HW 02

Homework 2

1. Fix each of the following common data frame subsetting errors: mtcars [mtcars\$cyl < 6] mtcars [-1:3,] mtcars [mtcars\$cyl = 8,] mtcars [mtcars\$cyl = 4 | 6,]

```
mtcars[mtcars$cyl <= 6,]</pre>
```

```
##
                    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
                                                                        4
                          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
                                                             0
                                                                        1
                                                          1
## Valiant
                   18.1
                          6 225.0 105 2.76 3.460 20.22
                                                                        1
## Merc 240D
                  24.4
                          4 146.7
                                   62 3.69 3.190 20.00
                                                                        2
                                                          1
                  22.8
                                   95 3.92 3.150 22.90
                                                                        2
## Merc 230
                          4 140.8
                                                          1
                                                             0
## Merc 280
                   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
                                                             0
                                                          1
                   32.4
## Fiat 128
                             78.7
                                   66 4.08 2.200 19.47
                                                                        1
                          4
                                                          1
                                                             1
                   30.4
                          4
                                                                        2
## Honda Civic
                             75.7
                                   52 4.93 1.615 18.52
                                                          1
                                                             1
                            71.1
                                   65 4.22 1.835 19.90
## Toyota Corolla 33.9
                                                                        1
## Toyota Corona
                  21.5
                          4 120.1
                                   97 3.70 2.465 20.01
                                                                       1
## Fiat X1-9
                   27.3
                            79.0
                                   66 4.08 1.935 18.90
                                                                        1
                  26.0
                          4 120.3
                                   91 4.43 2.140 16.70
                                                                  5
                                                                       2
## Porsche 914-2
                                                          0
                                                                        2
## Lotus Europa
                   30.4
                             95.1 113 3.77 1.513 16.90
## Ferrari Dino
                   19.7
                          6 145.0 175 3.62 2.770 15.50
                                                                        6
                                                          0
## Volvo 142E
                   21.4
                          4 121.0 109 4.11 2.780 18.60
```

