Data Science: Wrangling - Assessments

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Assessment Part 1: Data Import

In this part of the assessment, you will answer several multiple choice questions that review the concepts of data import. You can answer these questions without using R, although you may find it helpful to experiment with commands in your console.

In the second part of the assessment on the next page, you will import real datasets and learn more about useful arguments to readr functions. The second part of the assessment will require you to program in R.

Question 1

Which of the following is NOT part of the data wrangling process?

Respuesta: *Checking correlations between your variables*

Question 2

Which files could be opened in a basic text editor?

Respuesta: *data.txt data.csv data.tsv*

Question 3

You want to analyze a file containing race finish times for a recent marathon. You open the file in a basic text editor and see lines that look like the following:

```
initials,state,age,time
vib,MA,61,6:01
adc,TX,45,5:45
kme,CT,50,4:19
```

Respuesta: *A comma-delimited file with a header*

Question 4

Assume the following is the full path to the directory that a student wants to use as their working directory in R: "/Users/student/Documents/projects/"

Which of the following lines of code CANNOT set the working directory to the desired "projects" directory?

Respuesta: *setwd(/Users/student/Documents/projects/)*

Question 5

We want to copy the "murders.csv" file from the dslabs package into an existing folder "data", which is located in our HarvardX-Wrangling projects folder. We first enter the code below into our RStudio console.

```
> getwd()
[1] "C:/Users/UNIVERSITY/Documents/Analyses/HarvardX-Wrangling"
> filename <- "murders.csv"
> path <- system.file("extdata", package = "dslabs")
```

Which of the following commands would NOT successfully copy "murders.csv" into the folder "data"?

Respuesta: *file.copy(file.path(path, "murders.csv"), getwd())*

Question 6

You are not sure whether the murders.csv file has a header row. How could you check this?

Respuesta: *Open the file in a basic text editor. In the RStudio "Files" pane, click on your file, then select "View File". Use the command read_lines (remembering to specify the number of rows with the n_max argument).*

Question 7

What is one difference between `read_excel()` and `read_xlsx()`?

Respuesta: *`read_excel()` reads both .xls and .xlsx files by detecting the file format from its extension, while `read_xlsx()` only reads .xlsx files.*

Question 8

You have a file called "times.txt" that contains race finish times for a marathon. The first four lines of the file look like this:

```
initials,state,age,time
vib,MA,61,6:01
adc,TX,45,5:45
kme,CT,50,4:19
```

Which line of code will NOT produce a tibble with column names "initials", "state", "age", and "time"?

Respuesta: *race_times <- read.csv("times.txt")*

Question 9

You also have access to marathon finish times in the form of an Excel document named "times.xlsx". In the Excel document, different sheets contain race information for different years. The first sheet is named "2015", the second is named "2016", and the third is named "2017".

Which line of code will NOT import the data contained in the "2016" tab of this Excel sheet?

Respuesta: *times_2016 <- read_xlsx("times.xlsx", sheet = "2")*

Question 10

You have a comma-separated values file that contains the initials, home states, ages, and race finish times for marathon runners. The runners' initials contain three characters for the runners' first, middle, and last names (for example, "KME").

You read in the file using the following code.

```
race_times <- read.csv("times.csv")
```

What is the data type of the initials in the object `race_times`?

Respuesta: *factors* Nota:*In previous versions of R, this was true, but is not any more. read.csv() no longer automatically converts characters to factors. If you want to read in character columns as factors, you can supply the argument stringsAsFactors = T.*

Question 11

Which of the following is NOT a real difference between the readr import functions and the base R import functions?

Respuesta: *The base R import functions can read .csv files, but cannot read files with other delimiters, such as .tsv files, or fixed-width files.*

Question 12

You read in a file containing runner information and marathon finish times using the following code.

```
race_times <- read.csv("times.csv", stringsAsFactors = F)
```

What is the class of the object `race_times`?

Respuesta: *data frame*

Question 13

Select the answer choice that summarizes all of the actions that the following lines of code can perform. Please note that the url below is an example and does not lead to data.

```
  url <- "https://raw.githubusercontent.com/MyUserName/MyProject/master/MyData.csv "
dat <- read_csv(url)
download.file(url, "MyData.csv")
```

Respuesta: *Create a tibble in R called dat that contains the information contained in the csv file stored on Github. Download the csv file to the working directory and name the downloaded file "MyData.csv".*

Assessment Part 2: Data Import

In this part of the assessment, you will import real datasets and learn more about useful arguments to readr functions. You will encounter common issues that arise when importing raw data. This part of the assessment will require you to program in R.

