Data transformation Notebook

This is an R Markdown Notebook. When you execute code within the notebook, the results appear beneath the code.

Try executing this chunk by clicking the Run button within the chunk or by placing your cursor inside it and pressing Ctrl+Shift+Enter.

library(tidyverse)

Add a new chunk by clicking the $Insert\ Chunk$ button on the toolbar or by pressing Ctrl+Alt+I.

When you save the notebook, an HTML file containing the code and output will be saved alongside it (click the Preview button or press Ctrl+Shift+K to preview the HTML file).

The preview shows you a rendered HTML copy of the contents of the editor. Consequently, unlike *Knit*, *Preview* does not run any R code chunks. Instead, the output of the chunk when it was last run in the editor is displayed.

```
data = cars
data
```

```
speed dist
##
                 2
## 1
           4
## 2
           4
                10
## 3
           7
                 4
           7
## 4
                22
## 5
           8
                16
## 6
           9
                10
## 7
          10
                18
## 8
          10
                26
## 9
          10
                34
## 10
          11
                17
## 11
          11
                28
## 12
          12
                14
##
   13
          12
                20
## 14
          12
                24
## 15
          12
                28
## 16
          13
                26
## 17
          13
                34
## 18
          13
                34
## 19
          13
                46
## 20
          14
                26
## 21
          14
                36
## 22
          14
                60
## 23
          14
                80
## 24
          15
                20
```

```
## 25
              26
         15
## 26
              54
         15
## 27
         16
              32
## 28
         16
              40
## 29
         17
              32
## 30
         17
              40
## 31
         17
              50
## 32
         18
              42
## 33
         18
              56
## 34
         18
              76
## 35
         18
              84
## 36
              36
         19
## 37
         19
              46
## 38
         19
              68
## 39
         20
              32
## 40
         20
              48
## 41
         20
              52
## 42
         20
              56
## 43
         20
              64
## 44
         22
              66
## 45
         23
              54
## 46
         24
              70
## 47
         24
              92
## 48
         24
             93
## 49
         24 120
## 50
         25
              85
```

Summary

summary(data)

```
##
       speed
                      dist
                 Min. : 2.00
## Min. : 4.0
##
  1st Qu.:12.0
                 1st Qu.: 26.00
                 Median : 36.00
## Median :15.0
## Mean :15.4
                 Mean : 42.98
                 3rd Qu.: 56.00
##
   3rd Qu.:19.0
##
  Max.
          :25.0
                 Max. :120.00
```

data |> count(speed)

```
##
      speed n
## 1
          4 2
          7 2
## 2
## 3
          8 1
## 4
          9 1
         10 3
## 5
## 6
         11 2
## 7
         12 4
## 8
         13 4
## 9
         14 4
```

```
## 10
          15 3
## 11
          16 2
## 12
          17 3
          18 4
## 13
## 14
          19 3
## 15
          20 5
## 16
          22 1
## 17
          23 1
## 18
          24 4
## 19
          25 1
```

Group

mtcars

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

```
mtcars %>% group_by(cyl) %>% summary(avg = mean(mpg))
```

mpg cyl disp hp

```
Min. :10.40
                                     Min. :4.000
                                                                    Min. : 71.1
                                                                                                   Min. : 52.0
                                                                                                   1st Qu.: 96.5
                                     1st Qu.:4.000
                                                                    1st Qu.:120.8
##
       1st Qu.:15.43
       Median :19.20
                                     Median :6.000
                                                                    Median :196.3
                                                                                                   Median :123.0
      Mean
                  :20.09
                                     Mean :6.188
                                                                    Mean :230.7
                                                                                                   Mean
                                                                                                             :146.7
##
##
       3rd Qu.:22.80
                                      3rd Qu.:8.000
                                                                     3rd Qu.:326.0
                                                                                                   3rd Qu.:180.0
                                                  :8.000
       Max.
                    :33.90
                                                                                                               :335.0
##
                                     Max.
                                                                    Max. :472.0
                                                                                                   Max.
##
                 drat
                                                 wt
                                                                              qsec
                                                                                                              VS
##
       Min.
                    :2.760
                                      Min. :1.513
                                                                    Min. :14.50
                                                                                                   Min.
                                                                                                                :0.0000
##
       1st Qu.:3.080
                                      1st Qu.:2.581
                                                                    1st Qu.:16.89
                                                                                                   1st Qu.:0.0000
##
       Median :3.695
                                      Median :3.325
                                                                    Median :17.71
                                                                                                   Median :0.0000
     Mean :3.597
                                      Mean :3.217
                                                                    Mean :17.85
                                                                                                   Mean :0.4375
       3rd Qu.:3.920
                                                                     3rd Qu.:18.90
##
                                      3rd Qu.:3.610
                                                                                                   3rd Qu.:1.0000
##
       Max.
                   :4.930
                                      Max.
                                                  :5.424
                                                                    Max.
                                                                               :22.90
                                                                                                   Max. :1.0000
##
                  am
                                                 gear
                                                                                carb
##
                                        Min. :3.000
                                                                      Min. :1.000
      Min.
                    :0.0000
##
       1st Qu.:0.0000
                                        1st Qu.:3.000
                                                                      1st Qu.:2.000
     Median :0.0000
                                        Median :4.000
                                                                      Median :2.000
##
     Mean :0.4062
                                        Mean :3.688
                                                                      Mean :2.812
     3rd Qu.:1.0000
##
                                        3rd Qu.:4.000
                                                                      3rd Qu.:4.000
## Max. :1.0000
                                        Max. :5.000
                                                                      Max. :8.000
g_mtcars <- mtcars %>% group_by(cyl)
ungroup(g_mtcars)
## # A tibble: 32 x 11
##
                          cyl disp
                                                   hp drat
                                                                          wt qsec
                                                                                                 ٧s
                                                                                                             am gear
##
           <dbl> 
##
       1 21
                              6
                                  160
                                                  110
                                                         3.9
                                                                      2.62
                                                                                  16.5
                                                                                                   0
                                                                                                               1
                                                                                                                          4
##
       2 21
                                    160
                                                 110
                                                         3.9
                                                                      2.88
                                                                                  17.0
                                                                                                                          4
                                                                                                                                      4
                              6
                                                                                                   0
                                                                                                               1
      3 22.8
##
                                   108
                                                   93 3.85
                                                                     2.32
                                                                                  18.6
                                                                                                                          4
     4 21.4
                                    258
                                                 110 3.08 3.22
                                                                                  19.4
##
                                                                                                               0
                                                                                                                          3
                              6
                                                                                                                                      1
                                                                                                   1
##
       5 18.7
                              8
                                    360
                                                 175
                                                          3.15
                                                                     3.44
                                                                                  17.0
                                                                                                               0
                                                                                                                          3
                                                                                                                                      2
                                                                                                   0
##
       6 18.1
                                    225
                                                 105
                                                         2.76 3.46
                                                                                  20.2
                                                                                                               0
                                                                                                                          3
                              6
                                                                                                   1
                                                                                                                                      1
##
      7 14.3
                                    360
                                                  245
                                                         3.21 3.57
                                                                                15.8
                                                                                                               0
                                                                                                                          3
                                                                                                                                      4
                              8
                                                                                                   0
      8 24.4
##
                              4
                                    147.
                                                   62 3.69 3.19
                                                                                  20
                                                                                                               0
                                                                                                                          4
                                                                                                                                      2
                                                                                                   1
       9
             22.8
                                    141.
                                                   95
                                                          3.92 3.15
                                                                                  22.9
                                                                                                               0
                                                                                                                          4
                                                                                                                                      2
##
                                                                                                   1
## 10
             19.2
                              6 168.
                                                  123 3.92 3.44
                                                                                18.3
                                                                                                               0
                                                                                                                          4
                                                                                                   1
## # i 22 more rows
starwars %>% rowwise() %>%
mutate(film_count = length(films))
## # A tibble: 87 x 15
## # Rowwise:
##
                            height mass hair_color skin_color eye_color birth_year sex
           name
                                                                                                                                                   gender
##
           <chr>
                              <int> <dbl> <chr>
                                                                          <chr>
                                                                                                <chr>
                                                                                                                            <dbl> <chr> <chr>
##
      1 Luke Sk~
                                  172
                                               77 blond
                                                                          fair
                                                                                               blue
                                                                                                                                       male mascu~
                                                                                                                              19
##
     2 C-3PO
                                  167
                                               75 <NA>
                                                                          gold
                                                                                               yellow
                                                                                                                            112
                                                                                                                                       none mascu~
                                                                          white, bl~ red
##
       3 R2-D2
                                   96
                                               32 <NA>
                                                                                                                              33
                                                                                                                                       none
                                                                                                                                                   mascu~
                                  202
## 4 Darth V~
                                              136 none
                                                                          white
                                                                                               yellow
                                                                                                                              41.9 male mascu~
## 5 Leia Or~
                                  150
                                               49 brown
                                                                          light
                                                                                               brown
                                                                                                                              19
                                                                                                                                       fema~ femin~
                                  178
                                                                                                                              52 male mascu~
## 6 Owen La~
                                             120 brown, gr~ light
                                                                                               blue
```

```
## 7 Beru Wh~
                  165
                         75 brown
                                       light
                                                  blue
                                                                  47
                                                                       fema~ femin~
                         32 <NA>
## 8 R5-D4
                  97
                                                                  NA
                                                                       none mascu~
                                       white, red red
## 9 Biggs D~
                  183
                         84 black
                                       light
                                                  brown
                                                                  24
                                                                       male mascu~
## 10 Obi-Wan~
                  182
                         77 auburn, w~ fair
                                                                       male mascu~
                                                  blue-gray
                                                                  57
## # i 77 more rows
## # i 6 more variables: homeworld <chr>, species <chr>, films <list>,
      vehicles <list>, starships <list>, film count <int>
```