mtcars[-c(1:3),]

```
##
                         mpg cyl disp hp drat
                                                    wt
                                                        qsec vs
                                                                 am
                                                                    gear carb
## Hornet 4 Drive
                        21.4
                               6 258.0 110 3.08 3.215 19.44
                                                                  0
                                                                       3
                                                                             1
## Hornet Sportabout
                        18.7
                               8 360.0 175 3.15 3.440 17.02
                                                                       3
                                                                             2
## Valiant
                        18.1
                               6 225.0 105 2.76 3.460 20.22
                                                                             1
                               8 360.0 245 3.21 3.570 15.84
                                                                       3
## Duster 360
                        14.3
                                                                  0
                                                                             4
## Merc 240D
                        24.4
                               4 146.7
                                         62 3.69 3.190 20.00
                                                                       4
                                                                             2
                                                                  0
                                                                             2
## Merc 230
                        22.8
                               4 140.8
                                         95 3.92 3.150 22.90
## Merc 280
                               6 167.6 123 3.92 3.440 18.30
                        19.2
                                                                       4
                                                                             4
## Merc 280C
                        17.8
                               6 167.6 123 3.92 3.440 18.90
                                                                       4
                                                                             4
                                                                       3
## Merc 450SE
                        16.4
                               8 275.8 180 3.07 4.070 17.40
                                                               0
                                                                  0
                                                                             3
## Merc 450SL
                               8 275.8 180 3.07 3.730 17.60
                        17.3
## Merc 450SLC
                        15.2
                               8 275.8 180 3.07 3.780 18.00
                                                               \cap
                                                                  Ω
                                                                       3
                                                                             3
## Cadillac Fleetwood
                        10.4
                               8 472.0 205 2.93 5.250 17.98
                                                                       3
                                                                             4
                                                                       3
                                                                             4
## Lincoln Continental 10.4
                               8 460.0 215 3.00 5.424 17.82
## Chrysler Imperial
                               8 440.0 230 3.23 5.345 17.42
                                                                             4
                        14.7
## Fiat 128
                                        66 4.08 2.200 19.47
                        32.4
                               4 78.7
                                                                             1
```

```
## Honda Civic
                       30.4
                              4 75.7 52 4.93 1.615 18.52
                       33.9
                              4 71.1 65 4.22 1.835 19.90
                                                                           1
## Toyota Corolla
## Toyota Corona
                       21.5
                              4 120.1 97 3.70 2.465 20.01
## Dodge Challenger
                              8 318.0 150 2.76 3.520 16.87
                                                                           2
                       15.5
## AMC Javelin
                       15.2
                              8 304.0 150 3.15 3.435 17.30
                                                                           2
## Camaro Z28
                       13.3
                                                                     3
                                                                           4
                              8 350.0 245 3.73 3.840 15.41
                                                             0
                                                                Ω
## Pontiac Firebird
                       19.2
                              8 400.0 175 3.08 3.845 17.05
## 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
                                                                     5
                                                                           2
## Lotus Europa
                       30.4
                              4 95.1 113 3.77 1.513 16.90
                                                             1
                                                                1
## Ford Pantera L
                       15.8
                              8 351.0 264 4.22 3.170 14.50
                                                                     5
                                                                           4
                       19.7
                              6 145.0 175 3.62 2.770 15.50
                                                                     5
                                                                           6
## Ferrari Dino
                                                             0
                                                                1
## Maserati Bora
                       15.0
                              8 301.0 335 3.54 3.570 14.60
                                                             0
                                                                     5
                                                                           8
                       21.4
                              4 121.0 109 4.11 2.780 18.60
## Volvo 142E
mtcars[mtcars$cyl == 8, ]
##
                        mpg cyl disp hp drat
                                                   wt qsec vs am gear carb
## Hornet Sportabout
                       18.7
                              8 360.0 175 3.15 3.440 17.02
                                                             0
                                                                0
                                                                           2
                                                                           4
## Duster 360
                       14.3
                              8 360.0 245 3.21 3.570 15.84
                                                                0
## Merc 450SE
                       16.4
                              8 275.8 180 3.07 4.070 17.40
                                                             0
                                                                0
                                                                           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
## Lincoln Continental 10.4
                              8 460.0 215 3.00 5.424 17.82
                                                                     3
                                                                Ω
                                                                           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
                                                             0
                                                                0
                       13.3
                                                                     3
                       19.2
                              8 400.0 175 3.08 3.845 17.05
                                                                     3
                                                                           2
## Pontiac Firebird
                                                             0
                                                                0
## Ford Pantera L
                                                                      5
                       15.8
                              8 351.0 264 4.22 3.170 14.50
                                                                           4
                                                                1
                              8 301.0 335 3.54 3.570 14.60
## Maserati Bora
                       15.0
mtcars[mtcars$cyl == 4 | mtcars$cyl == 6, ]
                   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
                  22.8
                        4 108.0 93 3.85 2.320 18.61
                                                                      1
## Datsun 710
## Hornet 4 Drive 21.4
                        6 258.0 110 3.08 3.215 19.44
                                                           0
                                                                3
                                                                      1
                                                        1
## Valiant
                  18.1
                         6 225.0 105 2.76 3.460 20.22
                                                                      1
## Merc 240D
                  24.4
                         4 146.7
                                  62 3.69 3.190 20.00
                                                           0
                                                        1
                  22.8
                                                                      2
                         4 140.8 95 3.92 3.150 22.90
## Merc 230
                                                        1
                                                           0
                                                                 4
## Merc 280
                  19.2
                         6 167.6 123 3.92 3.440 18.30
                                                           0
                                                                 4
                                                                      4
                                                        1
## Merc 280C
                  17.8
                         6 167.6 123 3.92 3.440 18.90
                  32.4
                         4 78.7
                                  66 4.08 2.200 19.47
## Fiat 128
                                                           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
                                                           1
                  21.5
                         4 120.1
                                  97 3.70 2.465 20.01
## Toyota Corona
                                                                      1
```

