Homework 2

PSTAT 134/234

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Homework 2

Part One: Analyzing the Weather

In this section, you will gain more practice working with public APIs, this time using a public weather API, WeatherAPI. The first thing you'll need to access the API is an API key. You can sign up for a key here: https://www.weatherapi.com/signup.aspx

Exercise 1

Use the http://api.weatherapi.com/v1/current.json URL to access the API and obtain real-time weather data. Note that you will want to specify three query parameters, at least – `key`, which should be set to your individual API key, `q`, which should equal the city name of a specified location – for example `q = "Isla Vista"` – and `aqi`, which indicates whether you want to obtain air quality data (`"yes"` or `"no"`).

Obtain current real-time weather data for **fifty randomly-selected cities**. I have saved a data file containing the names of fifty cities to `/data/cities.csv`. This ensures that you are all working with the same locations (although your results will still differ, depending on when you obtain the data).

```r
library(tidyverse)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.0     v stringr   1.5.1
v ggplot2   3.5.1     v tibble    3.2.1
v lubridate 1.9.3     v tidyr     1.3.1
v purrr     1.0.2
```

```
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to becom
```

```r
library(jsonlite)
```

```

Attaching package: 'jsonlite'

The following object is masked from 'package:purrr':

    flatten
```

```r
library(httr)

cities <- read.csv("./data/cities.csv")

data <- list()
for(i in 1:50){
  l <- list(
    key = "9d229f421fc6437a9ab00002242210",
    q = cities$names[i],
    aqi = "yes"
  )
  res = GET("http://api.weatherapi.com/v1/current.json", query = l)

  con <- fromJSON(rawToChar(res$content))

  data[[i]] <- con
}
```

Exercise 2

Write code in R or Python (your choice) to extract and store the following data for each location:

- City name
- Country

- Whether or not it is currently daytime there
- Temperature (in Fahrenheit)
- Humidity
- Weather description (`condition` text; for example, “Mist”, “Clear”, etc.)
- Wind speed (in miles per hour)
- Precipitation (in millimeters)
- US EPA air quality index (ranges from 1 to 6, representing the 6 categories of air quality: https://www.airnow.gov/aqi/aqi-basics/)

```r
complete_data <- list()

for(i in 1:50){
  l <- list(
    key = "9d229f421fc6437a9ab00002242210",
    q = cities$names[i],
    aqi = "yes"
  )
  res = GET("http://api.weatherapi.com/v1/current.json", query = l)

  con <- fromJSON(rawToChar(res$content))

  weather_data <- tibble(
    city = con$location$name,
    country = con$location$country,
    is_daytime = con$current$is_day == 1,
    temperature_f = con$current$temp_f,
    humidity = con$current$humidity,
    weather_desc = con$current$condition$text,
    wind_speed_mph = con$current$wind_mph,
    precipitation_mm = con$current$precip_mm,
    air_quality_us_epa = con$current$air_quality$`us-epa-index`
  )
  complete_data[[i]] <- weather_data
}
complete_df <- bind_rows(complete_data)
complete_df
```