Manipulate Cases

```
mtcars |> filter(mpg > 20)
```

Extract Cases

```
##
                  mpg cyl disp hp drat
                                            wt qsec vs am gear carb
## Mazda RX4
                 21.0
                        6 160.0 110 3.90 2.620 16.46
                                                     0
## Mazda RX4 Wag
                 21.0
                        6 160.0 110 3.90 2.875 17.02
## Datsun 710
                 22.8
                       4 108.0 93 3.85 2.320 18.61
                                                      1
                                                         1
                                                                   1
## Hornet 4 Drive 21.4
                       6 258.0 110 3.08 3.215 19.44
## Merc 240D
                 24.4
                       4 146.7
                                62 3.69 3.190 20.00
                                                         0
                                                      1
                                                                   2
## Merc 230
                 22.8
                        4 140.8
                                95 3.92 3.150 22.90
                                                         0
## Fiat 128
                 32.4
                       4 78.7
                                66 4.08 2.200 19.47
                                                                   1
                                                      1
                                                         1
## Honda Civic
                 30.4
                       4 75.7
                                 52 4.93 1.615 18.52
## Toyota Corolla 33.9
                       4 71.1
                                65 4.22 1.835 19.90
                                                      1
                                                                   1
## Toyota Corona
                 21.5
                       4 120.1
                                97 3.70 2.465 20.01
                       4 79.0 66 4.08 1.935 18.90
                 27.3
## Fiat X1-9
                                                                  1
                                                      1
                 26.0
                        4 120.3 91 4.43 2.140 16.70
## Porsche 914-2
                        4 95.1 113 3.77 1.513 16.90
                                                                   2
## Lotus Europa
                 30.4
                                                      1 1
                                                              5
## Volvo 142E
                 21.4
                        4 121.0 109 4.11 2.780 18.60 1 1
```

mtcars |> filter(mpg < 20)</pre>

```
mpg cyl disp hp drat
                                                  wt qsec vs am gear carb
## Hornet Sportabout
                              8 360.0 175 3.15 3.440 17.02
                       18.7
## Valiant
                       18.1
                              6 225.0 105 2.76 3.460 20.22
                                                                         1
## Duster 360
                       14.3
                              8 360.0 245 3.21 3.570 15.84
                                                                         4
## Merc 280
                       19.2
                              6 167.6 123 3.92 3.440 18.30
                                                            1
                                                               0
                                                                         4
## Merc 280C
                       17.8
                              6 167.6 123 3.92 3.440 18.90
## Merc 450SE
                       16.4
                              8 275.8 180 3.07 4.070 17.40
## Merc 450SL
                       17.3
                              8 275.8 180 3.07 3.730 17.60
                                                                    3
                                                            0
                                                               0
                                                                         3
## Merc 450SLC
                       15.2
                              8 275.8 180 3.07 3.780 18.00
                                                            0
                                                               0
                                                                    3
                                                                         3
                                                                    3
## Cadillac Fleetwood 10.4
                              8 472.0 205 2.93 5.250 17.98
                              8 460.0 215 3.00 5.424 17.82
                                                                    3
## Lincoln Continental 10.4
                                                               0
                                                                         4
## Chrysler Imperial
                       14.7
                              8 440.0 230 3.23 5.345 17.42
                                                            0
                                                                    3
                                                                         4
                                                                    3
                                                                         2
## Dodge Challenger
                       15.5
                              8 318.0 150 2.76 3.520 16.87
                                                            0
                                                               0
## AMC Javelin
                       15.2
                              8 304.0 150 3.15 3.435 17.30
## Camaro Z28
                              8 350.0 245 3.73 3.840 15.41
                       13.3
                                                            Ω
                                                               Ω
                                                                    3
## Pontiac Firebird
                       19.2
                              8 400.0 175 3.08 3.845 17.05
                                                            0
                                                               0
                                                                    3
                                                                         2
## Ford Pantera L
                                                                    5
                                                                         4
                       15.8
                              8 351.0 264 4.22 3.170 14.50
                                                            Ω
                                                               1
## Ferrari Dino
                       19.7
                              6 145.0 175 3.62 2.770 15.50 0
                              8 301.0 335 3.54 3.570 14.60 0
                                                                         8
## Maserati Bora
                       15.0
```

mtcars |> filter(disp > 120)

```
##
                        mpg cyl disp hp drat
                                                  wt qsec vs am gear carb
                              6 160.0 110 3.90 2.620 16.46
## Mazda RX4
                       21.0
                                                                          4
                                                            0
                                                               1
## Mazda RX4 Wag
                       21.0
                              6 160.0 110 3.90 2.875 17.02
                       21.4
                              6 258.0 110 3.08 3.215 19.44
## Hornet 4 Drive
                                                            1
                                                               0
                                                                     3
                                                                          1
                       18.7
                              8 360.0 175 3.15 3.440 17.02
                                                                          2
## Hornet Sportabout
## Valiant
                       18.1
                              6 225.0 105 2.76 3.460 20.22
                                                            1
                                                               0
                                                                     3
                                                                          1
## Duster 360
                       14.3
                              8 360.0 245 3.21 3.570 15.84
                                                               0
                                                                          4
## Merc 240D
                              4 146.7 62 3.69 3.190 20.00
                       24.4
                                                               0
                                                                    4
                                                                          2
                                                            1
## Merc 230
                              4 140.8 95 3.92 3.150 22.90
                                                                    4
                                                                          2
                       22.8
                                                            1
                                                               0
## Merc 280
                                                                    4
                       19.2
                              6 167.6 123 3.92 3.440 18.30
                                                               0
                                                                          4
## Merc 280C
                       17.8
                              6 167.6 123 3.92 3.440 18.90
                                                            1
                                                               0
## Merc 450SE
                              8 275.8 180 3.07 4.070 17.40
                                                                    3
                       16.4
                                                            0
                                                               0
                                                                          3
## Merc 450SL
                       17.3
                              8 275.8 180 3.07 3.730 17.60
                                                            0
                                                               0
                                                                    3
                                                                          3
                                                                    3
                                                                          3
## Merc 450SLC
                       15.2
                              8 275.8 180 3.07 3.780 18.00
## Cadillac Fleetwood 10.4
                              8 472.0 205 2.93 5.250 17.98
                                                                    3
                                                               0
                                                                          4
## Lincoln Continental 10.4
                              8 460.0 215 3.00 5.424 17.82
                                                            0
                                                                    3
                                                                          4
## Chrysler Imperial
                       14.7
                              8 440.0 230 3.23 5.345 17.42
                                                            0
                                                               0
                                                                    3
                                                                          4
                                                                    3
## Toyota Corona
                       21.5
                              4 120.1 97 3.70 2.465 20.01
                              8 318.0 150 2.76 3.520 16.87
                                                                    3
## Dodge Challenger
                       15.5
                                                            0
                                                               0
                                                                          2
## AMC Javelin
                       15.2
                              8 304.0 150 3.15 3.435 17.30
                                                            0
                                                               0
                                                                    3
                                                                          2
## Camaro Z28
                       13.3
                              8 350.0 245 3.73 3.840 15.41
                                                            0
                                                               0
                                                                    3
                                                                          4
## Pontiac Firebird
                       19.2
                              8 400.0 175 3.08 3.845 17.05
                                                                          2
## Porsche 914-2
                       26.0
                              4 120.3 91 4.43 2.140 16.70
                                                                    5
                                                                          2
                                                           0
                                                               1
## Ford Pantera L
                              8 351.0 264 4.22 3.170 14.50
                                                                    5
                       15.8
                                                            0
                                                               1
                                                                          4
## Ferrari Dino
                       19.7
                              6 145.0 175 3.62 2.770 15.50 0
                                                                    5
                                                                          6
                                                              1
## Maserati Bora
                              8 301.0 335 3.54 3.570 14.60 0
                       15.0
## Volvo 142E
                       21.4
                              4 121.0 109 4.11 2.780 18.60 1 1
```