66 4.08 1.935 18.90

4 120.3 91 4.43 2.140 16.70

4 95.1 113 3.77 1.513 16.90

6 145.0 175 3.62 2.770 15.50

4 121.0 109 4.11 2.780 18.60

1 1

0

1 1

1

2

6

5

5

27.3

26.0

30.4

19.7

21.4

Fiat X1-9

Porsche 914-2

Lotus Europa

Ferrari Dino

Volvo 142E

4 79.0

2. Why does the following code generated five missing values? x = 1.5 x[NA]

```
"In contrast to NA_real NA has logical type and logical vectors are recycled to the same length as the vectorbeing subset. For the case x[NA] is recycled to x[NA, NA, NA, NA]."
```

[1] "In contrast to NA_real NA has logical type and logical vectors are recycled\n to the same length

3. Why does mtcars[1:15] return an error? How does it differ from mtcars[1:15,]?

```
"mtcars in general has 11 columns. When subsetting of dataframe is being done with two vector, like mtcars[1:15,], than the two dimentional subsetting comes into role, and the first index refered to as row. Whereas mtcar[1:15] would return a data frame that contains first 15 columns of the dataset, hence the index will be out of bounds and an erroroccurs."
```

[1] "mtcars in general has 11 columns. When subsetting of dataframe is being done\nwith two vector,

4. Explain how does the following code work. x = matrix(c(1:3, NA, 5:7, NA, NA), nrow = 3) x[is.na(x)] = 0

```
" x[is.na(x)] = 0, is a syntax to replace NA with 0 in the matrix x
x = matrix(c(1:3, NA, 5:7, NA, NA), x matrix with some values as NA
nrow = 3, total number of rows is 3
RESULT would be
   V1 V2 V3
1 1 0 7
2 2 5 0
3 3 6 0
Hence all the NA values were replaced by 0"
```

[1] " x[is.na(x)] = 0, is a syntax to replace NA with 0 in the matrix x = matrix(c(1:3, NA, 5:7, 1))

