## Introduction to the tidyverse and ggplot2 libraries

```
library(tidyverse)
## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr 1.1.4 v readr
                                 2.1.5
## v forcats 1.0.0 v stringr 1.5.1
## v ggplot2 3.5.1
                    v tibble
                                  3.2.1
                    v tidyr
## v lubridate 1.9.3
                                  1.3.1
## v purrr
             1.0.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()
                   masks stats::lag()
## i Use the conflicted package (<a href="http://conflicted.r-lib.org/">http://conflicted.r-lib.org/</a>) to force all conflicts to become error
data() # lists all the availale datasets
?mtcars # Details of the mtcars dataset
# Load the Motor Trend Car Road Tests (mtcars) dataset
carData = read.csv('mtcars.csv')
\#carData = mtcars
# Print the first five rows (or samples) in the data frame
head(carData, 5)
Check the datasets available in R
                   X mpg cyl disp hp drat wt qsec vs am gear carb
## 1
           Mazda RX4 21.0 6 160 110 3.90 2.620 16.46 0 1
        Mazda RX4 Wag 21.0 6 160 110 3.90 2.875 17.02 0 1
## 2
           Datsun 710 22.8 4 108 93 3.85 2.320 18.61 1 1
       Hornet 4 Drive 21.4 6 258 110 3.08 3.215 19.44 1 0 3 1
## 5 Hornet Sportabout 18.7 8 360 175 3.15 3.440 17.02 0 0 3
# Print the structure of the data frame
str(carData)
## 'data.frame':
                  32 obs. of 12 variables:
## $ X : chr "Mazda RX4" "Mazda RX4 Wag" "Datsun 710" "Hornet 4 Drive" ...
## $ mpg : num 21 21 22.8 21.4 18.7 18.1 14.3 24.4 22.8 19.2 ...
## $ cyl : int 6646868446 ...
## $ disp: num 160 160 108 258 360 ...
## $ hp : int 110 110 93 110 175 105 245 62 95 123 ...
## $ drat: num 3.9 3.9 3.85 3.08 3.15 2.76 3.21 3.69 3.92 3.92 ...
## $ wt : num 2.62 2.88 2.32 3.21 3.44 ...
## $ qsec: num 16.5 17 18.6 19.4 17 ...
## $ vs : int 0 0 1 1 0 1 0 1 1 1 ...
## $ am : int 1 1 1 0 0 0 0 0 0 0 ...
## $ gear: int 4 4 4 3 3 3 3 4 4 4 ...
```

```
## $ carb: int 4 4 1 1 2 1 4 2 2 4 ...
# Print the names of the columns (features or variables)
colnames(carData)
## [1] "X"
               "mpg" "cyl" "disp" "hp"
                                                          "qsec" "vs"
                                            "drat" "wt"
                                                                         "am"
## [11] "gear" "carb"
# Print the number of samples (rows) and features (columns) in the data frame
nrow(carData)
## [1] 32
ncol(carData)
## [1] 12
# Basic data management using the tidyverse package
# mutate() function is used to add new columns (features or variables) or modify current ones
# Add a new column called cyltype
carData %>% mutate(cyltype = 'High')
##
                        X mpg cyl disp hp drat
                                                      wt qsec vs am gear carb
## 1
                Mazda RX4 21.0
                                 6 160.0 110 3.90 2.620 16.46
                                                                0
## 2
            Mazda RX4 Wag 21.0
                                 6 160.0 110 3.90 2.875 17.02
## 3
               Datsun 710 22.8
                                 4 108.0 93 3.85 2.320 18.61
                                                                         4
                                                                              1
## 4
           Hornet 4 Drive 21.4
                                 6 258.0 110 3.08 3.215 19.44
        Hornet Sportabout 18.7
## 5
                                 8 360.0 175 3.15 3.440 17.02
                                                                         3
                                                                              2
                                                                0
                                                                   0
## 6
                  Valiant 18.1
                                 6 225.0 105 2.76 3.460 20.22
                                                                         3
                                                                              1
## 7
               Duster 360 14.3
                                 8 360.0 245 3.21 3.570 15.84
                                                                         3
                                                                Ω
## 8
                Merc 240D 24.4
                                 4 146.7 62 3.69 3.190 20.00
## 9
                 Merc 230 22.8
                                 4 140.8 95 3.92 3.150 22.90
                                                                              2
                                                                1
                                                                   0
                                                                         4
## 10
                 Merc 280 19.2
                                 6 167.6 123 3.92 3.440 18.30
                                                                         4
                                                                              4
## 11
                Merc 280C 17.8
                                 6 167.6 123 3.92 3.440 18.90
                                                                1
                                                                         4
## 12
               Merc 450SE 16.4
                                 8 275.8 180 3.07 4.070 17.40
                                                                         3
                                 8 275.8 180 3.07 3.730 17.60
## 13
               Merc 450SL 17.3
                                                                         3
                                                                              3
                                                                0
                                                                   0
## 14
              Merc 450SLC 15.2
                                 8 275.8 180 3.07 3.780 18.00
                                                                0
                                                                         3
                                                                              3
## 15
       Cadillac Fleetwood 10.4
                                 8 472.0 205 2.93 5.250 17.98
                                                                         3
## 16 Lincoln Continental 10.4
                                 8 460.0 215 3.00 5.424 17.82
                                                                         3
## 17
        Chrysler Imperial 14.7
                                 8 440.0 230 3.23 5.345 17.42
                                                                0
                                                                   0
                                                                         3
                                                                              4
## 18
                 Fiat 128 32.4
                                 4 78.7
                                          66 4.08 2.200 19.47
                                                                         4
                                                                              1
                                                                1
## 19
              Honda Civic 30.4
                                 4 75.7
                                          52 4.93 1.615 18.52
                                                                         4
                                                                              2
## 20
                                 4 71.1 65 4.22 1.835 19.90
           Toyota Corolla 33.9
                                                                         4
                                                                              1
## 21
            Toyota Corona 21.5
                                 4 120.1 97 3.70 2.465 20.01
                                                                         3
                                                                              1
