



Week 11: *Programming with Data*

🏛️ EMSE 4571: Intro to Programming for Analytics

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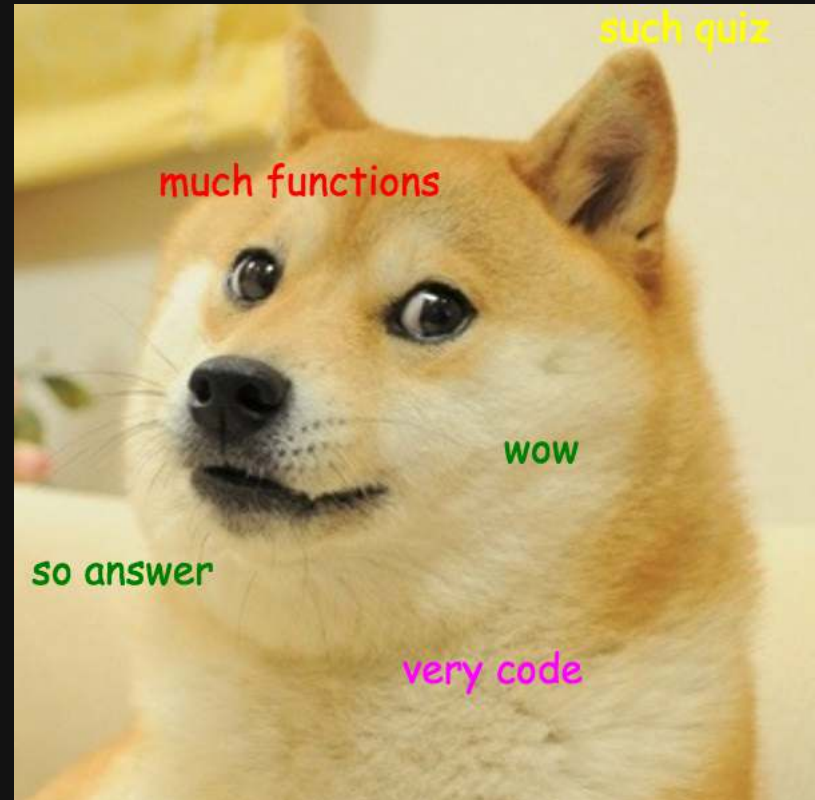
Quiz 6

10:00

Write your name on the quiz!

Rules:

- Work alone; no outside help of any kind is allowed.
- No calculators, no notes, no books, no computers, no phones.



Week 11: *Programming with Data*

1. Writing functions for data frames

2. Writing custom plot functions

BREAK

3. Iteration with purrr

Week 11: *Programming with Data*

1. Writing functions for data frames

2. Writing custom plot functions

BREAK

3. Iteration with purrr

Motivation

I want a summary of a variable in a data frame:

```
head(diamonds)
```

```
#> # A tibble: 6 × 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  0.29 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
```

Motivation

I want a summary of a variable in a data frame:

```
length(diamonds$price)
```

```
#> [1] 53940
```

```
mean(diamonds$price)
```

```
#> [1] 3932.8
```

```
sd(diamonds$price)
```

```
#> [1] 3989.44
```

Motivation

I want a summary of a variable in a data frame:

```
diamonds %>%  
  summarise(  
    n = n(),  
    mean = mean(price),  
    sd = sd(price)  
  )
```

```
#> # A tibble: 1 × 3  
#>       n mean   sd  
#>   <int> <dbl> <dbl>  
#> 1 53940 3933. 3989.
```

Motivation

I can get **grouped** summaries really fast now:

```
diamonds %>%  
  group_by(cut) %>%  
  summarise(  
    n = n(),  
    mean = mean(price),  
    sd = sd(price)  
  )
```

```
#> # A tibble: 5 × 4  
#>   cut          n mean    sd  
#>   <ord>     <int> <dbl> <dbl>  
#> 1 Fair      1610 4359. 3560.  
#> 2 Good      4906 3929. 3682.  
#> 3 Very Good 12082 3982. 3936.  
#> 4 Premium  13791 4584. 4349.  
#> 5 Ideal    21551 3458. 3808.
```

```
diamonds %>%  
  group_by(color) %>%  
  summarise(  
    n = n(),  
    mean = mean(price),  
    sd = sd(price)  
  )
```

```
#> # A tibble: 7 × 4  
#>   color          n mean    sd  
#>   <ord>     <int> <dbl> <dbl>  
#> 1 D         6775 3170. 3357.  
#> 2 E         9797 3077. 3344.  
#> 3 F         9542 3725. 3785.  
#> 4 G        11292 3999. 4051.  
#> 5 H         8304 4487. 4216.  
#> 6 I         5422 5092. 4722.  
#> 7 J         2808 5324. 4438.
```


Convert this to a function

```
diamonds %>%
  group_by(color) %>%
  summarise(
    n = n(),
    mean = mean(price),
    sd = sd(price)
  )
```

```
#> # A tibble: 7 × 4
#>   color      n  mean   sd
#>   <ord> <int> <dbl> <dbl>
#> 1 D       6775 3170. 3357.
#> 2 E       9797 3077. 3344.
#> 3 F       9542 3725. 3785.
#> 4 G      11292 3999. 4051.
#> 5 H       8304 4487. 4216.
#> 6 I       5422 5092. 4722.
#> 7 J       2808 5324. 4438.
```

```
my_summary <- function(df, var) {
  df %>%
  group_by(var) %>%
  summarise(
    n = n(),
    mean = mean(price),
    sd = sd(price)
  )
}
```

...but this doesn't work

```
my_summary <- function(df, var) {  
  df %>%  
  group_by(var) %>%  
  summarise(  
    n = n(),  
    mean = mean(price),  
    sd = sd(price)  
  )  
}  
  
my_summary(diamonds, color)
```

```
#> Error in `group_by()`:  
#> ! Must group by variables found in `.data`.  
#> ✖ Column `var` is not found.
```

Solution: "embrace" your variables 🤗

```
my_summary <- function(df, var) {  
  df %>%  
  group_by({{ var }}) %>%  
  summarise(  
    n = n(),  
    mean = mean(price),  
    sd = sd(price)  
  )  
}
```

```
my_summary(diamonds, cut)
```

```
#> # A tibble: 5 × 4  
#>   cut          n  mean    sd  
#>   <ord>     <int> <dbl> <dbl>  
#> 1 Fair      1610 4359. 3560.  
#> 2 Good      4906 3929. 3682.  
#> 3 Very Good 12082 3982. 3936.  
#> 4 Premium  13791 4584. 4349.  
#> 5 Ideal    21551 3458. 3808.
```

```
my_summary(diamonds, color)
```

```
#> # A tibble: 7 × 4  
#>   color          n  mean    sd  
#>   <ord> <int> <dbl> <dbl>  
#> 1 D      6775 3170. 3357.  
#> 2 E      9797 3077. 3344.  
#> 3 F      9542 3725. 3785.  
#> 4 C     11202 3000. 4051.
```

Make it even more general!

```
my_summary <- function(df, group, var) {  
  df %>%  
    group_by({{ group }}) %>%  
    summarise(  
      n = n(),  
      mean = mean({{ var }}),  
      sd = sd({{ var }})  
    )  
}
```

```
my_summary(diamonds, cut, price)
```

```
#> # A tibble: 5 × 4  
#>   cut          n  mean    sd  
#>   <ord>    <int> <dbl> <dbl>  
#> 1 Fair      1610  4359. 3560.  
#> 2 Good      4906  3929. 3682.  
#> 3 Very Good 12082  3982. 3936.  
#> 4 Premium  13791  4584. 4349.  
#> 5 Ideal    21551  3458. 3808.
```

