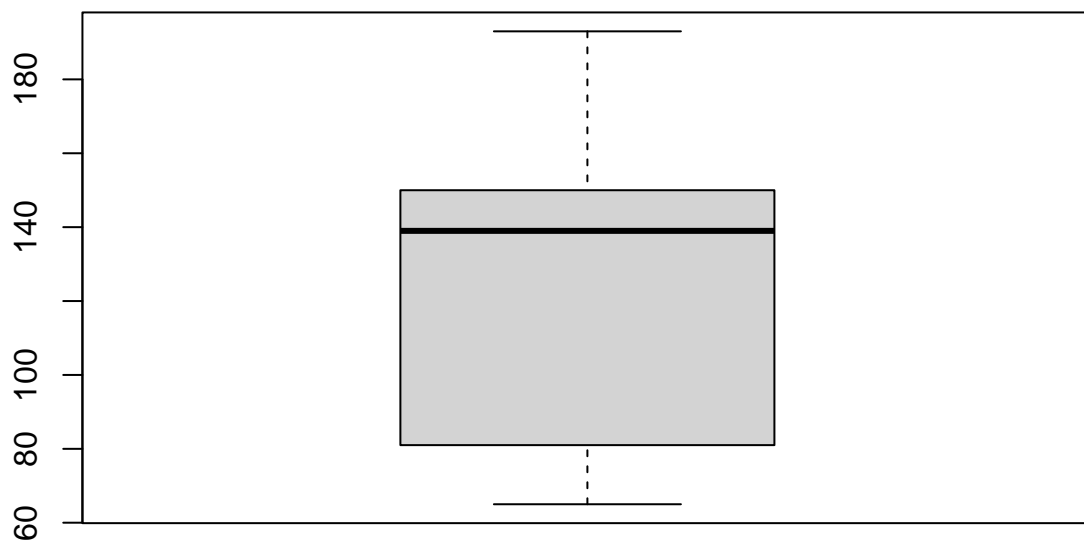
```
boxplot(cowboys$Pass_TD, main = "Boxplot of Passing Touchdowns Team Cowboys")
```

Boxplot of Passing Touchdowns Team Cowboys



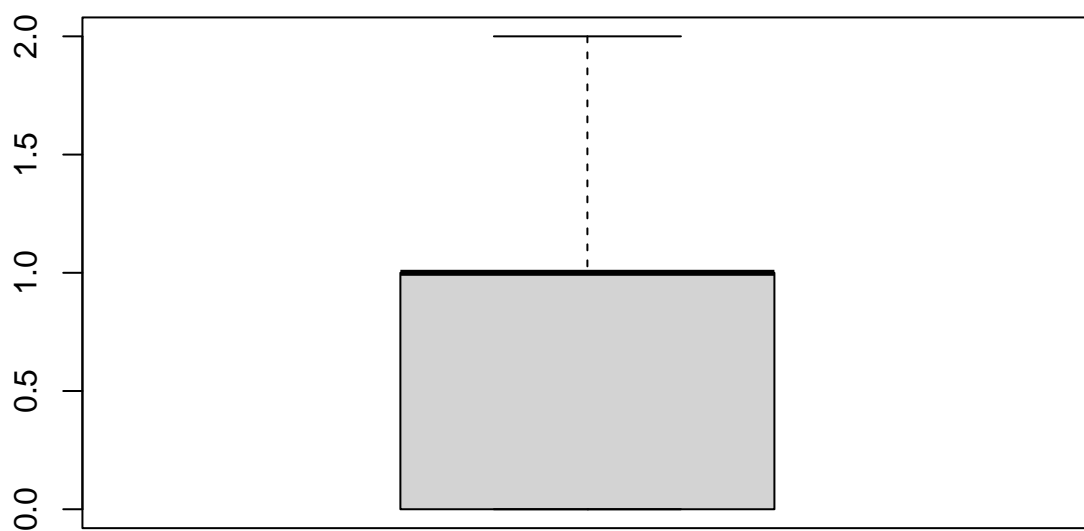
```
boxplot(dolphins$Rush_Yds, main = "Boxplot of Rushing Yards Team Dolphins")
```

Boxplot of Rushing Yards Team Dolphins



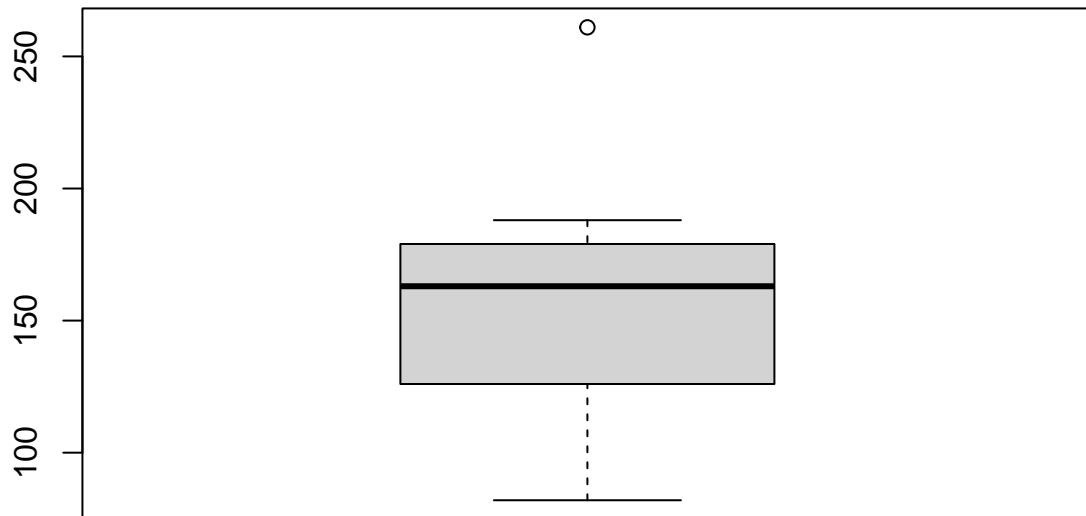
```
boxplot(dolphins$Pass_TD, main = "Boxplot of Passing Touchdowns Team Dolphins")
```

Boxplot of Passing Touchdowns Team Dolphins



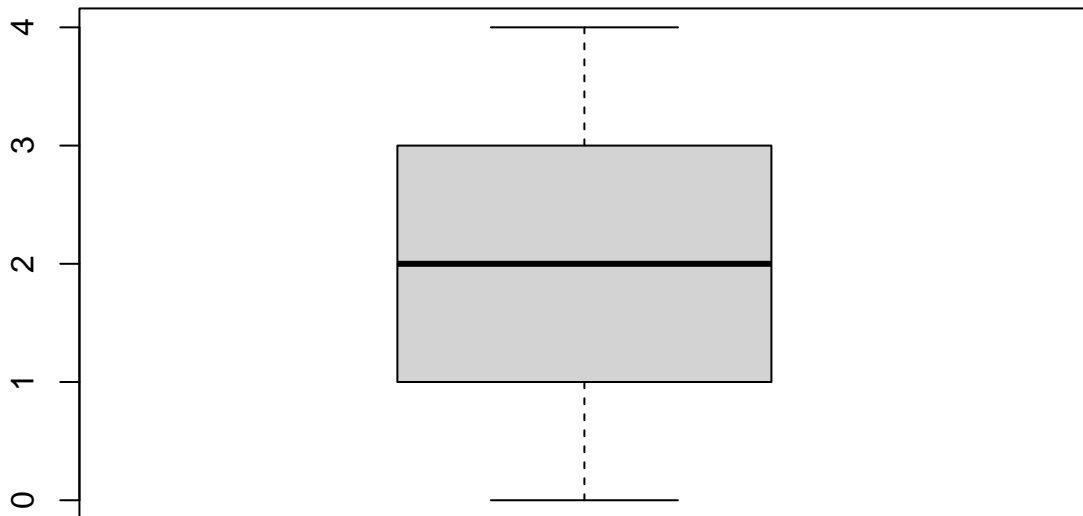
```
boxplot(packers$Rush_Yds, main = "Boxplot of Rushing Yards Team Packers")
```

Boxplot of Rushing Yards Team Packers



```
boxplot(packers$Pass_TD, main = "Boxplot of Passing Touchdowns Team Packers")
```

Boxplot of Passing Touchdowns Team Packers



#remove outlier

```
Q1 <- quantile(packers$Rush_Yds, 0.25, na.rm = TRUE)
Q3 <- quantile(packers$Rush_Yds, 0.75, na.rm = TRUE)
IQR_value <- Q3 - Q1
```

```
lower_threshold <- Q1 - 1.5 * IQR_value
upper_threshold <- Q3 + 1.5 * IQR_value
print(paste("Lower threshold:", lower_threshold))
```

```
## [1] "Lower threshold: 46.5"
```

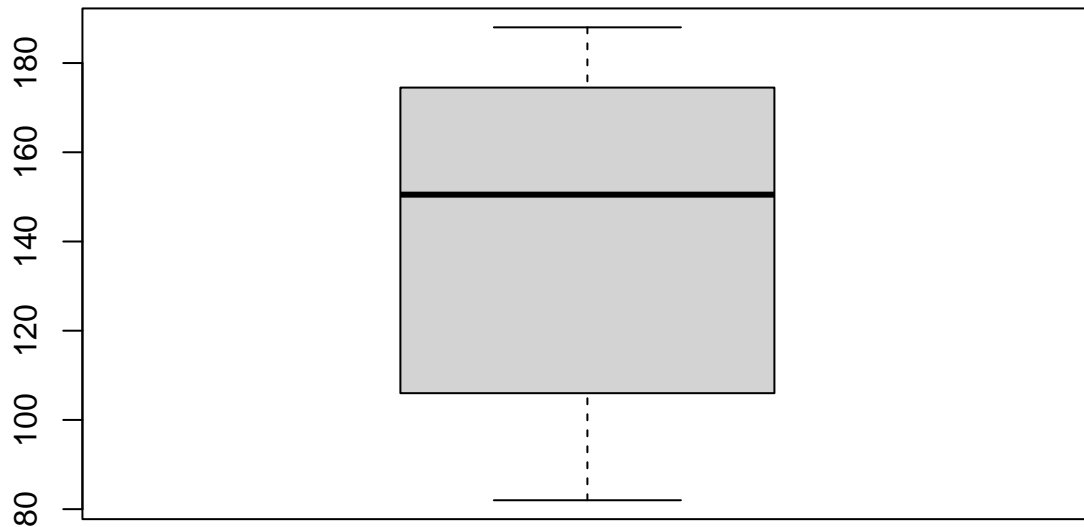
```
print(paste("Upper threshold:", upper_threshold))
```

```
## [1] "Upper threshold: 258.5"
```

```
packers_filtered <- packers[packers$Rush_Yds >= lower_threshold & packers$Rush_Yds <= upper_threshold, ]
```

```
boxplot(packers_filtered$Rush_Yds, main = "Boxplot of Rushing Yards Team Packers (Outliers Removed)")
```


Boxplot of Rushing Yards Team Packers (Outliers Removed)



```
#calculate correlation features
```

```
cor_bears <- cor(bears[, sapply(bears, is.numeric)], use = "pairwise.complete.obs")
```

```
bears_rush <- cor_bears["Rush_Yds", ]  
bears_rush <- bears_rush[abs(bears_rush) > 0.7]  
print("Correlation with rushing yards")
```

```
## [1] "Correlation with rushing yards"
```

```
print(bears_rush)
```

```
##      Rush_Yds      Rush_YA Field_Goals_Made Field_Goals_Att  
##      1.0000000      0.8994552      -0.7021648      -0.7775036  
## Fourth_Down_Conv Fourth_Down_Att      <NA>  
##      -0.7293242      -0.7397284      NA
```

```
bears_td <- cor_bears["Pass_TD", ]  
bears_td <- bears_td[abs(bears_td) > 0.7]  
print("Correlation with passing touchdowns")
```

```
## [1] "Correlation with passing touchdowns"
```

```
print(bears_td)
```

```
##           Score_Tm           Pass_TD           Sack_Yds
##           0.7315003           1.0000000           -0.7825520
##           Pass_ya           Pass_nya           Pass_Cmp_Percentage
##           0.7255303           0.7542035           0.7967342
##           Pass_Rate           Extra_Points_Made Extra_Points_Attempted
##           0.8512277           0.8528029           0.8407101
##           Punts           Punt_Yds           <NA>
##           -0.8215838           -0.8310651           NA
```

```
cor_lions <- cor(lions[, sapply(lions, is.numeric)], use = "pairwise.complete.obs")
```

```
lions_rush <- cor_lions["Rush_Yds", ]
lions_rush <- lions_rush[abs(lions_rush) > 0.5]
print("Correlation with rushing yards")
```

```
## [1] "Correlation with rushing yards"
```

```
print(lions_rush)
```

```
## Score_Opp Rush_Yds Rush_YA <NA>
## -0.6496883 1.0000000 0.5588807 NA
```

```
lions_td <- cor_lions["Pass_TD", ]
lions_td <- lions_td[abs(lions_td) > 0.7]
print("Correlation with passing touchdowns")
```

```
## [1] "Correlation with passing touchdowns"
```

```
print(lions_td)
```

```
##           Score_Tm           Pass_Att           Pass_TD
##           0.9026280           -0.7050240           1.0000000
##           Pass_Sacks           Sack_Yds           Extra_Points_Made
##           0.7306323           0.7312189           0.8882348
## Extra_Points_Attempted           Third_Down_Att           Fourth_Down_Conv
##           0.9185587           -0.8414758           -0.7470874
##           Fourth_Down_Att           <NA>
##           -0.7100469           NA
```

```
cor_giants <- cor(giants[, sapply(giants, is.numeric)], use = "pairwise.complete.obs")
```

```
giants_rush <- cor_giants["Rush_Yds", ]
giants_rush <- giants_rush[abs(giants_rush) > 0.7]
print("Correlation with rushing yards")
```

```
## [1] "Correlation with rushing yards"
```

```
print(giants_rush)
```

```
## Rush_Yds Rush_YA <NA>
## 1.0000000 0.8364108 NA
```

```
giants_td <- cor_giants["Pass_TD", ]
giants_td <- giants_td[abs(giants_td) > 0.7]
print("Correlation with passing touchdowns")
```

```
## [1] "Correlation with passing touchdowns"
```

```
print(giants_td)
```

```
## Score_Tm Pass_TD Pass_Int Pass_Rate <NA>
## 0.7344583 1.0000000 -0.7317917 0.9071450 NA
```

```
cor_cowboys <- cor(cowboys[, sapply(cowboys, is.numeric)], use = "pairwise.complete.obs")

cowboys_rush <- cor_cowboys["Rush_Yds", ]
cowboys_rush <- cowboys_rush[abs(cowboys_rush) > 0.7]
print("Correlation with rushing yards")
```

```
## [1] "Correlation with rushing yards"
```

```
print(cowboys_rush)
```

```
## Rush_Yds Rush_YA <NA>
## 1.0000000 0.8500239 NA
```

```
cowboys_td <- cor_cowboys["Pass_TD", ]
cowboys_td <- cowboys_td[abs(cowboys_td) > 0.7]
print("Correlation with passing touchdowns")
```

```
## [1] "Correlation with passing touchdowns"
```

```
print(cowboys_td)
```

```
## Pass_TD Pass_ya Pass_nya Pass_Rate <NA>
## 1.0000000 0.7160081 0.7672822 0.8349286 NA
```

```
cor_dolphins <- cor(dolphins[, sapply(dolphins, is.numeric)], use = "pairwise.complete.obs")

dolphins_rush <- cor_dolphins["Rush_Yds", ]
dolphins_rush <- dolphins_rush[abs(dolphins_rush) > 0.7]
print("Correlation with rushing yards")
```

```
## [1] "Correlation with rushing yards"
```

```
print(dolphins_rush)
```

```
##      Sack_Yds   Rush_Att   Rush_Yds   Rush_YA      <NA>
## -0.7639721  0.8896409  1.0000000  0.7601700      NA
```

```
dolphins_td <- cor_dolphins["Pass_TD", ]
dolphins_td <- dolphins_td[abs(dolphins_td) > 0.7]
print("Correlation with passing touchdowns")
```

```
## [1] "Correlation with passing touchdowns"
```

```
print(dolphins_td)
```

```
##           Pass_TD           Pass_nya   Pass_Cmp_Percentage
##           1.0000000           0.7782195           0.7358487
##           Pass_Rate   Extra_Points_Made Extra_Points_Attempted
##           0.7566470           0.8675276           0.8675276
##           <NA>
##           NA
```

```
cor_packers <- cor(packers[, sapply(packers, is.numeric)], use = "pairwise.complete.obs")
```

```
packers_rush <- cor_packers["Rush_Yds", ]
packers_rush <- packers_rush[abs(packers_rush) > 0.7]
print("Correlation with rushing yards")
```

```
## [1] "Correlation with rushing yards"
```

```
print(packers_rush)
```

```
##           Pass_Cmp   Pass_Att   Pass_Int   Pass_nya
##          -0.7530319  -0.7618262  -0.8529777   0.7901611
##           Pass_Rate   Rush_Att   Rush_Yds Field_Goals_Made
##           0.7008398   0.8901823   1.0000000   0.8136659
## Field_Goals_Att Third_Down_Conv Third_Down_Att      <NA>
##           0.7819559   0.7024368   0.7489959      NA
```

```
packers_td <- cor_packers["Pass_TD", ]
packers_td <- packers_td[abs(packers_td) > 0.7]
print("Correlation with passing touchdowns")
```

```
## [1] "Correlation with passing touchdowns"
```

```
print(packers_td)
```

```
##           Pass_TD   Extra_Points_Made Extra_Points_Attempted
##           1.0000000           0.7150969           0.7150969
##           <NA>
##           NA
```