mtcars |> distinct(gear)

```
## Mazda RX4 4
## Hornet 4 Drive 3
## Porsche 914-2 5
```

mtcars |> distinct(disp)

```
##
                         disp
## Mazda RX4
                        160.0
## Datsun 710
                        108.0
## Hornet 4 Drive
                        258.0
## Hornet Sportabout
                        360.0
## Valiant
                        225.0
## Merc 240D
                        146.7
## Merc 230
                        140.8
## Merc 280
                        167.6
## Merc 450SE
                        275.8
## Cadillac Fleetwood 472.0
## Lincoln Continental 460.0
```

```
## Chrysler Imperial
                      440.0
## Fiat 128
                       78.7
## Honda Civic
                       75.7
## Toyota Corolla
                       71.1
## Toyota Corona
                      120.1
## Dodge Challenger
                      318.0
## AMC Javelin
                      304.0
## Camaro Z28
                      350.0
## Pontiac Firebird
                      400.0
## Fiat X1-9
                       79.0
## Porsche 914-2
                      120.3
## Lotus Europa
                       95.1
## Ford Pantera L
                      351.0
## Ferrari Dino
                      145.0
## Maserati Bora
                      301.0
## Volvo 142E
                      121.0
mtcars |> distinct(am)
                 am
## Mazda RX4
                  1
## Hornet 4 Drive 0
mtcars |> slice(10:15)
##
                      mpg cyl disp hp drat wt qsec vs am gear carb
## Merc 280
                            6 167.6 123 3.92 3.44 18.30
                     19.2
                                                       1
## Merc 280C
                            6 167.6 123 3.92 3.44 18.90
                                                                     4
                     17.8
                                                       1 0
## Merc 450SE
                     16.4
                            8 275.8 180 3.07 4.07 17.40 0 0
                                                                     3
## Merc 450SL
                            8 275.8 180 3.07 3.73 17.60 0 0
                                                                     3
                     17.3
## Merc 450SLC
                     15.2 8 275.8 180 3.07 3.78 18.00 0
                                                                     3
## Cadillac Fleetwood 10.4 8 472.0 205 2.93 5.25 17.98 0 0
mtcars |> slice(1:15)
##
                      mpg cyl disp hp drat
                                               wt qsec vs am gear carb
                            6 160.0 110 3.90 2.620 16.46
## Mazda RX4
                     21.0
                                                         0
                                                           1
## Mazda RX4 Wag
                     21.0
                            6 160.0 110 3.90 2.875 17.02
## Datsun 710
                     22.8 4 108.0 93 3.85 2.320 18.61 1 1
                                                                      1
## Hornet 4 Drive
                     21.4 6 258.0 110 3.08 3.215 19.44
                                                                      1
## Hornet Sportabout 18.7 8 360.0 175 3.15 3.440 17.02 0 0
## Valiant
                     18.1
                            6 225.0 105 2.76 3.460 20.22 1 0
## Duster 360
                     14.3
                            8 360.0 245 3.21 3.570 15.84 0 0
                                                                 3
## Merc 240D
                     24.4 4 146.7 62 3.69 3.190 20.00 1 0
## Merc 230
                     22.8 4 140.8 95 3.92 3.150 22.90 1 0
## Merc 280
                     19.2
                            6 167.6 123 3.92 3.440 18.30 1 0
## Merc 280C
                     17.8
                            6 167.6 123 3.92 3.440 18.90 1 0
## Merc 450SE
                     16.4 8 275.8 180 3.07 4.070 17.40 0 0
                                                                 3
                                                                      3
```

17.3 8 275.8 180 3.07 3.730 17.60 0 0

15.2 8 275.8 180 3.07 3.780 18.00 0 0

Cadillac Fleetwood 10.4 8 472.0 205 2.93 5.250 17.98 0 0

3

3

Merc 450SL

Merc 450SLC

```
mtcars |> slice_sample(n = 5, replace = TRUE)
##
                      mpg cyl disp hp drat
                                               wt qsec vs am gear carb
## Duster 360
                            8 360.0 245 3.21 3.570 15.84
                      14.3
                                                         0
                            8 460.0 215 3.00 5.424 17.82
                                                                     4
## Lincoln Continental 10.4
                                                         0
                                                            0
## Merc 450SLC
                     15.2
                           8 275.8 180 3.07 3.780 18.00 0
                                                           0
                                                                3
                                                                     3
## Hornet 4 Drive...4 21.4
                            6 258.0 110 3.08 3.215 19.44 1 0
                                                                     1
## Hornet 4 Drive...5 21.4 6 258.0 110 3.08 3.215 19.44 1 0
mtcars |> slice_sample(n = 5, replace = FALSE)
##
                    mpg cyl disp hp drat
                                             wt qsec vs am gear carb
## AMC Javelin
                    15.2
                         8 304.0 150 3.15 3.435 17.30
                                                      0
## Pontiac Firebird 19.2
                         8 400.0 175 3.08 3.845 17.05
                                                                   2
                                                       0 0
## Mazda RX4
                   21.0
                         6 160.0 110 3.90 2.620 16.46
                                                      0 1
                                                                   4
## Chrysler Imperial 14.7
                          8 440.0 230 3.23 5.345 17.42 0 0
                                                                   4
## Merc 280
                   19.2
                          6 167.6 123 3.92 3.440 18.30 1 0
mtcars |> slice_min(mpg, prop = 0.25)
##
                      mpg cyl disp hp drat
                                               wt qsec vs am gear carb
## Cadillac Fleetwood 10.4
                           8 472.0 205 2.93 5.250 17.98 0
                                                           0
## Lincoln Continental 10.4
                           8 460.0 215 3.00 5.424 17.82
## Camaro Z28
                     13.3
                           8 350.0 245 3.73 3.840 15.41 0
                                                                     4
## Duster 360
                     14.3
                           8 360.0 245 3.21 3.570 15.84
                                                         0
## Chrysler Imperial 14.7 8 440.0 230 3.23 5.345 17.42 0 0
## Maserati Bora
                     15.0 8 301.0 335 3.54 3.570 14.60 0 1
## Merc 450SLC
                     15.2
                            8 275.8 180 3.07 3.780 18.00 0 0
                                                                3
                                                                     3
## AMC Javelin
                     15.2
                            8 304.0 150 3.15 3.435 17.30 0 0
mtcars |> slice_min(disp, prop = 0.25)
##
                 mpg cyl disp hp drat
                                          wt qsec vs am gear carb
## Toyota Corolla 33.9
                      4 71.1 65 4.22 1.835 19.90 1 1
## Honda Civic
                30.4
                      4 75.7 52 4.93 1.615 18.52 1
## Fiat 128
                 32.4 4 78.7 66 4.08 2.200 19.47
                                                    1 1
                                                                1
## Fiat X1-9
                 27.3 4 79.0 66 4.08 1.935 18.90
                30.4 4 95.1 113 3.77 1.513 16.90
## Lotus Europa
                                                   1 1
## Datsun 710
                 22.8 4 108.0 93 3.85 2.320 18.61
                                                    1 1
                                                                1
## Toyota Corona 21.5 4 120.1 97 3.70 2.465 20.01 1 0
                                                            3
                                                                1
## Porsche 914-2 26.0 4 120.3 91 4.43 2.140 16.70 0 1
mtcars |> slice_head(n = 5)
##
                    mpg cyl disp hp drat
                                            wt qsec vs am gear carb
## Mazda RX4
                   21.0
                          6 160 110 3.90 2.620 16.46
                                                      0
                                                        1
                                                                  4
## Mazda RX4 Wag
                          6 160 110 3.90 2.875 17.02 0
                   21.0
## Datsun 710
                    22.8 4 108 93 3.85 2.320 18.61 1 1
                                                                  1
## Hornet 4 Drive
                   21.4 6 258 110 3.08 3.215 19.44
                                                      1 0
                                                             3
                                                                  1
## Hornet Sportabout 18.7
                        8 360 175 3.15 3.440 17.02 0 0
                                                                  2
```

mtcars |> slice_tail(n = 5)

```
##
                  mpg cyl disp hp drat
                                            wt qsec vs am gear carb
## Lotus Europa
                 30.4
                        4 95.1 113 3.77 1.513 16.9
                                                    1
                                                        1
                                                             5
                                                                  2
## Ford Pantera L 15.8
                        8 351.0 264 4.22 3.170 14.5
                                                        1
## Ferrari Dino
                 19.7
                        6 145.0 175 3.62 2.770 15.5
                                                    0
                                                       1
## Maserati Bora 15.0
                        8 301.0 335 3.54 3.570 14.6 0 1
                                                             5
                                                                  8
## Volvo 142E
                 21.4
                        4 121.0 109 4.11 2.780 18.6 1 1
                                                                  2
```

mtcars |> arrange(mpg)