Make it even more general!

```
my_summary <- function(df, group, var) {  
  df %>%  
    group_by({{ group }}) %>%  
    summarise(  
      n = n(),  
      mean = mean({{ var }}),  
      sd = sd({{ var }})  
    )  
}
```

```
my_summary(diamonds, color, carat)
```

```
#> # A tibble: 7 × 4  
#>   color      n  mean   sd  
#>   <ord> <int> <dbl> <dbl>  
#> 1 D       6775 0.658 0.360  
#> 2 E       9797 0.658 0.369  
#> 3 F       9542 0.737 0.398  
#> 4 G      11292 0.771 0.441  
#> 5 H       8304 0.912 0.521  
#> 6 I       5422 1.03  0.579  
#> 7 J       2808 1.16  0.506
```

Use it on a different data frame!

```
library(palmerpenguins)
```

```
glimpse(penguins)
```

```
#> Rows: 344  
#> Columns: 8  
#> $ species      <fct> Adelie, Adelie,  
#> $ island       <fct> Torgersen, Torg  
#> $ bill_length_mm <dbl> 39.1, 39.5, 40.  
#> $ bill_depth_mm <dbl> 18.7, 17.4, 18.  
#> $ flipper_length_mm <int> 181, 186, 195,  
#> $ body_mass_g   <int> 3750, 3800, 325  
#> $ sex           <fct> male, female, f  
#> $ year          <int> 2007, 2007, 200
```

```
my_summary(penguins, sex, body_mass_g)
```

```
#> # A tibble: 3 × 4  
#>   sex      n  mean   sd  
#>   <fct> <int> <dbl> <dbl>  
#> 1 female   165 3862.  666.  
#> 2 male    168 4546.  788.  
#> 3 <NA>     11  NA    NA
```

```
my_summary(penguins, species, bill_length_mm)
```

```
#> # A tibble: 3 × 4  
#>   species      n  mean   sd  
#>   <fct>     <int> <dbl> <dbl>  
#> 1 Adelie    152  NA    NA  
#> 2 Chinstrap  68  48.8  3.34  
#> 3 Gentoo   124  NA    NA
```

Defining a filter condition

```
filter_summary <- function(df, condition, var) {  
  df %>%  
  filter({{ condition }}) %>%  
  summarise(  
    n = n(),  
    mean = mean({{ var }}, na.rm = TRUE),  
    sd = sd({{ var }}, na.rm = TRUE)  
  )  
}
```

```
filter_summary(penguins, species == 'Adelie', bill_length_mm)
```

```
#> # A tibble: 1 × 3  
#>       n   mean   sd  
#>   <int> <dbl> <dbl>  
#> 1    152  38.8  2.66
```

15:00

Your turn - write the following functions

```
my_subset <- function(df, condition, cols)
```

Returns a subset of **df** by filtering the rows based on **condition** and only includes the select **cols**. Example:

```
nycflights13::flights %>%  
  my_subset(month == 12, c("carrier", "flight"))
```

```
#> # A tibble: 5 × 2  
#>   carrier flight  
#>   <chr>    <int>  
#> 1 B6         745  
#> 2 B6         839  
#> 3 US        1895  
#> 4 UA        1487  
#> 5 AA        2243
```

```
count_p <- function(df, group)
```

Returns a summary data frame of the count of rows in **df** by **group** as well as the percentage of those counts.

```
nycflights13::flights %>%  
  count_p(carrier)
```

```
#> # A tibble: 6 × 3  
#>   carrier      n      p  
#>   <chr>    <int> <dbl>  
#> 1 UA      58665 0.174  
#> 2 B6      54635 0.162  
#> 3 EV      54173 0.161  
#> 4 DL      48110 0.143  
#> 5 AA      32729 0.0972  
#> 6 MQ      26397 0.0784
```


Testing data frame functions

Function:

```
my_summary <- function(df, group, var) {  
  df %>%  
    group_by({{ group }}) %>%  
    summarise(  
      n = n(),  
      mean = mean({{ var }}),  
      sd = sd({{ var }})  
    )  
}
```

Make two data frames and compare them

```
test_my_summary <- function() {  
  cat("Testing my_summary()...")  
  
  df1 <- diamonds %>%  
    my_summary(cut, price)  
  
  df2 <- diamonds %>%  
    group_by(cut) %>%  
    summarise(  
      n = n(),  
      mean = mean(price),  
      sd = sd(price)  
    )  
  
  stopifnot(identical(df1, df2))  
  
  cat("passed!")  
}  
  
test_my_summary()
```

```
#> Testing my_summary()...passed!
```