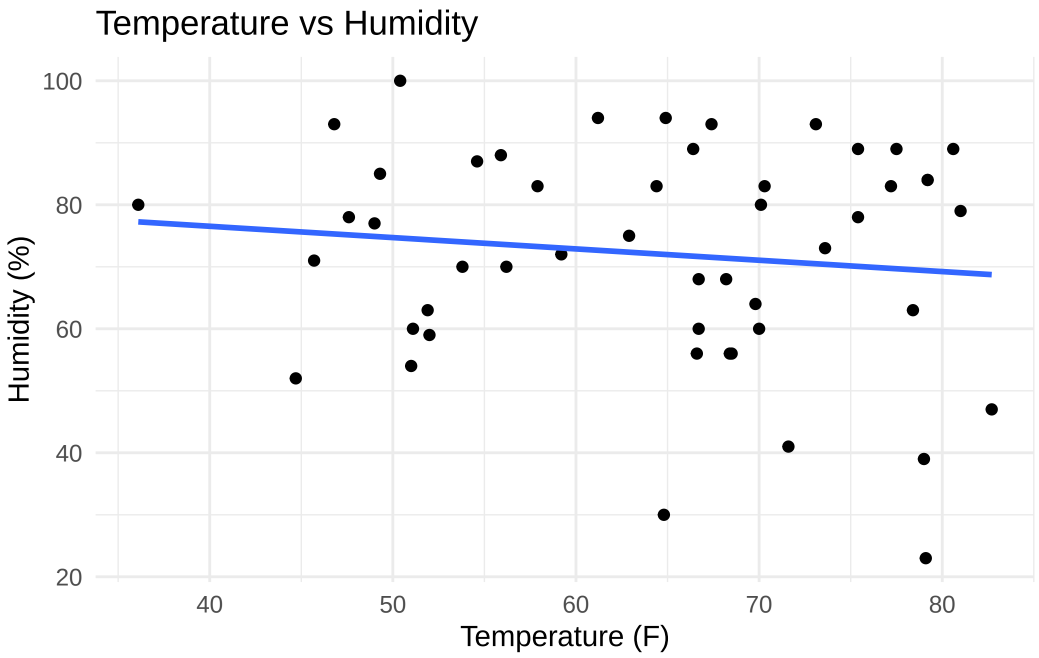
```
# A tibble: 50 x 9
   city    country is_daytime temperature_f humidity weather_desc wind_speed_mph
   <chr>   <chr>   <lgl>              <dbl>    <int> <chr>                 <dbl>
 1 Shangh~ China   TRUE                59.2       72 Partly clou~            4.7
 2 Chongq~ China   TRUE                64.4       83 Sunny                   2.2
 3 Palemb~ Indone~ TRUE                77.5       89 Partly clou~            2.2
 4 Berlin  Germany FALSE               49.3       85 Clear                   3.8
 5 Seoul   South ~ TRUE                51         54 Sunny                   2.2
 6 Tangsh~ China   TRUE                51.1       60 Sunny                   3.6
 7 Cairo   Egypt   FALSE               68.5       56 Clear                  12.8
 8 Warsaw  Poland  FALSE               47.6       78 Clear                   4.7
 9 Zunyi   China   TRUE                54.6       87 Sunny                   2.2
10 Saitama Japan   TRUE                73.6       73 Partly clou~            8.5
# i 40 more rows
# i 2 more variables: precipitation_mm <dbl>, air_quality_us_epa <int>
```

Exercise 3

Create a scatterplot of temperature vs. humidity. Add a linear regression line to the plot. What are the estimated intercept and slope values for this linear regression? Does there appear to be a significant relationship between temperature and humidity?

```r
ggplot(complete_df, aes(x = temperature_f, y = humidity)) +
  geom_point() +
  geom_smooth(method = "lm", se = F) +
  labs(title = "Temperature vs Humidity",
       x = "Temperature (F)",
       y = "Humidity (%)") +
  theme_minimal()
```

```
`geom_smooth()` using formula = 'y ~ x'
```



```
model <- lm(temperature_f ~ humidity, data = complete_df)
summary(model)
```

