8. Exploring Data with dplyr (1)

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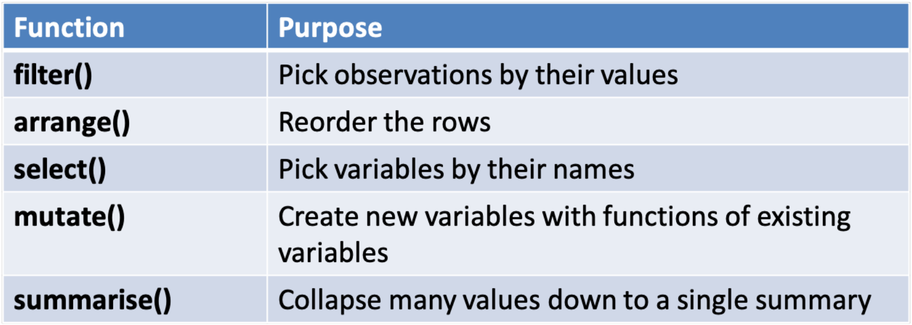
Overview

- Visualisation is an important tool for insight generation, but it's rare that you get the data in exactly the right form you need" (Wickham and Grolemund 2017)
    - Create new variables
    - Create summaries
    - Order data
- dplyr package is designed for data transformation

dplyr

- All verbs (functions) work similarly
- The first argument is a data frame/tibble
- The subsequent arguments decide what to do with the data frame
- The result is a data frame (supports chaining of steps)



Function	Purpose
filter()	Pick observations by their values
arrange()	Reorder the rows
select()	Pick variables by their names
mutate()	Create new variables with functions of existing variables
summarise()	Collapse many values down to a single summary

Sample Data set ggplot2::mpg

```
## Observations: 234
## Variables: 11
## $ manufacturer <chr> "audi", "audi", "audi", "audi", "audi'
## $ model        <chr> "a4", "a4", "a4", "a4", "a4", "a4", "a
## $ displ        <dbl> 1.8, 1.8, 2.0, 2.0, 2.8, 2.8, 3.1, 1.8
## $ year         <int> 1999, 1999, 2008, 2008, 1999, 1999, 20
## $ cyl          <int> 4, 4, 4, 4, 6, 6, 6, 4, 4, 4, 4, 6, 6,
## $ trans        <chr> "auto(l5)", "manual(m5)", "manual(m6)'
## $ drv          <chr> "f", "f", "f", "f", "f", "f", "f", "4'
## $ cty          <int> 18, 21, 20, 21, 16, 18, 18, 18, 16, 20
## $ hwy          <int> 29, 29, 31, 30, 26, 26, 27, 26, 25, 28
## $ fl           <chr> "p", "p", "p", "p", "p", "p", "p", "p'
## $ class        <chr> "compact", "compact", "compact", "comp
```

(1) filter()

- Subset observations based on their values.
- First argument the name of the data frame
- Subsequent arguments are expressions that filter the data frame
- Only includes rows that have no missing values

```
filter(mpg,manufacturer=="audi",year==1999,model=="a4")
```

```
## # A tibble: 4 x 11
##   manufacturer model displ  year   cyl trans  drv     cty
##   <chr>        <chr> <dbl> <int> <int> <chr>  <chr> <int> <
## 1 audi         a4      1.8  1999     4 auto(~ f        18
## 2 audi         a4      1.8  1999     4 manua~ f        21
## 3 audi         a4      2.8  1999     6 auto(~ f        16
## 4 audi         a4      2.8  1999     6 manua~ f        18
```

Cars with highest mpg, lowest mpg?

```
filter(mpg,hwy==max(hwy))
```

```
## # A tibble: 2 x 11
##   manufacturer model  displ  year   cyl trans drv     cty
##   <chr>        <chr>  <dbl> <int> <int> <chr> <chr> <int> <
## 1 volkswagen   jetta    1.9  1999     4 manu~ f        33
## 2 volkswagen   new b~   1.9  1999     4 manu~ f        35
```

```
filter(mpg,hwy==min(hwy))
```

```
## # A tibble: 5 x 11
##   manufacturer model  displ  year   cyl trans drv     cty
##   <chr>        <chr>  <dbl> <int> <int> <chr> <chr> <int> <
## 1 dodge        dakot~   4.7  2008     8 auto~ 4         9
## 2 dodge        duran~   4.7  2008     8 auto~ 4         9
## 3 dodge        ram 1~   4.7  2008     8 auto~ 4         9
## 4 dodge        ram 1~   4.7  2008     8 manu~ 4         9
```