Week 11: *Programming with Data*

1. Writing functions for data frames

2. **Writing custom plot functions**

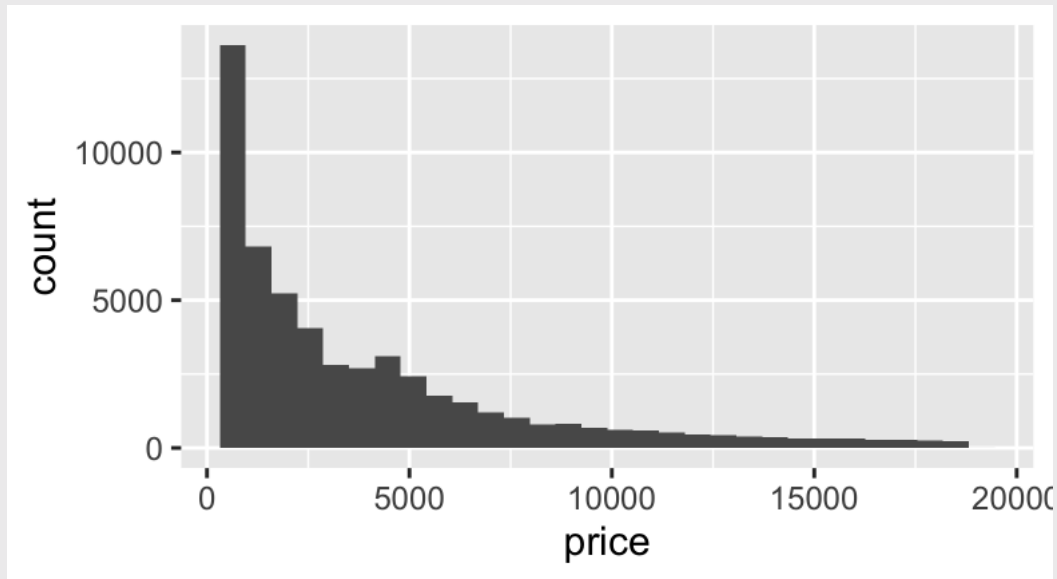
BREAK

3. Iteration with purrr

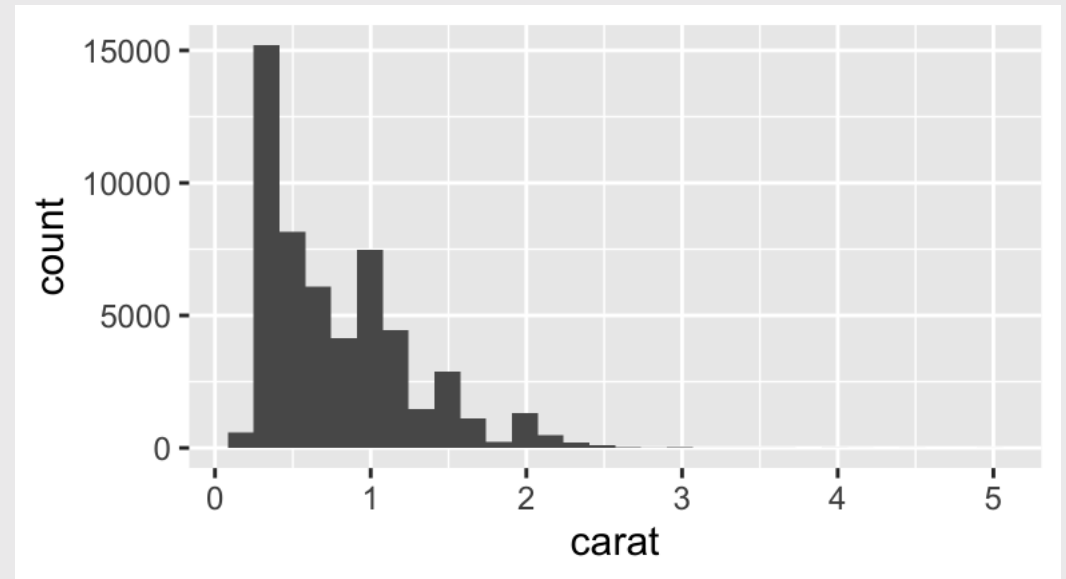
Motivation

I want to see a histogram of multiple variables

```
diamonds %>%  
  ggplot() +  
  geom_histogram(aes(x = price))
```



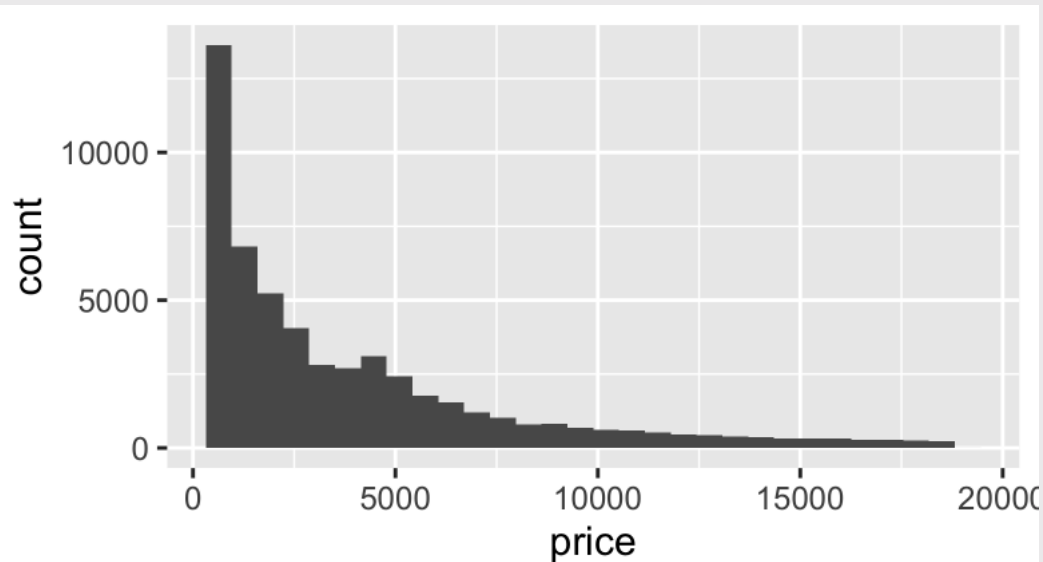
```
diamonds %>%  
  ggplot() +  
  geom_histogram(aes(x = carat))
```



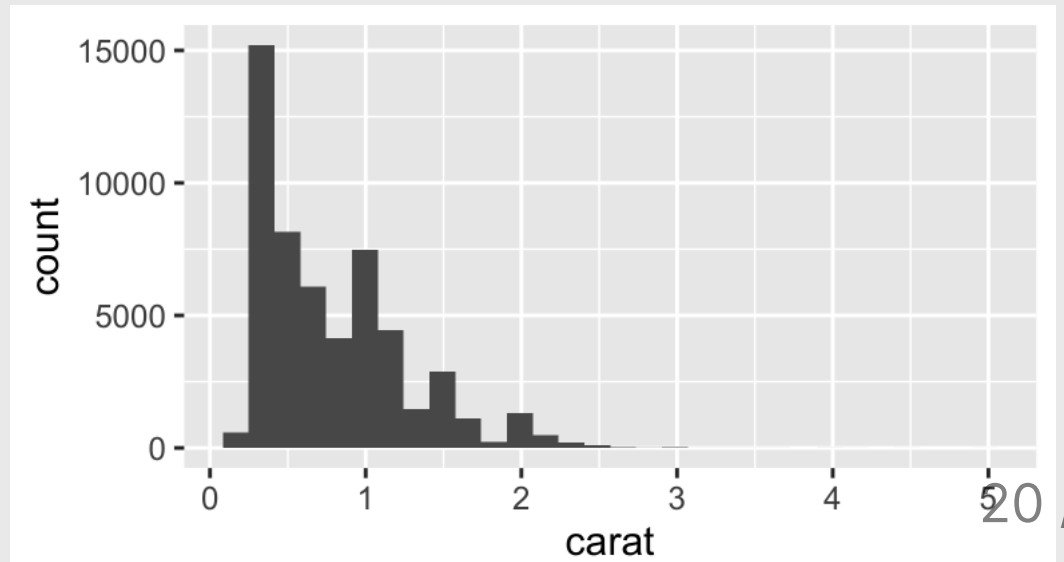
Convert this to a function

```
my_hist <- function(df, var) {  
  df %>%  
    ggplot() +  
    geom_histogram(aes(x = {{ var }})) # <<  
}
```

```
my_hist(diamonds, price)
```



