

# Subsetting Data in R

Data Wrangling in R

# Overview

We showed different ways to read data into R using `readr::read_csv()`, `readr::read_delim()` and `readxl::read_excel()`. In this module, we will show you how select rows and columns of datasets.

# Setup

We will be using the `dplyr` package in the tidyverse.

Many resources on how to use `dplyr` exist and are straightforward:

- <https://dplyr.tidyverse.org/>
- <https://r4ds.had.co.nz/>
- <https://cran.rstudio.com/web/packages/dplyr/vignettes/dplyr.html>
- <https://stat545.com/dplyr-intro.html>

The `dplyr` package also interfaces well with tibbles.

# Dataset

We will be using the `diamonds` dataset in the `ggplot2` package as an example (so make sure you initiate the `ggplot2` package if you are following along on your own).

## Selecting a single column of a `data.frame`:

We can grab the `carat` column using the `$` operator.

```
head(diamonds$carat)
```

```
[1] 0.23 0.21 0.23 0.29 0.31 0.24
```

Note this does *not* return a `tibble` (or `data.frame`) but rather a vector.

## Selecting a single column of a `data.frame`:

The `select` function extracts one or more columns from a `tibble` or `data.frame` and returns a `tibble` (not a vector)

```
select(diamonds, carat)
```

```
# A tibble: 53,940 x 1
  carat
  <dbl>
1  0.23
2  0.21
3  0.23
4  0.290
5  0.31
6  0.24
7  0.24
8  0.26
9  0.22
10 0.23
# ... with 53,930 more rows
```

## Selecting multiple columns of a `data.frame`:

The `select` command from `dplyr` is very flexible. You just need to list all columns you want to extract separated by commas

```
select(diamonds, carat, depth)
```

```
# A tibble: 53,940 x 2
  carat depth
  <dbl> <dbl>
1  0.23   61.5
2  0.21   59.8
3  0.23   56.9
4  0.290  62.4
5  0.31   63.3
6  0.24   62.8
7  0.24   62.3
8  0.26   61.9
9  0.22   65.1
10 0.23   59.4
# ... with 53,930 more rows
```

## Subset columns of a `data.frame`: dplyr

If you were just selecting a single column, and you wanted the output to be a vector (and not a `tibble`), you need to use `pull`:

```
head(pull(select(diamonds, carat)))
```

```
[1] 0.23 0.21 0.23 0.29 0.31 0.24
```

This is equivalent to using the `$` method (in base R).



## Using the `pipe` (comes with `dplyr`):

That was a lot of typing and nested functions, which can be confusing. Recently, the pipe `%>%` makes things such as this much more readable. It reads left side “pipes” into right side. RStudio CMD/Ctrl + Shift + M shortcut.

## Using the `pipe` (comes with `dplyr`):

Pipe `diamonds` into `select`, then pipe that into `pull`, and then show the head:

```
diamonds %>% select(carat) %>% pull() %>% head()
```

```
[1] 0.23 0.21 0.23 0.29 0.31 0.24
```

## See the Select “helpers”

Run the command:

```
??tidyselect::select_helpers
```

Here are a few:

```
one_of()  
last_col()  
ends_with()  
contains() # like searching  
matches() # Matches a regular expression - cover later
```

# Tidysselect helpers

For example, we can take all columns that start with a "c":

```
diamonds %>% select(starts_with("c"))
```

```
# A tibble: 53,940 x 4
  carat cut      color clarity
  <dbl> <ord>    <ord> <ord>
1  0.23 Ideal      E      SI2
2  0.21 Premium    E      SI1
3  0.23 Good       E      VS1
4  0.290 Premium    I      VS2
5  0.31 Good       J      SI2
6  0.24 Very Good J      VVS2
7  0.24 Very Good I      VVS1
8  0.26 Very Good H      SI1
9  0.22 Fair       E      VS2
10 0.23 Very Good H      VS1
# ... with 53,930 more rows
```

# Tidysselect helpers

Or we can take all columns that end with an "e":

```
diamonds %>% select(ends_with("e"))
```

```
# A tibble: 53,940 x 2
  table price
  <dbl> <int>
1     55   326
2     61   326
3     65   327
4     58   334
5     58   335
6     57   336
7     57   336
8     55   337
9     61   337
10    61   338
# ... with 53,930 more rows
```

## Tidymodels helpers

We are going to cover “fancier” ways of matching column names (and strings more generally) in the data cleaning lecture.

## Subset rows of a `data.frame`:

The command in `dplyr` for subsetting rows is `filter`. Try `?filter`.