## 22
         Dodge Challenger 15.5
                                 8 318.0 150 2.76 3.520 16.87
                                                                Λ
                                                                         3
                                                                              2
## 23
              AMC Javelin 15.2
                                 8 304.0 150 3.15 3.435 17.30
                                                                              2
                                 8 350.0 245 3.73 3.840 15.41
## 24
               Camaro Z28 13.3
                                                                         3
                                                                              4
                                                                   0
## 25
         Pontiac Firebird 19.2
                                 8 400.0 175 3.08 3.845 17.05
                                                                         3
                                                                              2
                                                                   0
## 26
                Fiat X1-9 27.3
                                 4 79.0 66 4.08 1.935 18.90
                                                                         4
                                                                1
                                                                              1
## 27
            Porsche 914-2 26.0
                                  4 120.3 91 4.43 2.140 16.70
                                                                         5
## 28
             Lotus Europa 30.4
                                  4 95.1 113 3.77 1.513 16.90
                                                                         5
                                                                              2
                                                                1
                                                                   1
                                 8 351.0 264 4.22 3.170 14.50
## 29
           Ford Pantera L 15.8
                                                                0
                                                                   1
                                                                         5
                                                                              4
## 30
                                 6 145.0 175 3.62 2.770 15.50
                                                                         5
                                                                              6
             Ferrari Dino 19.7
## 31
            Maserati Bora 15.0
                                 8 301.0 335 3.54 3.570 14.60
                                                                         5
                                                                              8
## 32
               Volvo 142E 21.4
                                 4 121.0 109 4.11 2.780 18.60 1
                                                                         4
                                                                              2
##
      cyltype
```

```
## 1
         High
## 2
         High
## 3
         High
## 4
         High
## 5
         High
## 6
         High
## 7
         High
## 8
         High
## 9
         High
## 10
         High
## 11
         High
## 12
         High
## 13
         High
## 14
         High
## 15
         High
## 16
         High
## 17
         High
## 18
         High
## 19
         High
## 20
         High
## 21
         High
## 22
         High
## 23
         High
## 24
         High
## 25
         High
## 26
         High
## 27
         High
## 28
         High
## 29
         High
## 30
         High
## 31
         High
## 32
         High
carData %>% mutate(cyltype = ifelse(cyl >6, 'High', 'Low'))
##
                         X mpg cyl disp hp drat
                                                        wt
                                                            qsec vs am gear carb
## 1
                 Mazda RX4 21.0
                                   6 160.0 110 3.90 2.620 16.46
                                                                            4
                                                                                 4
                                                                   0
                                                                      1
                                   6 160.0 110 3.90 2.875 17.02
                                                                                 4
## 2
            Mazda RX4 Wag 21.0
                                                                      1
                                                                            4
## 3
                Datsun 710 22.8
                                   4 108.0 93 3.85 2.320 18.61
                                                                                 1
## 4
           Hornet 4 Drive 21.4
                                   6 258.0 110 3.08 3.215 19.44
                                                                                 1
                                                                                 2
## 5
        Hornet Sportabout 18.7
                                   8 360.0 175 3.15 3.440 17.02
                                                                   0
                                                                      0
                                                                            3
## 6
                   Valiant 18.1
                                   6 225.0 105 2.76 3.460 20.22
                                                                      0
                                                                            3
                                                                                 1
## 7
               Duster 360 14.3
                                   8 360.0 245 3.21 3.570 15.84
                                                                            3
                                                                                 4
## 8
                Merc 240D 24.4
                                   4 146.7
                                            62 3.69 3.190 20.00
                                                                      0
                                                                            4
                                                                                 2
                                            95 3.92 3.150 22.90
                                                                                 2
## 9
                  Merc 230 22.8
                                   4 140.8
                                                                      0
                                                                            4
## 10
                  Merc 280 19.2
                                   6 167.6 123 3.92 3.440 18.30
                                                                            4
                                                                                 4
                                                                      0
## 11
                Merc 280C 17.8
                                   6 167.6 123 3.92 3.440 18.90
                                                                                 4
## 12
                Merc 450SE 16.4
                                   8 275.8 180 3.07 4.070 17.40
                                                                            3
                                                                                 3
                                                                                 3
## 13
                Merc 450SL 17.3
                                   8 275.8 180 3.07 3.730 17.60
                                                                      0
                                                                            3
```