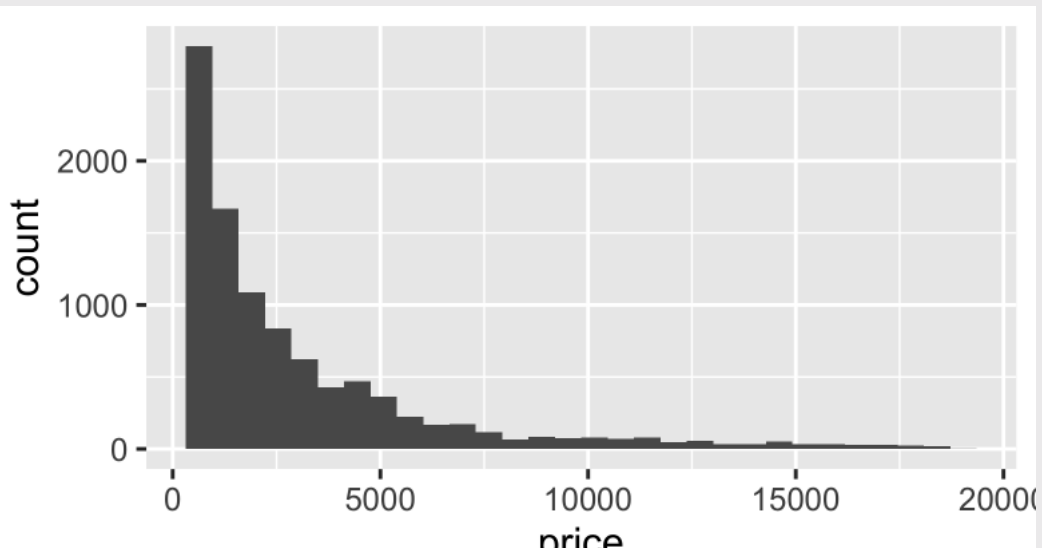
```
my_hist(diamonds, carat)
```



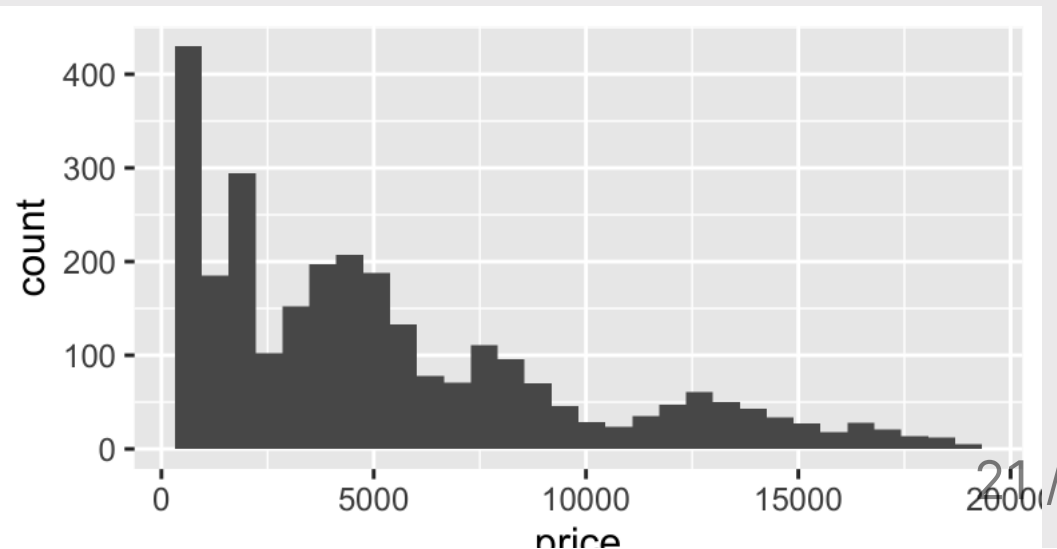
Combine with other functions

```
filtered_hist <- function(df, condition, var) {  
  df %>%  
  filter({{ condition }}) %>%  
  ggplot() +  
  geom_histogram(aes(x = {{ var }}))  
}
```

```
filtered_hist(diamonds, color == "E", price)
```



```
filtered_hist(diamonds, color == "J", price)
```



10:00

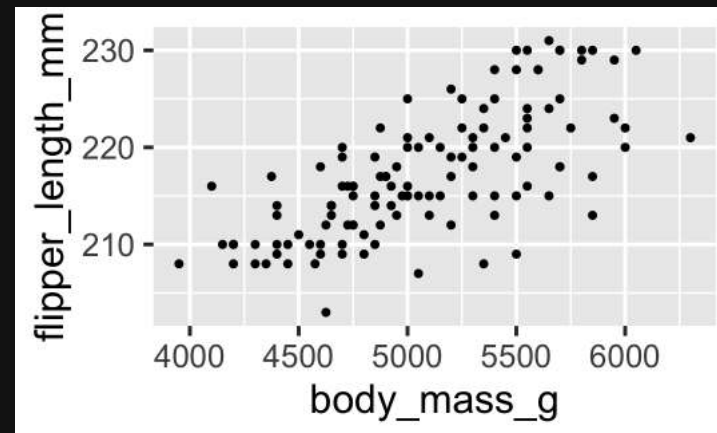
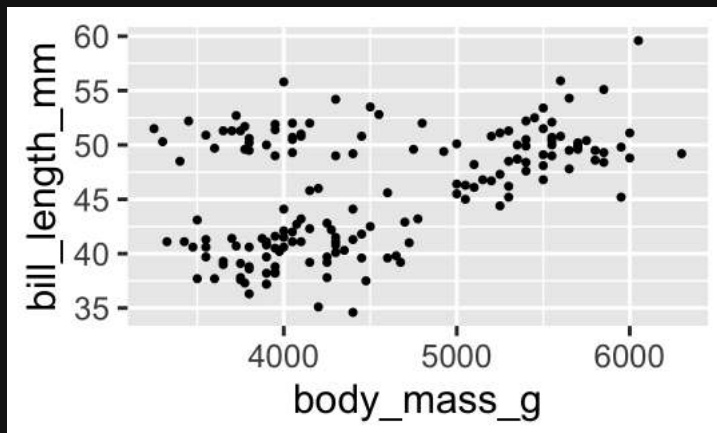
Your turn

Write the function `filtered_scatter` which plots a scatterplot based on a condition, then use it for the two examples below.

```
filtered_scatter <- function(df, condition, x, y)
```

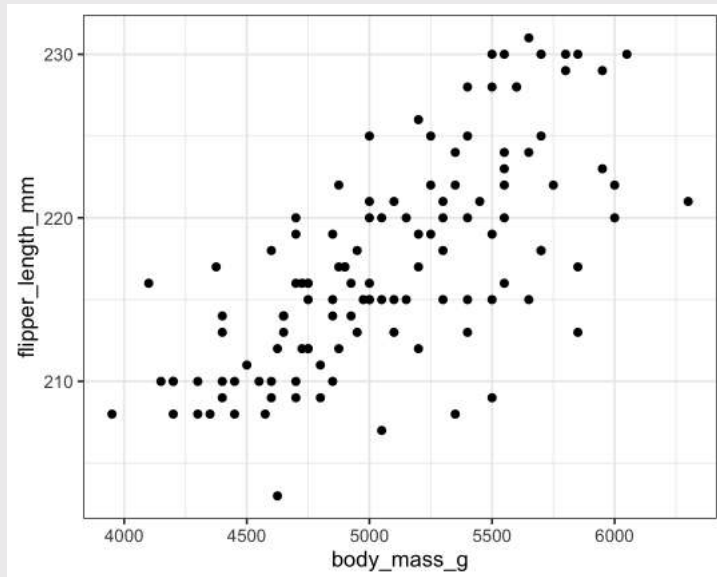
```
  filtered_scatter(  
    penguins, sex == "male",  
    x = body_mass_g, y = bill_length_mm)
```

```
  filtered_scatter(  
    penguins, species == "Gentoo",  
    x = body_mass_g, y = flipper_length_mm)
```



You can add layers to your custom plot functions

```
filtered_scatter(  
  penguins, species == "Gentoo",  
  x = body_mass_g, y = flipper_length_mm) +  
  theme_bw()
```



Break

05:00

Week 11: *Programming with Data*

1. Writing functions for data frames
2. Writing custom plot functions

BREAK

3. Iteration with purrr

Much of this content is adapted from Shannon Pileggi's workshop at <https://github.com/shannonpileggi/iterating-well-with-purrr>