#AIC

```
full_mod1 <- lm(Rush_Yds ~ Pass_Cmp + Pass_Att + Pass_Sacks + Sack_Yds + Rush_Att + Rush_YA + Rush_TD +  
  Third_Down_Conv + Fourth_Down_Att + Fourth_Down_Conv,  
  data = bears)
```

```
null_mod1 <- lm(Rush_Yds ~ 1, data = bears)
```

```
stepwise_mod1 <- step(null_mod1, scope = list(lower = null_mod1, upper = full_mod1),  
  direction = "both")
```

```
## Start: AIC=70.61
```

```
## Rush_Yds ~ 1
```

```
##
```

	Df	Sum of Sq	RSS	AIC
## + Rush_YA	1	14899.6	3517.3	57.714
## + Field_Goals_Att	1	11133.2	7283.7	64.265
## + Fourth_Down_Att	1	10077.7	8339.2	65.483
## + Fourth_Down_Conv	1	9796.2	8620.7	65.782
## + Field_Goals_Made	1	9080.2	9336.7	66.500
## + Rush_TD	1	9000.0	9416.9	66.577
## + Pass_Att	1	8822.0	9594.9	66.746
## + Rush_Att	1	8253.6	10163.3	67.264
## + Sack_Yds	1	7395.3	11021.6	67.994
## + Pass_Sacks	1	5388.9	13027.9	69.499
## + Pass_Cmp	1	5313.8	13103.1	69.550
## + Extra_Points_Made	1	5111.3	13305.6	69.688
## + Extra_Points_Attempted	1	4937.6	13479.3	69.805
## <none>			18416.9	70.614
## + Third_Down_Conv	1	1534.4	16882.5	71.831

```
##
```

```
## Step: AIC=57.71
```

```
## Rush_Yds ~ Rush_YA
```

```
##
```

	Df	Sum of Sq	RSS	AIC
## + Rush_Att	1	3407.6	109.6	28.498
## + Rush_TD	1	2201.9	1315.3	50.862
## + Sack_Yds	1	1666.5	1850.8	53.935
## + Pass_Sacks	1	1552.6	1964.7	54.473
## + Field_Goals_Att	1	928.6	2588.7	56.955
## + Extra_Points_Attempted	1	880.6	2636.7	57.120
## + Field_Goals_Made	1	859.7	2657.5	57.191
## <none>			3517.3	57.714
## + Third_Down_Conv	1	558.1	2959.2	58.159
## + Fourth_Down_Conv	1	541.8	2975.5	58.208
## + Extra_Points_Made	1	530.1	2987.2	58.244
## + Fourth_Down_Att	1	417.8	3099.5	58.576
## + Pass_Cmp	1	245.5	3271.7	59.063
## + Pass_Att	1	24.7	3492.6	59.650
## - Rush_YA	1	14899.6	18416.9	70.614

```
##
```

```
## Step: AIC=28.5
```

```
## Rush_Yds ~ Rush_YA + Rush_Att
```

```

##
##              Df Sum of Sq    RSS    AIC
## + Pass_Att      1      48.8    60.8 25.194
## + Extra_Points_Attempted 1      47.9    61.7 25.328
## + Extra_Points_Made      1      40.0    69.6 26.410
## + Sack_Yds          1      29.9    79.7 27.627
## + Fourth_Down_Att      1      22.4    87.3 28.446
## <none>                      109.6 28.498
## + Third_Down_Conv      1       9.2   100.5 29.712
## + Pass_Sacks          1       8.5   101.1 29.774
## + Rush_TD            1       5.9   103.7 30.002
## + Fourth_Down_Conv      1       4.3   105.3 30.137
## + Pass_Cmp           1       1.9   107.8 30.343
## + Field_Goals_Att      1       1.7   107.9 30.358
## + Field_Goals_Made      1       1.4   108.2 30.380
## - Rush_Att           1    3407.6  3517.3 57.714
## - Rush_YA            1   10053.6 10163.3 67.264
##
## Step:  AIC=25.19
## Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att
##
##              Df Sum of Sq    RSS    AIC
## + Extra_Points_Made      1      32.2    28.6 20.402
## + Extra_Points_Attempted 1      30.9    29.9 20.808
## + Pass_Cmp               1      30.6    30.2 20.909
## + Sack_Yds               1      25.8    35.0 22.228
## + Fourth_Down_Conv       1      22.1    38.8 23.141
## + Field_Goals_Made       1      17.1    43.7 24.220
## <none>                      60.8 25.194
## + Rush_TD               1      11.2    49.6 25.355
## + Third_Down_Conv        1       9.5    51.3 25.666
## + Pass_Sacks             1       4.2    56.6 26.542
## + Field_Goals_Att        1       1.3    59.5 26.996
## + Fourth_Down_Att        1       0.0    60.8 27.194
## - Pass_Att               1      48.8   109.6 28.498
## - Rush_Att               1    3431.7  3492.6 59.650
## - Rush_YA                1    4662.8  4723.6 62.368
##
## Step:  AIC=20.4
## Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att + Extra_Points_Made
##
##              Df Sum of Sq    RSS    AIC
## + Fourth_Down_Conv       1      21.7     6.9  9.552
## + Fourth_Down_Att        1      15.3    13.3 15.494
## + Rush_TD                1      11.5    17.1 17.779
## + Field_Goals_Made       1       7.7    20.9 19.566
## <none>                      28.6 20.402
## + Field_Goals_Att        1       3.6    25.0 21.188
## + Extra_Points_Attempted 1       2.4    26.2 21.624
## + Third_Down_Conv        1       2.0    26.6 21.751
## + Pass_Cmp               1       0.4    28.2 22.278
## + Pass_Sacks             1       0.1    28.5 22.368
## + Sack_Yds               1       0.0    28.6 22.402
## - Extra_Points_Made      1      32.2    60.8 25.194

```

```

## - Pass_Att          1      41.0   69.6 26.410
## - Rush_Att          1    2904.7 2933.3 60.080
## - Rush_YA           1    4681.3 4709.9 64.342
##
## Step:  AIC=9.55
## Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att + Extra_Points_Made +
##   Fourth_Down_Conv
##
##              Df Sum of Sq   RSS   AIC
## + Sack_Yds      1      6.3    0.5 -11.373
## + Pass_Cmp      1      5.8    1.0  -5.457
## + Field_Goals_Att 1      3.6    3.2   4.756
## + Field_Goals_Made 1      3.4    3.5   5.380
## + Pass_Sacks    1      2.8    4.1   6.837
## + Rush_TD       1      1.9    5.0   8.642
## <none>                      6.9   9.552
## + Extra_Points_Attempted 1      1.3    5.6   9.701
## + Fourth_Down_Att 1      1.2    5.7   9.865
## + Third_Down_Conv 1      0.0    6.8  11.535
## - Fourth_Down_Conv 1     21.7   28.6  20.402
## - Extra_Points_Made 1     31.9   38.8  23.141
## - Pass_Att       1     60.0   66.9  28.052
## - Rush_Att       1    1932.6 1939.4  58.356
## - Rush_YA        1    4698.7 4705.6  66.333
##
## Step:  AIC=-11.37
## Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att + Extra_Points_Made +
##   Fourth_Down_Conv + Sack_Yds
##
##              Df Sum of Sq   RSS   AIC
## + Extra_Points_Attempted 1      0.5    0.0 -64.998
## + Fourth_Down_Att 1      0.5    0.0 -31.404
## + Pass_Sacks 1      0.4    0.1 -23.140
## + Rush_TD 1      0.2    0.3 -14.120
## + Pass_Cmp 1      0.2    0.4 -12.383
## + Third_Down_Conv 1      0.1    0.4 -12.224
## <none>                      0.5 -11.373
## + Field_Goals_Made 1      0.0    0.5 -10.168
## + Field_Goals_Att 1      0.0    0.5  -9.961
## - Sack_Yds 1      6.3    6.9   9.552
## - Extra_Points_Made 1     20.8   21.3  19.771
## - Fourth_Down_Conv 1     28.1   28.6  22.402
## - Pass_Att 1     66.3   66.9  30.049
## - Rush_Att 1    469.2  469.8  47.595
## - Rush_YA 1   4697.0 4697.5  68.318
##
## Step:  AIC=-65
## Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att + Extra_Points_Made +
##   Fourth_Down_Conv + Sack_Yds + Extra_Points_Attempted
##
##              Df Sum of Sq   RSS   AIC
## + Pass_Cmp 1      0.00    0.00 -Inf
## + Pass_Sacks 1      0.00    0.00 -Inf
## + Rush_TD 1      0.00    0.00 -Inf

```

```
## + Field_Goals_Made      1      0.00  0.00 -Inf
## + Field_Goals_Att      1      0.00  0.00 -Inf
## + Third_Down_Conv      1      0.00  0.00 -Inf
## + Fourth_Down_Att      1      0.00  0.00 -Inf
## <none>                  0.00 -65
## - Extra_Points_Attempted 1      0.54  0.54 -11
## - Extra_Points_Made     1      2.22  2.22  1
## - Sack_Yds              1      5.58  5.58 10
## - Fourth_Down_Conv      1     26.20 26.21 24
## - Pass_Att              1     38.44 38.45 27
## - Rush_Att              1    196.31 196.31 42
## - Rush_YA               1    745.37 745.37 54
##
## Step: AIC=-Inf
## Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att + Extra_Points_Made +
##      Fourth_Down_Conv + Sack_Yds + Extra_Points_Attempted + Pass_Cmp

## Warning: attempting model selection on an essentially perfect fit is nonsense
## Warning: attempting model selection on an essentially perfect fit is nonsense
```

```
##              Df Sum of Sq    RSS  AIC
## <none>                  0.00 -Inf
## - Pass_Cmp              1      0.00  0.00 -65
## - Extra_Points_Attempted 1      0.38  0.38 -12
## - Extra_Points_Made     1      0.72  0.72 -7
## - Sack_Yds              1      0.97  0.97 -4
## - Pass_Att              1      3.16  3.16  7
## - Fourth_Down_Conv      1     25.74 25.74 25
## - Rush_Att              1     75.41 75.41 35
## - Rush_YA               1    326.61 326.61 48
```

```
summary(stepwise_mod1)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att + Extra_Points_Made +
##      Fourth_Down_Conv + Sack_Yds + Extra_Points_Attempted + Pass_Cmp,
##      data = bears)
##
## Residuals:
## ALL 9 residuals are 0: no residual degrees of freedom!
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -126.97362         NaN      NaN    NaN
## Rush_YA         35.05118         NaN      NaN    NaN
## Rush_Att        3.10276         NaN      NaN    NaN
## Pass_Att        0.91138         NaN      NaN    NaN
## Extra_Points_Made -5.78348         NaN      NaN    NaN
## Fourth_Down_Conv -3.50555         NaN      NaN    NaN
## Sack_Yds       -0.22847         NaN      NaN    NaN
## Extra_Points_Attempted 2.90170         NaN      NaN    NaN
## Pass_Cmp       -0.02808         NaN      NaN    NaN
```



```
##
## Residual standard error: NaN on 0 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared: 1, Adjusted R-squared: NaN
## F-statistic: NaN on 8 and 0 DF, p-value: NA
```

```
full_mod2 <- lm(Rush_Yds ~ Rush_YA + Score_Opp + Score_Tm + Pass_Att + Pass_TD + Pass_Sacks + Sack_Yds +
null_mod2 <- lm(Rush_Yds ~ 1, data = lions)

stepwise_mod2 <- step(null_mod2, scope = list(lower = null_mod2, upper = full_mod2),
direction = "both")
```

```
## Start: AIC=61.7
## Rush_Yds ~ 1
##
##           Df Sum of Sq    RSS    AIC
## + Score_Opp      1  2887.13 3952.9 58.765
## + Rush_YA        1  2136.46 4703.5 60.330
## <none>                        6840.0 61.700
## + Pass_Sacks      1  1299.41 5540.6 61.804
## + Sack_Yds        1  1022.46 5817.5 62.243
## + Pass_TD         1   330.75 6509.2 63.254
## + Score_Tm        1   264.49 6575.5 63.345
## + Extra_Points_Attempted 1  231.13 6608.9 63.390
## + Pass_Att        1    72.00 6768.0 63.605
## + Fourth_Down_Att  1    68.45 6771.5 63.609
## + Extra_Points_Made  1    62.73 6777.3 63.617
## + Fourth_Down_Conv  1    39.12 6800.9 63.648
## + Third_Down_Att   1    27.94 6812.1 63.663
##
## Step: AIC=58.76
## Rush_Yds ~ Score_Opp
##
##           Df Sum of Sq    RSS    AIC
## + Pass_Sacks      1  1535.62 2417.2 56.338
## + Sack_Yds        1  1352.36 2600.5 56.996
## + Rush_YA        1  1253.63 2699.2 57.332
## <none>                        3952.9 58.765
## + Fourth_Down_Conv  1   432.32 3520.6 59.722
## + Pass_TD         1   146.24 3806.6 60.425
## + Extra_Points_Attempted 1  142.02 3810.8 60.435
## + Score_Tm        1    85.84 3867.0 60.567
## + Extra_Points_Made  1    55.70 3897.2 60.637
## + Third_Down_Att   1    49.75 3903.1 60.651
## + Pass_Att        1    34.78 3918.1 60.685
## + Fourth_Down_Att  1    14.26 3938.6 60.732
## - Score_Opp       1  2887.13 6840.0 61.700
##
## Step: AIC=56.34
## Rush_Yds ~ Score_Opp + Pass_Sacks
##
##           Df Sum of Sq    RSS    AIC
```

```

## + Extra_Points_Made      1  1660.02  757.2 47.892
## + Extra_Points_Attempted 1  1409.93 1007.3 50.460
## + Third_Down_Att         1  1047.73 1369.5 53.225
## + Score_Tm               1  1024.26 1393.0 53.378
## + Pass_TD                1   648.66 1768.6 55.526
## + Pass_Att               1   608.34 1808.9 55.729
## <none>                   2417.2 56.338
## + Sack_Yds               1   465.58 1951.7 56.413
## + Fourth_Down_Att        1   294.17 2123.1 57.171
## + Rush_YA                1   167.82 2249.4 57.691
## + Fourth_Down_Conv       1    6.87 2410.4 58.313
## - Pass_Sacks             1  1535.62 3952.9 58.765
## - Score_Opp              1  3123.34 5540.6 61.804
##
## Step:  AIC=47.89
## Rush_Yds ~ Score_Opp + Pass_Sacks + Extra_Points_Made
##
##           Df Sum of Sq  RSS  AIC
## + Pass_Att      1    194.2  563.0 47.225
## <none>          757.2 47.892
## + Score_Tm      1     95.8  661.4 48.675
## + Rush_YA       1     66.7  690.5 49.062
## + Extra_Points_Attempted 1     58.7  698.6 49.166
## + Pass_TD       1     51.2  706.0 49.261
## + Fourth_Down_Att 1     31.0  726.3 49.516
## + Third_Down_Att 1     17.0  740.2 49.687
## + Fourth_Down_Conv 1      0.6  756.7 49.885
## + Sack_Yds      1      0.1  757.1 49.891
## - Extra_Points_Made 1  1660.0 2417.2 56.338
## - Pass_Sacks    1  3139.9 3897.2 60.637
## - Score_Opp     1  3527.6 4284.9 61.491
##
## Step:  AIC=47.22
## Rush_Yds ~ Score_Opp + Pass_Sacks + Extra_Points_Made + Pass_Att
##
##           Df Sum of Sq  RSS  AIC
## + Extra_Points_Attempted 1    209.6  353.4 45.034
## + Third_Down_Att         1    186.1  376.9 45.612
## + Pass_TD                1    181.0  382.1 45.736
## + Fourth_Down_Conv       1    176.0  387.0 45.851
## + Fourth_Down_Att        1    140.5  422.5 46.641
## <none>                   563.0 47.225
## - Pass_Att              1    194.2  757.2 47.892
## + Score_Tm              1     45.8  517.2 48.462
## + Sack_Yds              1     33.4  529.7 48.675
## + Rush_YA               1      8.1  555.0 49.095
## - Extra_Points_Made     1  1245.9 1808.9 55.729
## - Pass_Sacks            1  3332.0 3895.0 62.632
## - Score_Opp             1  3645.8 4208.8 63.329
##
## Step:  AIC=45.03
## Rush_Yds ~ Score_Opp + Pass_Sacks + Extra_Points_Made + Pass_Att +
##           Extra_Points_Attempted
##