5. Load the Car Road Tests dataset (in R, run data ("mtcars"), ?mtcars), then add a new column named as mpg_2 for the mtcars data frame. You can use if ... else ... or if else or any other functions that can get the job done. This new column will categorize mpg into four categories using the thresholds below: mpg_2 category Thresholds Low mpg < 16 Low_intermediate $16 <= \mathrm{mpg} < 21$ Intermediate_high $21 <= \mathrm{mpg} < 26$ High $26 <= \mathrm{mpg}$

```
mtcars
```

```
wt qsec vs am gear carb
##
                        mpg cyl disp hp drat
## Mazda RX4
                       21.0
                              6 160.0 110 3.90 2.620 16.46
                                                                          4
## Mazda RX4 Wag
                              6 160.0 110 3.90 2.875 17.02
                                                                          4
                       21.0
                                                             0
                                                                     4
## Datsun 710
                       22.8
                              4 108.0 93 3.85 2.320 18.61
                                                                          1
                                                             1
                                                                1
## Hornet 4 Drive
                              6 258.0 110 3.08 3.215 19.44
                                                                     3
                                                                          1
                       21.4
                                                             1
                                                                0
## Hornet Sportabout
                              8 360.0 175 3.15 3.440 17.02
                                                                          2
                       18.7
## Valiant
                       18.1
                              6 225.0 105 2.76 3.460 20.22
                                                             1
                                                                Ω
                                                                     3
                                                                          1
## Duster 360
                       14.3
                              8 360.0 245 3.21 3.570 15.84
                                                                     3
                                                                          4
                                                                     4
                                                                          2
## 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
                                                                          2
                       19.2
                              6 167.6 123 3.92 3.440 18.30 1
## Merc 280
                                                                          4
```

```
17.8
                            6 167.6 123 3.92 3.440 18.90
## Merc 280C
## Merc 450SE
                      16.4
                            8 275.8 180 3.07 4.070 17.40
                                                         0
                                                                 3
                                                                      3
                                                            0
## Merc 450SL
                      17.3
                            8 275.8 180 3.07 3.730 17.60
                                                                      3
## Merc 450SLC
                      15.2
                            8 275.8 180 3.07 3.780 18.00
                                                            Ω
                                                                      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 0
                                                            Λ
                                                                 3
                                                                      4
                            8 440.0 230 3.23 5.345 17.42
## Chrysler Imperial 14.7
                            4 78.7 66 4.08 2.200 19.47
## Fiat 128
                      32.4
                                                         1
                                                            1
                                                                 4
                                                                      1
## Honda Civic
                      30.4
                            4
                               75.7 52 4.93 1.615 18.52
                                                         1
                                                            1
                                                                 4
                                                                      2
                      33.9
                            4 71.1 65 4.22 1.835 19.90 1
                                                                 4
## Toyota Corolla
                                                            1
                                                                      1
## Toyota Corona
                      21.5
                            4 120.1 97 3.70 2.465 20.01 1
                                                                      1
                                                                      2
## Dodge Challenger
                            8 318.0 150 2.76 3.520 16.87
                                                            0
                                                                 3
                      15.5
                                                         0
## AMC Javelin
                     15.2
                            8 304.0 150 3.15 3.435 17.30
                                                         0
                                                            0
                                                                 3
                                                                      2
## Camaro Z28
                     13.3
                                                                 3
                            8 350.0 245 3.73 3.840 15.41 0
                                                            Ω
## Pontiac Firebird
                     19.2
                            8 400.0 175 3.08 3.845 17.05 0
                                                            0
                                                                 3
## Fiat X1-9
                      27.3
                            4 79.0 66 4.08 1.935 18.90
                                                         1
                                                            1
                                                                 4
                     26.0
                            4 120.3 91 4.43 2.140 16.70 0
                                                                 5
                                                                      2
## Porsche 914-2
                                                           1
## Lotus Europa
                     30.4
                            4 95.1 113 3.77 1.513 16.90 1 1
                                                               5
## 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
## Volvo 142E
                     21.4 4 121.0 109 4.11 2.780 18.60 1 1
```

head(mtcars)

```
##
                    mpg cyl disp hp drat
                                            wt qsec vs am gear carb
## Mazda RX4
                   21.0
                          6 160 110 3.90 2.620 16.46
## Mazda RX4 Wag
                   21.0
                          6 160 110 3.90 2.875 17.02
                                                                  4
                                                       1
                    22.8
                         4 108 93 3.85 2.320 18.61
## Datsun 710
                                                     1
                                                                  1
## Hornet 4 Drive
                   21.4 6 258 110 3.08 3.215 19.44 1 0
                                                             3
                                                                  1
                                                                  2
## Hornet Sportabout 18.7 8 360 175 3.15 3.440 17.02 0 0
## Valiant
                    18.1
                        6 225 105 2.76 3.460 20.22 1 0
                                                                  1
```

```
vec_mpg <-
ifelse(mtcars$mpg < 16, "Low",
ifelse(mtcars$mpg < 21, "Low_intermediate",
ifelse(mtcars$mpg < 26, "Intermediate_high",
ifelse(mtcars$mpg > 26, "High", NA))))
vec_mpg_2 <- mtcars$mpg
mtcars["mpg_2"] <- vec_mpg
subset(mtcars)</pre>
```