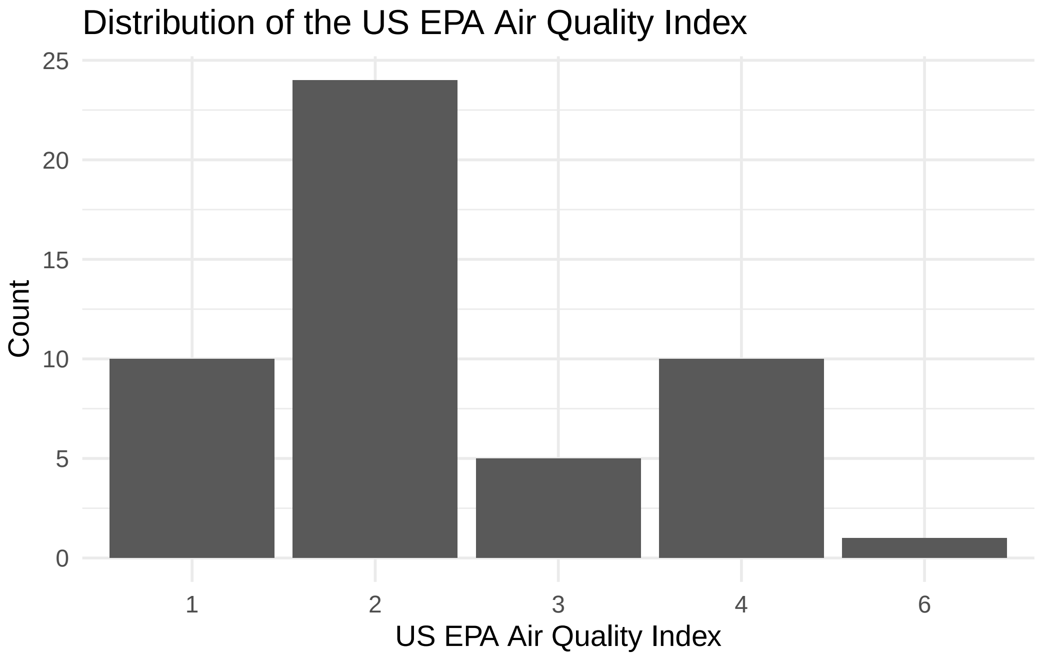
```
Call:
lm(formula = temperature_f ~ humidity, data = complete_df)

Residuals:
    Min      1Q  Median      3Q     Max 
-27.520 -10.093   2.262  10.263  17.720 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 70.20105    7.13014   9.846  4.2e-13 ***
humidity    -0.08226    0.09613  -0.856    0.396    
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 11.83 on 48 degrees of freedom
Multiple R-squared:  0.01503,   Adjusted R-squared:  -0.005495 
F-statistic: 0.7322 on 1 and 48 DF,  p-value: 0.3964
```

The estimated y-intercept is 80% humidity, and the slope is approximately (79-70)/(40-80) = -0.0.225.The p-value indicates there is no significant relationship between temperature and humidity.

Exercise 4

Create a bar chart of the EPA air quality index values. What does the distribution of air quality look like? Identify the location(s) with the best air quality and the worst air quality.

```r
ggplot(complete_df, aes(x = factor(air_quality_us_epa))) +
  geom_bar() +
  labs(
    title = "Distribution of the US EPA Air Quality Index",
    x = "US EPA Air Quality Index",
    y = "Count") +
  theme_minimal()
```



```r
best_aqi <- complete_df %>% filter(air_quality_us_epa == max(air_quality_us_epa))
print(best_aqi$city)
```

```
[1] "Riyadh"
```

```r
worst_aqi <- complete_df %>% filter(air_quality_us_epa == min(air_quality_us_epa))
print(worst_aqi$city)
```

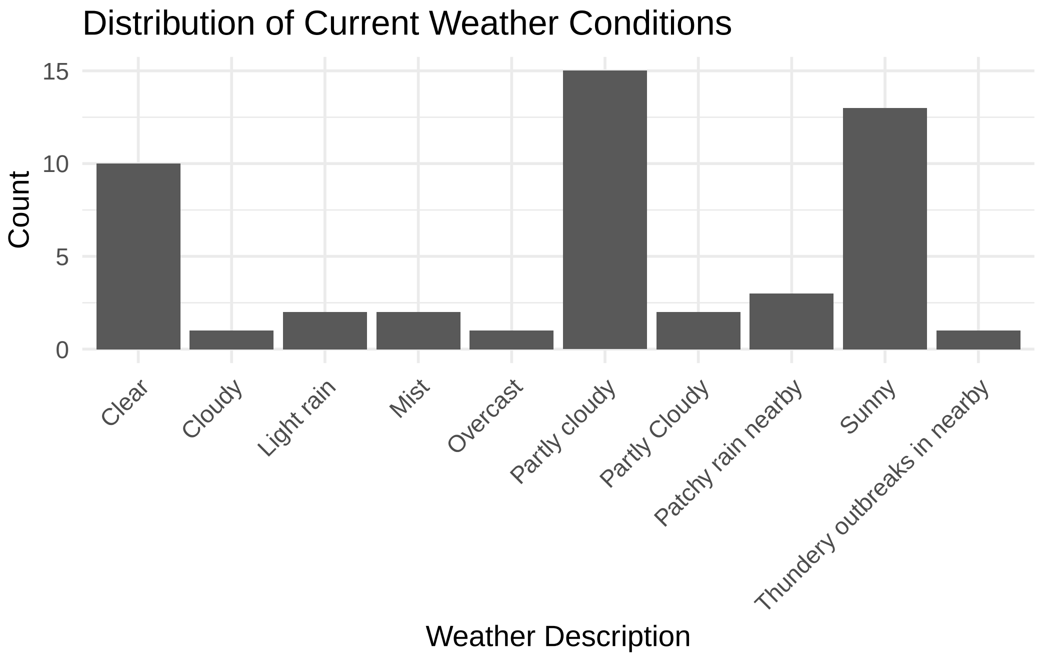
```
 [1] "Munich"            "Fes-Saïss Airport" "Basra"            
 [4] "Toronto"           "Porto Alegre"      "Quezon City"      
 [7] "Brisbane"          "Guatemala City"    "Accra"            
[10] "Kyoto"            
```