ARRANGE CASES

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

mtcars |> arrange(desc(mpg))

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

```
cars |> add_row(speed = 1, dist = 1)
```

Add Cases

```
##
       speed dist
## 1
                 2
           4
## 2
           4
                10
## 3
           7
                 4
## 4
           7
                22
## 5
           8
                16
## 6
           9
                10
## 7
          10
                18
## 8
          10
                26
## 9
          10
                34
## 10
          11
                17
## 11
                28
          11
## 12
          12
                14
```

```
## 13
             20
        12
## 14
        12
             24
## 15
        12
             28
## 16
        13
             26
## 17
        13
             34
## 18
        13
             34
## 19
        13
             46
## 20
        14
             26
## 21
        14
             36
## 22
        14
             60
## 23
        14
             80
## 24
             20
        15
## 25
        15
             26
## 26
        15
             54
## 27
        16
             32
## 28
        16
             40
## 29
        17
             32
## 30
        17
             40
## 31
        17
             50
## 32
             42
        18
## 33
        18
             56
## 34
        18
             76
## 35
        18
             84
## 36
        19
             36
## 37
        19
             46
## 38
        19
             68
## 39
        20
             32
## 40
        20
             48
## 41
        20 52
## 42
        20 56
## 43
        20 64
## 44
        22 66
## 45
        23 54
## 46
        24 70
## 47
        24 92
## 48
        24 93
## 49
        24 120
## 50
        25
             85
## 51
         1
#?base::Logic
```

```
#?base::Logic
?Comparison
```

starting httpd help server \dots done

Manipulate Variables

```
mtcars |> pull(wt)
```

Extract Variables

```
## [1] 2.620 2.875 2.320 3.215 3.440 3.460 3.570 3.190 3.150 3.440 3.440 4.070
## [13] 3.730 3.780 5.250 5.424 5.345 2.200 1.615 1.835 2.465 3.520 3.435 3.840
## [25] 3.845 1.935 2.140 1.513 3.170 2.770 3.570 2.780
mtcars |> pull(disp)
## [1] 160.0 160.0 108.0 258.0 360.0 225.0 360.0 146.7 140.8 167.6 167.6 275.8
## [13] 275.8 275.8 472.0 460.0 440.0 78.7 75.7 71.1 120.1 318.0 304.0 350.0
## [25] 400.0 79.0 120.3 95.1 351.0 145.0 301.0 121.0
mtcars |> pull(mpg)
## [1] 21.0 21.0 22.8 21.4 18.7 18.1 14.3 24.4 22.8 19.2 17.8 16.4 17.3 15.2 10.4
## [16] 10.4 14.7 32.4 30.4 33.9 21.5 15.5 15.2 13.3 19.2 27.3 26.0 30.4 15.8 19.7
## [31] 15.0 21.4
mtcars |> select(mpg, wt)
##
                       mpg
                               wt
## Mazda RX4
                       21.0 2.620
## Mazda RX4 Wag
                       21.0 2.875
## Datsun 710
                       22.8 2.320
```

Hornet 4 Drive 21.4 3.215 ## Hornet Sportabout 18.7 3.440 ## Valiant 18.1 3.460 ## Duster 360 14.3 3.570 ## Merc 240D 24.4 3.190 ## Merc 230 22.8 3.150 ## Merc 280 19.2 3.440 ## Merc 280C 17.8 3.440 ## Merc 450SE 16.4 4.070 ## Merc 450SL 17.3 3.730 ## Merc 450SLC 15.2 3.780 ## Cadillac Fleetwood 10.4 5.250 ## Lincoln Continental 10.4 5.424 ## Chrysler Imperial 14.7 5.345 ## Fiat 128 32.4 2.200 ## Honda Civic 30.4 1.615 ## Toyota Corolla 33.9 1.835 ## Toyota Corona 21.5 2.465 ## Dodge Challenger 15.5 3.520 ## AMC Javelin 15.2 3.435 ## Camaro Z28 13.3 3.840 ## Pontiac Firebird 19.2 3.845 ## Fiat X1-9 27.3 1.935 ## Porsche 914-2 26.0 2.140 ## Lotus Europa 30.4 1.513 ## Ford Pantera L 15.8 3.170 ## Ferrari Dino 19.7 2.770 ## Maserati Bora 15.0 3.570 ## Volvo 142E 21.4 2.780

mtcars |> select(am, disp)

```
##
                       am disp
## Mazda RX4
                        1 160.0
## Mazda RX4 Wag
                        1 160.0
## Datsun 710
                        1 108.0
## Hornet 4 Drive
                        0 258.0
## Hornet Sportabout
                        0 360.0
## Valiant
                        0 225.0
## Duster 360
                       0 360.0
## Merc 240D
                        0 146.7
## Merc 230
                       0 140.8
## Merc 280
                        0 167.6
## Merc 280C
                       0 167.6
## Merc 450SE
                       0 275.8
## Merc 450SL
                        0 275.8
## Merc 450SLC
                        0 275.8
## Cadillac Fleetwood
                       0 472.0
## Lincoln Continental 0 460.0
## Chrysler Imperial
                        0 440.0
## Fiat 128
                        1 78.7
## Honda Civic
                        1 75.7
## Toyota Corolla
                       1 71.1
## Toyota Corona
                        0 120.1
## Dodge Challenger
                        0 318.0
## AMC Javelin
                        0 304.0
## Camaro Z28
                        0 350.0
## Pontiac Firebird
                       0 400.0
                       1 79.0
## Fiat X1-9
## Porsche 914-2
                       1 120.3
## Lotus Europa
                       1 95.1
## Ford Pantera L
                       1 351.0
## Ferrari Dino
                        1 145.0
## Maserati Bora
                        1 301.0
## Volvo 142E
                        1 121.0
```