Use the readr package in the tidyverse library:

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
## v ggplot2 3.3.4     v purrr   0.3.4
## v tibble  3.1.2     v dplyr   1.0.6
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

Question 14

Inspect the file at the following URL:

https://archive.ics.uci.edu/ml/machine-learning-databases/breast-cancer-wisconsin/wdbc.data

Which **readr** function should be used to import this file?

Respuesta: `read_csv()`

Question 15

Check the documentation for the readr function you chose in the previous question to learn about its arguments. Determine which arguments you need to the file from the previous question:

```
url <- "https://archive.ics.uci.edu/ml/machine-learning-databases/breast-cancer-wisconsin/wdbc.data"
```

Does this file have a header row? Does the readr function you chose need any additional arguments to import the data correctly?

Respuesta: *No, there is no header. The col_names=FALSE argument is necessary.*

Question 16

Inspect the imported data from the previous question.

```
d_q16 <- read_csv(url, col_names = FALSE)
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   .default = col_double(),
##   X2 = col_character()
## )
## i Use `spec()` for the full column specifications.
```

How many rows are in the dataset? *569*

How many columns are in the dataset? *32*

Assessment Part 1: Reshaping Data

Part 1 consists of 8 questions are conceptual questions about tidy data and reshaping data. They do not necessarily require R, but you may benefit from checking your work on the console.

Part 2 consists of 7 questions which require you to write code in R to apply the new concepts about tidy data and reshaping data.

Question 1

A collaborator sends you a file containing data for three years of average race finish times.

```
age_group,2015,2016,2017
20,3:46,3:22,3:50
30,3:50,3:43,4:43
40,4:39,3:49,4:51
50,4:48,4:59,5:01
```

Are these data considered "tidy" in R? Why or why not?

Respuesta: *No. These data are not considered "tidy" because the variable "year" is stored in the header.*

Question 2

Below are four versions of the same dataset. Which one is in a tidy format?

Respuesta:

```
state      abb region  population total
Alabama     AL  South   4779736   135
Alaska      AK   West   710231    19
Arizona     AZ   West   6392017   232
Arkansas    AR  South   2915918   93
California  CA   West   37253956  1257
Colorado    CO   West   5029196   65
```

Question 3

Your file called "times.csv" has age groups and average race finish times for three years of marathons.

```
age_group,2015,2016,2017
20,3:46,3:22,3:50
30,3:50,3:43,4:43
40,4:39,3:49,4:51
50,4:48,4:59,5:01
```

You read in the data file using the following command.

```
d <- read_csv("times.csv")
```

Respuesta:

```
  tidy_data <- d %>%
    gather(year, time, `2015`:`2017`)
```

Question 4

You have a dataset on U.S. contagious diseases, but it is in the following wide format:

```
> head(dat_wide)
state year population HepatitisA Mumps Polio Rubella
Alabama 1990    4040587      86    19    76    1
Alabama 1991    4066003      39    14    65    0
Alabama 1992    4097169      35    12    24    0
Alabama 1993    4133242      40    22    67    0
Alabama 1994    4173361      72    12    39    0
Alabama 1995    4216645      75     2    38    0
```

You want to transform this into a tidy dataset, with each row representing an observation of the incidence of each specific disease (as shown below):

```
> head(dat_tidy)
state   year  population  disease  count
Alabama 1990    4040587 HepatitisA  86
Alabama 1991    4066003 HepatitisA  39
Alabama 1992    4097169 HepatitisA  35
Alabama 1993    4133242 HepatitisA  40
Alabama 1994    4173361 HepatitisA  72
Alabama 1995    4216645 HepatitisA  75
```

Which of the following commands would achieve this transformation to tidy the data?

Respuesta:

```
dat_tidy <- dat_wide %>%
    gather(key = disease, value = count, HepatitisA:Rubella)
```

Question 5

You have successfully formatted marathon finish times into a tidy object called tidy_data. The first few lines are shown below.

```
age_group year   time
20        2015   03:46
30        2015   03:50
40        2015   04:39
50        2015   04:48
20        2016   03:22
```

Select the code that converts these data back to the wide format, where each year has a separate column.