78.7

75.7

8 275.8 180 3.07 3.780 18.00

8 472.0 205 2.93 5.250 17.98

8 460.0 215 3.00 5.424 17.82

8 440.0 230 3.23 5.345 17.42

66 4.08 2.200 19.47

52 4.93 1.615 18.52

0 0

0 0

1

3

3

3

3

4

3

4

4

4

1

2

## 14

## 15

## 16

## 17

## 18

## 19

Merc 450SLC 15.2

Fiat 128 32.4

Honda Civic 30.4

Cadillac Fleetwood 10.4

Chrysler Imperial 14.7

Lincoln Continental 10.4

```
4 71.1 65 4.22 1.835 19.90
## 20
           Toyota Corolla 33.9
                                                                                1
## 21
                                   4 120.1 97 3.70 2.465 20.01
                                                                           3
                                                                                1
            Toyota Corona 21.5
                                                                                2
## 22
         Dodge Challenger 15.5
                                   8 318.0 150 2.76 3.520 16.87
                                                                           3
## 23
                                   8 304.0 150 3.15 3.435 17.30
                                                                           3
                                                                                2
              AMC Javelin 15.2
## 24
               Camaro Z28 13.3
                                   8 350.0 245 3.73 3.840 15.41
                                                                           3
                                                                                4
## 25
         Pontiac Firebird 19.2
                                   8 400.0 175 3.08 3.845 17.05
                                                                  0
                                                                      0
                                                                           3
                                                                                2
## 26
                Fiat X1-9 27.3
                                   4 79.0
                                           66 4.08 1.935 18.90
                                                                                1
## 27
            Porsche 914-2 26.0
                                   4 120.3 91 4.43 2.140 16.70
                                                                                2
                                                                  0
                                                                      1
                                                                           5
## 28
             Lotus Europa 30.4
                                     95.1 113 3.77 1.513 16.90
                                                                  1
                                                                      1
                                                                           5
                                                                                2
## 29
                                   8 351.0 264 4.22 3.170 14.50
                                                                           5
                                                                                4
           Ford Pantera L 15.8
## 30
             Ferrari Dino 19.7
                                   6 145.0 175 3.62 2.770 15.50
                                                                           5
                                                                                6
            Maserati Bora 15.0
                                   8 301.0 335 3.54 3.570 14.60
## 31
                                                                           5
                                                                                8
                                                                  0
               Volvo 142E 21.4
                                   4 121.0 109 4.11 2.780 18.60
                                                                                2
## 32
##
      cyltype
## 1
          Low
## 2
          Low
## 3
          Low
## 4
          Low
## 5
         High
## 6
          Low
## 7
         High
## 8
          Low
## 9
          I.ow
## 10
          Low
## 11
          Low
## 12
         High
## 13
         High
## 14
         High
## 15
         High
## 16
         High
## 17
         High
## 18
          Low
## 19
          Low
## 20
          Low
## 21
          Low
## 22
         High
## 23
         High
## 24
         High
## 25
         High
## 26
          Low
## 27
          Low
## 28
          Low
## 29
         High
## 30
          Low
## 31
         High
## 32
          Low
# Add a new column called wtton
carData %>% mutate(wtton = 0.45*wt)
##
                         X mpg cyl disp hp drat
                                                        wt
                                                            qsec vs am gear carb
## 1
                 Mazda RX4 21.0
                                   6 160.0 110 3.90 2.620 16.46
                                                                  0
                                                                      1
                                                                           4
                                                                                4
## 2
            Mazda RX4 Wag 21.0
                                   6 160.0 110 3.90 2.875 17.02
                                                                  0
                                                                           4
                                                                                4
                                                                      1
## 3
               Datsun 710 22.8
                                   4 108.0 93 3.85 2.320 18.61
                                                                   1
                                                                           4
                                                                                1
## 4
           Hornet 4 Drive 21.4
                                   6 258.0 110 3.08 3.215 19.44 1
                                                                                1
```

```
## 5
        Hornet Sportabout 18.7
                                  8 360.0 175 3.15 3.440 17.02
                                                                          3
## 6
                  Valiant 18.1
                                  6 225.0 105 2.76 3.460 20.22
                                                                          3
                                                                                1
                                                                  1
                                                                     0
## 7
               Duster 360 14.3
                                  8 360.0 245 3.21 3.570 15.84
                                                                          3
                                                                                4
                                  4 146.7 62 3.69 3.190 20.00
## 8
                Merc 240D 24.4