Most the US EPA Air Quality Index has a index number 2.

Exercise 5

Create a bar chart of the current weather description. Which conditions are the most common? Which are the least?

```r
ggplot(complete_df, aes(x = weather_desc)) +
  geom_bar() +
  labs(
    title = "Distribution of Current Weather Conditions",
    x = "Weather Description",
    y = "Count") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



```r
weather_counts <- complete_df %>%
  group_by(weather_desc) %>%
  summarise(count = n()) %>%
  arrange(desc(count))

max <- weather_counts %>% select(count) %>% max()

max_con <- weather_counts %>%
  filter(count == max)

min <- weather_counts %>% select(count) %>% min()

min_con <- weather_counts %>%
  filter(count == min)

print(paste("The most common weather condition: ", max_con$weather_desc))
```

```
[1] "The most common weather condition:  Partly cloudy"
```

```r
print(paste("The least common weather condition: ", paste(min_con$weather_desc, collapse =
```

```
[1] "The least common weather condition:  Cloudy, Overcast, Thundery outbreaks in nearby"
```

Exercises for 234 Students

Exercise 6

Do you think day vs. night cycles cause a significant difference in temperature? Test this hypothesis using a t-test.

Exercise 7

Create a table of the average temperature, humidity, wind speed, and precipitation broken down by weather description.

Exercise 8

Learn how to use the forecast API (http://api.weatherapi.com/v1/forecast.json).

Determine the chance of rain (in percentage) for Goleta, California tomorrow. *(Note that "tomorrow" may vary depending on when you do this assignment; that is fine.)*

Based on the percentage you obtained, do you think it will rain in Goleta tomorrow?

Part Two: Scraping Books

In this section, you'll practice your web scraping skills by experimenting with a fictional online bookstore located at https://books.toscrape.com/. Use the tools that we demonstrate in class to do the following, in either R or Python (your choice):

Exercise 9

Scrape the first 20 results from this site. Create a data frame (or tibble) that stores the following for each book:

- Title
- Price (excluding tax)
- Star rating
- Whether the book is in stock

```r
library(rvest)
```

```
Attaching package: 'rvest'


The following object is masked from 'package:readr':

    guess_encoding
```

```r
# html <- read_html('https://books.toscrape.com/')
# write_html(html, file = "hw2.html")
html <- read_html(x = "hw2.html")

title <- html %>%
  html_elements('a') %>%
  html_attr("title") %>%
  na.omit() %>%
  as.vector()

price <- html %>%
  html_elements('p.price_color') %>%
  html_text() %>%
  str_remove("£") %>%
  as.numeric()

star_rating <- html %>%
  html_elements('p.star-rating') %>%
  html_attr("class")

stock <- html %>%
  html_elements('p.instock.availability') %>%
  html_text(trim = T)