Iterating *without* purrr

Gapminder example

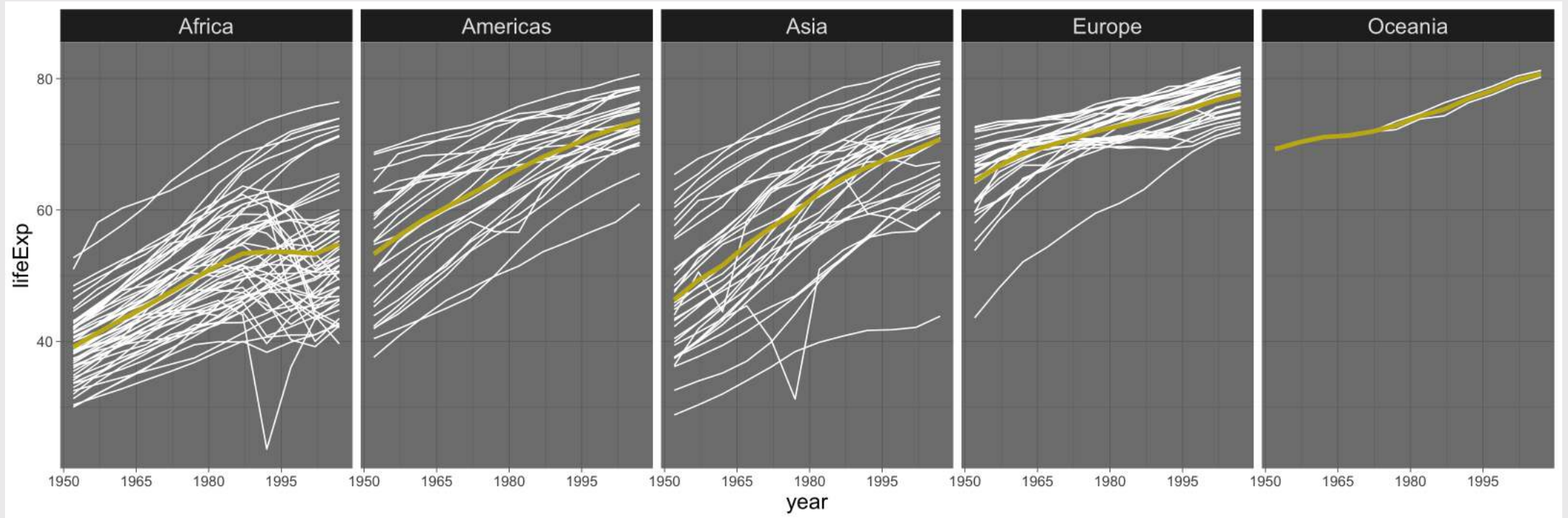
```
library(gapminder)
library(tidyverse)

head(gapminder)
```

```
#> # A tibble: 6 × 6
#>   country      continent  year lifeExp      pop gdpPercap
#>   <fct>        <fct>    <int> <dbl>    <int>    <dbl>
#> 1 Afghanistan Asia      1952  28.8  8425333  779.
#> 2 Afghanistan Asia      1957  30.3  9240934  821.
#> 3 Afghanistan Asia      1962  32.0 10267083  853.
#> 4 Afghanistan Asia      1967  34.0 11537966  836.
#> 5 Afghanistan Asia      1972  36.1 13079460  740.
#> 6 Afghanistan Asia      1977  38.4 14880372  786.
```

Hans Rosling discusses Gapminder data <https://youtu.be/hVimVzgtD6w>

Gapminder life expectancy



What am I doing here? Are there mistakes?

```
africa <- gapminder[gapminder$continent == "Africa", ]
africa_mm <- max(africa$lifeExp) - min(africa$lifeExp)

americas <- gapminder[gapminder$continent == "Americas", ]
americas_mm <- max(americas$lifeExp) - min(americas$lifeExp)

asia <- gapminder[gapminder$continent == "Asia", ]
asia_mm <- max(asia$lifeExp) - min(africa$lifeExp)

europe <- gapminder[gapminder$continent == "Europe", ]
europe_mm <- max(europe$lifeExp) - min(europe$lifeExp)

oceania <- gapminder[gapminder$continent == "Oceania", ]
oceania_mm <- max(europe$lifeExp) - min(oceania$lifeExp)

cbind(
  continent = c("Africa", "Asias", "Europe", "Oceania"),
  max_minus_min = c(africa_mm, americas_mm, asia_mm, europe_mm, oceania_mm)
)
```

1. What are the drawbacks of this code?

2. How would you do it instead?

```
africa <- gapminder[gapminder$continent == "Africa", ]
africa_mm <- max(africa$lifeExp) - min(africa$lifeExp)

americas <- gapminder[gapminder$continent == "Americas", ]
americas_mm <- max(americas$lifeExp) - min(americas$lifeExp)

asia <- gapminder[gapminder$continent == "Asia", ]
asia_mm <- max(asia$lifeExp) - min(africa$lifeExp)

europe <- gapminder[gapminder$continent == "Europe", ]
europe_mm <- max(europe$lifeExp) - min(europe$lifeExp)

oceania <- gapminder[gapminder$continent == "Oceania", ]
oceania_mm <- max(europe$lifeExp) - min(oceania$lifeExp)

cbind(
  continent = c("Africa", "Asias", "Europe", "Oceania"),
  max_minus_min = c(africa_mm, americas_mm, asia_mm, europe_mm, oceania_mm)
)
```

An alternative solution

```
gapminder %>%  
  group_by(continent) %>%  
  summarize(max_minus_min = max(lifeExp) - min(lifeExp))
```

group_by approach

```
#> # A tibble: 5 × 2  
#>   continent max_minus_min  
#>   <fct>      <dbl>  
#> 1 Africa      52.8  
#> 2 Americas   43.1  
#> 3 Asia       53.8  
#> 4 Europe     38.2  
#> 5 Oceania    12.1
```

previous approach

```
#>   continent max_minus_min  
#> [1,] "Africa" "52.843"  
#> [2,] "Asias"  "43.074"  
#> [3,] "Europe" "59.004"  
#> [4,] "Oceania" "38.172"  
#> [5,] "Africa" "12.637"
```

More iteration

```
year <- 2017:2021
location <- c("Orlando", "San Diego", "Austin", "San Francisco", "remote")

conf <- rep("", length(year))
for (i in 1:length(conf)) {
  conf[i] <- paste0("The ", year[i], " RStudio Conference was in ", location[i], ".")
}
conf
```

```
#> [1] "The 2017 RStudio Conference was in Orlando."
#> [2] "The 2018 RStudio Conference was in San Diego."
#> [3] "The 2019 RStudio Conference was in Austin."
#> [4] "The 2020 RStudio Conference was in San Francisco."
#> [5] "The 2021 RStudio Conference was in remote."
```

Can you think of other ways to do this?

More iteration, cont.

```
year <- 2017:2021  
location <- c("Orlando", "San Diego", "Austin", "San Francisco", "remote")
```

```
paste0("The ", year, " RStudio Conference was in ", location, ".")
```

```
#> [1] "The 2017 RStudio Conference was in Orlando."  
#> [2] "The 2018 RStudio Conference was in San Diego."  
#> [3] "The 2019 RStudio Conference was in Austin."  
#> [4] "The 2020 RStudio Conference was in San Francisco."  
#> [5] "The 2021 RStudio Conference was in remote."
```

```
glue::glue("The {year} RStudio Conference was in {location}.")
```

```
#> The 2017 RStudio Conference was in Orlando.  
#> The 2018 RStudio Conference was in San Diego.  
#> The 2019 RStudio Conference was in Austin.  
#> The 2020 RStudio Conference was in San Francisco.  
#> The 2021 RStudio Conference was in remote.
```