                                                                          4
                                                                                2
                                                                  1
## 9
                 Merc 230 22.8
                                  4 140.8 95 3.92 3.150 22.90
                                                                     0
                                                                          4
                                                                                2
## 10
                 Merc 280 19.2
                                  6 167.6 123 3.92 3.440 18.30
                                                                          4
                                                                                4
                                                                  1
                                                                     0
## 11
                Merc 280C 17.8
                                  6 167.6 123 3.92 3.440 18.90
                                                                          4
                                                                                4
               Merc 450SE 16.4
                                  8 275.8 180 3.07 4.070 17.40
## 12
                                                                  0
                                                                     0
                                                                          3
                                                                                3
## 13
               Merc 450SL 17.3
                                  8 275.8 180 3.07 3.730 17.60
                                                                  Λ
                                                                     0
                                                                          3
                                                                                3
## 14
                                  8 275.8 180 3.07 3.780 18.00
              Merc 450SLC 15.2
                                                                  0
                                                                     0
                                                                          3
                                                                                3
## 15
       Cadillac Fleetwood 10.4
                                  8 472.0 205 2.93 5.250 17.98
                                                                          3
                                                                                4
      Lincoln Continental 10.4
                                  8 460.0 215 3.00 5.424 17.82
                                                                          3
                                                                                4
## 16
                                                                  0
                                                                     0
## 17
        Chrysler Imperial 14.7
                                  8 440.0 230 3.23 5.345 17.42
                                                                  0
                                                                     0
                                                                          3
                                                                                4
## 18
                                           66 4.08 2.200 19.47
                                                                          4
                 Fiat 128 32.4
                                     78.7
                                                                                1
## 19
              Honda Civic 30.4
                                  4
                                     75.7
                                           52 4.93 1.615 18.52
                                                                          4
                                                                                2
                                                                  1
                                                                     1
## 20
           Toyota Corolla 33.9
                                  4
                                     71.1
                                           65 4.22 1.835 19.90
                                                                  1
                                                                          4
                                                                                1
## 21
                                  4 120.1 97 3.70 2.465 20.01
                                                                          3
            Toyota Corona 21.5
                                                                  1
                                                                     0
                                                                                1
         Dodge Challenger 15.5
## 22
                                  8 318.0 150 2.76 3.520 16.87
                                                                          3
                                                                                2
## 23
              AMC Javelin 15.2
                                  8 304.0 150 3.15 3.435 17.30
                                                                          3
                                                                                2
                                                                  0
                                                                     0
## 24
               Camaro Z28 13.3
                                  8 350.0 245 3.73 3.840 15.41
                                                                  0
                                                                     0
                                                                          3
                                                                                4
## 25
         Pontiac Firebird 19.2
                                  8 400.0 175 3.08 3.845 17.05
                                                                  0
                                                                     0
                                                                          3
                                                                                2
## 26
                Fiat X1-9 27.3
                                  4 79.0 66 4.08 1.935 18.90
                                                                          4
                                                                                1
## 27
            Porsche 914-2 26.0
                                  4 120.3 91 4.43 2.140 16.70
                                                                                2
                                                                  0
                                                                     1
                                                                          5
             Lotus Europa 30.4