book_20 <- data.frame(title, price, star_rating, stock)
book_20
```

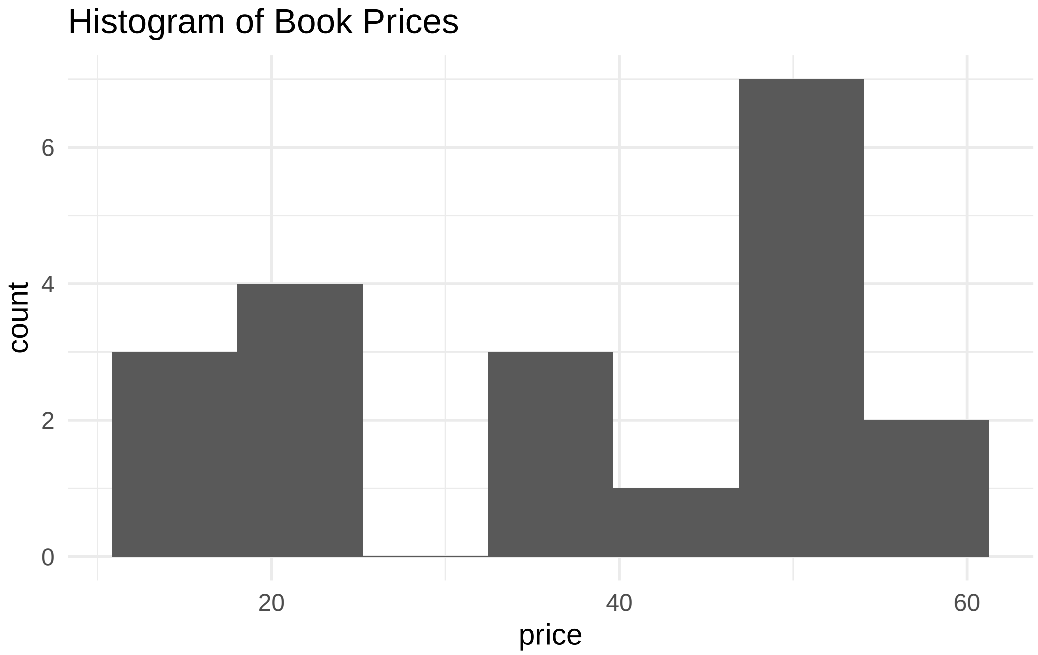
```
1                                                                             A Light in the A
2                                                                               Tipping the Ve
3                                                                                       Soumis
4                                                                                    Sharp Obj
5                                                            Sapiens: A Brief History of Human
6                                                                                  The Requiem
```

```
7                                              The Dirty Little Secrets of Getting Your Drea
8          The Coming Woman: A Novel Based on the Life of the Infamous Feminist, Victoria Woo
9  The Boys in the Boat: Nine Americans and Their Epic Quest for Gold at the 1936 Berlin Oly
10                                                                                The Black 
11                                                 Starving Hearts (Triangular Trade Trilogy
12                                                                          Shakespeare's So
13                                                                                    Set Me
14                                        Scott Pilgrim's Precious Little Life (Scott Pilgri
15                                                                      Rip it Up and Start 
16             Our Band Could Be Your Life: Scenes from the American Indie Underground, 1981
17
18                                          Mesaerion: The Best Science Fiction Stories 1800
19                                                                   Libertarianism for Begi
20                                                                        It's Only the Hima
   price       star_rating    stock
1  51.77 star-rating Three In stock
2  53.74   star-rating One In stock
3  50.10   star-rating One In stock
4  47.82  star-rating Four In stock
5  54.23  star-rating Five In stock
6  22.65   star-rating One In stock
7  33.34  star-rating Four In stock
8  17.93 star-rating Three In stock
9  22.60  star-rating Four In stock
10 52.15   star-rating One In stock
11 13.99   star-rating Two In stock
12 20.66  star-rating Four In stock
13 17.46  star-rating Five In stock
14 52.29  star-rating Five In stock
15 35.02  star-rating Five In stock
16 57.25 star-rating Three In stock
17 23.88   star-rating One In stock
18 37.59   star-rating One In stock
19 51.33   star-rating Two In stock
20 45.17   star-rating Two In stock
```

Exercise 10

Create a histogram of prices for these 20 books. What is the average price?