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

```
6 167.6 123 3.92 3.440 18.90
## Merc 280C
                       17.8
## Merc 450SE
                               8 275.8 180 3.07 4.070 17.40
                                                                      3
                                                                            3
                        16.4
                       17.3
## Merc 450SL
                               8 275.8 180 3.07 3.730 17.60
                                                                      3
                                                                            3
## Merc 450SLC
                               8 275.8 180 3.07 3.780 18.00
                                                                      3
                                                                            3
                        15.2
## 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
                                                                 Ω
                                                                      3
                                                                            4
## Chrysler Imperial
                               8 440.0 230 3.23 5.345 17.42
                        14.7
## Fiat 128
                                 78.7
                                        66 4.08 2.200 19.47
                        32.4
                                                              1
                                                                 1
                                                                      4
                                                                            1
## Honda Civic
                        30.4
                                  75.7
                                        52 4.93 1.615 18.52
                                                                            2
                               4 71.1
                                                                       4
## Toyota Corolla
                        33.9
                                        65 4.22 1.835 19.90
                                                                 1
                                                                            1
## Toyota Corona
                        21.5
                               4 120.1 97 3.70 2.465 20.01
                                                                            1
                                                                      3
                                                                            2
## Dodge Challenger
                               8 318.0 150 2.76 3.520 16.87
                                                                 0
                       15.5
                                                                      3
                                                                            2
## AMC Javelin
                       15.2
                               8 304.0 150 3.15 3.435 17.30
                                                                 0
## Camaro Z28
                               8 350.0 245 3.73 3.840 15.41
                                                                      3
                        13.3
                                                                            4
## Pontiac Firebird
                        19.2
                               8 400.0 175 3.08 3.845 17.05
                                                                      3
                                                                            2
## Fiat X1-9
                        27.3
                               4 79.0 66 4.08 1.935 18.90
                                                                       4
                                                                            1
## Porsche 914-2
                        26.0
                               4 120.3 91 4.43 2.140 16.70
                                                                      5
                                                                            2
                                                                 1
                                                                            2
## Lotus Europa
                        30.4
                               4 95.1 113 3.77 1.513 16.90
                                                                      5
## Ford Pantera L
                        15.8
                               8 351.0 264 4.22 3.170 14.50
                                                                      5
                                                                            4
                               6 145.0 175 3.62 2.770 15.50
## Ferrari Dino
                        19.7
                                                              0
                                                                      5
                                                                            6
## Maserati Bora
                        15.0
                               8 301.0 335 3.54 3.570 14.60
                                                                      5
                                                                            8
## Volvo 142E
                        21.4
                               4 121.0 109 4.11 2.780 18.60
                                                                            2
##
                                    mpg 2
## Mazda RX4
                       Intermediate high
## Mazda RX4 Wag
                        Intermediate high
## Datsun 710
                       Intermediate high
## Hornet 4 Drive
                       Intermediate_high
## Hornet Sportabout
                        Low_intermediate
## Valiant
                        Low_intermediate
## Duster 360
                                      Low
## Merc 240D
                        Intermediate_high
## Merc 230
                        Intermediate_high
## Merc 280
                        Low_intermediate
## Merc 280C
                        Low_intermediate
## Merc 450SE
                        Low intermediate
## Merc 450SL
                        Low_intermediate
## Merc 450SLC
                                      Low
## Cadillac Fleetwood
                                      Low
## Lincoln Continental
                                      Low
## Chrysler Imperial
                                      Low
## Fiat 128
                                     High
## Honda Civic
                                     High
## Toyota Corolla
                                     High
## Toyota Corona
                        Intermediate_high
## Dodge Challenger
                                      Low
## AMC Javelin
                                      Low
## Camaro Z28
                                      Low
## Pontiac Firebird
                         Low_intermediate
## Fiat X1-9
                                     High
## Porsche 914-2
                                     <NA>
## Lotus Europa
                                     High
## Ford Pantera L
                                      Low
## Ferrari Dino
                        Low_intermediate
## Maserati Bora
                                      I.ow
```

Volvo 142E Inte

Intermediate_high