Challenge 2.1

- List the cars with an average city mpg greater than the median.
- Show the cars with the maximum displacement

(2) arrange()

- Changes the order of rows.
- Takes a data frame and a set of column names to order by

```
arrange(mpg,displ)
```

```
## # A tibble: 234 x 11
##    manufacturer model displ  year   cyl trans drv     cty
##    <chr>        <chr> <dbl> <int> <int> <chr> <chr> <int> <
##  1 honda        civic   1.6  1999     4 manu~ f        28
##  2 honda        civic   1.6  1999     4 auto~ f        24
##  3 honda        civic   1.6  1999     4 manu~ f        25
##  4 honda        civic   1.6  1999     4 manu~ f        23
##  5 honda        civic   1.6  1999     4 auto~ f        24
##  6 audi         a4      1.8  1999     4 auto~ f        18
##  7 audi         a4      1.8  1999     4 manu~ f        21
##  8 audi         a4 q~   1.8  1999     4 manu~ 4        18
##  9 audi         a4 q~   1.8  1999     4 auto~ 4        16
```

Show in descending order

```
arrange(mpg,desc(displ))
```

```
## # A tibble: 234 x 11
##    manufacturer model displ  year   cyl trans drv     cty
##    <chr>        <chr> <dbl> <int> <int> <chr> <chr> <int> <
##  1 chevrolet    corv~   7    2008     8 manu~ r        15
##  2 chevrolet    k150~   6.5  1999     8 auto~ 4        14
##  3 chevrolet    corv~   6.2  2008     8 manu~ r        16
##  4 chevrolet    corv~   6.2  2008     8 auto~ r        15
##  5 jeep         gran~   6.1  2008     8 auto~ 4        11
##  6 chevrolet    c150~   6    2008     8 auto~ r        12
##  7 dodge        dura~   5.9  1999     8 auto~ 4        11
##  8 dodge        ram ~   5.9  1999     8 auto~ 4        11
##  9 chevrolet    c150~   5.7  1999     8 auto~ r        13
## 10 chevrolet    corv~   5.7  1999     8 manu~ r        16
## # ... with 224 more rows
```

Add an extra sort column

```r
arrange(mpg,desc(year),desc(displ))
```

```
## # A tibble: 234 x 11
##    manufacturer model displ  year   cyl trans drv     cty
##    <chr>        <chr> <dbl> <int> <int> <chr> <chr> <int> <
##  1 chevrolet    corv~   7    2008     8 manu~ r        15
##  2 chevrolet    corv~   6.2  2008     8 manu~ r        16
##  3 chevrolet    corv~   6.2  2008     8 auto~ r        15
##  4 jeep         gran~   6.1  2008     8 auto~ 4        11
##  5 chevrolet    c150~   6    2008     8 auto~ r        12
##  6 dodge        dura~   5.7  2008     8 auto~ 4        13
##  7 dodge        ram ~   5.7  2008     8 auto~ 4        13
##  8 jeep         gran~   5.7  2008     8 auto~ 4        13
##  9 toyota       land~   5.7  2008     8 auto~ 4        13
## 10 nissan       path~   5.6  2008     8 auto~ 4        12
## # ... with 224 more rows
```

The pipe operator

- The pipe %>% comes from the magrittr package (Stefan Milton Bache)
- Helps to write code that is easier to read and understand
    - x %>% f(y) turns into f(x, y)

```
mpg %>% select(model,displ,cty) %>% slice(1:2)
```

```
## # A tibble: 2 x 3
##   model displ   cty
##   <chr> <dbl> <int>
## 1 a4      1.8    18
## 2 a4      1.8    21
```

Summary One

- dplyr - a grammar of data manipulation
- Five verbs
    - **filter()**
    - **arrange()**
- Usefully combined with **%>%** operator