```

```

##              Df Sum of Sq      RSS      AIC
## + Score_Tm      1      205.22   148.19 39.212
## + Sack_Yds      1      190.74   162.67 40.051
## + Fourth_Down_Att 1      103.23   250.18 43.925
## <none>                      353.41 45.034
## + Third_Down_Att 1       68.60   284.81 45.091
## + Pass_TD       1       56.96   296.45 45.452
## + Fourth_Down_Conv 1      51.75   301.67 45.609
## + Rush_YA       1        1.92   351.50 46.985
## - Extra_Points_Attempted 1     209.62   563.03 47.225
## - Pass_Att      1     345.15   698.56 49.166
## - Extra_Points_Made 1     514.66   868.08 51.122
## - Pass_Sacks    1    2444.53  2797.95 61.655
## - Score_Opp     1    2464.95  2818.36 61.720
##
## Step:  AIC=39.21
## Rush_Yds ~ Score_Opp + Pass_Sacks + Extra_Points_Made + Pass_Att +
##      Extra_Points_Attempted + Score_Tm
##
##              Df Sum of Sq      RSS      AIC
## + Pass_TD      1     106.55    41.64 29.787
## + Fourth_Down_Conv 1      83.50    64.70 33.752
## + Sack_Yds      1      50.77    97.43 37.437
## <none>                      148.19 39.212
## + Rush_YA      1      11.17   137.02 40.506
## + Fourth_Down_Att 1       4.78   143.41 40.916
## + Third_Down_Att 1       0.89   147.30 41.157
## - Score_Tm     1     205.22   353.41 45.034
## - Pass_Att     1     318.66   466.86 47.539
## - Extra_Points_Attempted 1     369.05   517.24 48.462
## - Extra_Points_Made 1     683.68   831.88 52.738
## - Score_Opp    1    1147.49  1295.69 56.726
## - Pass_Sacks   1    2128.21  2276.41 61.798
##
## Step:  AIC=29.79
## Rush_Yds ~ Score_Opp + Pass_Sacks + Extra_Points_Made + Pass_Att +
##      Extra_Points_Attempted + Score_Tm + Pass_TD
##
##              Df Sum of Sq      RSS      AIC
## + Rush_YA      1      41.64     0.00 -Inf
## + Sack_Yds      1      41.64     0.00 -Inf
## + Third_Down_Att 1      41.64     0.00 -Inf
## + Fourth_Down_Conv 1      41.64     0.00 -Inf
## + Fourth_Down_Att 1      41.64     0.00 -Inf
## <none>                      41.64    30
## - Pass_TD      1     106.55   148.19    39
## - Pass_Att     1     120.56   162.20    40
## - Score_Tm     1     254.81   296.45    45
## - Score_Opp    1     315.69   357.34    47
## - Extra_Points_Attempted 1     340.43   382.07    48
## - Extra_Points_Made 1     508.24   549.88    51
## - Pass_Sacks   1     984.83  1026.47    57
##
## Step:  AIC=-Inf

```

```
## Rush_Yds ~ Score_Opp + Pass_Sacks + Extra_Points_Made + Pass_Att +
## Extra_Points_Attempted + Score_Tm + Pass_TD + Rush_YA
```

```
## Warning: attempting model selection on an essentially perfect fit is nonsense
## Warning: attempting model selection on an essentially perfect fit is nonsense
```

```
##           Df Sum of Sq    RSS   AIC
## <none>                0.00 -Inf
## - Pass_Att           1    11.65  11.65   18
## - Rush_YA            1    41.64  41.64   30
## - Score_Opp          1   116.93 116.93   39
## - Pass_TD            1   137.02 137.02   41
## - Pass_Sacks         1   225.01 225.01   45
## - Score_Tm           1   294.83 294.83   47
## - Extra_Points_Attempted 1   380.60 380.60   50
## - Extra_Points_Made   1   541.74 541.74   53
```

```
summary(stepwise_mod2)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Score_Opp + Pass_Sacks + Extra_Points_Made +
## Pass_Att + Extra_Points_Attempted + Score_Tm + Pass_TD +
## Rush_YA, data = lions)
##
## Residuals:
## ALL 9 residuals are 0: no residual degrees of freedom!
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)      74.552         NaN      NaN      NaN
## Score_Opp        -1.178         NaN      NaN      NaN
## Pass_Sacks       12.664         NaN      NaN      NaN
## Extra_Points_Made -83.587         NaN      NaN      NaN
## Pass_Att          0.248         NaN      NaN      NaN
## Extra_Points_Attempted 66.717         NaN      NaN      NaN
## Score_Tm          4.152         NaN      NaN      NaN
## Pass_TD         -19.997         NaN      NaN      NaN
## Rush_YA           4.818         NaN      NaN      NaN
##
## Residual standard error: NaN on 0 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  1, Adjusted R-squared:  NaN
## F-statistic:  NaN on 8 and 0 DF, p-value: NA
```

```
full_mod3 <- lm(Rush_Yds ~ Rush_YA + Score_Tm + Pass_TD + Pass_Int + Pass_Rate, data = giants)
```

```
null_mod3 <- lm(Rush_Yds ~ 1, data = giants)
```

```
stepwise_mod3 <- step(null_mod3, scope = list(lower = null_mod3, upper = full_mod3),
direction = "both")
```

```

## Start: AIC=78.77
## Rush_Yds ~ 1
##
##           Df Sum of Sq    RSS    AIC
## + Rush_YA   1  15092.0  6480.9  68.740
## + Score_Tm   1   8320.2 13252.7  75.894
## + Pass_TD    1   4200.1 17372.8  78.601
## <none>                21572.9  78.766
## + Pass_Rate   1   2114.1 19458.8  79.735
## + Pass_Int    1    501.3 21071.6  80.531
##
## Step: AIC=68.74
## Rush_Yds ~ Rush_YA
##
##           Df Sum of Sq    RSS    AIC
## + Score_Tm   1   2735.1  3745.8  65.258
## <none>                6480.9  68.740
## + Pass_TD    1    611.6  5869.2  69.749
## + Pass_Rate   1    474.3  6006.6  69.980
## + Pass_Int    1     31.0  6449.8  70.692
## - Rush_YA    1  15092.0 21572.9  78.766
##
## Step: AIC=65.26
## Rush_Yds ~ Rush_YA + Score_Tm
##
##           Df Sum of Sq    RSS    AIC
## + Pass_Rate   1     757.0  2988.7  65.000
## <none>                3745.8  65.258
## + Pass_Int    1    611.5  3134.2  65.475
## + Pass_TD    1    275.6  3470.1  66.494
## - Score_Tm    1   2735.1  6480.9  68.740
## - Rush_YA    1   9507.0 13252.7  75.894
##
## Step: AIC=65
## Rush_Yds ~ Rush_YA + Score_Tm + Pass_Rate
##
##           Df Sum of Sq    RSS    AIC
## <none>                2988.7  65.000
## - Pass_Rate   1     757.0  3745.8  65.258
## + Pass_TD    1    101.5  2887.3  66.655
## + Pass_Int    1      1.2  2987.6  66.996
## - Score_Tm    1   3017.8  6006.6  69.980
## - Rush_YA    1   8862.6 11851.3  76.776

summary(stepwise_mod3)

##
## Call:
## lm(formula = Rush_Yds ~ Rush_YA + Score_Tm + Pass_Rate, data = giants)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -23.378 -16.089   1.115  11.584  31.080
##

```

```
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)   6.7450    30.3484   0.222  0.83149
## Rush_YA      22.3572     5.3004   4.218  0.00557 **
## Score_Tm      3.7021     1.5041   2.461  0.04903 *
## Pass_Rate    -0.5313     0.4309  -1.233  0.26377
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 22.32 on 6 degrees of freedom
## (7 observations deleted due to missingness)
## Multiple R-squared:  0.8615, Adjusted R-squared:  0.7922
## F-statistic: 12.44 on 3 and 6 DF,  p-value: 0.005506

full_mod4 <- lm(Rush_Yds ~ Rush_YA + Pass_TD + Pass_ya + Pass_nya + Pass_Rate, data = cowboys)
null_mod4 <- lm(Rush_Yds ~ 1, data = cowboys)

stepwise_mod4 <- step(null_mod4, scope = list(lower = null_mod4, upper = full_mod4),
                      direction = "both")

## Start:  AIC=61.95
## Rush_Yds ~ 1
##
##           Df Sum of Sq    RSS    AIC
## + Rush_YA   1    5080.9 1951.1 52.410
## <none>                        7032.0 61.949
## + Pass_ya   1     366.5 6665.5 63.467
## + Pass_nya  1     299.1 6732.9 63.558
## + Pass_Rate 1     264.4 6767.6 63.604
## + Pass_TD   1     170.7 6861.3 63.728
##
## Step:  AIC=52.41
## Rush_Yds ~ Rush_YA
##
##           Df Sum of Sq    RSS    AIC
## <none>                        1951.1 52.410
## + Pass_Rate 1      64.0 1887.1 54.110
## + Pass_ya   1      54.9 1896.2 54.153
## + Pass_nya  1      39.5 1911.6 54.226
## + Pass_TD   1       4.6 1946.5 54.389
## - Rush_YA   1    5080.9 7032.0 61.949

summary(stepwise_mod4)

##
## Call:
## lm(formula = Rush_Yds ~ Rush_YA, data = cowboys)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -19.385  -9.243  -2.385   8.225  31.719
```

```
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -3.173      21.087   -0.15  0.8846
## Rush_YA      22.987       5.384    4.27  0.0037 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 16.7 on 7 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.7225, Adjusted R-squared:  0.6829
## F-statistic: 18.23 on 1 and 7 DF, p-value: 0.003703

full_mod5 <- lm(Rush_Yds ~ Sack_Yds + Rush_Att + Rush_YA + Pass_TD + Pass_nya + Pass_Cmp_Percentage + P
              data = dolphins)

null_mod5 <- lm(Rush_Yds ~ 1, data = dolphins)

stepwise_mod5 <- step(null_mod5, scope = list(lower = null_mod5, upper = full_mod5),
                     direction = "both")

## Start:  AIC=71
## Rush_Yds ~ 1
##
##           Df Sum of Sq    RSS    AIC
## + Rush_Att      1  15221.6 4010.7 58.895
## + Sack_Yds      1  11225.0 8007.3 65.118
## + Rush_YA       1  11113.5 8118.7 65.242
## <none>                  19232.2 71.004
## + Pass_TD       1    403.8 18828.5 72.813
## + Pass_nya      1    247.1 18985.2 72.888
## + Pass_Cmp_Percentage 1    71.6 19160.7 72.971
## + Pass_Rate     1     9.3 19222.9 73.000
## + Extra_Points_Made 1     0.6 19231.6 73.004
## + Extra_Points_Attempted 1     0.6 19231.6 73.004
##
## Step:  AIC=58.9
## Rush_Yds ~ Rush_Att
##
##           Df Sum of Sq    RSS    AIC
## + Rush_YA      1   3909.1   101.5 27.808
## + Sack_Yds     1   1078.7  2931.9 58.076
## + Extra_Points_Made 1    999.7  3011.0 58.315
## + Extra_Points_Attempted 1    999.7  3011.0 58.315
## <none>                  4010.7 58.895
## + Pass_Cmp_Percentage 1    692.5  3318.2 59.190
## + Pass_Rate      1    646.8  3363.9 59.313
## + Pass_TD       1    283.2  3727.4 60.236
## + Pass_nya      1    100.4  3910.3 60.667
## - Rush_Att      1  15221.6 19232.2 71.004
##
## Step:  AIC=27.81
## Rush_Yds ~ Rush_Att + Rush_YA
```

```

##
##              Df Sum of Sq    RSS    AIC
## + Sack_Yds      1      50.6   51.0 23.604
## <none>                      101.5 27.808
## + Pass_Rate      1       3.0   98.5 29.534
## + Pass_nya       1       0.9  100.6 29.727
## + Pass_Cmp_Percentage 1       0.6  100.9 29.750
## + Extra_Points_Made  1       0.6  100.9 29.754
## + Extra_Points_Attempted 1       0.6  100.9 29.754
## + Pass_TD         1       0.2  101.3 29.792
## - Rush_YA         1    3909.1 4010.7 58.895
## - Rush_Att        1    8017.2 8118.7 65.242
##
## Step:  AIC=23.6
## Rush_Yds ~ Rush_Att + Rush_YA + Sack_Yds
##
##              Df Sum of Sq    RSS    AIC
## + Pass_Rate      1      40.0   11.0 11.783
## + Pass_nya       1      39.0   11.9 12.532
## + Extra_Points_Made  1      32.7   18.3 16.364
## + Extra_Points_Attempted 1      32.7   18.3 16.364
## + Pass_TD         1      20.3   30.6 21.020
## <none>                      51.0 23.604
## + Pass_Cmp_Percentage 1       8.8   42.2 23.904
## - Sack_Yds        1      50.6  101.5 27.808
## - Rush_YA         1    2881.0 2931.9 58.076
## - Rush_Att        1    5897.9 5948.9 64.444
##
## Step:  AIC=11.78
## Rush_Yds ~ Rush_Att + Rush_YA + Sack_Yds + Pass_Rate
##
##              Df Sum of Sq    RSS    AIC
## + Pass_nya       1       7.5    3.4  3.321
## + Extra_Points_Made  1       4.1    6.8  9.520
## + Extra_Points_Attempted 1       4.1    6.8  9.520
## <none>                      11.0 11.783
## + Pass_Cmp_Percentage 1       0.5   10.4 13.329
## + Pass_TD         1       0.2   10.8 13.644
## - Pass_Rate       1      40.0   51.0 23.604
## - Sack_Yds        1      87.5   98.5 29.534
## - Rush_YA         1    2874.9 2885.9 59.933
## - Rush_Att        1    4350.6 4361.6 63.650
##
## Step:  AIC=3.32
## Rush_Yds ~ Rush_Att + Rush_YA + Sack_Yds + Pass_Rate + Pass_nya
##
##              Df Sum of Sq    RSS    AIC
## <none>                      3.4  3.321
## + Pass_TD         1       0.6    2.9  3.741
## + Extra_Points_Made  1       0.3    3.1  4.492
## + Extra_Points_Attempted 1       0.3    3.1  4.492
## + Pass_Cmp_Percentage 1       0.2    3.2  4.738
## - Pass_nya        1       7.5   11.0 11.783
## - Pass_Rate       1       8.5   11.9 12.532