                                  4 95.1 113 3.77 1.513 16.90
                                                                          5
                                                                                2
## 28
                                                                     1
                                  8 351.0 264 4.22 3.170 14.50
                                                                                4
## 29
           Ford Pantera L 15.8
                                                                  0
                                                                     1
                                                                          5
## 30
             Ferrari Dino 19.7
                                  6 145.0 175 3.62 2.770 15.50
                                                                  0
                                                                     1
                                                                          5
                                                                                6
## 31
            Maserati Bora 15.0
                                  8 301.0 335 3.54 3.570 14.60
                                                                          5
                                                                                8
                                                                  0
                                                                     1
                                  4 121.0 109 4.11 2.780 18.60 1
                                                                                2
## 32
               Volvo 142E 21.4
                                                                          4
##
        wtton
## 1
     1.17900
## 2
      1.29375
## 3
      1.04400
## 4
     1.44675
## 5
     1.54800
## 6
      1.55700
## 7
     1.60650
## 8 1.43550
## 9 1.41750
## 10 1.54800
## 11 1.54800
## 12 1.83150
## 13 1.67850
## 14 1.70100
## 15 2.36250
## 16 2.44080
## 17 2.40525
## 18 0.99000
## 19 0.72675
## 20 0.82575
## 21 1.10925
## 22 1.58400
## 23 1.54575
## 24 1.72800
## 25 1.73025
```

```
## 26 0.87075
## 27 0.96300
## 28 0.68085
## 29 1.42650
## 30 1.24650
## 31 1.60650
## 32 1.25100
# Create a new data frame with the cyltype and wtton added
carData.new = carData %>% mutate(cyltype = ifelse(cyl >6, 'High', 'Low'), wtton = 0.45*wt)
str(carData.new)
## 'data.frame':
                   32 obs. of 14 variables:
           : chr "Mazda RX4" "Mazda RX4 Wag" "Datsun 710" "Hornet 4 Drive" ...
## $ X
## $ mpg
          : num 21 21 22.8 21.4 18.7 18.1 14.3 24.4 22.8 19.2 ...
## $ cyl
                   6 6 4 6 8 6 8 4 4 6 ...
            : int
           : num 160 160 108 258 360 ...
## $ disp
## $ hp
            : int 110 110 93 110 175 105 245 62 95 123 ...
## $ drat : num 3.9 3.9 3.85 3.08 3.15 2.76 3.21 3.69 3.92 3.92 ...
            : num 2.62 2.88 2.32 3.21 3.44 ...
## $ wt
## $ qsec : num 16.5 17 18.6 19.4 17 ...
## $ vs
           : int 0 0 1 1 0 1 0 1 1 1 ...
## $ am
            : int 1 1 1 0 0 0 0 0 0 0 ...
## $ gear
            : int 4 4 4 3 3 3 3 4 4 4 ...
           : int 4 4 1 1 2 1 4 2 2 4 ...
## $ carb
## $ cyltype: chr "Low" "Low" "Low" "Low" ...
## $ wtton : num 1.18 1.29 1.04 1.45 1.55 ...
head(carData.new, 5)
##
                    X mpg cyl disp hp drat
                                               wt qsec vs am gear carb cyltype
## 1
            Mazda RX4 21.0 6 160 110 3.90 2.620 16.46 0 1
## 2
        Mazda RX4 Wag 21.0
                           6 160 110 3.90 2.875 17.02 0 1
                                                                            Low
           Datsun 710 22.8 4 108 93 3.85 2.320 18.61 1 1
## 3
                                                                    1
                                                                            Low
       Hornet 4 Drive 21.4
                           6 258 110 3.08 3.215 19.44 1 0
                                                                      1
                                                                            Low
## 5 Hornet Sportabout 18.7 8 360 175 3.15 3.440 17.02 0 0
                                                                           High
##
       wtton
## 1 1.17900
## 2 1.29375
## 3 1.04400
## 4 1.44675
## 5 1.54800
# summarize() function collapses all rows (samples) and returns a summary
# Return the mean weight (in tons) of the cars
carData.new %>% summarise(mean(wtton))
##
     mean(wtton)
## 1
       1.447763
# Return the mean weight (in tons) and mean displacement of the cars
carData.new %>% summarise(mean(wtton), mean(disp))
##
     mean(wtton) mean(disp)
## 1
       1.447763
                  230.7219
# group_by() function is used to group samples according to features
# Group cars according to cyltype and calculate mean weight and mean displacement
```

```
carData.new %>% group_by(cyltype) %>%
 summarise(mean(wtton), mean(disp))
## # A tibble: 2 x 3
     cyltype `mean(wtton)` `mean(disp)`
##
    <chr>
                    <dbl>
                                 <dbl>
## 1 High
                     1.80
                                  353.
## 2 Low
                     1.17
                                  136.
# filter() function is used to retain samples satisfying a specific condition
# Filter cars that weight more than 2 tons
carData.new %>% filter (wtton > 2)
                      X mpg cyl disp hp drat
                                                wt qsec vs am gear carb
## 1 Cadillac Fleetwood 10.4 8 472 205 2.93 5.250 17.98 0 0
## 2 Lincoln Continental 10.4 8 460 215 3.00 5.424 17.82 0 0
## 3 Chrysler Imperial 14.7 8 440 230 3.23 5.345 17.42 0 0
                                                                        4
## cyltype wtton
## 1
       High 2.36250
## 2
       High 2.44080
## 3
       High 2.40525
# Filter cars that weight more than 2 tons and have more than 4 cylinders
carData.new %>% filter (wtton > 2 & cyl > 4)
##
                      X mpg cyl disp hp drat
                                                 wt qsec vs am gear carb
## 1 Cadillac Fleetwood 10.4 8 472 205 2.93 5.250 17.98 0 0
## 2 Lincoln Continental 10.4 8 460 215 3.00 5.424 17.82 0 0
                                                                   3
                                                                        4
      Chrysler Imperial 14.7 8 440 230 3.23 5.345 17.42 0 0
                                                                        4
   cyltype wtton
## 1
       High 2.36250
## 2
       High 2.44080
## 3
       High 2.40525
# select() function is used to retain specific features
# Select only the feature wtton
carData.new %>% select(wtton)
##
       wtton
## 1 1.17900
## 2 1.29375
## 3 1.04400
## 4 1.44675
## 5 1.54800
## 6 1.55700
## 7 1.60650
## 8 1.43550
## 9 1.41750
## 10 1.54800
## 11 1.54800
## 12 1.83150
## 13 1.67850
## 14 1.70100
## 15 2.36250
## 16 2.44080
## 17 2.40525
```

```
## 18 0.99000
## 19 0.72675
## 20 0.82575
## 21 1.10925
## 22 1.58400
## 23 1.54575
## 24 1.72800
## 25 1.73025
## 26 0.87075
## 27 0.96300
## 28 0.68085
## 29 1.42650
## 30 1.24650
## 31 1.60650
## 32 1.25100
```

