

## hw\_02

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Q1 a)

```
mtcars[mtcars$cyl < 6, ]
```

| ##                | mpg  | cyl | disp  | hp  | drat | wt    | qsec  | vs | am | gear | carb |
|-------------------|------|-----|-------|-----|------|-------|-------|----|----|------|------|
| ## Datsun 710     | 22.8 | 4   | 108.0 | 93  | 3.85 | 2.320 | 18.61 | 1  | 1  | 4    | 1    |
| ## 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    |
| ## 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    |
| ## 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    |
| ## Volvo 142E     | 21.4 | 4   | 121.0 | 109 | 4.11 | 2.780 | 18.60 | 1  | 1  | 4    | 2    |

Q1 b)

```
mtcars[-(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 | 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 |
| ## Volvo 142E       | 21.4 | 4 | 121.0 | 109 | 4.11 | 2.780 | 18.60 | 1 | 1 | 4 | 2 |

Q1 c)

```
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  | 3    | 2    |
| ## Duster 360          | 14.3 | 8   | 360.0 | 245 | 3.21 | 3.570 | 15.84 | 0  | 0  | 3    | 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    |
| ## 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    |
| ## Ford Pantera L      | 15.8 | 8   | 351.0 | 264 | 4.22 | 3.170 | 14.50 | 0  | 1  | 5    | 4    |
| ## Maserati Bora       | 15.0 | 8   | 301.0 | 335 | 3.54 | 3.570 | 14.60 | 0  | 1  | 5    | 8    |

Q1 d)

```
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  | 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    |
| ## Valiant        | 18.1 | 6   | 225.0 | 105 | 2.76 | 3.460 | 20.22 | 1  | 0  | 3    | 1    |
| ## 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    |

```
## 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
## 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
## Ferrari Dino 19.7  6 145.0 175 3.62 2.770 15.50 0 1  5  6
## Volvo 142E   21.4  4 121.0 109 4.11 2.780 18.60 1 1  4  2
```

## Q2

When we execute `x[NA]`, it returns five missing values because there are no elements in `x` that satisfy the condition of being missing.

## Q3 `mtcars[1:15]`

Above line of code returns an error as we are not specifying the row. Syntax should be `x[1,1] mtcars[1:5,]` is different than `mtcars[1:5]` as we are specifying both row and column.

## Q4

```
x = matrix(c(1:3, NA, 5:7, NA, NA), nrow = 3)
```

*#Here we are creating a matrix of three rows with multiple values and three of the cells  
# contains "NA" as values.*

```
x
```

```
##      [,1] [,2] [,3]
## [1,]    1  NA    7
## [2,]    2    5   NA
## [3,]    3    6   NA
```

```
x[is.na(x)] = 0
```

*# is.na(x) is a logical matrix which looks for a missing values and returns TRUE or FALSE. x[is.na(x)]  
# replaces all those NA to "0".*

```
x
```

```
##      [,1] [,2] [,3]
## [1,]    1    0    7
## [2,]    2    5    0
## [3,]    3    6    0
```

## Q5

```
#loading the dataframe
```

```
data("mtcars")
```

```
#checking the dataframe
```

```
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  0  1    4    4
## Mazda RX4 Wag  21.0   6  160 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710     22.8   4  108  93 3.85 2.320 18.61  1  1    4    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    3    2
## Valiant        18.1   6  225 105 2.76 3.460 20.22  1  0    3    1
```

```
#now we need to add another column for the dataframe which has a
#different category of milage for each car model.
#For that we will make use of ifelse function to first to segregate the data into 4 type.
```

```
milage_cat <- ifelse(mtcars$mpg < 16.0, "Low",
                    ifelse(mtcars$mpg >= 16.0 & mtcars$mpg < 21.0, "Low_intermediate",
                          ifelse(mtcars$mpg >= 21.0 & mtcars$mpg < 26.0, "Intermidate_High", "High")
                    )
#checking the new column data
head(milage_cat, n=10)
```

```
## [1] "Intermidate_High" "Intermidate_High" "Intermidate_High" "Intermidate_High"
## [5] "Low_intermediate" "Low_intermediate" "Low" "Intermidate_High"
## [9] "Intermidate_High" "Low_intermediate"
```

```
#adding the data to dataframe as a new column at the end
```

```
mtcars$mpg_2 <- milage_cat
```

```
#checking the dataframe to ensure the column and category makes sense
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  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 |
| ## Volvo 142E          | 21.4              | 4 | 121.0 | 109 | 4.11 | 2.780 | 18.60 | 1 | 1 | 4 | 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       | High              |   |       |     |      |       |       |   |   |   |   |
| ## Lotus Europa        | High              |   |       |     |      |       |       |   |   |   |   |
| ## Ford Pantera L      | Low               |   |       |     |      |       |       |   |   |   |   |
| ## Ferrari Dino        | Low_intermediate  |   |       |     |      |       |       |   |   |   |   |
| ## Maserati Bora       | Low               |   |       |     |      |       |       |   |   |   |   |
| ## Volvo 142E          | Intermediate_High |   |       |     |      |       |       |   |   |   |   |