The easiest way to filter is by testing whether numeric observations are greater than or less than some cutoff:

```
filter(diamonds, depth > 60)
```

```
# A tibble: 48,315 x 10
  carat cut      color clarity depth table price      x      y      z
  <dbl> <ord>    <ord> <ord>    <dbl> <dbl> <int> <dbl> <dbl> <dbl>
1  0.23 Ideal      E      SI2     61.5    55   326  3.95  3.98  2.43
2  0.290 Premium    I      VS2     62.4    58   334  4.2   4.23  2.63
3  0.31  Good      J      SI2     63.3    58   335  4.34  4.35  2.75
4  0.24  Very Good J      VVS2     62.8    57   336  3.94  3.96  2.48
5  0.24  Very Good I      VVS1     62.3    57   336  3.95  3.98  2.47
6  0.26  Very Good H      SI1     61.9    55   337  4.07  4.11  2.53
7  0.22  Fair      E      VS2     65.1    61   337  3.87  3.78  2.49
8  0.3   Good      J      SI1     64      55   339  4.25  4.28  2.73
9  0.23  Ideal      J      VS1     62.8    56   340  3.93  3.9   2.46
10 0.22  Premium    F      SI1     60.4    61   342  3.88  3.84  2.33
# ... with 48,305 more rows
```

Note, no `$` or subsetting is necessary. R “knows” `depth` refers to a column of `diamonds`.

## Subset rows of a `data.frame`:

You can also using piping here:

```
diamonds %>% filter(depth > 60)
```

```
# A tibble: 48,315 x 10
```

	carat	cut	color	clarity	depth	table	price	x	y	z
	<dbl>	<ord>	<ord>	<ord>	<dbl>	<dbl>	<int>	<dbl>	<dbl>	<dbl>
1	0.23	Ideal	E	SI2	61.5	55	326	3.95	3.98	2.43
2	0.290	Premium	I	VS2	62.4	58	334	4.2	4.23	2.63
3	0.31	Good	J	SI2	63.3	58	335	4.34	4.35	2.75
4	0.24	Very Good	J	VVS2	62.8	57	336	3.94	3.96	2.48
5	0.24	Very Good	I	VVS1	62.3	57	336	3.95	3.98	2.47
6	0.26	Very Good	H	SI1	61.9	55	337	4.07	4.11	2.53
7	0.22	Fair	E	VS2	65.1	61	337	3.87	3.78	2.49
8	0.3	Good	J	SI1	64	55	339	4.25	4.28	2.73
9	0.23	Ideal	J	VS1	62.8	56	340	3.93	3.9	2.46
10	0.22	Premium	F	SI1	60.4	61	342	3.88	3.84	2.33

```
# ... with 48,305 more rows
```



## Subset rows of a `data.frame`:

You can combine filtering on multiple columns by separating the filter arguments with commas:

```
diamonds %>% filter(depth > 60, table > 60, price > 2775)
```

```
# A tibble: 1,704 x 10
```

	carat	cut	color	clarity	depth	table	price	x	y	z
	<dbl>	<ord>	<ord>	<ord>	<dbl>	<dbl>	<int>	<dbl>	<dbl>	<dbl>
1	0.72	Premium	F	SI1	61.8	61	2777	5.82	5.71	3.56
2	0.72	Very Good	H	VS1	60.6	63	2782	5.83	5.76	3.51
3	0.81	Good	G	SI2	61	61	2789	5.94	5.99	3.64
4	0.71	Premium	F	VS1	60.1	62	2790	5.77	5.74	3.46
5	0.71	Premium	G	VS1	62.4	61	2803	5.7	5.65	3.54
6	0.74	Fair	F	VS2	61.1	68	2805	5.82	5.75	3.53
7	0.7	Good	F	VS1	62.8	61	2810	5.57	5.61	3.51
8	0.7	Very Good	F	VS2	60.9	61	2812	5.66	5.71	3.46
9	0.71	Good	E	SI1	62.8	64	2817	5.6	5.54	3.5
10	0.7	Premium	E	VS2	62.4	61	2818	5.66	5.63	3.52

```
# ... with 1,694 more rows
```

