

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,]
```

##		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

```
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	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

```
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

```
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

2. Why does the following code generate 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 vector being subset.
For the case x[NA] is recycled to x[NA, 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, ], then the two dimensional subsetting comes
into role, and the first index referred to as row. Whereas mtcars[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 error occurs."
```

```
## [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), 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\nx = matrix(c(1:3, NA, 5:7, NA, NA), nrow = 3, total number of rows is 3"
```

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 `ifelse` 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 <= mpg < 21` Intermediate_high `21 <= mpg < 26` High `26 <= mpg`

```
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

```
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

```
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)
```

##	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						<NA>					
## Lotus Europa						High					
## Ford Pantera L						Low					
## Ferrari Dino						Low_intermediate					
## Maserati Bora						Low					

Volvo 142E

Intermediate_high