## # Select everything except the feature wtton carData.new %>% select(-wtton)

## 2

Low

```
##
                         X mpg cyl disp hp drat
                                                        wt
                                                            qsec vs am gear
## 1
                Mazda RX4 21.0
                                   6 160.0 110 3.90 2.620 16.46
                                                                  0
                                                                     1
                                                                           4
                                                                                4
## 2
                                                                           4
                                                                                4
            Mazda RX4 Wag 21.0
                                   6 160.0 110 3.90 2.875 17.02
## 3
               Datsun 710 22.8
                                   4 108.0 93 3.85 2.320 18.61
                                                                           4
                                                                                1
## 4
           Hornet 4 Drive 21.4
                                   6 258.0 110 3.08 3.215 19.44
                                                                           3
                                                                                1
## 5
                                  8 360.0 175 3.15 3.440 17.02
                                                                           3
                                                                                2
        Hornet Sportabout 18.7
                                                                  0
                                                                     0
## 6
                  Valiant 18.1
                                   6 225.0 105 2.76 3.460 20.22
                                                                           3
                                                                                1
## 7
               Duster 360 14.3
                                  8 360.0 245 3.21 3.570 15.84
                                                                           3
                                                                                4
                                                                     0
## 8
                Merc 240D 24.4
                                  4 146.7
                                           62 3.69 3.190 20.00
                                                                                2
                                                                     0
                                                                           4
## 9
                 Merc 230 22.8
                                   4 140.8 95 3.92 3.150 22.90
                                                                           4
                                                                                2
                                                                     0
## 10
                 Merc 280 19.2
                                   6 167.6 123 3.92 3.440 18.30
## 11
                Merc 280C 17.8
                                   6 167.6 123 3.92 3.440 18.90
                                                                     0
                                                                           4
                                                                                4
## 12
               Merc 450SE 16.4
                                   8 275.8 180 3.07 4.070 17.40
                                                                           3
                                                                                3
## 13
               Merc 450SL 17.3
                                   8 275.8 180 3.07 3.730 17.60
                                                                           3
                                                                                3
## 14
              Merc 450SLC 15.2
                                   8 275.8 180 3.07 3.780 18.00
                                                                           3
                                                                                3
                                   8 472.0 205 2.93 5.250 17.98
                                                                           3
## 15
       Cadillac Fleetwood 10.4
                                                                  0
                                                                     0
                                                                                4
## 16
      Lincoln Continental 10.4
                                   8 460.0 215 3.00 5.424 17.82
                                                                  0
                                                                     0
                                                                           3
                                                                                4
## 17
        Chrysler Imperial 14.7
                                   8 440.0 230 3.23 5.345 17.42
                                                                           3
                                                                                4
## 18
                 Fiat 128 32.4
                                   4
                                     78.7
                                            66 4.08 2.200 19.47
                                                                           4
                                                                     1
                                                                                1
                                     75.7
                                                                                2
## 19
              Honda Civic 30.4
                                   4
                                            52 4.93 1.615 18.52
                                                                  1
                                                                     1
                                                                           4
## 20
           Toyota Corolla 33.9
                                   4 71.1
                                            65 4.22 1.835 19.90
                                                                           4
                                                                                1
                                                                     1
## 21
            Toyota Corona 21.5
                                   4 120.1
                                           97 3.70 2.465 20.01
                                                                           3
                                                                                1
## 22
         Dodge Challenger 15.5
                                   8 318.0 150 2.76 3.520 16.87