mtcars |> relocate(mpg, cyl, .after = last_col())

```
##
                      disp hp drat
                                      wt qsec vs am gear carb mpg cyl
                     160.0 110 3.90 2.620 16.46
## Mazda RX4
                                               0 1
                                                       4
                                                           4 21.0
                                                                    6
                     160.0 110 3.90 2.875 17.02 0 1
## Mazda RX4 Wag
                                                       4
                                                           4 21.0
                                                                    6
## Datsun 710
                     108.0 93 3.85 2.320 18.61 1 1
                                                      4
                                                           1 22.8
                                                                    4
## Hornet 4 Drive
                     258.0 110 3.08 3.215 19.44 1 0
                                                       3
                                                           1 21.4
                                                                    6
## Hornet Sportabout
                     360.0 175 3.15 3.440 17.02 0 0
                                                       3
                                                           2 18.7
                                                                    8
## Valiant
                     225.0 105 2.76 3.460 20.22 1 0
                                                      3
                                                           1 18.1
                                                                    6
## Duster 360
                     360.0 245 3.21 3.570 15.84 0 0
                                                      3
                                                           4 14.3
## Merc 240D
                     146.7 62 3.69 3.190 20.00 1 0
                                                      4
                                                           2 24.4
                                                                    4
## Merc 230
                     140.8 95 3.92 3.150 22.90 1 0
                                                       4
                                                           2 22.8
                                                                    4
                                                           4 19.2
## Merc 280
                     167.6 123 3.92 3.440 18.30 1 0
                                                    4
                                                                    6
## Merc 280C
                    167.6 123 3.92 3.440 18.90 1 0 4 4 17.8
## Merc 450SE
                    275.8 180 3.07 4.070 17.40 0 0 3
                                                           3 16.4
                                                                    8
## Merc 450SL
                     275.8 180 3.07 3.730 17.60 0 0
                                                           3 17.3
```

```
## Merc 450SLC
                        275.8 180 3.07 3.780 18.00
                                                                  3 15.2
## Cadillac Fleetwood 472.0 205 2.93 5.250 17.98
                                                     0
                                                                  4 10.4
                                                                            8
                                                        0
                                                             3
## Lincoln Continental 460.0 215 3.00 5.424 17.82
                                                                  4 10.4
                                                                            8
## Chrysler Imperial
                        440.0 230 3.23 5.345 17.42
                                                        Λ
                                                             3
                                                                  4 14.7
                                                                            8
## Fiat 128
                         78.7
                               66 4.08 2.200 19.47
                                                             4
                                                                  1 32.4
                                                                            4
## Honda Civic
                               52 4.93 1.615 18.52
                                                             4
                                                                  2 30.4
                         75.7
                                                     1
                                                        1
## Toyota Corolla
                         71.1
                              65 4.22 1.835 19.90
                                                                  1 33.9
## Toyota Corona
                        120.1 97 3.70 2.465 20.01
                                                     1
                                                        0
                                                             3
                                                                  1 21.5
                                                                            4
## Dodge Challenger
                        318.0 150 2.76 3.520 16.87
                                                     Λ
                                                        Λ
                                                             3
                                                                  2 15.5
                                                                            8
                                                        0
## AMC Javelin
                        304.0 150 3.15 3.435 17.30
                                                     0
                                                             3
                                                                  2 15.2
                                                                            8
## Camaro Z28
                        350.0 245 3.73 3.840 15.41
                                                     0
                                                                  4 13.3
                                                                            8
## Pontiac Firebird
                        400.0 175 3.08 3.845 17.05
                                                        0
                                                             3
                                                                  2 19.2
                                                     0
                                                                            8
## Fiat X1-9
                         79.0 66 4.08 1.935 18.90
                                                     1
                                                        1
                                                             4
                                                                  1 27.3
                                                                            4
## Porsche 914-2
                                                             5
                                                                  2 26.0
                        120.3 91 4.43 2.140 16.70
                                                     0
                                                        1
                         95.1 113 3.77 1.513 16.90
                                                                  2 30.4
## Lotus Europa
                                                     1
                                                        1
                                                             5
                                                                            4
## Ford Pantera L
                        351.0 264 4.22 3.170 14.50
                                                     0
                                                        1
                                                             5
                                                                  4 15.8
                                                                            8
                        145.0 175 3.62 2.770 15.50
                                                     0
                                                             5
                                                                            6
## Ferrari Dino
                                                        1
                                                                  6 19.7
                        301.0 335 3.54 3.570 14.60
                                                                  8 15.0
                                                                            8
## Maserati Bora
## Volvo 142E
                        121.0 109 4.11 2.780 18.60
                                                                  2 21.4
                                                    1
```

mtcars |> select(mpg:am)

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

#df |> summary(across(everything(), mean)) mtcars |> rowwise() |> mutate(x_total = sum(c_across(1:2)))

MANIPULATE MULTIPLE VARIABLES AT ONCE

```
## # A tibble: 32 x 12
## # Rowwise:
                                                                                                  hp drat
                            mpg
                                                cyl disp
                                                                                                                                                wt qsec
                                                                                                                                                                                             ٧s
                                                                                                                                                                                                                   am gear carb x_total
##
                      <dbl> 
                                                          6 160
                                                                                         110 3.9
                                                                                                                                        2.62 16.5
                                                                                                                                                                                                0
                                                                                                                                                                                                                                                                                      27
## 2 21
                                                                                                                                         2.88 17.0
                                                                                                                                                                                                                                             4
                                                                                                                                                                                                                                                                    4
                                                                                                                                                                                                                                                                                      27
                                                           6 160
                                                                                               110 3.9
                                                                                                                                                                                                0
                                                                                                                                                                                                                       1
## 3 22.8
                                                          4 108
                                                                                                93 3.85 2.32 18.6
                                                                                                                                                                                                1
                                                                                                                                                                                                                       1
                                                                                                                                                                                                                                             4
                                                                                                                                                                                                                                                                    1
                                                                                                                                                                                                                                                                                      26.8
                                                          6 258
                                                                                                                                                                                                                                             3
## 4 21.4
                                                                                       110 3.08 3.22 19.4
                                                                                                                                                                                                                       0
                                                                                                                                                                                                                                                                   1
                                                                                                                                                                                                                                                                                      27.4
                                                                                                                                                                                                1
## 5 18.7
                                                     8 360
                                                                                              175 3.15 3.44 17.0
                                                                                                                                                                                                0
                                                                                                                                                                                                                      0
                                                                                                                                                                                                                                             3
                                                                                                                                                                                                                                                                    2
                                                                                                                                                                                                                                                                                      26.7
## 6 18.1
                                                       6 225
                                                                                               105 2.76 3.46 20.2
                                                                                                                                                                                                1
                                                                                                                                                                                                                      0
                                                                                                                                                                                                                                             3
                                                                                                                                                                                                                                                                   1
                                                                                                                                                                                                                                                                                      24.1
##
             7 14.3
                                                     8 360
                                                                                               245 3.21 3.57
                                                                                                                                                            15.8
                                                                                                                                                                                                0
                                                                                                                                                                                                                      0
                                                                                                                                                                                                                                             3
                                                                                                                                                                                                                                                                   4
                                                                                                                                                                                                                                                                                      22.3
                                                                                                                                                                                                                                                                   2
## 8 24.4
                                                                                                   62 3.69 3.19 20
                                                                                                                                                                                                                  0
                                                                                                                                                                                                                                                                                     28.4
                                                         4 147.
                                                                                                                                                                                                1
                                                                                                                                                                                                                                             4
## 9 22.8
                                                                                                                                                                                                                                                                                      26.8
                                                           4 141.
                                                                                                   95 3.92 3.15 22.9
                                                                                                                                                                                           1
                                                                                                                                                                                                                  0
                                                                                                                                                                                                                                             4
                                                                                                                                                                                                                                                                  2
## 10 19.2
                                                                                               123 3.92 3.44 18.3
                                                                                                                                                                                                                                                                                      25.2
                                                           6 168.
                                                                                                                                                                                               1
                                                                                                                                                                                                                      0
                                                                                                                                                                                                                                             4
## # i 22 more rows
```

```
mtcars |> mutate(gpm = 1 / mpg)
```