Introducing `purrr`



Loaded automatically with `library(tidyverse)`

```
purrr::map(x, f, ...)
```

for every element of `x` do `f`

x = minis

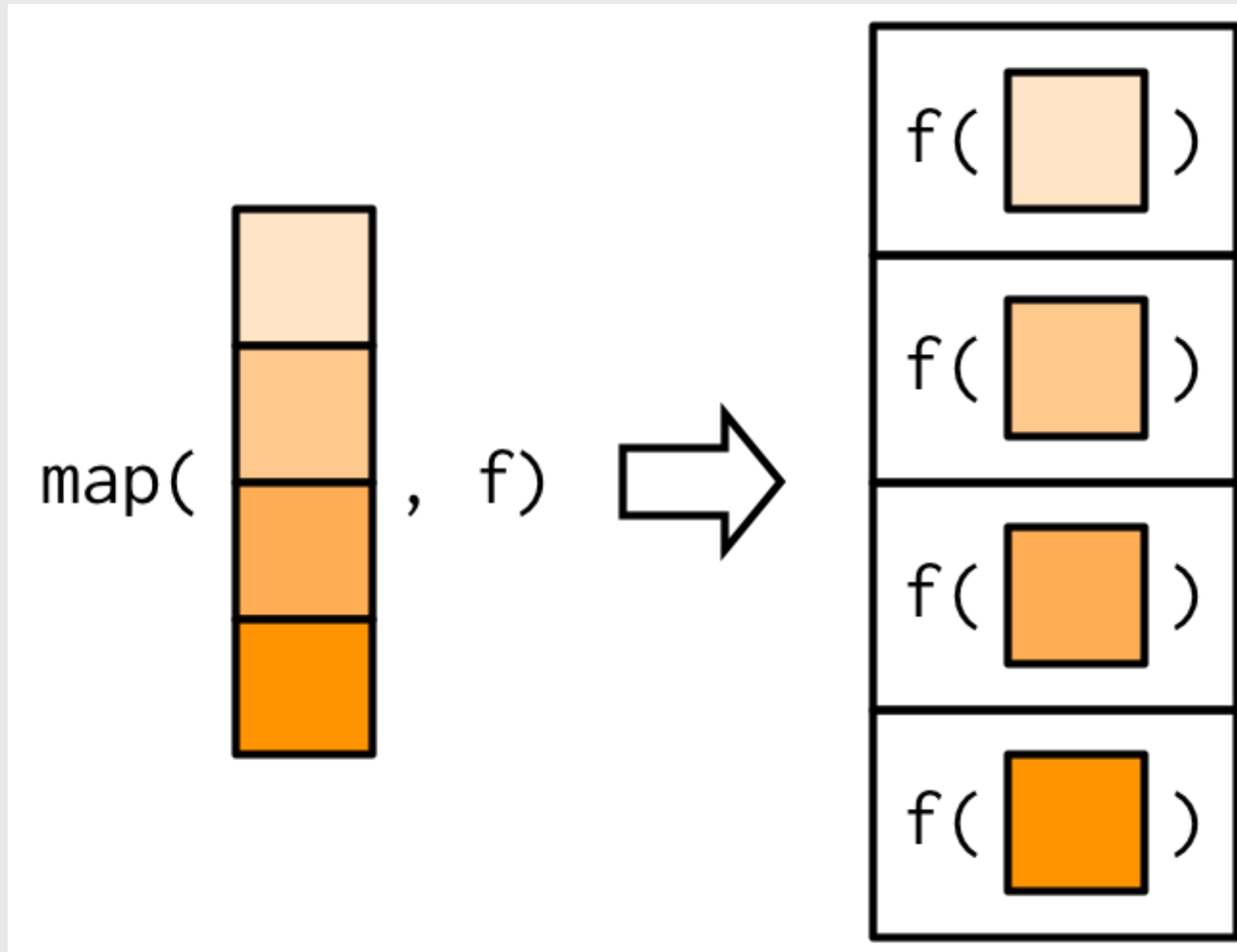
f = add_antenna



```
map(minis, add_antenna)
```



for every element of x do f



map() returns a list

Vector example

```
addTen <- function(x) {  
  return(x + 10)  
}
```

```
map(c(1, 7, 13), addTen)
```

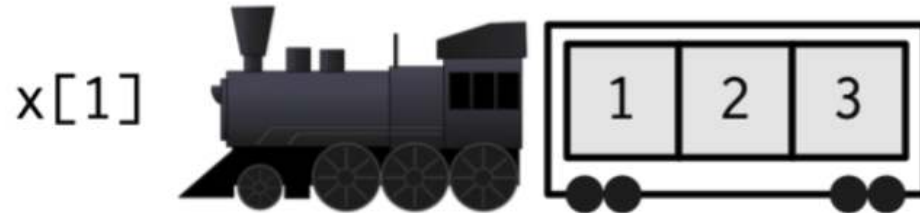
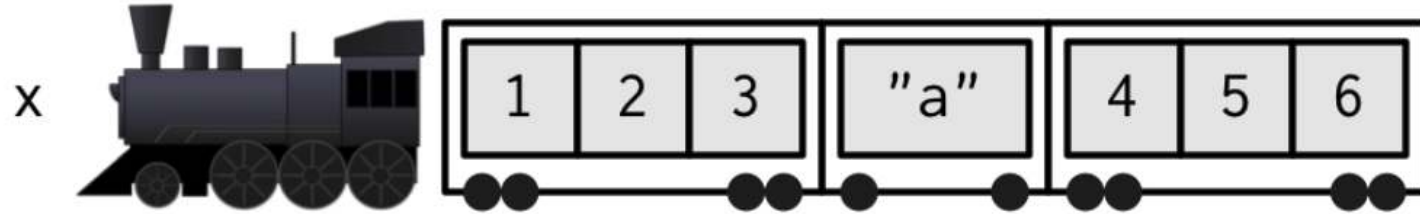
```
#> [[1]]  
#> [1] 11  
#>  
#> [[2]]  
#> [1] 17  
#>  
#> [[3]]  
#> [1] 23
```

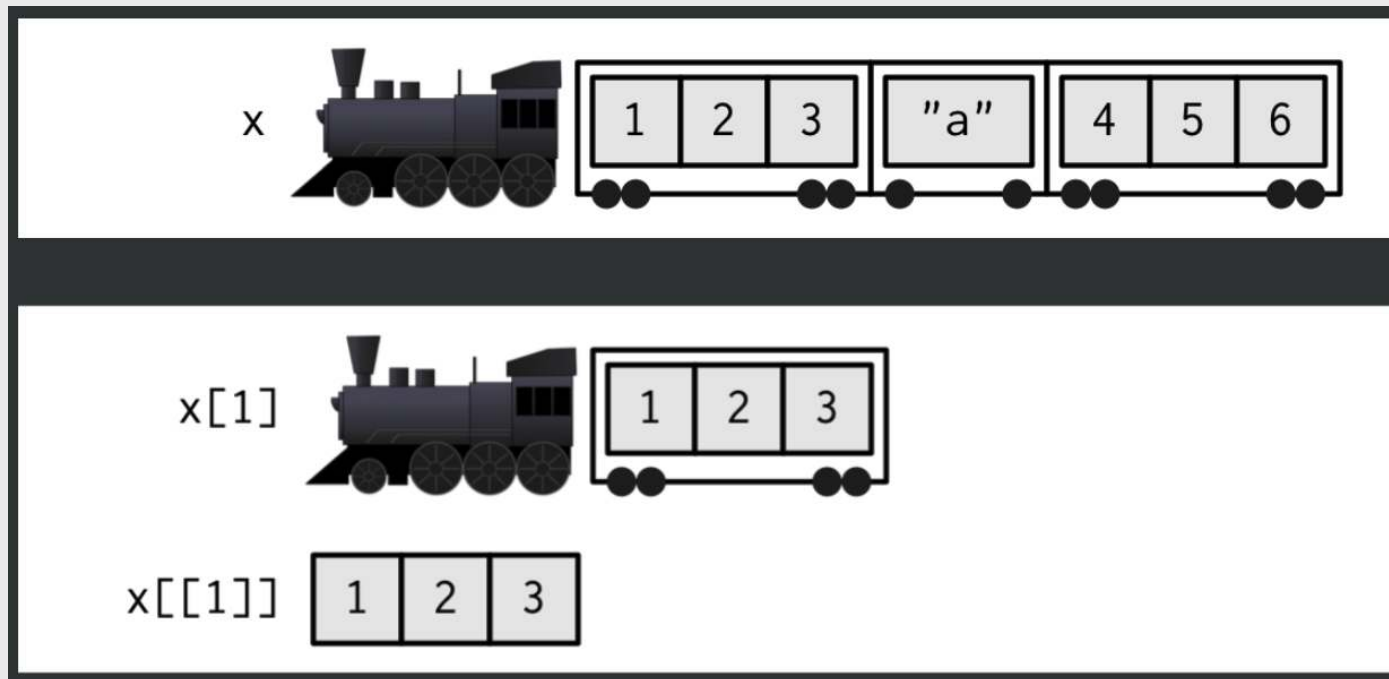
Working with lists feels like...