Respuesta:
tidy_data %>% spread(year, time)

Question 6

You have the following dataset:

```
    > head(dat)
state   abb region      var   people
Alabama  AL  South population 4779736
Alabama  AL  South      total     135
Alaska   AK   West population  710231
Alaska   AK   West      total      19
Arizona  AZ   West population 6392017
Arizona  AZ   West      total     232
```

You would like to transform it into a dataset where population and total are each their own column (shown below):

```
state      abb region population total
Alabama     AL  South   4779736   135
Alaska      AK   West 710231    19
Arizona     AZ   West   6392017   232
Arkansas    AR  South   2915918    93
California  CA   West  37253956  1257
Colorado    CO   West   5029196    65
```

Which code would best accomplish this?

Respuesta:
dat_tidy <- dat %>% spread(key = var, value = people)

Question 7

A collaborator sends you a file containing data for two years of average race finish times, "times.csv":

```
age_group,2015_time,2015_participants,2016_time,2016_participants
20,3:46,54,3:22,62
30,3:50,60,3:43,58
40,4:39,29,3:49,33
50,4:48,10,4:59,14
```

You read in the data file:

```
d <- read_csv("times.csv")
```

Which of the answers below best makes the data tidy?

Respuesta:

```
  tidy_data <- d %>%
    gather(key = "key", value = "value", -age_group) %>%
    separate(col = key, into = c("year", "variable_name"), sep = "_") %>%
    spread(key = variable_name, value = value)
```

Question 8

You are in the process of tidying some data on heights, hand length, and wingspan for basketball players in the draft. Currently, you have the following:

```
    > head(stats)
key                value
allen_height       75
allen_hand_length  8.25
allen_wingspan     79.25
bamba_height       83.25
bamba_hand_length  9.75
bamba_wingspan     94
```

Select all of the correct commands below that would turn this data into a "tidy" format with columns "height", "hand_length" and "wingspan".

Respuesta:

```
 tidy_data <- stats %>%
    separate(col = key, into = c("player", "variable_name"), sep = "_", extra = "merge") %>%
    spread(key = variable_name, value = value)
```

Assessment Part 2: Reshaping Data

Use the following libraries for these questions:

```
library(tidyverse)
library(dslabs)
```

Question 9

Examine the built-in dataset `co2`. This dataset comes with base R, not **dslabs** - just type `co2` to access the dataset.

Is `co2` tidy? Why or why not?

```
head(co2)
```

```
## [1] 315.42 316.31 316.50 317.56 318.13 318.00
```

Respuesta: *co2 is not tidy: to be tidy we would have to wrangle it to have three columns (year, month and value), and then each co2 observation would have a row.*

Question 10

Run the following command to define the co2_wide object:

```
co2_wide <- data.frame(matrix(co2, ncol = 12, byrow = TRUE)) %>%
      setNames(1:12) %>%
    mutate(year = as.character(1959:1997))
```

Use the `gather()` function to make this dataset tidy. Call the column with the CO2 measurements `co2` and call the month column `month`. Name the resulting object `co2_tidy`.

Which code would return the correct tidy format?