MAKE NEW VARIABLES

```
##
                      mpg cyl disp hp drat
                                              wt qsec vs am gear carb
## Mazda RX4
                     21.0
                            6 160.0 110 3.90 2.620 16.46
## Mazda RX4 Wag
                     21.0
                            6 160.0 110 3.90 2.875 17.02
                                                                     4
                                                           1
## Datsun 710
                     22.8
                           4 108.0 93 3.85 2.320 18.61
## Hornet 4 Drive
                     21.4 6 258.0 110 3.08 3.215 19.44
                                                                     1
                                                        1
                           8 360.0 175 3.15 3.440 17.02 0
## Hornet Sportabout 18.7
## Valiant
                     18.1 6 225.0 105 2.76 3.460 20.22 1
                                                                3
                                                           0
## Duster 360
                     14.3 8 360.0 245 3.21 3.570 15.84 0
                                                           0
                                                                3
## Merc 240D
                            4 146.7 62 3.69 3.190 20.00
                     24.4
                                                            0
                                                                4
                                                         1
## Merc 230
                            4 140.8 95 3.92 3.150 22.90
                                                                     2
                     22.8
                                                         1
                                                            0
                                                                4
## Merc 280
                            6 167.6 123 3.92 3.440 18.30
                     19.2
## Merc 280C
                     17.8
                            6 167.6 123 3.92 3.440 18.90 1
                                                            Ω
                                                                     4
                            8 275.8 180 3.07 4.070 17.40
                                                                3
                                                                     3
## Merc 450SE
                     16.4
                                                         0
                                                            0
                            8 275.8 180 3.07 3.730 17.60 0
## Merc 450SL
                     17.3
                                                                3
                                                                     3
                                                           Ω
                                                                3
## Merc 450SLC
                     15.2 8 275.8 180 3.07 3.780 18.00 0 0
                                                                     3
## Cadillac Fleetwood 10.4 8 472.0 205 2.93 5.250 17.98 0 0
                                                                3
                                                                     4
## Lincoln Continental 10.4 8 460.0 215 3.00 5.424 17.82 0 0
```

```
## Chrysler Imperial
                       14.7
                               8 440.0 230 3.23 5.345 17.42
## Fiat 128
                       32.4
                               4 78.7
                                        66 4.08 2.200 19.47
                                                                           1
                                                              1
                                                                1
## Honda Civic
                       30.4
                               4 75.7
                                        52 4.93 1.615 18.52
                                                                           2
## Toyota Corolla
                       33.9
                               4 71.1
                                       65 4.22 1.835 19.90
                                                                           1
## Toyota Corona
                       21.5
                               4 120.1
                                        97 3.70 2.465 20.01
                                                                           1
## Dodge Challenger
                               8 318.0 150 2.76 3.520 16.87
                                                                      3
                                                                           2
                       15.5
                                                                 0
## AMC Javelin
                                                                           2
                       15.2
                               8 304.0 150 3.15 3.435 17.30
## Camaro Z28
                       13.3
                               8 350.0 245 3.73 3.840 15.41
                                                              0
                                                                 0
                                                                      3
                                                                           4
## Pontiac Firebird
                       19.2
                               8 400.0 175 3.08 3.845 17.05
                                                              0
                                                                 Λ
                                                                      3
                                                                           2
## Fiat X1-9
                                                                      4
                       27.3
                               4 79.0 66 4.08 1.935 18.90
                                                              1
                                                                 1
                                                                           1
## Porsche 914-2
                       26.0
                               4 120.3 91 4.43 2.140 16.70
                                                                      5
                                                                           2
                                                                           2
                               4 95.1 113 3.77 1.513 16.90
                                                                      5
## Lotus Europa
                       30.4
                                                              1
                                                                1
## Ford Pantera L
                       15.8
                               8 351.0 264 4.22 3.170 14.50
                                                              0
                                                                1
                                                                      5
                                                                           4
## Ferrari Dino
                                                                      5
                       19.7
                               6 145.0 175 3.62 2.770 15.50
                                                                           6
## Maserati Bora
                       15.0
                               8 301.0 335 3.54 3.570 14.60
                                                                      5
                                                                           8
                                                              0 1
## Volvo 142E
                       21.4
                               4 121.0 109 4.11 2.780 18.60
                                                                      4
                                                                           2
##
## Mazda RX4
                       0.04761905
## Mazda RX4 Wag
                       0.04761905
## Datsun 710
                       0.04385965
## Hornet 4 Drive
                       0.04672897
                       0.05347594
## Hornet Sportabout
## Valiant
                       0.05524862
## Duster 360
                       0.06993007
## Merc 240D
                       0.04098361
## Merc 230
                       0.04385965
## Merc 280
                       0.05208333
## Merc 280C
                       0.05617978
## Merc 450SE
                       0.06097561
## Merc 450SL
                       0.05780347
## Merc 450SLC
                       0.06578947
## Cadillac Fleetwood 0.09615385
## Lincoln Continental 0.09615385
## Chrysler Imperial
                       0.06802721
## Fiat 128
                       0.03086420
## Honda Civic
                       0.03289474
## Toyota Corolla
                       0.02949853
## Toyota Corona
                       0.04651163
## Dodge Challenger
                       0.06451613
## AMC Javelin
                       0.06578947
## Camaro Z28
                       0.07518797
## Pontiac Firebird
                       0.05208333
## Fiat X1-9
                       0.03663004
## Porsche 914-2
                       0.03846154
## Lotus Europa
                       0.03289474
## Ford Pantera L
                       0.06329114
## Ferrari Dino
                       0.05076142
## Maserati Bora
                       0.06666667
## Volvo 142E
                       0.04672897
mtcars |> mutate(gpm = 1 / mpg, .keep = "none")
##
                               gpm
## Mazda RX4
                       0.04761905
```

```
## Mazda RX4 Wag
                       0.04761905
## Datsun 710
                       0.04385965
## Hornet 4 Drive
                       0.04672897
## Hornet Sportabout
                       0.05347594
## Valiant
                       0.05524862
## Duster 360
                       0.06993007
## Merc 240D
                       0.04098361
## Merc 230
                       0.04385965
## Merc 280
                       0.05208333
## Merc 280C
                       0.05617978
## Merc 450SE
                       0.06097561
## Merc 450SL
                       0.05780347
## Merc 450SLC
                       0.06578947
## Cadillac Fleetwood 0.09615385
## Lincoln Continental 0.09615385
## Chrysler Imperial
                       0.06802721
## Fiat 128
                       0.03086420
## Honda Civic
                       0.03289474
## Toyota Corolla
                       0.02949853
## Toyota Corona
                       0.04651163
## Dodge Challenger
                       0.06451613
## AMC Javelin
                       0.06578947
## Camaro Z28
                       0.07518797
## Pontiac Firebird
                       0.05208333
## Fiat X1-9
                       0.03663004
## Porsche 914-2
                       0.03846154
## Lotus Europa
                       0.03289474
## Ford Pantera L
                       0.06329114
## Ferrari Dino
                       0.05076142
## Maserati Bora
                       0.06666667
## Volvo 142E
                       0.04672897
```

mtcars |> rename(miles_per_gallon = mpg)

```
##
                      miles_per_gallon cyl disp hp drat
                                                           wt qsec vs am gear
## Mazda RX4
                                 21.0
                                        6 160.0 110 3.90 2.620 16.46 0
## Mazda RX4 Wag
                                 21.0
                                        6 160.0 110 3.90 2.875 17.02 0
## Datsun 710
                                 22.8
                                        4 108.0 93 3.85 2.320 18.61 1
## Hornet 4 Drive
                                 21.4
                                        6 258.0 110 3.08 3.215 19.44 1
                                                                             3
                                 18.7
## Hornet Sportabout
                                        8 360.0 175 3.15 3.440 17.02 0
                                                                             3
## Valiant
                                 18.1
                                        6 225.0 105 2.76 3.460 20.22 1
## Duster 360
                                14.3
                                        8 360.0 245 3.21 3.570 15.84
                                 24.4
## Merc 240D
                                        4 146.7 62 3.69 3.190 20.00
                                                                     1
## Merc 230
                                22.8
                                        4 140.8 95 3.92 3.150 22.90
                                                                             4
                                                                     1
## Merc 280
                                19.2
                                        6 167.6 123 3.92 3.440 18.30
## Merc 280C
                                17.8
                                        6 167.6 123 3.92 3.440 18.90
## Merc 450SE
                                 16.4
                                        8 275.8 180 3.07 4.070 17.40
                                                                        0
                                                                             3
## Merc 450SL
                                17.3
                                        8 275.8 180 3.07 3.730 17.60
                                                                     Ω
                                                                             3
## Merc 450SLC
                                15.2
                                        8 275.8 180 3.07 3.780 18.00
## Cadillac Fleetwood
                                10.4
                                        8 472.0 205 2.93 5.250 17.98
                                                                     Ω
                                                                             3
                                10.4
## Lincoln Continental
                                        8 460.0 215 3.00 5.424 17.82
                                                                             3
## Chrysler Imperial
                                14.7
                                        8 440.0 230 3.23 5.345 17.42 0
                                                                             3
## Fiat 128
                                32.4
                                        4 78.7 66 4.08 2.200 19.47 1 1
                                        4 75.7 52 4.93 1.615 18.52 1 1
## Honda Civic
                                 30.4
```

```
33.9
                                        4 71.1 65 4.22 1.835 19.90 1 1
## Toyota Corolla
                                21.5
## Toyota Corona
                                        4 120.1 97 3.70 2.465 20.01 1
                                                                              3
                                        8 318.0 150 2.76 3.520 16.87 0
## Dodge Challenger
                                15.5
## AMC Javelin
                                15.2
                                        8 304.0 150 3.15 3.435 17.30 0
                                                                              3
                                13.3
## Camaro Z28
                                        8 350.0 245 3.73 3.840 15.41 0
                                                                              3
                            19.2
27.3
## Pontiac Firebird
                                        8 400.0 175 3.08 3.845 17.05 0
                                                                              3
## Fiat X1-9
                                        4 79.0 66 4.08 1.935 18.90 1 1
                                26.0
## Porsche 914-2
                                        4 120.3 91 4.43 2.140 16.70 0 1
                                                                              5
                                30.4
## Lotus Europa
                                        4 95.1 113 3.77 1.513 16.90 1
                                                                              5
## Ford Pantera L
                                15.8
                                        8 351.0 264 4.22 3.170 14.50 0
                                                                              5
## Ferrari Dino
                                 19.7
                                        6 145.0 175 3.62 2.770 15.50 0 1
                                                                              5
                                 15.0 8 301.0 335 3.54 3.570 14.60 0 1
## Maserati Bora
                                                                              5
                                 21.4 4 121.0 109 4.11 2.780 18.60 1 1
## Volvo 142E
                                                                              4
##
                      carb
## Mazda RX4
                         4
## Mazda RX4 Wag
## Datsun 710
                         1
## Hornet 4 Drive
                         1
## Hornet Sportabout
                         2
## Valiant
## Duster 360
                         4
## Merc 240D
## Merc 230
                         2
## Merc 280
## Merc 280C
## Merc 450SE
## Merc 450SL
                         3
## Merc 450SLC
                         3
## Cadillac Fleetwood
## Lincoln Continental
## Chrysler Imperial
                         4
## Fiat 128
                         1
                         2
## Honda Civic
## Toyota Corolla
                         1
## Toyota Corona
                         1
## Dodge Challenger
                         2
## AMC Javelin
## Camaro Z28
## Pontiac Firebird
## Fiat X1-9
                         1
## Porsche 914-2
## Lotus Europa
                         2
## Ford Pantera L
                         4
## Ferrari Dino
                         6
## Maserati Bora
                         8
                         2
## Volvo 142E
```