```



```
## - Sack_Yds          1      94.7   98.1 31.503
## - Rush_YA           1    2574.8 2578.3 60.919
## - Rush_Att          1    4320.1 4323.6 65.572
```

```
summary(stepwise_mod5)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Rush_Att + Rush_YA + Sack_Yds + Pass_Rate +
##     Pass_nya, data = dolphins)
##
## Residuals:
##      2      3      4      5      6      7      8      9
## 0.13876 -0.90146 -0.75787  0.22304  0.58434 -0.04663  0.55353 -0.70424
##     10
## 0.91054
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -156.55894     5.72286  -27.357 0.000107 ***
## Rush_Att      4.88258     0.07944   61.460 9.49e-06 ***
## Rush_YA      27.68174     0.58341   47.448 2.06e-05 ***
## Sack_Yds      0.54223     0.05958    9.100 0.002804 **
## Pass_Rate     0.08295     0.03044    2.725 0.072244 .
## Pass_nya      1.03448     0.40288    2.568 0.082659 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.069 on 3 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.9998, Adjusted R-squared:  0.9995
## F-statistic: 3363 on 5 and 3 DF, p-value: 8.089e-06
```

```
full_mod6 <- lm(Rush_Yds ~ Pass_Cmp + Pass_Att + Pass_Int + Pass_nya + Pass_Rate + Rush_Att + Rush_Yds +
               data = packers)
```

```
## Warning in model.matrix.default(mt, mf, contrasts): the response appeared on
## the right-hand side and was dropped
```

```
## Warning in model.matrix.default(mt, mf, contrasts): problem with term 7 in
## model.matrix: no columns are assigned
```

```
null_mod6 <- lm(Rush_Yds ~ 1, data = packers)
```

```
stepwise_mod6 <- step(null_mod6, scope = list(lower = null_mod6, upper = full_mod6),
                     direction = "both")
```

```
## Start:  AIC=73.15
## Rush_Yds ~ 1
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 7 in model.matrix: no columns are assigned
```

	Df	Sum of Sq	RSS	AIC
## + Rush_Att	1	19342.7	5066.8	60.999
## + Pass_Int	1	17759.7	6649.9	63.446
## + Field_Goals_Made	1	16160.4	8249.2	65.386
## + Pass_nya	1	15240.2	9169.3	66.338
## + Field_Goals_Att	1	14925.3	9484.2	66.641
## + Pass_Att	1	14166.8	10242.8	67.334
## + Pass_Cmp	1	13841.6	10567.9	67.615
## + Third_Down_Att	1	13693.6	10715.9	67.740
## + Third_Down_Conv	1	12044.1	12365.5	69.029
## + Pass_Rate	1	11989.4	12420.2	69.069
## + Pass_TD	1	5005.6	19404.0	73.084
## <none>			24409.6	73.150
## + Extra_Points_Made	1	1746.7	22662.9	74.481
## + Extra_Points_Attempted	1	1746.7	22662.9	74.481

```
##
## Step: AIC=61
## Rush_Yds ~ Rush_Att
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 7 in model.matrix: no columns are assigned
```

	Df	Sum of Sq	RSS	AIC
## + Field_Goals_Att	1	4159.5	907.4	47.520
## + Field_Goals_Made	1	2962.3	2104.6	55.092
## + Pass_Int	1	2065.3	3001.5	58.287
## + Extra_Points_Made	1	1507.0	3559.9	59.822
## + Extra_Points_Attempted	1	1507.0	3559.9	59.822
## + Third_Down_Att	1	1273.1	3793.7	60.395
## + Pass_Cmp	1	1013.2	4053.6	60.991
## <none>			5066.8	60.999
## + Pass_TD	1	810.4	4256.4	61.431
## + Third_Down_Conv	1	290.5	4776.3	62.468
## + Pass_Rate	1	159.0	4907.8	62.712
## + Pass_Att	1	131.3	4935.5	62.763
## + Pass_nya	1	122.5	4944.4	62.779
## - Rush_Att	1	19342.7	24409.6	73.150

```
##
## Step: AIC=47.52
## Rush_Yds ~ Rush_Att + Field_Goals_Att
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 8 in model.matrix: no columns are assigned
```

	Df	Sum of Sq	RSS	AIC
--	----	-----------	-----	-----

```

## + Pass_Cmp          1      599.1  308.3 39.804
## + Pass_Int          1      559.4  348.0 40.894
## + Pass_Att          1      531.0  376.4 41.600
## + Pass_nya          1      197.5  709.8 47.310
## <none>              1      907.4  47.520
## + Field_Goals_Made   1      108.8  798.6 48.371
## + Extra_Points_Made  1       97.3  810.0 48.499
## + Extra_Points_Attempted 1       97.3  810.0 48.499
## + Pass_TD           1       96.8  810.5 48.504
## + Pass_Rate         1       26.1  881.3 49.257
## + Third_Down_Conv    1        7.1  900.2 49.449
## + Third_Down_Att     1         4.8  902.6 49.472
## - Field_Goals_Att    1     4159.5 5066.8 60.999
## - Rush_Att           1     8576.9 9484.2 66.641
##
## Step:  AIC=39.8
## Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 8 in model.matrix: no columns are assigned

##              Df Sum of Sq    RSS    AIC
## + Third_Down_Conv      1      160.6  147.6 35.178
## + Field_Goals_Made      1      152.6  155.6 35.653
## + Pass_nya              1      130.3  178.0 36.859
## + Third_Down_Att        1       70.3  238.0 39.474
## <none>                  1      308.3  39.804
## + Pass_Rate             1       45.2  263.0 40.375
## + Extra_Points_Made     1       37.3  271.0 40.645
## + Extra_Points_Attempted 1       37.3  271.0 40.645
## + Pass_Int              1       21.9  286.4 41.141
## + Pass_TD               1       17.7  290.5 41.271
## + Pass_Att              1        1.2  307.1 41.769
## - Pass_Cmp              1      599.1  907.4 47.520
## - Rush_Att              1     3447.2 3755.5 60.304
## - Field_Goals_Att       1     3745.3 4053.6 60.991
##
## Step:  AIC=35.18
## Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp + Third_Down_Conv

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 9 in model.matrix: no columns are assigned

##              Df Sum of Sq    RSS    AIC
## + Field_Goals_Made      1      80.85   66.79 30.039
## + Pass_Att              1      62.57   85.07 32.217
## <none>                  1     147.64  35.178
## + Extra_Points_Made     1      25.74  121.90 35.454

```

```

## + Extra_Points_Attempted 1      25.74  121.90 35.454
## + Pass_Int                1      15.43  132.21 36.184
## + Pass_Rate               1      11.15  136.49 36.471
## + Pass_nya                1       3.92  143.72 36.936
## + Pass_TD                 1       0.47  147.18 37.150
## + Third_Down_Att          1       0.46  147.18 37.150
## - Third_Down_Conv         1     160.63  308.28 39.804
## - Pass_Cmp                1     752.58  900.22 49.449
## - Rush_Att                1     883.81 1031.45 50.673
## - Field_Goals_Att         1    2552.32 2699.96 59.334
##
## Step: AIC=30.04
## Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp + Third_Down_Conv +
##      Field_Goals_Made

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 10 in model.matrix: no columns are assigned

##              Df Sum of Sq    RSS    AIC
## + Pass_Int          1      50.56   16.23 19.308
## <none>                      66.79 30.039
## + Extra_Points_Made  1      10.15   56.64 30.555
## + Extra_Points_Attempted 1      10.15   56.64 30.555
## + Pass_Att          1       8.17   58.62 30.864
## + Pass_TD           1       5.87   60.91 31.210
## + Pass_nya          1       4.65   62.14 31.390
## + Third_Down_Att    1       2.99   63.79 31.626
## + Pass_Rate         1       2.39   64.40 31.711
## - Field_Goals_Made  1      80.85  147.64 35.178
## - Third_Down_Conv   1      88.86  155.65 35.653
## - Pass_Cmp          1     715.34  782.13 50.183
## - Rush_Att          1     942.41 1009.20 52.477
## - Field_Goals_Att   1    1209.04 1275.83 54.587
##
## Step: AIC=19.31
## Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp + Third_Down_Conv +
##      Field_Goals_Made + Pass_Int

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 10 in model.matrix: no columns are assigned

##              Df Sum of Sq    RSS    AIC
## + Pass_nya          1      12.66    3.57  7.686
## + Third_Down_Att    1      10.97    5.26 11.173
## <none>                      16.23 19.308
## + Pass_Rate         1       2.56   13.68 19.766
## + Pass_TD           1       0.51   15.72 21.020
## + Extra_Points_Made  1       0.44   15.79 21.061

```

```
## + Extra_Points_Attempted 1      0.44  15.79 21.061
## + Pass_Att                1      0.07  16.16 21.268
## - Pass_Int                1     50.56  66.79 30.039
## - Third_Down_Conv         1     67.21  83.44 32.042
## - Field_Goals_Made        1    115.98 132.21 36.184
## - Pass_Cmp                1    185.27 201.50 39.977
## - Rush_Att                1    879.69 895.92 53.406
## - Field_Goals_Att         1   1204.04 1220.27 56.186
##
## Step: AIC=7.69
## Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp + Third_Down_Conv +
##      Field_Goals_Made + Pass_Int + Pass_nya
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 10 in model.matrix: no columns are assigned
```

	Df	Sum of Sq	RSS	AIC
## + Pass_Att	1	3.57	0.00	-Inf
## + Pass_Rate	1	3.57	0.00	-Inf
## + Third_Down_Att	1	3.57	0.00	-Inf
## + Pass_TD	1	3.57	0.00	-Inf
## + Extra_Points_Made	1	3.57	0.00	-Inf
## + Extra_Points_Attempted	1	3.57	0.00	-Inf
## <none>			3.57	8
## - Third_Down_Conv	1	4.00	7.57	12
## - Pass_nya	1	12.66	16.23	19
## - Pass_Int	1	58.57	62.14	31
## - Pass_Cmp	1	93.84	97.41	35
## - Field_Goals_Made	1	121.35	124.92	38
## - Rush_Att	1	230.31	233.89	43
## - Field_Goals_Att	1	943.04	946.62	56

```
## Step: AIC=-Inf
## Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp + Third_Down_Conv +
##      Field_Goals_Made + Pass_Int + Pass_nya + Pass_Att
```

```
## Warning: attempting model selection on an essentially perfect fit is nonsense
```

```
## Warning: attempting model selection on an essentially perfect fit is nonsense
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 10 in model.matrix: no columns are assigned
```