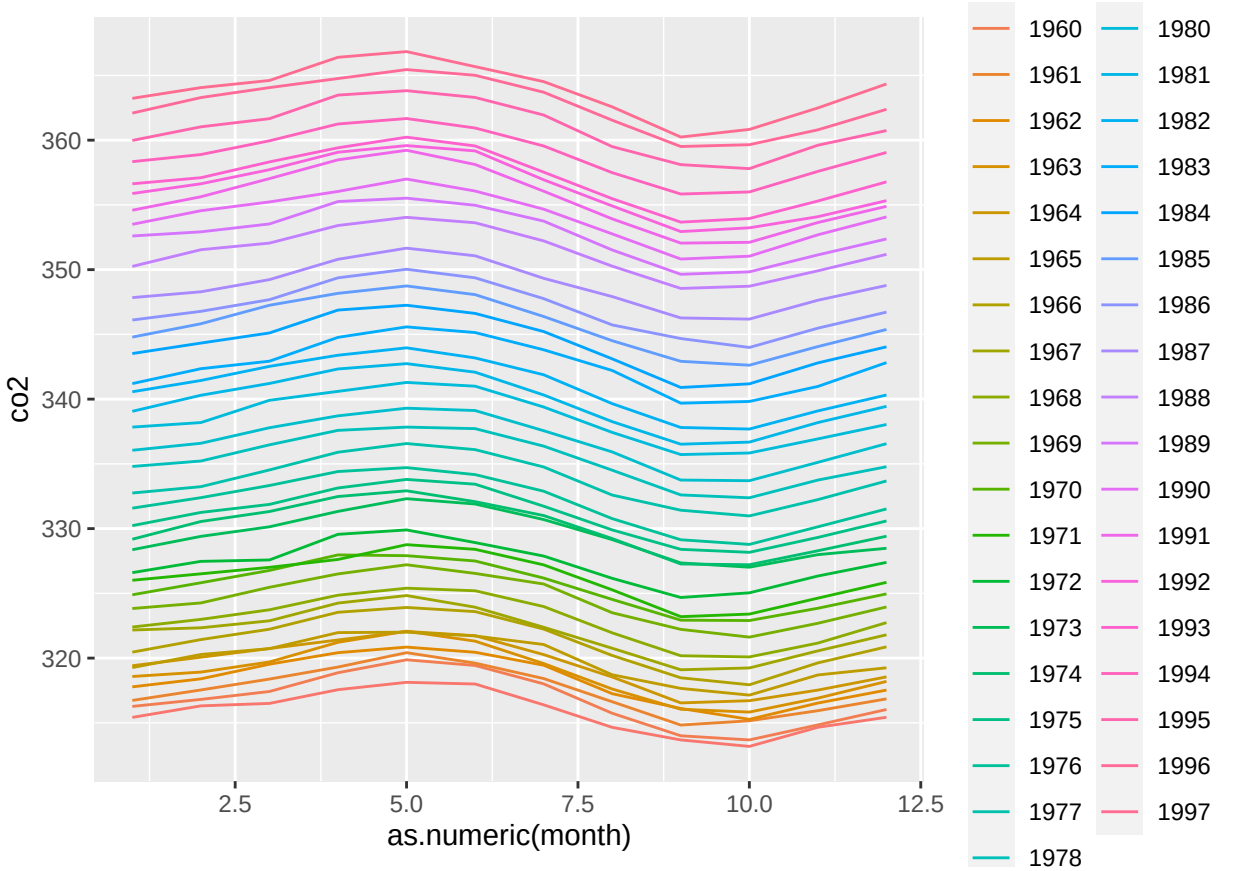
Respuesta:

```
co2_tidy <- gather(co2_wide,month,co2,-year)
```

Question 11

Use co2_tidy to plot CO2 versus month with a different curve for each year:

```
co2_tidy %>% ggplot(aes(as.numeric(month), co2, color = year)) + geom_line()
```



What can be concluded from this plot?

Respuesta: *CO2 concentrations are highest around May and the yearly average increased from 1959 to 1997.*

Question 12

Load the `admissions` dataset from **dslabs**, which contains college admission information for men and women across six majors, and remove the `applicants` percentage column:

```
library(dslabs)
data(admissions)
dat <- admissions %>% select(-applicants)
```

Your goal is to get the data in the shape that has one row for each major, like this:

```
major  men   women
A      62    82
B      63    68
C      37    34
D      33    35
E      28    24
F       6     7
```

Which command could help you to wrangle the data into the desired format?

Respuesta:

```
dat_tidy <- spread(dat, gender, admitted)
```

Question 13

Now use the `admissions` dataset to create the object tmp, which has columns `major`, `gender`, `key` and `value`:

```
tmp <- gather(admissions, key, value, admitted:applicants)
tmp
```

```
##    major gender        key value
## 1      A    men   admitted    62
## 2      B    men   admitted    63
## 3      C    men   admitted    37
## 4      D    men   admitted    33
## 5      E    men   admitted    28
## 6      F    men   admitted     6
## 7      A  women   admitted    82
## 8      B  women   admitted    68
## 9      C  women   admitted    34
## 10     D  women   admitted    35
## 11     E  women   admitted    24
## 12     F  women   admitted     7
## 13     A    men applicants   825
## 14     B    men applicants   560
## 15     C    men applicants   325
## 16     D    men applicants   417
## 17     E    men applicants   191
## 18     F    men applicants   373
## 19     A  women applicants   108
## 20     B  women applicants    25
## 21     C  women applicants   593
## 22     D  women applicants   375
## 23     E  women applicants   393
## 24     F  women applicants   341
```

Combine the `key` and `gender` and create a new column called `column_name` to get a variable with the following values: `admitted_men`, `admitted_women`, `applicants_men` and `applicants_women`. Save the new data as `tmp2`.