                                                                           3
                                                                                2
## 23
              AMC Javelin 15.2
                                  8 304.0 150 3.15 3.435 17.30
                                                                  0
                                                                     0
                                                                           3
                                                                                2
## 24
               Camaro Z28 13.3
                                  8 350.0 245 3.73 3.840 15.41
                                                                  Ω
                                                                     0
                                                                           3
                                                                                4
## 25
         Pontiac Firebird 19.2
                                   8 400.0 175 3.08 3.845 17.05
                                                                           3
                                                                                2
## 26
                Fiat X1-9 27.3
                                   4 79.0
                                           66 4.08 1.935 18.90
                                                                           4
                                                                                1
## 27
            Porsche 914-2 26.0
                                   4 120.3
                                           91 4.43 2.140 16.70
                                                                           5
                                                                                2
## 28
             Lotus Europa 30.4
                                     95.1 113 3.77 1.513 16.90
                                                                           5
                                                                                2
                                                                  1
##
  29
           Ford Pantera L 15.8
                                   8 351.0 264 4.22 3.170 14.50
                                                                                4
## 30
             Ferrari Dino 19.7
                                   6 145.0 175 3.62 2.770 15.50
                                                                           5
                                                                                6
                                                                  0
                                                                     1
## 31
            Maserati Bora 15.0
                                  8 301.0 335 3.54 3.570 14.60
                                                                  0
                                                                           5
                                                                                8
                                                                                2
## 32
               Volvo 142E 21.4
                                  4 121.0 109 4.11 2.780 18.60
##
      cyltype
## 1
          Low
```

```
## 3
          Low
## 4
          Low
## 5
         High
## 6
          Low
## 7
         High
## 8
          Low
## 9
          Low
## 10
          Low
## 11
          Low
## 12
         High
## 13
         High
## 14
         High
## 15
         High
## 16
         High
## 17
         High
## 18
          Low
## 19
          Low
## 20
          Low
## 21
          Low
## 22
         High
## 23
         High
## 24
         High
## 25
         High
## 26
          Low
## 27
          Low
## 28
          Low
## 29
         High
## 30
          Low
## 31
         High
## 32
          Low
# Select only the features cyltype and wtton
carData.new %>% select(cyltype, wtton)
##
```

```
cyltype
               wtton
## 1
          Low 1.17900
## 2
          Low 1.29375
## 3
          Low 1.04400
## 4
          Low 1.44675
## 5
         High 1.54800
## 6
          Low 1.55700
## 7
         High 1.60650
## 8
          Low 1.43550
## 9
          Low 1.41750
## 10
          Low 1.54800
## 11
          Low 1.54800
## 12
         High 1.83150
## 13
         High 1.67850
## 14
         High 1.70100
## 15
         High 2.36250
         High 2.44080
## 16
## 17
         High 2.40525
          Low 0.99000
## 18
## 19
          Low 0.72675
## 20
          Low 0.82575
```

```
## 21
          Low 1.10925
## 22
         High 1.58400
## 23
         High 1.54575
## 24
         High 1.72800
## 25
         High 1.73025
## 26
          Low 0.87075
## 27
          Low 0.96300
          Low 0.68085
## 28
## 29
         High 1.42650
## 30
          Low 1.24650
## 31
         High 1.60650
## 32
          Low 1.25100
# Select everything except the features cyltype and wtton
carData.new %>% select(-cyltype, -wtton)
##
                         X mpg cyl disp hp drat
                                                       wt
                                                           qsec vs am gear carb
## 1
                Mazda RX4 21.0
                                  6 160.0 110 3.90 2.620 16.46
## 2
            Mazda RX4 Wag 21.0
                                  6 160.0 110 3.90 2.875 17.02
                                                                  0
                                                                          4
                                                                                4
## 3
               Datsun 710 22.8
                                  4 108.0 93 3.85 2.320 18.61
                                                                          4
                                                                                1
## 4
           Hornet 4 Drive 21.4
                                  6 258.0 110 3.08 3.215 19.44
                                                                          3
                                                                                1
## 5
        Hornet Sportabout 18.7
                                  8 360.0 175 3.15 3.440 17.02
                                                                          3
                                                                                2
                                                                     0
## 6
                   Valiant 18.1
                                  6 225.0 105 2.76 3.460 20.22
                                                                          3
                                                                                1
## 7
               Duster 360 14.3
                                  8 360.0 245 3.21 3.570 15.84
                                                                  0
                                                                     0
                                                                          3
                                                                                4