	Df	Sum of Sq	RSS	AIC
## <none>			0.000	-Inf
## - Field_Goals_Made	1	0.549	0.549	-9
## - Pass_Att	1	3.573	3.573	8

```
## - Third_Down_Conv    1      6.487   6.487   13
## - Field_Goals_Att    1     14.903  14.903   21
## - Pass_nya           1     16.160  16.160   21
## - Pass_Cmp           1     17.836  17.836   22
## - Pass_Int           1     57.471  57.471   33
## - Rush_Att           1    123.235 123.235   40
```

```
summary(stepwise_mod6)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp +
##      Third_Down_Conv + Field_Goals_Made + Pass_Int + Pass_nya +
##      Pass_Att, data = packers)
##
## Residuals:
## ALL 9 residuals are 0: no residual degrees of freedom!
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      80.986         NaN     NaN     NaN
## Rush_Att          2.898         NaN     NaN     NaN
## Field_Goals_Att  18.423         NaN     NaN     NaN
## Pass_Cmp         -3.431         NaN     NaN     NaN
## Third_Down_Conv   2.583         NaN     NaN     NaN
## Field_Goals_Made -3.120         NaN     NaN     NaN
## Pass_Int        -11.658         NaN     NaN     NaN
## Pass_nya         -5.046         NaN     NaN     NaN
## Pass_Att          1.525         NaN     NaN     NaN
##
## Residual standard error: NaN on 0 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  1, Adjusted R-squared:  NaN
## F-statistic:  NaN on 8 and 0 DF, p-value: NA
```

```
bears_mod_rush <- lm(Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att + Fourth_Down_Conv, bears)
summary(bears_mod_rush)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Rush_YA + Rush_Att + Pass_Att + Fourth_Down_Conv,
##     data = bears)
##
## Residuals:
##      2      3      4      5      6      7      8      9
## 1.78140 0.09876 -0.62775 -2.67108 0.39938 -3.77069 3.47991 1.24648
##     10
## 0.06359
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -136.6366    12.6919 -10.766 0.000422 ***
## Rush_YA        33.8568     1.5405  21.978 2.54e-05 ***
```

```
## Rush_Att          3.3351      0.2263  14.738 0.000123 ***
## Pass_Att          0.7738      0.2952   2.621 0.058744 .
## Fourth_Down_Conv -2.8066      1.8604  -1.509 0.205905
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.113 on 4 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.9979, Adjusted R-squared:  0.9958
## F-statistic: 474.2 on 4 and 4 DF, p-value: 1.327e-05
```

```
vif(bears_mod_rush)
```

```
##          Rush_YA          Rush_Att          Pass_Att Fourth_Down_Conv
##          2.800836          1.590201          6.099069          5.001061
```

```
lions_mod_rush <- lm(Rush_Yds ~ Score_Opp + Pass_Sacks + Pass_Att + Score_Tm, lions)
summary(lions_mod_rush)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Score_Opp + Pass_Sacks + Pass_Att + Score_Tm,
##     data = lions)
##
## Residuals:
##      2      3      4      5      6      7      8      9     10
## 13.905 -4.421 11.349  3.585  5.520 -8.223 -5.828 -21.622  5.734
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 183.3060    34.7477   5.275  0.00619 **
## Score_Opp    -3.2912     0.8133  -4.046  0.01552 *
## Pass_Sacks   20.8056     6.0906   3.416  0.02688 *
## Pass_Att      0.8277     0.6453   1.283  0.26887
## Score_Tm     -1.2760     0.6991  -1.825  0.14203
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 15.71 on 4 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.8557, Adjusted R-squared:  0.7114
## F-statistic:  5.93 on 4 and 4 DF, p-value: 0.05646
```

```
vif(lions_mod_rush)
```

```
## Score_Opp Pass_Sacks Pass_Att Score_Tm
##  1.083111  2.839747  1.721363  2.496400
```

```
giants_mod_rush <- lm(Rush_Yds ~ Rush_YA + Score_Tm + Pass_Rate, giants)
summary(giants_mod_rush)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Rush_YA + Score_Tm + Pass_Rate, data = giants)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -23.378 -16.089   1.115  11.584  31.080
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   6.7450    30.3484   0.222  0.83149
## Rush_YA       22.3572     5.3004   4.218  0.00557 **
## Score_Tm       3.7021     1.5041   2.461  0.04903 *
## Pass_Rate     -0.5313     0.4309  -1.233  0.26377
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 22.32 on 6 degrees of freedom
## (7 observations deleted due to missingness)
## Multiple R-squared:  0.8615, Adjusted R-squared:  0.7922
## F-statistic: 12.44 on 3 and 6 DF, p-value: 0.005506
```

```
vif(giants_mod_rush)
```

```
##      Rush_YA  Score_Tm Pass_Rate
##  1.145140  2.672268  2.457626
```

```
cowboys_mod_rush <- lm(Rush_Yds ~ Rush_YA, cowboys)
summary(cowboys_mod_rush)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Rush_YA, data = cowboys)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -19.385  -9.243  -2.385    8.225   31.719
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -3.173    21.087   -0.15  0.8846
## Rush_YA       22.987     5.384    4.27  0.0037 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 16.7 on 7 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.7225, Adjusted R-squared:  0.6829
## F-statistic: 18.23 on 1 and 7 DF, p-value: 0.003703
```

```
dolphins_mod_rush <- lm(Rush_Yds ~ Rush_Att + Rush_YA + Sack_Yds + Pass_Rate + Pass_nya, dolphins)
summary(dolphins_mod_rush)
```



```
##
## Call:
## lm(formula = Rush_Yds ~ Rush_Att + Rush_YA + Sack_Yds + Pass_Rate +
##     Pass_nya, data = dolphins)
##
## Residuals:
##      2      3      4      5      6      7      8      9
## 0.13876 -0.90146 -0.75787  0.22304  0.58434 -0.04663  0.55353 -0.70424
##     10
## 0.91054
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -156.55894    5.72286  -27.357  0.000107 ***
## Rush_Att      4.88258    0.07944   61.460  9.49e-06 ***
## Rush_YA      27.68174    0.58341   47.448  2.06e-05 ***
## Sack_Yds      0.54223    0.05958    9.100  0.002804 **
## Pass_Rate     0.08295    0.03044    2.725  0.072244 .
## Pass_nya      1.03448    0.40288    2.568  0.082659 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.069 on 3 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.9998, Adjusted R-squared:  0.9995
## F-statistic: 3363 on 5 and 3 DF, p-value: 8.089e-06
```

```
vif(dolphins_mod_rush)
```

```
## Rush_Att Rush_YA Sack_Yds Pass_Rate Pass_nya
## 2.727232 2.200933 4.369277 2.997542 2.756133
```

```
packers_mod_rush <- lm(Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp + Third_Down_Conv + Field_Goals_Made, data = packers)
summary(packers_mod_rush)
```

```
##
## Call:
## lm(formula = Rush_Yds ~ Rush_Att + Field_Goals_Att + Pass_Cmp +
##     Third_Down_Conv + Field_Goals_Made, data = packers)
##
## Residuals:
##      2      3      4      5      6      7      8      9     10
## -1.7304 -0.8459 -1.0358 -3.2490  1.1448  3.5850 -0.8085 -2.5496  5.4893
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    92.2049    17.4847   5.273  0.01329 *
## Rush_Att        2.0315     0.3122   6.506  0.00737 **
## Field_Goals_Att 25.5626     3.4688   7.369  0.00517 **
## Pass_Cmp       -3.1852     0.5619  -5.668  0.01088 *
## Third_Down_Conv  2.3117     1.1571   1.998  0.13962
## Field_Goals_Made -8.3910     4.4031  -1.906  0.15277
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.718 on 3 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.9973, Adjusted R-squared:  0.9927
## F-statistic: 218.7 on 5 and 3 DF,  p-value: 0.0004848
```

```
vif(packers_mod_rush)
```

```
##          Rush_Att  Field_Goals_Att          Pass_Cmp  Third_Down_Conv
##          4.654560          5.404670          4.569969          3.381087
## Field_Goals_Made
##          8.708322
```

```
avg_bears <- colMeans(bears[, c("Rush_YA", "Rush_Att", "Pass_Att", "Fourth_Down_Conv")], na.rm = TRUE)
predict_bears <- data.frame(t(avg_bears))
predict_bears_rush <- predict(bears_mod_rush, newdata = predict_bears)

avg_lions <- colMeans(lions[, c("Rush_Yds", "Score_Opp", "Pass_Sacks", "Pass_Att", "Score_Tm")], na.rm = TRUE)
predict_lions <- data.frame(t(avg_lions))
predict_lions_rush <- predict(lions_mod_rush, newdata = predict_lions)

combine1_rush <- predict_bears_rush + predict_lions_rush
print(combine1_rush)
```

```
##          1
## 255.4444
```

```
avg_giants <- colMeans(giants[, c("Rush_Yds", "Rush_YA", "Score_Tm", "Pass_Rate")], na.rm = TRUE)
predict_giants <- data.frame(t(avg_giants))
predict_giants_rush <- predict(giants_mod_rush, newdata = predict_giants)

avg_cowboys <- colMeans(cowboys[, c("Rush_Yds", "Rush_YA")], na.rm = TRUE)
predict_cowboys <- data.frame(t(avg_cowboys))
predict_cowboys_rush <- predict(cowboys_mod_rush, newdata = predict_cowboys)

combine2_rush <- predict_giants_rush + predict_cowboys_rush
print(combine2_rush)
```

```
##          1
## 203.5667
```

```
avg_dolphins <- colMeans(dolphins[, c("Rush_Yds", "Rush_YA", "Rush_Att", "Sack_Yds", "Pass_Rate", "Pass_Yds", "Score_Tm")], na.rm = TRUE)
predict_dolphins <- data.frame(t(avg_dolphins))
predict_dolphins_rush <- predict(dolphins_mod_rush, newdata = predict_dolphins)

avg_packers <- colMeans(packers[, c("Rush_Yds", "Rush_Att", "Field_Goals_Att", "Pass_Cmp", "Third_Down_Conv")], na.rm = TRUE)
predict_packers <- data.frame(t(avg_packers))
```

```
predict_packers_rush <- predict(packers_mod_rush, newdata = predict_packers)
```

```
combine3_rush <- predict_dolphins_rush + predict_packers_rush
print(combine3_rush)
```

```
##          1
## 281.2222
```

```
#AIC for Pass_TD
```

```
full_mod11 <- lm(Pass_TD ~ Rush_Yds + Pass_Cmp + Pass_Att + Pass_Sacks + Sack_Yds + Rush_Att + Rush_YA +
  Third_Down_Conv + Fourth_Down_Att + Fourth_Down_Conv,
  data = bears)
```

```
null_mod11 <- lm(Pass_TD ~ 1, data = bears)
```

```
stepwise_mod11 <- step(null_mod11, scope = list(lower = null_mod11, upper = full_mod11),
  direction = "both")
```

```
## Start:  AIC=7.18
```

```
## Pass_TD ~ 1
```

```
##
```

	Df	Sum of Sq	RSS	AIC
## + Extra_Points_Made	1	11.6364	4.3636	-2.5153
## + Extra_Points_Attempted	1	11.3087	4.6913	-1.8636
## + Sack_Yds	1	9.7982	6.2018	0.6485
## + Field_Goals_Made	1	4.9000	11.1000	5.8875
## + Third_Down_Conv	1	4.0091	11.9909	6.5823
## + Pass_Cmp	1	3.8941	12.1059	6.6682
## + Rush_Att	1	3.8419	12.1581	6.7069
## <none>			16.0000	7.1783
## + Pass_Sacks	1	3.1556	12.8444	7.2011
## + Rush_Yds	1	1.1893	14.8107	8.4831
## + Field_Goals_Att	1	1.0946	14.9054	8.5405
## + Rush_TD	1	0.9000	15.1000	8.6572
## + Fourth_Down_Att	1	0.6792	15.3208	8.7879
## + Rush_YA	1	0.1714	15.8286	9.0813
## + Pass_Att	1	0.0723	15.9277	9.1375
## + Fourth_Down_Conv	1	0.0000	16.0000	9.1783

```
##
```

```
## Step:  AIC=-2.52
```

```
## Pass_TD ~ Extra_Points_Made
```

```
##
```

	Df	Sum of Sq	RSS	AIC
## + Fourth_Down_Att	1	3.9743	0.3893	-22.2651
## + Fourth_Down_Conv	1	3.0522	1.3115	-11.3346
## + Pass_Att	1	2.9362	1.4274	-10.5723
## + Pass_Cmp	1	2.6260	1.7377	-8.8021
## + Third_Down_Conv	1	1.7869	2.5767	-5.2564
## + Rush_YA	1	1.2027	3.1610	-3.4171
## + Rush_TD	1	1.1200	3.2436	-3.1849

```

## <none>                                4.3636 -2.5153
## + Rush_Yds                            1    0.6909 3.6727 -2.0666
## + Field_Goals_Made                     1    0.1970 4.1667 -0.9310
## + Field_Goals_Att                      1    0.1114 4.2522 -0.7481
## + Pass_Sacks                           1    0.0920 4.2717 -0.7069
## + Sack_Yds                             1    0.0199 4.3437 -0.5564
## + Rush_Att                             1    0.0146 4.3490 -0.5454
## + Extra_Points_Attempted               1    0.0011 4.3625 -0.5176
## - Extra_Points_Made                    1   11.6364 16.0000  7.1783
##
## Step:  AIC=-22.27
## Pass_TD ~ Extra_Points_Made + Fourth_Down_Att
##
##              Df Sum of Sq    RSS    AIC
## + Rush_Att    1    0.2763 0.1130 -31.3980
## + Rush_Yds    1    0.2436 0.1457 -29.1124
## + Sack_Yds     1    0.2396 0.1497 -28.8659
## + Field_Goals_Made 1    0.1547 0.2346 -24.8237
## + Rush_TD      1    0.1456 0.2437 -24.4801
## + Field_Goals_Att 1    0.1271 0.2623 -23.8209
## + Pass_Sacks   1    0.0980 0.2913 -22.8754
## <none>         0.3893 -22.2651
## + Extra_Points_Attempted 1    0.0465 0.3428 -21.4105
## + Rush_YA      1    0.0432 0.3461 -21.3238
## + Third_Down_Conv 1    0.0266 0.3627 -20.9018
## + Fourth_Down_Conv 1    0.0122 0.3771 -20.5521
## + Pass_Att     1    0.0085 0.3809 -20.4629
## + Pass_Cmp     1    0.0009 0.3884 -20.2867
## - Fourth_Down_Att 1    3.9743 4.3636 -2.5153
## - Extra_Points_Made 1   14.9314 15.3208  8.7879
##
## Step:  AIC=-31.4
## Pass_TD ~ Extra_Points_Made + Fourth_Down_Att + Rush_Att
##
##              Df Sum of Sq    RSS    AIC
## + Rush_Yds    1    0.0630 0.0500 -36.729
## + Rush_YA      1    0.0575 0.0555 -35.802
## + Extra_Points_Attempted 1    0.0466 0.0664 -34.183
## + Field_Goals_Made 1    0.0388 0.0742 -33.180
## + Rush_TD      1    0.0291 0.0839 -32.076
## <none>         0.1130 -31.398
## + Field_Goals_Att 1    0.0206 0.0924 -31.210
## + Sack_Yds     1    0.0146 0.0984 -30.644
## + Fourth_Down_Conv 1    0.0079 0.1051 -30.047
## + Pass_Cmp     1    0.0078 0.1052 -30.042
## + Third_Down_Conv 1    0.0020 0.1110 -29.562
## + Pass_Att     1    0.0005 0.1125 -29.436
## + Pass_Sacks   1    0.0000 0.1130 -29.400
## - Rush_Att     1    0.2763 0.3893 -22.265
## - Fourth_Down_Att 1    4.2360 4.3490 -0.545
## - Extra_Points_Made 1   12.0209 12.1339  8.689
##
## Step:  AIC=-36.73
## Pass_TD ~ Extra_Points_Made + Fourth_Down_Att + Rush_Att + Rush_Yds

```

```

##
##              Df Sum of Sq    RSS    AIC
## + Third_Down_Conv      1    0.0201  0.0299 -39.363
## + Sack_Yds              1    0.0153  0.0348 -38.008
## + Fourth_Down_Conv     1    0.0131  0.0369 -37.469
## + Pass_Att              1    0.0107  0.0394 -36.892
## <none>                  0    0.0500 -36.729
## + Rush_YA              1    0.0084  0.0417 -36.375
## + Pass_Cmp              1    0.0057  0.0443 -35.819
## + Rush_TD              1    0.0038  0.0462 -35.441
## + Pass_Sacks           1    0.0024  0.0477 -35.165
## + Extra_Points_Attempted 1    0.0017  0.0484 -35.033
## + Field_Goals_Made      1    0.0009  0.0492 -34.885
## + Field_Goals_Att       1    0.0002  0.0498 -34.768
## - Rush_Yds             1    0.0630  0.1130 -31.398
## - Rush_Att             1    0.0956  0.1457 -29.112
## - Fourth_Down_Att       1    3.1716  3.2216  -1.246
## - Extra_Points_Made     1   12.0171 12.0671  10.639
##
## Step:  AIC=-39.36
## Pass_TD ~ Extra_Points_Made + Fourth_Down_Att + Rush_Att + Rush_Yds +
##      Third_Down_Conv
##
##              Df Sum of Sq    RSS    AIC
## + Pass_Cmp              1    0.0245  0.0054 -52.701
## + Sack_Yds              1    0.0140  0.0159 -43.035
## + Extra_Points_Attempted 1    0.0124  0.0175 -42.189
## <none>                  0    0.0299 -39.363
## + Pass_Att              1    0.0042  0.0258 -38.708
## + Rush_TD              1    0.0040  0.0259 -38.671
## + Fourth_Down_Conv     1    0.0038  0.0261 -38.596
## + Pass_Sacks           1    0.0021  0.0278 -38.015
## + Rush_YA              1    0.0005  0.0294 -37.516
## + Field_Goals_Att       1    0.0001  0.0298 -37.397
## + Field_Goals_Made      1    0.0000  0.0299 -37.363
## - Third_Down_Conv       1    0.0201  0.0500 -36.729
## - Rush_Att             1    0.0540  0.0839 -32.082
## - Rush_Yds             1    0.0811  0.1110 -29.562
## - Fourth_Down_Att       1    2.4377  2.4676  -1.646
## - Extra_Points_Made     1    8.5363  8.5662   9.555
##
## Step:  AIC=-52.7
## Pass_TD ~ Extra_Points_Made + Fourth_Down_Att + Rush_Att + Rush_Yds +
##      Third_Down_Conv + Pass_Cmp
##
##              Df Sum of Sq    RSS    AIC
## + Extra_Points_Attempted 1    0.0044  0.0010 -65.891
## + Rush_YA              1    0.0038  0.0016 -61.514
## + Fourth_Down_Conv     1    0.0029  0.0026 -57.459
## <none>                  0    0.0054 -52.701
## + Pass_Sacks           1    0.0008  0.0046 -52.148
## + Pass_Att             1    0.0004  0.0050 -51.425
## + Field_Goals_Made      1    0.0002  0.0052 -51.095
## + Rush_TD              1    0.0002  0.0053 -51.002