Vectorized Functions

TO USE WITH MUTATE ()

lag(mtcars)

OFFSET

##		mpg	cyl	disp	hp	drat	wt	qsec	٧s	am	gear	carb
##	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
##	Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
##	Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
##	Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
##	Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
##	Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
##	Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
##	Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
##	Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
##	Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
##	Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
##	Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
##	Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
##	Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
##	Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
##	Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
##	Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
##	Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
##	Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
##	Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
##	Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
##	Toyota Corona	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
##	Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
##	AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
##	Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
##	Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
##	Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
##	Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
##	Lotus Europa	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
##	Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
##	Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
##	Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8

lead(mtcars)

```
##
                    mpg cyl disp hp drat wt qsec vs am gear carb
## Mazda RX4 Wag
                    21.0 6 160.0 110 3.90 2.875 17.02 0 1
                                                               4
## Datsun 710
                    22.8 4 108.0 93 3.85 2.320 18.61 1 1
                                                               1
## Hornet 4 Drive
                    21.4
                          6 258.0 110 3.08 3.215 19.44 1 0
                                                               1
                                                         3
## Hornet Sportabout 18.7
                        8 360.0 175 3.15 3.440 17.02 0 0
                                                               2
                          6 225.0 105 2.76 3.460 20.22 1 0 3
## Valiant
                   18.1
                                                               1
## Duster 360
                   14.3
                          8 360.0 245 3.21 3.570 15.84 0 0 3
                                                               4
                        4 146.7 62 3.69 3.190 20.00 1 0 4
                                                               2
                   24.4
## Merc 240D
                   22.8 4 140.8 95 3.92 3.150 22.90 1 0 4
                                                               2
## Merc 230
## Merc 280
                  19.2
                          6 167.6 123 3.92 3.440 18.30 1 0 4
                                                               4
## Merc 280C
                  17.8 6 167.6 123 3.92 3.440 18.90 1 0
                                                               4
```

```
## 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
                                                                    3
                                                                         3
                                                            0
                                                               0
                                                                         3
## Merc 450SLC
                       15.2
                              8 275.8 180 3.07 3.780 18.00
                                                                    3
## 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
## Chrysler Imperial
                              8 440.0 230 3.23 5.345 17.42
                                                                    3
                                                                         4
                       14.7
                                                               0
## Fiat 128
                                       66 4.08 2.200 19.47
                       32.4
                              4 78.7
                                                                         1
                       30.4
## Honda Civic
                                       52 4.93 1.615 18.52
                                                                         2
                              4 75.7
                                                            1
                                                               1
                                                                    4
## Toyota Corolla
                       33.9
                              4 71.1
                                       65 4.22 1.835 19.90
                                                            1
                                                               1
                                                                    4
                                                                         1
                       21.5
                              4 120.1 97 3.70 2.465 20.01
                                                                    3
## Toyota Corona
                                                            1
                                                                         1
## Dodge Challenger
                       15.5
                              8 318.0 150 2.76 3.520 16.87
                                                                    3
                                                                         2
                                                                         2
## AMC Javelin
                       15.2
                              8 304.0 150 3.15 3.435 17.30
                                                                    3
                                                            0
                                                               0
## Camaro Z28
                                                                    3
                                                                         4
                       13.3
                              8 350.0 245 3.73 3.840 15.41
                                                            0
                                                               0
## Pontiac Firebird
                                                                    3
                                                                         2
                       19.2
                              8 400.0 175 3.08 3.845 17.05
                                                               0
## Fiat X1-9
                       27.3
                              4 79.0 66 4.08 1.935 18.90
                                                                    4
                                                               1
                                                                         1
## Porsche 914-2
                       26.0
                              4 120.3 91 4.43 2.140 16.70
                                                            0
                                                                    5
                                                                         2
## Lotus Europa
                       30.4
                              4 95.1 113 3.77 1.513 16.90
                                                                    5
                                                                         2
                                                            1
                                                               1
## Ford Pantera L
                       15.8
                              8 351.0 264 4.22 3.170 14.50
                                                                    5
                                                                         4
## Ferrari Dino
                       19.7
                              6 145.0 175 3.62 2.770 15.50
                                                                    5
                                                                         6
                                                            0
## Maserati Bora
                       15.0
                              8 301.0 335 3.54 3.570 14.60
                                                            0
                                                                    5
                                                                         8
## Volvo 142E
                       21.4
                              4 121.0 109 4.11 2.780 18.60
                                                            1 1
                                                                    4
                                                                         2
## ...32
                         NA NA
                                   NA NA
                                            NA
                                                  NA
                                                        NA NA NA
                                                                   NA
                                                                        NA
```

CUMULATIVE AGGREGATE

- dplyr::cumall() cumulative all()
- dplyr::cumany() cumulative any()
- cummax() cumulative max()
- dplyr::cummean() cumulative mean()
- cummin() cumulative min()
- cumprod() cumulative prod()
- cumsum() cumulative sum()

cumall(1:12)

```
cumany(1:12)
```

```
cummax(1:12)
```

[1] 1 2 3 4 5 6 7 8 9 10 11 12

```
cummean(1:12)
```

[1] 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5

```
cummin(1:12)
## [1] 1 1 1 1 1 1 1 1 1 1 1 1
cumprod(1:12)
   [1]
                                                                 720
                                                                           5040
                                                       120
   [8]
            40320
                     362880
                              3628800 39916800 479001600
cumsum(1:12)
   [1] 1 3 6 10 15 21 28 36 45 55 66 78
RANKING
  • dplyr::cume_dist() - proportion of all values <=
  • dplyr::dense_rank() - rank w ties = min, no gaps
  • dplyr::min rank() - rank with ties = min
  • dplyr::ntile() - bins into n bins
  • dplyr::percent_rank() - min_rank scaled to [0,1]
  • dplyr::row_number() - rank with ties = "first"
cume_dist(1:12)
  [1] 0.08333333 0.16666667 0.25000000 0.33333333 0.41666667 0.50000000
## [7] 0.58333333 0.66666667 0.75000000 0.83333333 0.91666667 1.00000000
dense_rank(1:12)
## [1] 1 2 3 4 5 6 7 8 9 10 11 12
min_rank(1:12)
## [1] 1 2 3 4 5 6 7 8 9 10 11 12
x \leftarrow c(5, 1, 3, 2, 2, NA)
ntile(x, 2)
## [1] 2 1 2 1 1 NA
ntile(x, 4)
## [1] 4 1 3 1 2 NA
ntile(1:8, 3)
```

[1] 1 1 1 2 2 2 3 3

```
percent_rank(1:5)
## [1] 0.00 0.25 0.50 0.75 1.00
row_number(1:12)
## [1] 1 2 3 4 5 6 7 8 9 10 11 12
MATH
  • +, -, *, /, ^{^{\circ}}, \%/\%, \%\% - arithmetic ops
  • \log(), \log(2), \log(10) - \log(10)
  • <, <=, >=, !=, == - logical comparisons
  • dplyr::between() - x >= left & x <= right
  • dplyr::near() - safe == for floating point numbers
2 + 3
## [1] 5
3 - 7
## [1] -4
3 * 7
## [1] 21
4 / 8
## [1] 0.5
2 ^ 5
## [1] 32
4 %/% 8
## [1] 0
4 %% 8
## [1] 4
log(10)
```

[1] 2.302585

```
log2(10)
## [1] 3.321928
log10(100)
## [1] 2
3 < 7
## [1] TRUE
4 > 8
## [1] FALSE
3 <= 4
## [1] TRUE
7 >= 8
## [1] FALSE
12 != 13
## [1] TRUE
4 == 4
## [1] TRUE
between(13,12,14)
## [1] TRUE
near(29.9, 30)
## [1] FALSE
```

```
starwars |>
mutate(type = case_when(
height > 200 | mass > 200 ~ "large",
species == "Droid" ~ "robot",
TRUE ~ "other")
```