## Subset rows of a `data.frame`:

You can also filter character strings by a single value or category:

```
diamonds %>% filter(color == "I",  
                    clarity == "SI2", cut == "Premium")
```

```
# A tibble: 312 x 10  
  carat cut      color clarity depth table price      x      y      z  
  <dbl> <ord>   <ord> <ord>   <dbl> <dbl> <int> <dbl> <dbl> <dbl>  
1  0.42 Premium I      SI2     61.5    59   552  4.78  4.84  2.96  
2    1    Premium I      SI2     58.2    60  2795  6.61  6.55  3.83  
3  0.9    Premium I      SI2     62.2    59  2826  6.11  6.07  3.79  
4  1.05 Premium I      SI2     58.3    57  2911  6.72  6.67  3.9  
5  0.91 Premium I      SI2     62      59  2913  6.18  6.23  3.85  
6  0.9    Premium I      SI2     62.5    58  2948  6.15  6.1    3.83  
7  0.9    Premium I      SI2     60.6    60  2948  6.28  6.23  3.79  
8  1.06 Premium I      SI2     61.5    57  2968  6.57  6.49  4.02  
9  0.91 Premium I      SI2     60.2    59  2981  6.29  6.24  3.77  
10 0.9    Premium I      SI2     60.6    60  3001  6.23  6.28  3.79  
# ... with 302 more rows
```

## Subset rows of a `data.frame`:

Sometimes you want to be able to filter on matching several values or categories. The `%in%` operator is useful here:

```
diamonds %>% filter(clarity %in% c("SI1", "SI2"))
```

```
# A tibble: 22,259 x 10
```

	carat	cut	color	clarity	depth	table	price	x	y	z
	<dbl>	<ord>	<ord>	<ord>	<dbl>	<dbl>	<int>	<dbl>	<dbl>	<dbl>
1	0.23	Ideal	E	SI2	61.5	55	326	3.95	3.98	2.43
2	0.21	Premium	E	SI1	59.8	61	326	3.89	3.84	2.31
3	0.31	Good	J	SI2	63.3	58	335	4.34	4.35	2.75
4	0.26	Very Good	H	SI1	61.9	55	337	4.07	4.11	2.53
5	0.3	Good	J	SI1	64	55	339	4.25	4.28	2.73
6	0.22	Premium	F	SI1	60.4	61	342	3.88	3.84	2.33
7	0.31	Ideal	J	SI2	62.2	54	344	4.35	4.37	2.71
8	0.2	Premium	E	SI2	60.2	62	345	3.79	3.75	2.27
9	0.3	Ideal	I	SI2	62	54	348	4.31	4.34	2.68
10	0.3	Good	J	SI1	63.4	54	351	4.23	4.29	2.7

```
# ... with 22,249 more rows
```

## Subset rows of a `data.frame`:

You can mix and match filtering on numeric and categorical/character columns in the same `filter()` command:

```
diamonds %>% filter(clarity %in% c("SI1", "SI2"),  
                    cut == "Premium", price > 3000)
```

```
# A tibble: 3,976 x 10
```

	carat	cut	color	clarity	depth	table	price	x	y	z
	<dbl>	<ord>	<ord>	<ord>	<dbl>	<dbl>	<int>	<dbl>	<dbl>	<dbl>
1	0.9	Premium	I	SI2	60.6	60	3001	6.23	6.28	3.79
2	0.81	Premium	F	SI1	61.9	58	3004	5.99	5.96	3.7
3	0.92	Premium	D	SI2	60.2	61	3004	6.32	6.27	3.79
4	0.9	Premium	D	SI1	62.2	60	3013	6.08	6.05	3.77
5	0.96	Premium	E	SI2	62.8	60	3016	6.3	6.24	3.94
6	0.93	Premium	G	SI2	61.4	56	3019	6.27	6.23	3.84
7	0.78	Premium	D	SI1	60.4	57	3019	6.02	5.97	3.62
8	0.75	Premium	E	SI1	61.7	60	3024	5.84	5.8	3.59
9	0.75	Premium	D	SI1	59.2	58	3024	5.96	5.93	3.52
10	1.02	Premium	G	SI2	61.7	58	3027	6.46	6.41	3.97

```
# ... with 3,966 more rows
```

## Subset rows of a `data.frame`:

Other useful logical tests:

`&` : AND

`|` : OR

`<=` : less than or equals

`>=` : greater than or equals

`!=` : not equals

## Subset rows of a `data.frame`:

The AND operator (&) is the what is being performed “behind the scenes” when chaining together filter statements with commas:

```
diamonds %>% filter(depth > 60 & table > 60 & price > 2775)
```

```
# A tibble: 1,704 x 10
```