Which command could help you to wrangle the data into the desired format?

Respuesta:

```
tmp2 <- unite(tmp, column_name, c(key, gender))
```

Question 14

Which function can reshape `tmp2` to a table with six rows and five columns named `major`, `admitted_men`, `admitted_women`, `applicants_men` and `applicants_women`?

Respuesta:

```
spread(tmp2,column_name,value)
```

```
##   major admitted_men admitted_women applicants_men applicants_women
## 1     A           62             82            825              108
## 2     B           63             68            560               25
## 3     C           37             34            325              593
## 4     D           33             35            417              375
## 5     E           28             24            191              393
## 6     F            6              7            373              341
```

Assessment: Combining Tables

Question 1

You have created data frames `tab1` and `tab2` of state population and election data, similar to our module videos:

```
      > tab1
state            population
Alabama             4779736
Alaska               710231
Arizona             6392017
Delaware             897934
District of Columbia 601723

> tab2
state  electoral_votes
Alabama      9
Alaska       3
Arizona     11
California  55
Colorado     9
Connecticut  7

> dim(tab1)
[1] 5 2

> dim(tab2)
[1] 6 2
```

What are the dimensions of the table dat, created by the following command?

```
dat <- left_join(tab1, tab2, by = "state")
```

Respuesta: *5 rows by 3 columns*

Question 2

We are still using the `tab1` and `tab2` tables shown in question 1. What join command would create a new table "dat" with three rows and two columns?

Respuesta: *dat <- semi_join(tab1, tab2, by = "state")*

Question 3

Which of the following are real differences between the join and bind functions?

Respuesta: *Binding functions combine by position, while join functions match by variables. Joining functions can join datasets of different dimensions, but the bind functions must match on the appropriate dimension (either same row or column numbers). Bind functions can combine both vectors and dataframes, while join functions work for only for dataframes.*

Question 4

We have two simple tables, shown below, with columns x and y:

```
> df1
 x     y
 a     a
 b     a

> df2
 x     y
 a     a
 a     b
```

Which command would result in the following table?

```
> final
 x     y
 b     a
```

Respuesta:

```
final <- setdiff(df1, df2)
```

Introduction to Questions 5-7

Install and load the Lahman library. This library contains a variety of datasets related to US professional baseball. We will use this library for the next few questions and will discuss it more extensively in the Regression course. For now, focus on wrangling the data rather than understanding the statistics.

The Batting data frame contains the offensive statistics for all baseball players over several seasons. Filter this data frame to define top as the top 10 home run (HR) hitters in 2016:

```
install.packages("Lahman")
```

```
## Installing package into 'C:/Users/guy_l/OneDrive/Documentos/R/win-library/4.1'
## (as 'lib' is unspecified)
```

```
## package 'Lahman' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##  C:\Users\guy_l\AppData\Local\Temp\RtmpiEVqTi\downloaded_packages
```

```
library(Lahman)
```

```
## Warning: package 'Lahman' was built under R version 4.1.2
```

```
top <- Batting %>%
  filter(yearID == 2016) %>%
  arrange(desc(HR)) %>%    # arrange by descending HR count
```

```
  slice(1:10)    # take entries 1-10
top %>% as_tibble()
```

```
## # A tibble: 10 x 22
##    playerID  yearID stint teamID lgID      G    AB     R     H   X2B   X3B    HR
##    <chr>      <int> <int> <fct>  <fct> <int> <int> <int> <int> <int> <int> <int>
##  1 trumbma01   2016     1 BAL    AL      159   613    94   157    27     1    47
##  2 cruzne02    2016     1 SEA    AL      155   589    96   169    27     1    43
##  3 daviskh01   2016     1 OAK    AL      150   555    85   137    24     2    42
##  4 doziebr01   2016     1 MIN    AL      155   615   104   165    35     5    42
##  5 encared01   2016     1 TOR    AL      160   601    99   158    34     0    42
##  6 arenano01   2016     1 COL    NL      160   618   116   182    35     6    41
##  7 cartech02   2016     1 MIL    NL      160   549    84   122    27     1    41
##  8 frazito01   2016     1 CHA    AL      158   590    89   133    21     0    40
##  9 bryankr01   2016     1 CHN    NL      155   603   121   176    35     3    39
## 10 canoro01    2016     1 SEA    AL      161   655   107   195    33     2    39
## # ... with 10 more variables: RBI <int>, SB <int>, CS <int>, BB <int>,
## #   SO <int>, IBB <int>, HBP <int>, SH <int>, SF <int>, GIDP <int>
```