MISCELLANEOUS

```
## # A tibble: 87 x 15
##
     name
              height mass hair_color skin_color eye_color birth_year sex
##
      <chr>
                <int> <dbl> <chr>
                                      <chr>>
                                                  <chr>
                                                                <dbl> <chr> <chr>
## 1 Luke Sk~
                 172
                        77 blond
                                      fair
                                                 blue
                                                                 19
                                                                      male
                                                                            mascu~
##
  2 C-3PO
                 167
                        75 <NA>
                                      gold
                                                 yellow
                                                                112
                                                                      none
                                                                            mascu~
## 3 R2-D2
                  96
                        32 <NA>
                                      white, bl~ red
                                                                 33
                                                                      none
                                                                            mascu~
## 4 Darth V~
                 202 136 none
                                                                 41.9 male
                                      white
                                                 yellow
                                                                            mascu~
##
   5 Leia Or~
                 150
                        49 brown
                                      light
                                                 brown
                                                                 19
                                                                      fema~ femin~
## 6 Owen La~
                 178
                       120 brown, gr~ light
                                                 blue
                                                                 52
                                                                      male mascu~
## 7 Beru Wh~
                 165
                       75 brown
                                                 blue
                                                                 47
                                                                      fema~ femin~
                                      light
## 8 R5-D4
                  97
                        32 <NA>
                                      white, red red
                                                                 NA
                                                                      none mascu~
## 9 Biggs D~
                 183
                        84 black
                                      light
                                                                 24
                                                                      male mascu~
                                                 brown
## 10 Obi-Wan~
                 182
                        77 auburn, w~ fair
                                                 blue-gray
                                                                 57
                                                                      male mascu~
## # i 77 more rows
## # i 6 more variables: homeworld <chr>, species <chr>, films <list>,
      vehicles <list>, starships <list>, type <chr>
pmax(5:1, pi)
## [1] 5.000000 4.000000 3.141593 3.141593 3.141593
pmin(5:1, pi)
```

[1] 3.141593 3.141593 3.000000 2.000000 1.000000

Summary Functions

COUNT

- dplyr::n() number of values/rows
- dplyr::n distinct() # of uniques
- sum(!is.na()) # of non-NAs

```
#summary(n= n(mtcars))
n_distinct(cars)
```

[1] 49

```
sum(!is.na(airquality))
## [1] 874
POSITION
  • mean() - mean, also mean(!is.na())
  • median() - median
mean(12:30)
## [1] 21
median(12:30)
## [1] 21
RANK
  • quantile() - nth quantile
  • min() - minimum value
  • max() - maximum value
quantile(1:3)
     0% 25% 50% 75% 100%
## 1.0 1.5 2.0 2.5 3.0
min(1:30)
## [1] 1
max(1:30)
## [1] 30
SPREAD
  • IQR() - Inter-Quartile Range
  \bullet mad() - median absolute deviation
  • sd() - standard deviation
  • var() - variance
IQR(1:30)
```

[1] 14.5

```
mad(1:30)

## [1] 11.1195

sd(1:30)

## [1] 8.803408

var(1:30)
```

[1] 77.5

Row Names

Tidy data does not use row names, which store a variable outside of the columns. To work with the row names, first move them into a column.

```
a<- mtcars |> rownames_to_column(var = "C")
a
```

```
##
                         C mpg cyl
                                     disp hp drat
                                                        wt
                                                            qsec vs am gear carb
                Mazda RX4 21.0
## 1
                                   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
                                                                                4
## 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
                                                                           3
                                                                                1
## 5
        Hornet Sportabout 18.7
                                   8 360.0 175 3.15 3.440 17.02
                                                                   0
                                                                      0
                                                                           3
                                                                                2
## 6
                   Valiant 18.1
                                   6 225.0 105 2.76 3.460 20.22
                                                                      0
                                                                           3
                                                                                1
## 7
                                                                           3
                                                                                4
               Duster 360 14.3
                                   8 360.0 245 3.21 3.570 15.84
                                                                   0
                                                                      0
## 8
                Merc 240D 24.4
                                   4 146.7
                                            62 3.69 3.190 20.00
                                                                                2
## 9
                  Merc 230 22.8
                                           95 3.92 3.150 22.90
                                                                                2
                                   4 140.8
                                                                      0
                                                                           4
                                                                   1
                  Merc 280 19.2
                                   6 167.6 123 3.92 3.440 18.30
                                                                                4
## 10
                                                                   1
                                                                      0
                                                                           4
## 11
                 Merc 280C 17.8
                                   6 167.6 123 3.92 3.440 18.90
                                                                           4
                                                                                4
                                                                      0
## 12
                Merc 450SE 16.4
                                   8 275.8 180 3.07 4.070 17.40
                                                                           3
                                                                                3
                Merc 450SL 17.3
                                   8 275.8 180 3.07 3.730 17.60
                                                                                3
## 13
                                                                   0
                                                                      0
                                                                           3
## 14
              Merc 450SLC 15.2
                                   8 275.8 180 3.07 3.780 18.00
                                                                           3
                                                                                3
                                                                                4
## 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
                                                                                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
                                                                   1
                                                                      1
## 19
              Honda Civic 30.4
                                      75.7
                                            52 4.93 1.615 18.52
                                                                           4
                                                                                2
## 20
           Toyota Corolla 33.9
                                      71.1
                                            65 4.22 1.835 19.90
                                                                           4
                                                                                1
                                                                   1
                                            97 3.70 2.465 20.01
## 21
            Toyota Corona 21.5
                                   4 120.1
                                                                           3
                                                                                1
## 22
                                   8 318.0 150 2.76 3.520 16.87
                                                                           3
                                                                                2
         Dodge Challenger 15.5
                                                                   0
                                                                      0
                                                                                2
## 23
              AMC Javelin 15.2
                                   8 304.0 150 3.15 3.435 17.30
                                                                           3
                Camaro Z28 13.3
                                                                                4
## 24
                                   8 350.0 245 3.73 3.840 15.41
                                                                   0
                                                                      0
                                                                           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
                                           66 4.08 1.935 18.90
                                                                           4
                                      79.0
                                                                   1
                                                                                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
## 29
           Ford Pantera L 15.8
                                   8 351.0 264 4.22 3.170 14.50
                                                                           5
                                                                                4
## 30
             Ferrari Dino 19.7
                                   6 145.0 175 3.62 2.770 15.50
                                                                   0
                                                                           5
                                                                                6
                                                                      1
                                   8 301.0 335 3.54 3.570 14.60
                                                                                8
## 31
            Maserati Bora 15.0
                                                                           5
## 32
                                   4 121.0 109 4.11 2.780 18.60
                                                                                2
               Volvo 142E 21.4
```

Combine Tables

3 3 c ## 4 4 d

```
df <- data.frame(a = 1:4, b = letters[1:4]) # Creating a data frame</pre>
COMBINE VARIABLES
##
   a b
## 1 1 a
## 2 2 b
## 3 3 c
## 4 4 d
df2 \leftarrow data.frame(a = 5:7, b = letters[5:7])
rbind(df, df2) # Combining them using their rows
##
   a b
## 1 1 a
## 2 2 b
## 3 3 c
## 4 4 d
## 5 5 e
## 6 6 f
## 7 7 g
df3 \leftarrow data.frame(c = 5:8, d = letters[5:8])
cbind(df, df3) # Combining them using their columns
## abcd
## 1 1 a 5 e
## 2 2 b 6 f
## 3 3 c 7 g
## 4 4 d 8 h
left_join(df, df2, by = NULL, copy = FALSE,
keep = FALSE, na_matches = "na")
RELATIONAL DATA
## Joining with 'by = join_by(a, b)'
##
   a b
## 1 1 a
## 2 2 b
```

```
right_join(df, df2, by = NULL, copy = FALSE,
keep = FALSE, na_matches = "na")
## Joining with 'by = join_by(a, b)'
##
   a b
## 1 5 e
## 2 6 f
## 3 7 g
inner_join(df, df2, by = NULL, copy = FALSE,
keep = FALSE, na_matches = "na")
## Joining with 'by = join_by(a, b)'
## [1] a b
## <0 rows> (or 0-length row.names)
full_join(df, df2, by = NULL, copy = FALSE,
keep = FALSE, na_matches = "na")
## Joining with 'by = join_by(a, b)'
## a b
## 1 1 a
## 2 2 b
## 3 3 c
## 4 4 d
## 5 5 e
## 6 6 f
## 7 7 g
```