```

```
## + Field_Goals_Att      1      0.0001 0.0053 -50.861
## + Sack_Yds             1      0.0001 0.0053 -50.859
## - Rush_Yds            1      0.0080 0.0134 -46.570
## - Pass_Cmp            1      0.0245 0.0299 -39.363
## - Third_Down_Conv     1      0.0389 0.0443 -35.819
## - Rush_Att            1      0.0726 0.0781 -30.724
## - Fourth_Down_Att     1      1.1072 1.1126 -6.814
## - Extra_Points_Made   1      3.2767 3.2821  2.921
##
## Step:  AIC=-65.89
## Pass_TD ~ Extra_Points_Made + Fourth_Down_Att + Rush_Att + Rush_Yds +
##      Third_Down_Conv + Pass_Cmp + Extra_Points_Attempted
##
##              Df Sum of Sq      RSS  AIC
## + Pass_Att      1    0.00101 0.00000 -Inf
## + Pass_Sacks    1    0.00101 0.00000 -Inf
## + Sack_Yds      1    0.00101 0.00000 -Inf
## + Rush_YA       1    0.00101 0.00000 -Inf
## + Rush_TD       1    0.00101 0.00000 -Inf
## + Field_Goals_Made 1    0.00101 0.00000 -Inf
## + Field_Goals_Att 1    0.00101 0.00000 -Inf
## + Fourth_Down_Conv 1    0.00101 0.00000 -Inf
## - Rush_Att      1    0.00018 0.00119  -66
## <none>              0.00101  -66
## - Extra_Points_Attempted 1    0.00443 0.00544  -53
## - Rush_Yds      1    0.01028 0.01129  -46
## - Pass_Cmp      1    0.01649 0.01749  -42
## - Extra_Points_Made 1    0.03881 0.03982  -35
## - Third_Down_Conv 1    0.04231 0.04331  -34
## - Fourth_Down_Att 1    1.10351 1.10452   -5
##
## Step:  AIC=-Inf
## Pass_TD ~ Extra_Points_Made + Fourth_Down_Att + Rush_Att + Rush_Yds +
##      Third_Down_Conv + Pass_Cmp + Extra_Points_Attempted + Pass_Att

## Warning: attempting model selection on an essentially perfect fit is nonsense
## Warning: attempting model selection on an essentially perfect fit is nonsense

##              Df Sum of Sq      RSS  AIC
## <none>              0.00000 -Inf
## - Rush_Att      1    0.00006 0.00006  -92
## - Pass_Att      1    0.00101 0.00101  -66
## - Extra_Points_Attempted 1    0.00502 0.00502  -51
## - Rush_Yds      1    0.01077 0.01077  -45
## - Pass_Cmp      1    0.01638 0.01638  -41
## - Third_Down_Conv 1    0.03361 0.03361  -34
## - Extra_Points_Made 1    0.03814 0.03814  -33
## - Fourth_Down_Att 1    0.82811 0.82811   -5
```

```
summary(stepwise_mod11)
```

```
##
## Call:
```

```
## lm(formula = Pass_TD ~ Extra_Points_Made + Fourth_Down_Att +
##     Rush_Att + Rush_Yds + Third_Down_Conv + Pass_Cmp + Extra_Points_Attempted +
##     Pass_Att, data = bears)
##
## Residuals:
## ALL 9 residuals are 0: no residual degrees of freedom!
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -2.672858         NaN      NaN      NaN
## Extra_Points_Made  0.837548         NaN      NaN      NaN
## Fourth_Down_Att   0.688809         NaN      NaN      NaN
## Rush_Att         0.002528         NaN      NaN      NaN
## Rush_Yds         0.004259         NaN      NaN      NaN
## Third_Down_Conv   0.109481         NaN      NaN      NaN
## Pass_Cmp        -0.049648         NaN      NaN      NaN
## Extra_Points_Attempted 0.287421         NaN      NaN      NaN
## Pass_Att         0.008034         NaN      NaN      NaN
##
## Residual standard error: NaN on 0 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared: 1, Adjusted R-squared: NaN
## F-statistic: NaN on 8 and 0 DF, p-value: NA
```

```
full_mod21 <- lm(Pass_TD ~ Rush_Yds + Rush_YA + Score_Opp + Score_Tm + Pass_Att + Pass_TD + Pass_Sacks +
```

```
## Warning in model.matrix.default(mt, mf, contrasts): the response appeared on
## the right-hand side and was dropped
```

```
## Warning in model.matrix.default(mt, mf, contrasts): problem with term 6 in
## model.matrix: no columns are assigned
```

```
null_mod21 <- lm(Pass_TD ~ 1, data = lions)
```

```
stepwise_mod21 <- step(null_mod21, scope = list(lower = null_mod21, upper = full_mod21),
  direction = "both")
```

```
## Start: AIC=4.59
## Pass_TD ~ 1
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 6 in model.matrix: no columns are assigned
```

```
##              Df Sum of Sq    RSS    AIC
## + Extra_Points_Attempted  1  10.1250  1.8750 -10.1175
## + Score_Tm                1   9.7768  2.2232  -8.5847
## + Extra_Points_Made       1   9.4675  2.5325  -7.4123
```

```

## + Third_Down_Att          1      8.4970  3.5030 -4.4924
## + Fourth_Down_Conv        1      6.6977  5.3023 -0.7617
## + Sack_Yds                 1      6.4162  5.5838 -0.2962
## + Pass_Sacks               1      6.4059  5.5941 -0.2796
## + Fourth_Down_Att          1      6.0500  5.9500  0.2755
## + Pass_Att                 1      5.9647  6.0353  0.4036
## <none>                     12.0000  4.5891
## + Rush_YA                  1      1.3632 10.6368  5.5038
## + Rush_Yds                 1      0.5803 11.4197  6.1431
## + Score_Opp                1      0.1584 11.8416  6.4695
##
## Step:  AIC=-10.12
## Pass_TD ~ Extra_Points_Attempted

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 7 in model.matrix: no columns are assigned

##
## Df Sum of Sq    RSS    AIC
## + Fourth_Down_Conv      1    0.9896  0.8854 -14.8705
## + Fourth_Down_Att        1    0.7038  1.1712 -12.3530
## <none>                    1.8750 -10.1175
## + Score_Tm               1    0.2354  1.6396  -9.3248
## + Extra_Points_Made      1    0.1607  1.7143  -8.9241
## + Pass_Att               1    0.1262  1.7488  -8.7444
## + Rush_YA                1    0.0859  1.7891  -8.5396
## + Third_Down_Att         1    0.0803  1.7947  -8.5117
## + Sack_Yds               1    0.0591  1.8159  -8.4060
## + Score_Opp              1    0.0410  1.8340  -8.3166
## + Rush_Yds               1    0.0324  1.8426  -8.2742
## + Pass_Sacks             1    0.0321  1.8429  -8.2728
## - Extra_Points_Attempted  1   10.1250 12.0000   4.5891
##
## Step:  AIC=-14.87
## Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 8 in model.matrix: no columns are assigned

##
## Df Sum of Sq    RSS    AIC
## + Score_Tm               1    0.3714  0.5140 -17.7652
## + Score_Opp              1    0.3464  0.5390 -17.3372
## + Pass_Sacks             1    0.2054  0.6800 -15.2453
## + Sack_Yds               1    0.1930  0.6924 -15.0836
## <none>                    0.8854 -14.8705
## + Third_Down_Att         1    0.1759  0.7095 -14.8637
## + Pass_Att               1    0.0909  0.7945 -13.8454

```



```
## + Rush_Yds          1    0.0448 0.8406 -13.3374
## + Fourth_Down_Att    1    0.0057 0.8797 -12.9282
## + Rush_YA            1    0.0006 0.8848 -12.8769
## + Extra_Points_Made  1    0.0000 0.8854 -12.8706
## - Fourth_Down_Conv   1    0.9896 1.8750 -10.1175
## - Extra_Points_Attempted 1    4.4169 5.3023 -0.7617
##
## Step:  AIC=-17.77
## Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv + Score_Tm

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 8 in model.matrix: no columns are assigned
```

```
##              Df Sum of Sq    RSS    AIC
## + Score_Opp      1    0.24418 0.26980 -21.5658
## + Sack_Yds        1    0.23931 0.27467 -21.4048
## + Extra_Points_Made 1    0.22252 0.29146 -20.8708
## + Pass_Sacks      1    0.18049 0.33349 -19.6584
## + Third_Down_Att  1    0.13100 0.38298 -18.4130
## - Extra_Points_Attempted 1    0.12374 0.63772 -17.8238
## <none>              0.51398 -17.7652
## + Fourth_Down_Att  1    0.03029 0.48369 -16.3119
## + Rush_Yds        1    0.02909 0.48489 -16.2896
## + Pass_Att        1    0.02444 0.48954 -16.2036
## + Rush_YA         1    0.01172 0.50226 -15.9727
## - Score_Tm        1    0.37142 0.88540 -14.8705
## - Fourth_Down_Conv 1    1.12565 1.63962  -9.3248
##
## Step:  AIC=-21.57
## Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv + Score_Tm +
##          Score_Opp
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 8 in model.matrix: no columns are assigned
```

```
##              Df Sum of Sq    RSS    AIC
## + Sack_Yds        1    0.15188 0.11792 -27.0151
## + Pass_Sacks      1    0.14025 0.12955 -26.1682
## + Pass_Att        1    0.12252 0.14728 -25.0141
## <none>              0.26980 -21.5658
## + Rush_Yds        1    0.05223 0.21756 -21.5023
## + Fourth_Down_Att  1    0.02570 0.24410 -20.4666
## + Rush_YA         1    0.02207 0.24773 -20.3339
## + Third_Down_Att  1    0.02044 0.24936 -20.2749
## + Extra_Points_Made 1    0.01108 0.25872 -19.9431
## - Extra_Points_Attempted 1    0.13719 0.40699 -19.8658
## - Score_Opp        1    0.24418 0.51398 -17.7652
## - Score_Tm        1    0.26921 0.53901 -17.3372
## - Fourth_Down_Conv 1    1.35790 1.62770  -7.3905
```

```

##
## Step:  AIC=-27.02
## Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv + Score_Tm +
##      Score_Opp + Sack_Yds

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 9 in model.matrix: no columns are assigned

##
##      Df Sum of Sq    RSS    AIC
## + Fourth_Down_Att      1  0.10530 0.01262 -45.128
## + Pass_Att             1  0.10353 0.01439 -43.946
## + Pass_Sacks           1  0.08111 0.03681 -35.493
## + Third_Down_Att       1  0.05302 0.06489 -30.390
## + Rush_Yds             1  0.03141 0.08651 -27.803
## + Extra_Points_Made    1  0.02871 0.08921 -27.526
## <none>                  0.11792 -27.015
## + Rush_YA              1  0.01883 0.09908 -26.581
## - Sack_Yds             1  0.15188 0.26980 -21.566
## - Score_Opp            1  0.15675 0.27467 -21.405
## - Extra_Points_Attempted 1  0.24690 0.36482 -18.850
## - Score_Tm             1  0.31467 0.43259 -17.317
## - Fourth_Down_Conv     1  1.44739 1.56530  -5.742
##
## Step:  AIC=-45.13
## Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv + Score_Tm +
##      Score_Opp + Sack_Yds + Fourth_Down_Att

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 10 in model.matrix: no columns are assigned

##
##      Df Sum of Sq    RSS    AIC
## + Third_Down_Att      1  0.01011 0.00251 -57.663
## + Pass_Sacks           1  0.00851 0.00411 -53.222
## + Rush_YA              1  0.00762 0.00500 -51.455
## + Extra_Points_Made    1  0.00564 0.00698 -48.460
## + Pass_Att             1  0.00504 0.00758 -47.713
## <none>                  0.01262 -45.128
## + Rush_Yds            1  0.00128 0.01134 -44.091
## - Fourth_Down_Att     1  0.10530 0.11792 -27.015
## - Score_Opp           1  0.12677 0.13939 -25.509
## - Sack_Yds            1  0.23148 0.24410 -20.467
## - Extra_Points_Attempted 1  0.27054 0.28316 -19.131
## - Score_Tm            1  0.38132 0.39394 -16.159
## - Fourth_Down_Conv     1  0.71123 0.72385 -10.684
##
## Step:  AIC=-57.66
## Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv + Score_Tm +
##      Score_Opp + Sack_Yds + Fourth_Down_Att + Third_Down_Att

```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 11 in model.matrix: no columns are assigned
```

```
##           Df Sum of Sq    RSS   AIC
## + Rush_Yds      1   0.00251 0.00000 -Inf
## + Rush_YA       1   0.00251 0.00000 -Inf
## + Pass_Att      1   0.00251 0.00000 -Inf
## + Pass_Sacks    1   0.00251 0.00000 -Inf
## + Extra_Points_Made 1   0.00251 0.00000 -Inf
## <none>                0.00251  -58
## - Third_Down_Att 1   0.01011 0.01262  -45
## - Fourth_Down_Att 1   0.06238 0.06489  -30
## - Score_Opp      1   0.06474 0.06725  -30
## - Extra_Points_Attempted 1 0.20861 0.21112  -20
## - Sack_Yds       1   0.23568 0.23819  -19
## - Score_Tm       1   0.36617 0.36868  -15
## - Fourth_Down_Conv 1 0.69456 0.69707   -9
##
## Step:  AIC=-Inf
## Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv + Score_Tm +
##           Score_Opp + Sack_Yds + Fourth_Down_Att + Third_Down_Att +
##           Rush_Yds
```

```
## Warning: attempting model selection on an essentially perfect fit is nonsense
```

```
## Warning: attempting model selection on an essentially perfect fit is nonsense
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 11 in model.matrix: no columns are assigned
```

```
##           Df Sum of Sq    RSS   AIC
## <none>                0.00000 -Inf
## - Rush_Yds      1   0.00251 0.00251  -58
## - Third_Down_Att 1   0.01134 0.01134  -44
## - Score_Opp      1   0.02429 0.02429  -37
## - Sack_Yds       1   0.04948 0.04948  -31
## - Fourth_Down_Att 1   0.05499 0.05499  -30
## - Extra_Points_Attempted 1 0.16772 0.16772  -20
## - Score_Tm       1   0.33882 0.33882  -14
## - Fourth_Down_Conv 1 0.41983 0.41983  -12
```

```
summary(stepwise_mod21)
```

```
##
## Call:
```

```
## lm(formula = Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv +
##      Score_Tm + Score_Opp + Sack_Yds + Fourth_Down_Att + Third_Down_Att +
##      Rush_Yds, data = lions)
##
## Residuals:
## ALL 9 residuals are 0: no residual degrees of freedom!
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.394887         NaN     NaN    NaN
## Extra_Points_Attempted 0.316783         NaN     NaN    NaN
## Fourth_Down_Conv   -0.798454         NaN     NaN    NaN
## Score_Tm          0.046510         NaN     NaN    NaN
## Score_Opp        -0.023218         NaN     NaN    NaN
## Sack_Yds         -0.022936         NaN     NaN    NaN
## Fourth_Down_Att    0.192912         NaN     NaN    NaN
## Third_Down_Att     0.042260         NaN     NaN    NaN
## Rush_Yds        -0.002008         NaN     NaN    NaN
##
## Residual standard error: NaN on 0 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared: 1, Adjusted R-squared: NaN
## F-statistic: NaN on 8 and 0 DF, p-value: NA
```

```
full_mod31 <- lm(Pass_TD ~ Rush_Yds + Rush_YA + Score_Tm + Pass_TD + Pass_Int + Pass_Rate, data = giants)
```