Also Inspect the Master data frame, which has demographic information for all players:

```
Master %>% as_tibble()
```

```
## # A tibble: 20,093 x 26
##    playerID  birthYear birthMonth birthDay birthCountry birthState birthCity
##    <chr>         <int>      <int>    <int> <chr>        <chr>      <chr>
##  1 aardsda01      1981         12       27 USA          CO         Denver
##  2 aaronha01      1934          2        5 USA          AL         Mobile
##  3 aaronto01      1939          8        5 USA          AL         Mobile
##  4 aasedo01       1954          9        8 USA          CA         Orange
##  5 abadan01       1972          8       25 USA          FL         Palm Beach
##  6 abadfe01       1985         12       17 D.R.         La Romana  La Romana
##  7 abadijo01      1850         11        4 USA          PA         Philadelphia
##  8 abbated01      1877          4       15 USA          PA         Latrobe
##  9 abbeybe01      1869         11       11 USA          VT         Essex
## 10 abbeych01      1866         10       14 USA          NE         Falls City
## # ... with 20,083 more rows, and 19 more variables: deathYear <int>,
## #   deathMonth <int>, deathDay <int>, deathCountry <chr>, deathState <chr>,
## #   deathCity <chr>, nameFirst <chr>, nameLast <chr>, nameGiven <chr>,
## #   weight <int>, height <int>, bats <fct>, throws <fct>, debut <chr>,
## #   finalGame <chr>, retroID <chr>, bbrefID <chr>, deathDate <date>,
## #   birthDate <date>
```

Question 5

Use the correct `join` or `bind` function to create a combined table of the names and statistics of the top 10 home run (HR) hitters for 2016. This table should have the player ID, first name, last name, and number of HR for the top 10 players. Name this data frame top_names.

Identify the join or bind that fills the blank in this code to create the correct table:

```
top_names <- top %>% left_join(Master, by="playerID") %>%
    select(playerID, nameFirst, nameLast, HR)
top_names
```

```
##     playerID nameFirst    nameLast HR
```

```
## 1  trumbma01      Mark      Trumbo 47
## 2   cruzne02    Nelson        Cruz 43
## 3  daviskh01     Khris       Davis 42
## 4  doziebr01     Brian      Dozier 42
## 5  encared01     Edwin Encarnacion 42
## 6  arenano01     Nolan     Arenado 41
## 7  cartech02     Chris      Carter 41
## 8  frazito01      Todd     Frazier 40
## 9  bryankr01      Kris      Bryant 39
## 10  canoro01  Robinson        Cano 39
```

Which bind or join function fills the blank to generate the correct table?

Respuesta:

`left_join(Master)`

Question 6

Inspect the `Salaries` data frame. Filter this data frame to the 2016 salaries, then use the correct bind join function to add a salary column to the `top_names` data frame from the previous question. Name the new data frame `top_salary`. Use this code framework:

```
top_salary <- Salaries %>% filter(yearID == 2016) %>%
  right_join(top_names) %>%
  select(nameFirst, nameLast, teamID, HR, salary)
```

```
## Joining, by = "playerID"
```

Which bind or join function fills the blank to generate the correct table?

Respuesta:

`right_join(Master)`

Question 7

Inspect the `AwardsPlayers` table. Filter awards to include only the year 2016.