	carat <dbl>	cut <ord>	color <ord>	clarity <ord>	depth <dbl>	table <dbl>	price <int>	x <dbl>	y <dbl>	z <dbl>
1	0.72	Premium	F	SI1	61.8	61	2777	5.82	5.71	3.56
2	0.72	Very Good	H	VS1	60.6	63	2782	5.83	5.76	3.51
3	0.81	Good	G	SI2	61	61	2789	5.94	5.99	3.64
4	0.71	Premium	F	VS1	60.1	62	2790	5.77	5.74	3.46
5	0.71	Premium	G	VS1	62.4	61	2803	5.7	5.65	3.54
6	0.74	Fair	F	VS2	61.1	68	2805	5.82	5.75	3.53
7	0.7	Good	F	VS1	62.8	61	2810	5.57	5.61	3.51
8	0.7	Very Good	F	VS2	60.9	61	2812	5.66	5.71	3.46
9	0.71	Good	E	SI1	62.8	64	2817	5.6	5.54	3.5
10	0.7	Premium	E	VS2	62.4	61	2818	5.66	5.63	3.52

```
# ... with 1,694 more rows
```

You can use either syntax.

## Subset rows of a `data.frame`:

The OR operator (`|`) is more permissive than the AND operator:

```
diamonds %>% filter(depth > 60 | table > 60 | price > 2775)
```

```
# A tibble: 52,198 x 10
```

	carat	cut	color	clarity	depth	table	price	x	y	z
	<dbl>	<ord>	<ord>	<ord>	<dbl>	<dbl>	<int>	<dbl>	<dbl>	<dbl>
1	0.23	Ideal	E	SI2	61.5	55	326	3.95	3.98	2.43
2	0.21	Premium	E	SI1	59.8	61	326	3.89	3.84	2.31
3	0.23	Good	E	VS1	56.9	65	327	4.05	4.07	2.31
4	0.290	Premium	I	VS2	62.4	58	334	4.2	4.23	2.63
5	0.31	Good	J	SI2	63.3	58	335	4.34	4.35	2.75
6	0.24	Very Good	J	VVS2	62.8	57	336	3.94	3.96	2.48
7	0.24	Very Good	I	VVS1	62.3	57	336	3.95	3.98	2.47
8	0.26	Very Good	H	SI1	61.9	55	337	4.07	4.11	2.53
9	0.22	Fair	E	VS2	65.1	61	337	3.87	3.78	2.49
10	0.23	Very Good	H	VS1	59.4	61	338	4	4.05	2.39

```
# ... with 52,188 more rows
```

## Subset rows of a `data.frame`:

The OR operator (`|`) can be a substitute for `%in%` (although it might take more typing):

```
diamonds %>% filter(clarity == "SI1" | clarity == "SI2")
```

```
# A tibble: 22,259 x 10
```

	carat	cut	color	clarity	depth	table	price	x	y	z
	<dbl>	<ord>	<ord>	<ord>	<dbl>	<dbl>	<int>	<dbl>	<dbl>	<dbl>
1	0.23	Ideal	E	SI2	61.5	55	326	3.95	3.98	2.43
2	0.21	Premium	E	SI1	59.8	61	326	3.89	3.84	2.31
3	0.31	Good	J	SI2	63.3	58	335	4.34	4.35	2.75
4	0.26	Very Good	H	SI1	61.9	55	337	4.07	4.11	2.53
5	0.3	Good	J	SI1	64	55	339	4.25	4.28	2.73
6	0.22	Premium	F	SI1	60.4	61	342	3.88	3.84	2.33
7	0.31	Ideal	J	SI2	62.2	54	344	4.35	4.37	2.71
8	0.2	Premium	E	SI2	60.2	62	345	3.79	3.75	2.27
9	0.3	Ideal	I	SI2	62	54	348	4.31	4.34	2.68
10	0.3	Good	J	SI1	63.4	54	351	4.23	4.29	2.7

```
# ... with 22,249 more rows
```



## Combining **filter** and **select**

You can combine `filter` and `select` to subset the rows and columns, respectively, of a `data.frame`:

```
diamonds %>%  
  filter(clarity == "SI2") %>%  
  select(starts_with("c"))
```

# A tibble: 9,194 x 4

	carat <dbl>	cut <ord>	color <ord>	clarity <ord>
1	0.23	Ideal	E	SI2
2	0.31	Good	J	SI2
3	0.31	Ideal	J	SI2
4	0.2	Premium	E	SI2
5	0.3	Ideal	I	SI2
6	0.3	Good	I	SI2
7	0.33	Ideal	I	SI2
8	0.33	Ideal	I	SI2
9	0.32	Good	H	SI2
10	0.32	Very Good	H	SI2

# ... with 9,184 more rows

## Combining **filter** and **select**

The order of these functions matters though, since you can remove columns that you might want to filter on.

```
diamonds %>%  
  select(starts_with("c")) %>%  
  filter(table > 60))
```