```
## Warning in model.matrix.default(mt, mf, contrasts): the response appeared on
## the right-hand side and was dropped
```

```
## Warning in model.matrix.default(mt, mf, contrasts): problem with term 4 in
## model.matrix: no columns are assigned
```

```
null_mod31 <- lm(Pass_TD ~ 1, data = giants)
```

```
stepwise_mod31 <- step(null_mod31, scope = list(lower = null_mod31, upper = full_mod31),
  direction = "both")
```

```
## Start: AIC=1.59
## Pass_TD ~ 1
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 4 in model.matrix: no columns are assigned
```

```
##              Df Sum of Sq    RSS    AIC
## + Pass_Rate   1     7.9000 1.7000 -13.7193
## + Score_Tm    1     5.1785 4.4215  -4.1611
## + Pass_Int    1     5.1410 4.4590  -4.0766
```

```
## + Rush_Yds    1    1.8690 7.7310    1.4265
## <none>                9.6000    1.5918
## + Rush_YA     1    1.0972 8.5028    2.3781
##
## Step:  AIC=-13.72
## Pass_TD ~ Pass_Rate

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 5 in model.matrix: no columns are assigned
```

```
##           Df Sum of Sq    RSS    AIC
## <none>                1.7000 -13.7193
## + Rush_Yds    1    0.2632 1.4368 -13.4014
## + Rush_YA     1    0.2437 1.4563 -13.2668
## + Score_Tm    1    0.0345 1.6656 -11.9241
## + Pass_Int    1    0.0086 1.6914 -11.7701
## - Pass_Rate   1    7.9000 9.6000    1.5918
```

```
summary(stepwise_mod31)
```

```
##
## Call:
## lm(formula = Pass_TD ~ Pass_Rate, data = giants)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.8589 -0.2238  0.1031  0.2828  0.4938
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.941790   0.472722  -4.108  0.00340 **
## Pass_Rate    0.034619   0.005678   6.097  0.00029 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.461 on 8 degrees of freedom
## (7 observations deleted due to missingness)
## Multiple R-squared:  0.8229, Adjusted R-squared:  0.8008
## F-statistic: 37.18 on 1 and 8 DF,  p-value: 0.0002904
```

```
full_mod41 <- lm(Pass_TD ~ Rush_Yds + Rush_YA + Pass_TD + Pass_ya + Pass_nya + Pass_Rate, data = cowboys)
```

```
## Warning in model.matrix.default(mt, mf, contrasts): the response appeared on
## the right-hand side and was dropped

## Warning in model.matrix.default(mt, mf, contrasts): problem with term 3 in
## model.matrix: no columns are assigned
```

```

null_mod41 <- lm(Pass_TD ~ 1, data = cowboys)

stepwise_mod41 <- step(null_mod41, scope = list(lower = null_mod41, upper = full_mod41),
  direction = "both")

## Start:  AIC=-1.65
## Pass_TD ~ 1

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 3 in model.matrix: no columns are assigned

##           Df Sum of Sq   RSS   AIC
## + Pass_Rate  1    4.1826 1.8174 -10.3985
## + Pass_nya   1    3.5323 2.4677  -7.6456
## + Pass_ya    1    3.0760 2.9240  -6.1185
## <none>                6.0000  -1.6492
## + Rush_Yds   1    0.1456 5.8544   0.1297
## + Rush_YA    1    0.1416 5.8584   0.1359
##
## Step:  AIC=-10.4
## Pass_TD ~ Pass_Rate

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 4 in model.matrix: no columns are assigned

##           Df Sum of Sq   RSS   AIC
## <none>                1.8174 -10.3985
## + Pass_nya   1    0.2689 1.5484  -9.8397
## + Pass_ya    1    0.1723 1.6451  -9.2949
## + Rush_YA    1    0.0192 1.7982  -8.4941
## + Rush_Yds   1    0.0002 1.8171  -8.3997
## - Pass_Rate  1    4.1826 6.0000  -1.6492

summary(stepwise_mod41)

##
## Call:
## lm(formula = Pass_TD ~ Pass_Rate, data = cowboys)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.6519 -0.4377 -0.1635  0.3859  0.6984
##
## Coefficients:

```

```

##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.009899   0.608002  -1.661   0.1407
## Pass_Rate    0.029483   0.007345   4.014   0.0051 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5095 on 7 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.6971, Adjusted R-squared:  0.6538
## F-statistic: 16.11 on 1 and 7 DF,  p-value: 0.0051

full_mod51 <- lm(Pass_TD ~ Rush_Yds + Sack_Yds + Rush_Att + Rush_YA + Pass_TD + Pass_nya + Pass_Cmp_Percentage,
                data = dolphins)

## Warning in model.matrix.default(mt, mf, contrasts): the response appeared on
## the right-hand side and was dropped

## Warning in model.matrix.default(mt, mf, contrasts): problem with term 5 in
## model.matrix: no columns are assigned

null_mod51 <- lm(Pass_TD ~ 1, data = dolphins)

stepwise_mod51 <- step(null_mod51, scope = list(lower = null_mod51, upper = full_mod51),
                      direction = "both")

## Start:  AIC=-6.36
## Pass_TD ~ 1

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 5 in model.matrix: no columns are assigned

##               Df Sum of Sq    RSS    AIC
## + Extra_Points_Made      1   2.67593 0.8796 -16.9293
## + Extra_Points_Attempted  1   2.67593 0.8796 -16.9293
## + Pass_nya                1   2.15334 1.4022 -12.7325
## + Pass_Rate               1   2.03561 1.5199 -12.0069
## + Pass_Cmp_Percentage     1   1.92524 1.6303 -11.3761
## + Sack_Yds                1   0.79995 2.7556  -6.6523
## <none>                    3.5556  -6.3584
## + Rush_YA                 1   0.24846 3.3071  -5.0104
## + Rush_Yds                1   0.07464 3.4809  -4.5494
## + Rush_Att                1   0.00250 3.5531  -4.3647
##
## Step:  AIC=-16.93
## Pass_TD ~ Extra_Points_Made

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 6 in model.matrix: no columns are assigned
```

```
##              Df Sum of Sq    RSS      AIC
## + Rush_Att      1   0.21180 0.6678 -17.4085
## <none>              0.8796 -16.9293
## + Pass_nya      1   0.11916 0.7605 -16.2394
## + Rush_Yds      1   0.06977 0.8099 -15.6730
## + Sack_Yds      1   0.05777 0.8219 -15.5407
## + Pass_Cmp_Percentage 1   0.04443 0.8352 -15.3958
## + Pass_Rate      1   0.02600 0.8536 -15.1993
## + Rush_YA       1   0.01239 0.8672 -15.0570
## - Extra_Points_Made 1   2.67593 3.5556 -6.3584
##
## Step:  AIC=-17.41
## Pass_TD ~ Extra_Points_Made + Rush_Att
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 6 in model.matrix: no columns are assigned
```

```
##              Df Sum of Sq    RSS      AIC
## + Rush_YA       1   0.17416 0.4937 -18.1279
## + Rush_Yds      1   0.16050 0.5073 -17.8823
## <none>              0.6678 -17.4085
## - Rush_Att      1   0.21180 0.8796 -16.9293
## + Sack_Yds      1   0.09089 0.5769 -16.7252
## + Pass_Cmp_Percentage 1   0.07761 0.5902 -16.5203
## + Pass_nya      1   0.03617 0.6317 -15.9096
## + Pass_Rate      1   0.03401 0.6338 -15.8789
## - Extra_Points_Made 1   2.88522 3.5531 -4.3647
##
## Step:  AIC=-18.13
## Pass_TD ~ Extra_Points_Made + Rush_Att + Rush_YA
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 6 in model.matrix: no columns are assigned
```

```
##              Df Sum of Sq    RSS      AIC
## <none>              0.4937 -18.1279
## + Pass_Cmp_Percentage 1   0.09814 0.3955 -18.1225
## - Rush_YA       1   0.17416 0.6678 -17.4085
## + Pass_Rate      1   0.02450 0.4692 -16.5860
## + Sack_Yds      1   0.02208 0.4716 -16.5397
## + Rush_Yds      1   0.00278 0.4909 -16.1786
## + Pass_nya      1   0.00075 0.4929 -16.1416
## - Rush_Att      1   0.37356 0.8672 -15.0570
## - Extra_Points_Made 1   2.78934 3.2830 -3.0761
```



```
summary(stepwise_mod51)
```

```
##
## Call:
## lm(formula = Pass_TD ~ Extra_Points_Made + Rush_Att + Rush_YA,
##     data = dolphins)
##
## Residuals:
##      2      3      4      5      6      7      8      9     10
## -0.2026  0.2522  0.2693 -0.1506 -0.2845  0.1686 -0.2387  0.3278 -0.1414
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.17028    0.55676  -0.306  0.77205
## Extra_Points_Made  0.58028    0.10918   5.315  0.00315 **
## Rush_Att        0.03337    0.01716   1.945  0.10935
## Rush_YA         -0.19435    0.14634  -1.328  0.24154
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3142 on 5 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.8612, Adjusted R-squared:  0.7778
## F-statistic: 10.34 on 3 and 5 DF, p-value: 0.01389
```

```
full_mod61 <- lm(Pass_TD ~ Rush_Yds + Pass_Cmp + Pass_Att + Pass_Int + Pass_nya + Pass_Rate + Rush_Att +
data = packers)
```

```
## Warning in model.matrix.default(mt, mf, contrasts): the response appeared on
## the right-hand side and was dropped
```

```
## Warning in model.matrix.default(mt, mf, contrasts): problem with term 12 in
## model.matrix: no columns are assigned
```

```
null_mod61 <- lm(Pass_TD ~ 1, data = packers)
```

```
stepwise_mod61 <- step(null_mod61, scope = list(lower = null_mod61, upper = full_mod61),
direction = "both")
```

```
## Start: AIC=7.18
## Pass_TD ~ 1
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
```

```
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 12 in model.matrix: no columns are assigned
```

```
##              Df Sum of Sq      RSS      AIC
```

```

## + Extra_Points_Made      1      8.1818  7.8182  2.7330
## + Extra_Points_Attempted 1      8.1818  7.8182  2.7330
## + Pass_Int               1      7.1129  8.8871  3.8864
## + Field_Goals_Made       1      6.4000  9.6000  4.5808
## + Pass_Cmp               1      5.7383 10.2617  5.1808
## + Pass_Att               1      4.1259 11.8741  6.4942
## + Rush_Yds               1      3.2811 12.7189  7.1128
## <none>                   16.0000  7.1783
## + Field_Goals_Att        1      2.5000 13.5000  7.6492
## + Pass_nya               1      2.2118 13.7882  7.8393
## + Rush_Att               1      1.5815 14.4185  8.2416
## + Third_Down_Att         1      1.2576 14.7424  8.4415
## + Pass_Rate              1      0.1033 15.8967  9.1200
## + Third_Down_Conv        1      0.0711 15.9289  9.1382
##
## Step:  AIC=2.73
## Pass_TD ~ Extra_Points_Made

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 13 in model.matrix: no columns are assigned

##
##      Df Sum of Sq    RSS    AIC
## + Pass_Cmp      1    3.8963  3.9219 -1.4759
## + Pass_Int      1    3.7924  4.0258 -1.2406
## + Pass_Att      1    3.4634  4.3547 -0.5337
## + Field_Goals_Made 1    3.3197  4.4985 -0.2413
## + Pass_nya      1    2.6105  5.2076  1.0761
## <none>          7.8182  2.7330
## + Rush_Att      1    1.4317  6.3865  2.9127
## + Rush_Yds      1    1.1789  6.6393  3.2620
## + Pass_Rate      1    0.3892  7.4289  4.2734
## + Third_Down_Conv 1    0.3284  7.4898  4.3468
## + Field_Goals_Att 1    0.1700  7.6482  4.5352
## + Third_Down_Att  1    0.0008  7.8174  4.7322
## - Extra_Points_Made 1    8.1818 16.0000  7.1783
##
## Step:  AIC=-1.48
## Pass_TD ~ Extra_Points_Made + Pass_Cmp

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 13 in model.matrix: no columns are assigned

##
##      Df Sum of Sq    RSS    AIC
## + Third_Down_Conv 1    1.0285  2.8934 -2.2131
## <none>          3.9219 -1.4759
## + Pass_Rate      1    0.5765  3.3454 -0.9067
## + Pass_nya      1    0.3701  3.5518 -0.3679
## + Rush_Yds      1    0.3437  3.5782 -0.3013

```

```

## + Field_Goals_Made 1 0.2617 3.6602 -0.0974
## + Third_Down_Att 1 0.2422 3.6797 -0.0496
## + Field_Goals_Att 1 0.1110 3.8109 0.2657
## + Pass_Int 1 0.0999 3.8220 0.2919
## + Rush_Att 1 0.0428 3.8790 0.4253
## + Pass_Att 1 0.0023 3.9196 0.5189
## - Pass_Cmp 1 3.8963 7.8182 2.7330
## - Extra_Points_Made 1 6.3399 10.2617 5.1808
##
## Step: AIC=-2.21
## Pass_TD ~ Extra_Points_Made + Pass_Cmp + Third_Down_Conv

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 13 in model.matrix: no columns are assigned

##
## Df Sum of Sq RSS AIC
## + Pass_nya 1 1.2012 1.6922 -5.0406
## + Rush_Att 1 0.8902 2.0032 -3.5225
## + Third_Down_Att 1 0.8853 2.0081 -3.5004
## + Pass_Att 1 0.7781 2.1153 -3.0321
## + Pass_Int 1 0.7731 2.1203 -3.0109
## + Field_Goals_Made 1 0.6311 2.2623 -2.4277
## <none> 2.8934 -2.2131
## + Pass_Rate 1 0.5218 2.3716 -2.0031
## - Third_Down_Conv 1 1.0285 3.9219 -1.4759
## + Rush_Yds 1 0.2388 2.6546 -0.9884
## + Field_Goals_Att 1 0.0376 2.8558 -0.3308
## - Pass_Cmp 1 4.5964 7.4898 4.3468
## - Extra_Points_Made 1 6.6865 9.5799 6.5620
##
## Step: AIC=-5.04
## Pass_TD ~ Extra_Points_Made + Pass_Cmp + Third_Down_Conv + Pass_nya

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 13 in model.matrix: no columns are assigned

##
## Df Sum of Sq RSS AIC
## + Pass_Att 1 1.0080 0.6842 -11.1904
## + Rush_Yds 1 0.6401 1.0521 -7.3176
## <none> 1.6922 -5.0406
## + Pass_Rate 1 0.2592 1.4330 -4.5371
## + Pass_Int 1 0.1956 1.4966 -4.1463
## + Third_Down_Att 1 0.1514 1.5408 -3.8841
## + Field_Goals_Att 1 0.1476 1.5446 -3.8622
## + Field_Goals_Made 1 0.1363 1.5559 -3.7963
## + Rush_Att 1 0.0124 1.6799 -3.1066
## - Pass_nya 1 1.2012 2.8934 -2.2131
## - Pass_Cmp 1 1.4922 3.1845 -1.3505
## - Third_Down_Conv 1 1.8596 3.5518 -0.3679

```

```

## - Extra_Points_Made 1 7.5795 9.2717 8.2677
##
## Step: AIC=-11.19
## Pass_TD ~ Extra_Points_Made + Pass_Cmp + Third_Down_Conv + Pass_nya +
## Pass_Att

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 13 in model.matrix: no columns are assigned