## 8
                Merc 240D 24.4
                                  4 146.7
                                           62 3.69 3.190 20.00
## 9
                 Merc 230 22.8
                                  4 140.8
                                           95 3.92 3.150 22.90
                                                                          4
                                                                                2
## 10
                 Merc 280 19.2
                                  6 167.6 123 3.92 3.440 18.30
                                                                          4
                                                                                4
                                                                     0
## 11
                Merc 280C 17.8
                                  6 167.6 123 3.92 3.440 18.90
                                                                     0
                                                                          4
                                                                                4
## 12
               Merc 450SE 16.4
                                  8 275.8 180 3.07 4.070 17.40
                                                                          3
               Merc 450SL 17.3
                                  8 275.8 180 3.07 3.730 17.60
## 13
                                                                  0
                                                                     0
                                                                          3
                                                                                3
              Merc 450SLC 15.2
                                  8 275.8 180 3.07 3.780 18.00
                                                                          3
## 14
                                                                                3
## 15
       Cadillac Fleetwood 10.4
                                  8 472.0 205 2.93 5.250 17.98
                                                                          3
                                                                                4
## 16 Lincoln Continental 10.4
                                  8 460.0 215 3.00 5.424 17.82
                                                                          3
                                                                                4
## 17
        Chrysler Imperial 14.7
                                  8 440.0 230 3.23 5.345 17.42
                                                                  0
                                                                     0
                                                                          3
                                                                                4
## 18
                 Fiat 128 32.4
                                     78.7
                                            66 4.08 2.200 19.47
                                                                          4
                                                                                1
## 19
              Honda Civic 30.4
                                  4 75.7
                                            52 4.93 1.615 18.52
                                                                          4
                                                                                2
## 20
           Toyota Corolla 33.9
                                  4 71.1
                                           65 4.22 1.835 19.90
                                                                          4
                                                                                1
                                  4 120.1
                                           97 3.70 2.465 20.01
## 21
            Toyota Corona 21.5
                                                                          3
                                                                                1
## 22
                                  8 318.0 150 2.76 3.520 16.87
                                                                  0
                                                                          3
                                                                                2
         Dodge Challenger 15.5
## 23
              AMC Javelin 15.2
                                  8 304.0 150 3.15 3.435 17.30
                                                                          3
                                                                                2
## 24
               Camaro Z28 13.3
                                  8 350.0 245 3.73 3.840 15.41
                                                                                4
                                                                          3
## 25
         Pontiac Firebird 19.2
                                  8 400.0 175 3.08 3.845 17.05
                                                                     0
                                                                          3
                                                                                2
## 26
                Fiat X1-9 27.3
                                  4 79.0 66 4.08 1.935 18.90
                                                                          4
                                                                  1
                                                                                1
## 27
            Porsche 914-2 26.0
                                  4 120.3 91 4.43 2.140 16.70
                                                                          5
                                                                                2
                                  4 95.1 113 3.77 1.513 16.90
                                                                                2
## 28
             Lotus Europa 30.4
                                                                          5
## 29
           Ford Pantera L 15.8
                                  8 351.0 264 4.22 3.170 14.50
                                                                          5
                                                                                4
```

# Initiate the ggplot() function binding to the data frame
ggplot(data = carData)

Ferrari Dino 19.7

Maserati Bora 15.0

Volvo 142E 21.4

## 30

## 31

## 32

6 145.0 175 3.62 2.770 15.50

8 301.0 335 3.54 3.570 14.60

4 121.0 109 4.11 2.780 18.60

5

0

6

8

```
#ggplot(data = carData.new)

# Create a plot object
carplot = ggplot(data = carData)

# Use the aes() function to specify the aesthetic mapping, that is, which variables should be plotted
carplot = ggplot(data = carData, aes(x = wt, y = disp))

# Use the geom_ type functions to add geometric elements
carplot = ggplot(data = carData, aes(x = wt, y = disp)) +
    geom_point()

# Add labels and title
carplot = carplot + labs(x = 'Weight (lbs)', y = 'Displacement (cu. in.)', title = 'Weight vs. Displacement)
```

Weight vs. Displacement