<https://media.giphy.com/media/Bqn8Z7xdPCFy0/giphy.gif>

Subsetting lists





```
x <- list(c(1, 2, 3), "a", c(4, 5, 6))
```

```
x[1]
```

```
#> [[1]]  
#> [1] 1 2 3
```

```
x[[1]]
```

```
#> [1] 1 2 3
```

Example data: `sw_people`

```
library(repurrrsive)
```

```
sw_people
```

```
#> [[1]]  
#> [[1]]$name  
#> [1] "Luke Skywalker"  
#>  
#> [[1]]$height  
#> [1] "172"  
#>  
#> [[1]]$mass  
#> [1] "77"  
#>  
#> [[1]]$hair_color  
#> [1] "blond"  
#>  
#> [[1]]$skin_color  
#> [1] "fair"  
#>
```



How many films was each Star Wars character in?

```
map(sw_people, f = 🙄)
```

Workflow:

1. Do it for one element.
2. Find the general recipe.
3. Drop into `map()` to do for all.

1. Do it for one element

```
x <- sw_people[[1]]  
x
```

```
#> $name  
#> [1] "Luke Skywalker"  
#>  
#> $height  
#> [1] "172"  
#>  
#> $mass  
#> [1] "77"  
#>  
#> $hair_color  
#> [1] "blond"  
#>  
#> $skin_color  
#> [1] "fair"  
#>  
#> $eye_color  
#> [1] "blue"  
#>
```

View the variables we have to work with:

```
names(x)
```

```
#> [1] "name"      "height"    "mass"  
#> [6] "eye_color" "birth_year" "gender"  
#> [11] "species"   "vehicles"   "starships"  
#> [16] "url"
```

Extract the films

```
x$films
```

```
#> [1] "http://swapi.co/api/films/6/" "http:  
#> [3] "http://swapi.co/api/films/2/" "http:  
#> [5] "http://swapi.co/api/films/7/"
```

1. Do it for one element

How many films was each Star Wars character in?

Character 1:

```
x <- sw_people[[1]]  
length(x$films)
```

```
#> [1] 5
```

Character 2:

```
x <- sw_people[[2]]  
length(x$films)
```

```
#> [1] 6
```

2. Find the general recipe

How many films was each Star Wars character in?

```
x <- sw_people[[1]]  
length(x$films)
```

```
#> [1] 5
```

Recipe:

```
x <- sw_people[[index]]
```

```
length(x$films)
```

3. Drop into `map()` to do for all items in list.

Recipe:

```
x <- sw_people[[index]]
```

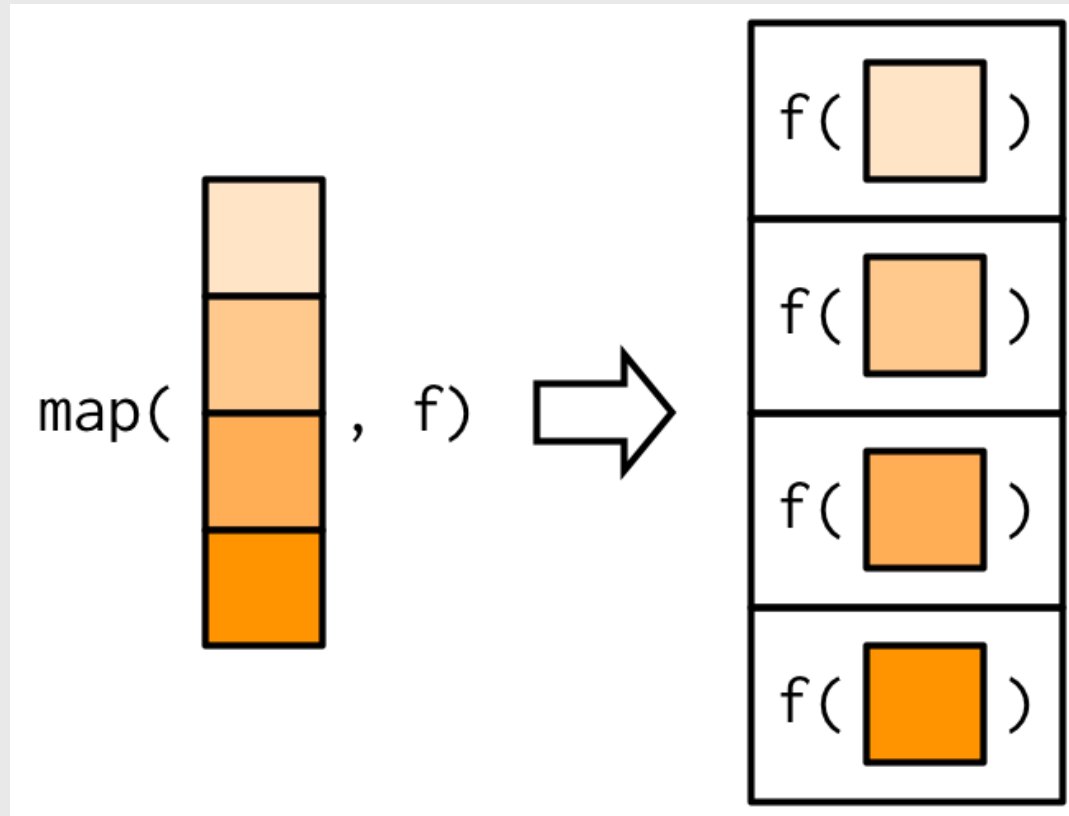
```
length(x$films)
```

Do for all items in list:

```
get_film_length <- function(x) {  
  return(length(x$films))  
}  
  
map(sw_people, get_film_length)
```

```
#> [[1]]  
#> [1] 5  
#>  
#> [[2]]  
#> [1] 6  
#>  
#> [[3]]  
#> [1] 7  
#>  
#> [[4]]
```


for every element of x do f



```
get_film_length <- function(x) {  
  return(length(x$films))  
}  
  
map(sw_people, get_film_length)
```

```
#> [[1]]  
#> [1] 5  
#>  
#> [[2]]  
#> [1] 6  
#>  
#> [[3]]  
#> [1] 7  
#>  
#> [[4]]  
#> [1] 4  
#>  
#> [[5]]  
#> [1] 5  
#>
```

Simplify it with "anonymous" functions

Version 1: **Custom function**

```
get_film_length <- function(x) {  
  return(length(x$films))  
}  
  
map(sw_people, get_film_length)
```

```
#> [[1]]  
#> [1] 5  
#>  
#> [[2]]  
#> [1] 6  
#>  
#> [[3]]  
#> [1] 7  
#>  
#> [[4]]  
#> [1] 4  
#>
```

Version 2: **Anonymous function**

```
map(sw_people, function(x) length(x$films))
```

```
#> [[1]]  
#> [1] 5  
#>  
#> [[2]]  
#> [1] 6  
#>  
#> [[3]]  
#> [1] 7  
#>  
#> [[4]]  
#> [1] 4  
#>  
#> [[5]]  
#> [1] 5  
#>  
#> [[6]]
```

Anonymous functions

Three ways of specifying anonymous functions:

```
map(sw_people, function(x) length( x$films)) # supported in base R
map(sw_people,      \ (x) length( x$films)) # supported R > 4.1.0
map(sw_people,      ~ length(.x$films)) # supported in purrr
```

03:00

Quick practice

- How many `vehicles` does each Star Wars character have?