##          Df Sum of Sq  RSS    AIC
## + Rush_Att      1    0.6524 0.0318 -36.810
## + Third_Down_Att 1    0.4031 0.2811 -17.196
## + Field_Goals_Made 1    0.3317 0.3525 -15.159
## + Field_Goals_Att 1    0.2812 0.4030 -13.954
## <none>                0.6842 -11.190
## + Pass_Int      1    0.1022 0.5820 -10.647
## - Pass_Cmp      1    0.2689 0.9532 -10.207
## + Rush_Yds      1    0.0095 0.6747 -9.317
## + Pass_Rate      1    0.0085 0.6757 -9.303
## - Pass_Att      1    1.0080 1.6922 -5.041
## - Pass_nya      1    1.4311 2.1153 -3.032
## - Third_Down_Conv 1    2.8642 3.5484 1.624
## - Extra_Points_Made 1    8.5852 9.2694 10.265
##
## Step: AIC=-36.81
## Pass_TD ~ Extra_Points_Made + Pass_Cmp + Third_Down_Conv + Pass_nya +
## Pass_Att + Rush_Att

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 13 in model.matrix: no columns are assigned

##          Df Sum of Sq  RSS    AIC
## + Pass_Rate      1    0.0281 0.0037 -54.125
## + Field_Goals_Att 1    0.0152 0.0166 -40.645
## + Field_Goals_Made 1    0.0150 0.0168 -40.530
## + Pass_Int      1    0.0118 0.0200 -38.998
## <none>                0.0318 -36.810
## + Rush_Yds      1    0.0043 0.0275 -36.111
## + Third_Down_Att 1    0.0000 0.0317 -34.824
## - Third_Down_Conv 1    0.4746 0.5064 -13.899
## - Pass_Cmp      1    0.6334 0.6652 -11.443
## - Rush_Att      1    0.6524 0.6842 -11.190
## - Pass_nya      1    1.6038 1.6356 -3.347
## - Pass_Att      1    1.6481 1.6799 -3.107
## - Extra_Points_Made 1    8.9692 9.0010 12.001
##
## Step: AIC=-54.13
## Pass_TD ~ Extra_Points_Made + Pass_Cmp + Third_Down_Conv + Pass_nya +
## Pass_Att + Rush_Att + Pass_Rate

```

```

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped
## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 13 in model.matrix: no columns are assigned

##           Df Sum of Sq    RSS   AIC
## + Rush_Yds      1   0.00372 0.00000 -Inf
## + Pass_Int       1   0.00372 0.00000 -Inf
## + Field_Goals_Made 1   0.00372 0.00000 -Inf
## + Field_Goals_Att 1   0.00372 0.00000 -Inf
## + Third_Down_Att  1   0.00372 0.00000 -Inf
## <none>                0.00372  -54
## - Pass_Rate       1   0.02808 0.03180 -37
## - Third_Down_Conv 1   0.03177 0.03549 -36
## - Pass_Cmp        1   0.64356 0.64728 -10
## - Rush_Att        1   0.67202 0.67574  -9
## - Extra_Points_Made 1   1.28286 1.28658  -4
## - Pass_Att        1   1.42433 1.42805  -3
## - Pass_nya        1   1.61581 1.61953  -1
##
## Step: AIC=-Inf
## Pass_TD ~ Extra_Points_Made + Pass_Cmp + Third_Down_Conv + Pass_nya +
##      Pass_Att + Rush_Att + Pass_Rate + Rush_Yds

## Warning: attempting model selection on an essentially perfect fit is nonsense

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## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## the response appeared on the right-hand side and was dropped

## Warning in model.matrix.default(Terms, m, contrasts.arg = object$contrasts):
## problem with term 13 in model.matrix: no columns are assigned

##           Df Sum of Sq    RSS   AIC
## <none>                0.00000 -Inf
## - Third_Down_Conv  1   0.00047 0.00047 -73
## - Rush_Yds        1   0.00372 0.00372 -54
## - Pass_Rate        1   0.02752 0.02752 -36
## - Pass_Cmp         1   0.05947 0.05947 -29
## - Rush_Att         1   0.63042 0.63042  -8
## - Pass_nya         1   0.69347 0.69347  -7
## - Pass_Att         1   0.95817 0.95817  -4
## - Extra_Points_Made 1   1.12219 1.12219  -3

summary(stepwise_mod61)

##
## Call:
## lm(formula = Pass_TD ~ Extra_Points_Made + Pass_Cmp + Third_Down_Conv +
##      Pass_nya + Pass_Att + Rush_Att + Pass_Rate + Rush_Yds, data = packers)
##

```

```
## Residuals:
## ALL 9 residuals are 0: no residual degrees of freedom!
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -1.378531      NaN      NaN      NaN
## Extra_Points_Made  0.827915      NaN      NaN      NaN
## Pass_Cmp       -0.140069      NaN      NaN      NaN
## Third_Down_Conv  0.027648      NaN      NaN      NaN
## Pass_nya       -1.216100      NaN      NaN      NaN
## Pass_Att        0.204060      NaN      NaN      NaN
## Rush_Att        0.126437      NaN      NaN      NaN
## Pass_Rate       0.022841      NaN      NaN      NaN
## Rush_Yds        0.004141      NaN      NaN      NaN
##
## Residual standard error: NaN on 0 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared: 1, Adjusted R-squared: NaN
## F-statistic: NaN on 8 and 0 DF, p-value: NA
```

```
bears_mod_td <- lm(Pass_TD ~ Extra_Points_Made + Rush_Att + Rush_Yds +
  Third_Down_Conv, bears)
summary(bears_mod_td)
```

```
##
## Call:
## lm(formula = Pass_TD ~ Extra_Points_Made + Rush_Att + Rush_Yds +
##     Third_Down_Conv, data = bears)
##
## Residuals:
##      2      3      4      5      6      7      8      9
## -0.22310 -0.91341  0.44460 -0.71401 -0.12684  0.63653  0.03182  0.23198
##     10
##  0.63243
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.923103    1.376209  -0.671   0.5391
## Extra_Points_Made  0.699011    0.220421   3.171   0.0338 *
## Rush_Att        0.021937    0.070527   0.311   0.7713
## Rush_Yds       -0.004205    0.010093  -0.417   0.6983
## Third_Down_Conv  0.158909    0.143737   1.106   0.3309
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7854 on 4 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.8458, Adjusted R-squared:  0.6915
## F-statistic: 5.484 on 4 and 4 DF, p-value: 0.06402
```

```
vif(bears_mod_td)
```

```
## Extra_Points_Made      Rush_Att      Rush_Yds Third_Down_Conv
##           1.732653           2.426078           3.040886           1.637299
```

```
lions_mod_td <- lm(Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv + Score_Tm +
  Score_Opp + Sack_Yds + Fourth_Down_Att, lions)
summary(lions_mod_td)
```

```
##
## Call:
## lm(formula = Pass_TD ~ Extra_Points_Attempted + Fourth_Down_Conv +
##     Score_Tm + Score_Opp + Sack_Yds + Fourth_Down_Att, data = lions)
##
## Residuals:
##      2      3      4      5      6      7      8
## -0.0153891  0.0199585 -0.0196959 -0.0573017 -0.0464713  0.0262502  0.0709565
##      9     10
##  0.0009924  0.0207004
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.620688   0.162966   3.809  0.06254 .
## Extra_Points_Attempted  0.282389   0.043126   6.548  0.02254 *
## Fourth_Down_Conv     -0.763577   0.071921 -10.617  0.00876 **
## Score_Tm             0.048078   0.006185   7.774  0.01615 *
## Score_Opp          -0.019834   0.004425  -4.482  0.04634 *
## Sack_Yds           -0.026992   0.004456  -6.057  0.02619 *
## Fourth_Down_Att      0.199027   0.048721   4.085  0.05502 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07943 on 2 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.9989, Adjusted R-squared:  0.9958
## F-statistic: 316.6 on 6 and 2 DF, p-value: 0.003152
```

```
vif(lions_mod_td)
```

```
## Extra_Points_Attempted      Fourth_Down_Conv      Score_Tm
##           9.432182           7.833400           7.639267
##           Score_Opp           Sack_Yds      Fourth_Down_Att
##           1.253744           4.242752           7.523886
```

```
giants_mod_td <- lm(Pass_TD ~ Pass_Rate, giants)
summary(giants_mod_td)
```

```
##
## Call:
## lm(formula = Pass_TD ~ Pass_Rate, data = giants)
##
## Residuals:
##      Min      1Q  Median      3Q      Max
## -0.8589 -0.2238  0.1031  0.2828  0.4938
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept) -1.941790  0.472722 -4.108  0.00340 **
## Pass_Rate    0.034619  0.005678  6.097  0.00029 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.461 on 8 degrees of freedom
## (7 observations deleted due to missingness)
## Multiple R-squared:  0.8229, Adjusted R-squared:  0.8008
## F-statistic: 37.18 on 1 and 8 DF, p-value: 0.0002904
```

```
cowboys_mod_td <- lm(Pass_TD ~ Pass_Rate, cowboys)
summary(cowboys_mod_td)
```

```
##
## Call:
## lm(formula = Pass_TD ~ Pass_Rate, data = cowboys)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.6519 -0.4377 -0.1635  0.3859  0.6984
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.009899   0.608002  -1.661   0.1407
## Pass_Rate    0.029483   0.007345   4.014   0.0051 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5095 on 7 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared:  0.6971, Adjusted R-squared:  0.6538
## F-statistic: 16.11 on 1 and 7 DF, p-value: 0.0051
```

```
dolphins_mod_td <- lm(Pass_TD ~ Extra_Points_Made + Rush_Att + Rush_YA, dolphins)
summary(dolphins_mod_td)
```

```
##
## Call:
## lm(formula = Pass_TD ~ Extra_Points_Made + Rush_Att + Rush_YA,
##     data = dolphins)
##
## Residuals:
##      2      3      4      5      6      7      8      9     10
## -0.2026  0.2522  0.2693 -0.1506 -0.2845  0.1686 -0.2387  0.3278 -0.1414
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.17028    0.55676  -0.306  0.77205
## Extra_Points_Made 0.58028    0.10918   5.315  0.00315 **
## Rush_Att        0.03337    0.01716   1.945  0.10935
## Rush_YA         -0.19435    0.14634  -1.328  0.24154
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



```
##
## Residual standard error: 0.3142 on 5 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared: 0.8612, Adjusted R-squared: 0.7778
## F-statistic: 10.34 on 3 and 5 DF, p-value: 0.01389
```

```
vif(dolphins_mod_td)
```

```
## Extra_Points_Made      Rush_Att      Rush_YA
##      1.448622      1.473391      1.604039
```

```
packers_mod_td <- lm(Pass_TD ~ Extra_Points_Made + Pass_nya + Pass_Att + Pass_Rate, packers)
summary(packers_mod_td)
```

```
##
## Call:
## lm(formula = Pass_TD ~ Extra_Points_Made + Pass_nya + Pass_Att +
##     Pass_Rate, data = packers)
##
## Residuals:
##      2      3      4      5      6      7      8      9
## 0.429482 0.355598 -0.740066 -0.007461 0.312883 0.195297 -0.235708 0.005102
##     10
## -0.315127
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -3.81934     2.39394  -1.595   0.1858
## Extra_Points_Made 0.50929     0.18129   2.809   0.0484 *
## Pass_nya       -0.47657     0.21284  -2.239   0.0887 .
## Pass_Att        0.09640     0.02650   3.638   0.0220 *
## Pass_Rate       0.05324     0.01716   3.102   0.0361 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5361 on 4 degrees of freedom
## (8 observations deleted due to missingness)
## Multiple R-squared: 0.9282, Adjusted R-squared: 0.8563
## F-statistic: 12.92 on 4 and 4 DF, p-value: 0.01475
```

```
vif(packers_mod_td)
```

```
## Extra_Points_Made      Pass_nya      Pass_Att      Pass_Rate
##      1.397663      1.711184      2.657716      3.248561
```

```
avg_bears_td <- colMeans(bears[, c("Pass_TD", "Extra_Points_Made", "Rush_Att", "Rush_Yds", "Third_Down_Conv", "Score_Tm")])
predict_bears_td <- data.frame(t(avg_bears_td))
predict_bears_td <- predict(bears_mod_td, newdata = predict_bears_td)
```

```
avg_lions_td <- colMeans(lions[, c("Pass_TD", "Extra_Points_Attempted", "Fourth_Down_Conv", "Score_Tm", "Third_Down_Conv")])
```

```

predict_lions_td <- data.frame(t(avg_lions_td))
predict_lions_td <- predict(lions_mod_td, newdata = predict_lions_td)

combine1_td <- predict_bears_td + predict_lions_td
print(combine1_td)

```

```

## 1
## 3

```

```

avg_giants_td <- colMeans(giants[, c("Pass_TD", "Pass_Rate")], na.rm = TRUE)
predict_giants_td <- data.frame(t(avg_giants_td))
predict_giants_td <- predict(giants_mod_td, newdata = predict_giants_td)

avg_cowboys_td <- colMeans(cowboys[, c("Pass_TD", "Pass_Rate")], na.rm = TRUE)
predict_cowboys_td <- data.frame(t(avg_cowboys_td))
predict_cowboys_td <- predict(cowboys_mod_td, newdata = predict_cowboys_td)

combine2_td <- predict_giants_td + predict_cowboys_td
print(combine2_td)

```

```

##          1
## 2.133333

```

```

avg_dolphins_td <- colMeans(dolphins[, c("Pass_TD", "Extra_Points_Made", "Rush_Att", "Rush_YA")], na.rm = TRUE)
predict_dolphins_td <- data.frame(t(avg_dolphins_td))
predict_dolphins_rush_td <- predict(dolphins_mod_td, newdata = predict_dolphins_td)

avg_packers_td <- colMeans(packers[, c("Pass_TD", "Extra_Points_Made", "Pass_nya", "Pass_Att", "Pass_Ra
predict_packers_td <- data.frame(t(avg_packers_td))
predict_packers_td <- predict(packers_mod_td, newdata = predict_packers_td)

combine3_td <- predict_dolphins_td + predict_packers_td
print(combine3_td)

```

```

##      Pass_TD Extra_Points_Made Rush_Att  Rush_YA
## 1 2.777778      3.333333 31.55556 6.177778

```

```

combine1 <- 255.4444 * combine1_td
combine2 <- combine2_rush * combine2_td
combine3 <- combine3_rush * 2.777778
cat(combine1, combine2, combine3)

```

```

## 766.3332 434.2756 781.1729

```

Summary of Work

Summarize (in 1 paragraph) the work you did that led to the exact prediction you made. In this paragraph, discuss why you think your actual prediction is the “best” or “most accurate.”

I first downloaded the historical data for all games of six teams this year from the Pro Football website because I couldn't find a dataset that included touchdown data in previous years' historical data, so I chose to use only the 2024 data for prediction. First, I downloaded the CSV format and imported it into R, then cleaned and checked the data to make it more suitable for use. After that, I wanted to check if there were any outliers in the data, so I used a boxplot to observe, and removed the identified outliers. Next, I used the `cor()` function to extract the most influential features, and then tried to build a linear regression model to predict the outcome. However, I found that all p-values were greater than 0.05, so I decided to use AIC to improve feature selection. In the end, I chose the AIC model that did not contain '-inf' values and built a linear regression model, and then took the average to predict the product of total rushing yards and total passing touchdowns. I believe this prediction is relatively accurate because my R-square is generally above 80%.

Sources

Cite all sources used. This includes your data and anything used for inspiration or learning new techniques. Your sources can be cited in any format you'd like as long as it's a professional format (i.e. MLA, APA, etc.).
data source: Pro Football Reference. (n.d.). Pro Football Reference. Retrieved from <https://www.pro-football-reference.com>