```r
library(ggplot2)

ggplot(book_20, aes(x = price)) +
  geom_histogram(bins = 7) +
  labs(title = "Histogram of Book Prices") +
  theme_minimal()
```



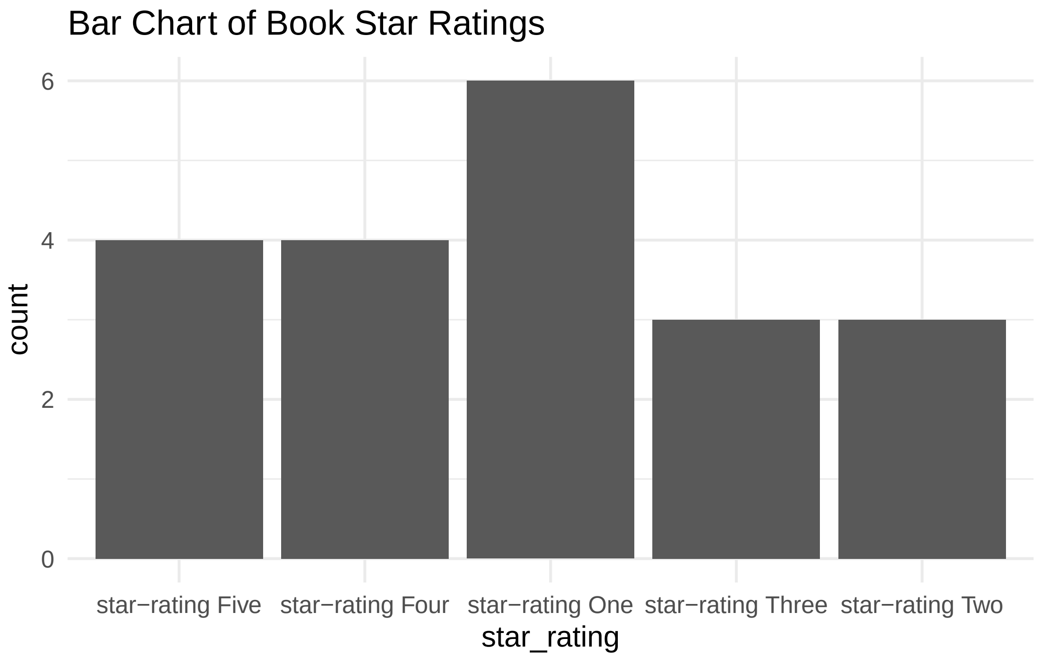
```r
avg_price <- mean(book_20$price)
print(paste("The average price is", avg_price))
```

```
[1] "The average price is 38.0485"
```

Exercise 11

Create a bar chart of star rating for these 20 books. Find the book(s) with the highest and lowest star ratings.

```r
ggplot(book_20, aes(x = star_rating)) +
  geom_bar() +
  labs(title = "Bar Chart of Book Star Ratings") +
  theme_minimal()
```



```
high_ratings <- book_20 %>%
  filter(star_rating == 'star-rating Five') %>%
  select(title, star_rating)
high_ratings
```

```
                                              title      star_rating
1                  Sapiens: A Brief History of Humankind star-rating Five
2                                           Set Me Free star-rating Five
3 Scott Pilgrim's Precious Little Life (Scott Pilgrim #1) star-rating Five
4                             Rip it Up and Start Again star-rating Five
```

```
low_ratings <- book_20 %>%
  filter(star_rating == 'star-rating One') %>%
  select(title, star_rating)
low_ratings
```

```
                                             title     star_rating
1                                Tipping the Velvet star-rating One
2                                        Soumission star-rating One
3                                   The Requiem Red star-rating One
4                                   The Black Maria star-rating One
```

```
5                                                  Olio star-rating One
6 Mesaerion: The Best Science Fiction Stories 1800-1849 star-rating One
```

Books “Sapiens: A Brief History of Humankind”, “Set Me Free”, “Scott Pilgrim’s Precious Little Life (Scott Pilgrim #1)”, “Rip it Up and Start Again” have the highest star rtings. Books “Tipping the Velvet”, “Soumission”, “The Requiem Red”, “The Black Maria”, “Olio”, “Mesaerion: The Best Science Fiction Stories 1800-1849” have the lowest star ratings.

Exercises for 234 Students

Exercise 12

Extend your skills; instead of scraping only the first 20 books, scrape the first **two hundred books**.

For each book, in addition to the information we stored previously (title, price, star rating, etc.), figure out how to extract the **category** (i.e., Travel, Mystery, Classics, etc.).

Exercise 13

What is the most common category? What is the least common?