(use `sw_people`)

- How many `titles` does each character in Game of Thrones have?

(use `got_chars`)

Type specific map variants

```
map_int(sw_people, \(x) length(x$films))
```

```
#> [1] 5 6 7 4 5 3 3 1 1 6 3 2 5 4 1 3 3 1 5 5 3 1 1 2 1 2 1 1 1 1 1 3 1 2 1 1 1 2  
#> [39] 1 1 2 1 1 3 1 1 1 3 3 3 2 2 2 1 3 2 1 1 1 2 2 1 1 2 2 1 1 1 1 1 1 1 1 2 1 1 2  
#> [77] 1 1 2 2 1 1 1 1 1 1 3
```

`map_lgl()`: Returns a *logical* vector

`map_int()`: Returns a *integer* vector

`map_dbl()`: Returns a *double* vector

`map_chr()`: Returns a *character* vector

Quick practice

Replace `map ()` with type-specific `map ()`.

```
# What's each character's name?  
map(got_chars, \(x) x$name)  
map(sw_people, \(x) x$name)  
  
# What color is each SW character's hair?  
map(sw_people, \(x) x$hair_color)  
  
# Is the GoT character alive?  
map(got_chars, \(x) x$alive)  
  
# Is the SW character female?  
map(sw_people, \(x) x$gender == "female")  
  
# How heavy is each SW character?  
map(sw_people, \(x) x$mass)
```

How many films was each Star Wars character in?

```
map(sw_people, \(x) length(x$films))
```

```
#> [[1]]  
#> [1] 5  
#>  
#> [[2]]  
#> [1] 6  
#>  
#> [[3]]  
#> [1] 7  
#>  
#> [[4]]  
#> [1] 4  
#>  
#> [[5]]  
#> [1] 5  
#>  
#> [[6]]  
#> [1] 3  
#>  
#> [[7]]
```

Wait, which character?

Use a tibble to get the character name as well!

Returns a list of data frames:

```
map(sw_people, \(x) tibble(
  name = x$name,
  n_vehicles = length(x$films)
))
```

```
#> [[1]]
#> # A tibble: 1 × 2
#>   name          n_vehicles
#>   <chr>         <int>
#> 1 Luke Skywalker     5
#>
#> [[2]]
#> # A tibble: 1 × 2
#>   name n_vehicles
#>   <chr>   <int>
#> 1 C-3P0     6
#>
```

Use `map_df()` to merge the data frames

```
map_df(sw_people, \(x) tibble(
  name = x$name,
  n_vehicles = length(x$films)
))
```

```
#> # A tibble: 87 × 2
#>   name          n_vehicles
#>   <chr>         <int>
#> 1 Luke Skywalker     5
#> 2 C-3P0             6
#> 3 R2-D2             7
#> 4 Darth Vader       4
#> 5 Leia Organa       5
#> 6 Owen Lars         3
#> 7 Beru Whitesun lars 3
#> 8 R5-D4             1
#> 9 Biggs Darklighter  1
```


Your turn

15:00

Try to answer these questions:

1. Which SW film has the most characters? (use `sw_films`)
2. Which SW species has the highest average lifespan? (use `sw_species`)
3. Which GoT character(s) have been played by multiple actors? (use `got_chars`)

Sometimes you really need do something on each row

Use a **for** loop to iterate across each row in a data frame:

```
for (i in 1:nrow(df)) {  
  row <- df[i,]  
  # Do stuff with row  
}
```

Example: tagging a new daily covid case record

```
covid_dc <- read_csv(here::here('data', 'us_covid.csv')) %>%  
  filter(state == 'District of Columbia') %>%  
  select(-state)  
  
head(covid_dc)
```

```
#> # A tibble: 6 × 6  
#>   date      day cases_daily deaths_daily cases_total deaths_total  
#>   <date>   <dbl>   <dbl>         <dbl>         <dbl>         <dbl>  
#> 1 2020-01-23     1         0             0             0             0  
#> 2 2020-01-24     2         0             0             0             0  
#> 3 2020-01-25     3         0             0             0             0  
#> 4 2020-01-26     4         0             0             0             0  
#> 5 2020-01-27     5         0             0             0             0  
#> 6 2020-01-28     6         0             0             0             0
```

Example: tagging a new daily covid case record

Initialize new column

```
covid_dc$new_record <- FALSE  
glimpse(covid_dc)
```

```
#> Rows: 403  
#> Columns: 7  
#> $ date      <date> 2020-01-23, 2020-01-24, 2020-01-25, 2020-01-26, 2020-01-27, 2020-01-28, 2020-01-29  
#> $ day       <dbl> 1, 2, 3, 4, 5, 6, 7  
#> $ cases_daily <dbl> 0, 0, 0, 0, 0, 0, 0  
#> $ deaths_daily <dbl> 0, 0, 0, 0, 0, 0, 0  
#> $ cases_total <dbl> 0, 0, 0, 0, 0, 0, 0  
#> $ deaths_total <dbl> 0, 0, 0, 0, 0, 0, 0  
#> $ new_record <lgl> FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE
```

Now loop through each row and check if a new record is met

```
record <- 0  
for (i in 1:nrow(covid_dc)) {  
  
  # Get the number of cases on row i  
  num_cases <- covid_dc[i,]$cases_daily  
  
  # Check if new record is met  
  if (num_cases > record) {  
  
    # Update new record in covid_dc  
    covid_dc[i, ]$new_record <- TRUE  
  
    # Update new record  
    record <- num_cases  
  
  }  
}
```

	date	day	state	cases_daily	deaths_daily	cases_total	deaths_total	new_record
58	2020-03-20	58	District of Columbia	31	1	71	1	TRUE
59	2020-03-21	59	District of Columbia	27	0	98	0	FALSE
60	2020-03-22	60	District of Columbia	4	2	102	2	FALSE
61	2020-03-23	61	District of Columbia	18	0	120	2	FALSE
62	2020-03-24	62	District of Columbia	21	0	141	2	FALSE
63	2020-03-25	63	District of Columbia	46	0	187	2	TRUE
64	2020-03-26	64	District of Columbia	44	1	231	3	FALSE
65	2020-03-27	65	District of Columbia	40	0	271	3	FALSE
66	2020-03-28	66	District of Columbia	33	1	304	4	FALSE
67	2020-03-29	67	District of Columbia	38	1	342	5	FALSE
68	2020-03-30	68	District of Columbia	59	4	401	9	TRUE
69	2020-03-31	69	District of Columbia	94	0	495	9	TRUE
70	2020-04-01	70	District of Columbia	91	0	586	9	FALSE
71	2020-04-02	71	District of Columbia	67	3	653	12	FALSE
72	2020-04-03	72	District of Columbia	104	3	757	15	TRUE
73	2020-04-04	73	District of Columbia	145	6	902	21	TRUE
74	2020-04-05	74	District of Columbia	100	1	1002	22	FALSE
75	2020-04-06	75	District of Columbia	95	2	1097	24	FALSE
76	2020-04-07	76	District of Columbia	114	0	1211	22	FALSE
77	2020-04-08	77	District of Columbia	229	5	1440	27	TRUE
78	2020-04-09	78	District of Columbia	83	5	1523	32	FALSE
79	2020-04-10	79	District of Columbia	137	6	1660	38	FALSE
80	2020-04-11	80	District of Columbia	118	9	1778	47	FALSE
81	2020-04-12	81	District of Columbia	97	3	1875	50	FALSE
82	2020-04-13	82	District of Columbia	80	2	1955	52	FALSE

Preview HW 11