How many players from the top 10 home run hitters won at least one award in 2016?

```
AwardsPlayers %>% filter(yearID == 2016) %>% semi_join(top_names, by="playerID") %>%  distinct(playerID)
```

```
##   n
## 1 3
```

How many players won an award in 2016 but were not one of the top 10 home run hitters in 2016?

```
AwardsPlayers %>% filter(yearID == 2016) %>% anti_join(top_names, by="playerID") %>% distinct(playerID)
```

```
##    n
## 1 44
```

Assessment: Web Scraping

Introduction: Questions 1-3

Load the following web page, which contains information about Major League Baseball payrolls, into R: https://web.archive.org/web/20181024132313/http://www.stevetheump.com/Payrolls.htm

```
library(rvest)
```

```
## Warning: package 'rvest' was built under R version 4.1.2
```

```
##
## Attaching package: 'rvest'
```

```
## The following object is masked from 'package:readr':
##
##     guess_encoding
```

```
url <- "https://web.archive.org/web/20181024132313/http://www.stevetheump.com/Payrolls.htm"
h <- read_html(url)
```

We learned that tables in html are associated with the table node. Use the html_nodes() function and the table node type to extract the first table. Store it in an object nodes:

```
nodes <- html_nodes(h, "table")
```

The html_nodes() function returns a list of objects of class xml_node. We can see the content of each one using, for example, the html_text() function. You can see the content for an arbitrarily picked component like this:

```
html_text(nodes[[8]])
```

```
## [1] "Team\nPayroll\nAverge\nMedianNew York Yankees\n$ 197,962,289\n$ 6,186,321\n$ 1,937,500Philadelp
```

If the content of this object is an html table, we can use the html_table() function to convert it to a data frame:

```
html_table(nodes[[8]])
```

```
## # A tibble: 30 x 4
##    Team                 Payroll       Averge      Median
##    <chr>                <chr>         <chr>       <chr>
##  1 New York Yankees     $ 197,962,289 $ 6,186,321 $ 1,937,500
##  2 Philadelphia Phillies $ 174,538,938 $ 5,817,964 $ 1,875,000
##  3 Boston Red Sox       $ 173,186,617 $ 5,093,724 $ 1,556,250
##  4 Los Angeles Angels   $ 154,485,166 $ 5,327,074 $ 3,150,000
##  5 Detroit Tigers       $ 132,300,000 $ 4,562,068 $ 1,100,000
##  6 Texas Rangers        $ 120,510,974 $ 4,635,037 $ 3,437,500
##  7 Miami Marlins        $ 118,078,000 $ 4,373,259 $ 1,500,000
##  8 San Francisco Giants $ 117,620,683 $ 3,920,689 $ 1,275,000
##  9 St. Louis Cardinals  $ 110,300,862 $ 3,939,316 $ 800,000
## 10 Milwaukee Brewers    $ 97,653,944  $ 3,755,920 $ 1,981,250
## # ... with 20 more rows
```

Question 1

Many tables on this page are team payroll tables, with columns for rank, team, and one or more money values.

Convert the first four tables in nodes to data frames and inspect them. (Note that "parsing errors" and/or "empty tables" still count towards the table index!)

Which of the first four nodes are tables of team payroll?

Respuesta:

Table 2, Table 3 and Table 4

```
html_table(nodes[1:4])
```

```
## [[1]]
## # A tibble: 1 x 2
##   X1    X2
##   <lgl> <chr>
## 1 NA    "Salary Stats 1967-2019\nTop ML Player Salaries / Baseball's Luxury Tax"
##
## [[2]]
## # A tibble: 30 x 3
##     RANK TEAM                Payroll
##    <int> <chr>               <chr>
##  1     1 Boston Red Sox      $235.65M
##  2     2 San Francisco Giants $208.51M
##  3     3 Los Angeles Dodgers  $186.14M
##  4     4 Chicago Cubs         $183.46M
##  5     5 Washington Nationals $181.59M
##  6     6 Los Angeles Angels   $175.1M
##  7     7 New York Yankees     $168.54M
##  8     8 Seattle Mariners     $162.48M
##  9     9 Toronto Blue Jays    $162.316M
## 10    10 St. Louis Cardinals  $161.01M
## # ... with 20 more rows
##
## [[3]]
## # A tibble: 31 x 5
##    X1    X2                  X3           X4            X5
##    <chr> <chr>               <chr>        <chr>         <chr>
##  1 Rank  Team                25 Man       Disabled List Total Payroll
##  2 1     Los Angeles Dodgers $155,887,854 $37,354,166   $242,065,828
##  3 2     New York Yankees    $168,045,699 $5,644,000    $201,539,699
##  4 3     Boston Red Sox      $136,780,500 $38,239,250   $199,805,178
##  5 4     Detroit Tigers      $168,500,600 $11,750,000   $199,750,600
##  6 5     Toronto Blue Jays   $159,175,968 $2,169,400    $177,795,368
##  7 6     Texas Rangers       $115,162,703 $39,136,360   $175,909,063
##  8 7     San Francisco Giants $169,504,611 $2,500,000   $172,354,611
##  9 8     Chicago Cubs        $170,189,880 $2,000,000    $172,189,880
## 10 9     Washington Nationals $163,111,918 $535,000     $167,846,918
## # ... with 21 more rows
##
## [[4]]
## # A tibble: 30 x 5
##     Rank Team      `Opening Day` `Avg Salary` Median
##    <int> <chr>     <chr>         <chr>        <chr>
##  1     1 Dodgers   $ 223,352,402 $ 7,445,080  $ 5,166,666
##  2     2 Yankees   $ 213,472,857 $ 7,361,133  $ 3,300,000
##  3     3 Red Sox   $ 182,161,414 $ 6,072,047  $ 3,500,000
##  4     4 Tigers    $ 172,282,250 $ 6,891,290  $ 3,000,000
##  5     5 Giants    $ 166,495,942 $ 5,946,284  $ 4,000,000
##  6     6 Nationals $ 166,010,977 $ 5,724,516  $ 2,500,000
##  7     7 Angels    $ 146,449,583 $ 5,049,986  $ 1,312,500
##  8     8 Rangers   $ 144,307,373 $ 4,509,605  $ 937,500
##  9     9 Phillies  $ 133,048,000 $ 4,434,933  $ 700,000
## 10    10 Blue Jays $ 126,369,628 $ 4,357,573  $ 1,650,000
```

```
## # ... with 20 more rows
```

Question 2

For the last 3 components of nodes, which of the following are true? (Check all correct answers.)

Respuesta:

All three entries are tables. The last entry shows the average across all teams through time, not payroll per team.

```
html_table(tail(nodes,n=3))
```

```
## [[1]]
## # A tibble: 31 x 3
##    X1          X2           X3
##    <chr>       <chr>        <chr>
##  1 Team        Payroll      Average
##  2 NY Yankees  $109,791,893 $3,541,674
##  3 Boston      $109,558,908 $3,423,716
##  4 Los Angeles $108,980,952 $3,757,964
##  5 NY Mets     $93,174,428  $3,327,658
##  6 Cleveland   $91,974,979  $3,065,833
##  7 Atlanta     $91,851,687  $2,962,958
##  8 Texas       $88,504,421  $2,854,981
##  9 Arizona     $81,206,513  $2,900,233
## 10 St. Louis   $77,270,855  $2,664,512
## # ... with 21 more rows
##
## [[2]]
## # A tibble: 31 x 3
##    X1          X2          X3
##    <chr>       <chr>       <chr>
##  1 Team        Payroll     Average
##  2 NY Yankees  $92,538,260 $3,190,974
##  3 Los Angeles $88,124,286 $3,263,862
##  4 Atlanta     $84,537,836 $2,817,928
##  5 Baltimore   $81,447,435 $2,808,532
##  6 Arizona     $81,027,833 $2,893,851
##  7 NY Mets     $79,509,776 $3,180,391
##  8 Boston      $77,940,333 $2,598,011
##  9 Cleveland   $75,880,871 $2,918,495
## 10 Texas       $70,795,921 $2,722,920
## # ... with 21 more rows
##
## [[3]]
## # A tibble: 54 x 4
##    X1    X2       X3           X4
##    <chr> <chr>    <chr>        <chr>
##  1 Year  Minimum  "Average"    "% Chg"
##  2 2019  $555,000 ""           "-"
##  3 2018  $545,000 "$4,520,000" ""
##  4 2017  $535,000 "$4,470,000" "5.4"
##  5 2016  $507,500 "$4,400,000" "-"
##  6 2015  $507,500 "$4,250,000" "-"
##  7 2014  $507,500 "$3,820,000" "12.8"
```

```
##  8 2013  $480,000 "$3,386,212" "5.4"
##  9 2012  $480,000 "$3,440,000" "3.8"
## 10 2011  $414,500 "$3,305,393" "0.2"
## # ... with 44 more rows
```

Question 3

Create a table called `tab_1` using entry 10 of `nodes`. Create a table called `tab_2` using entry 19 of `nodes`.

Note that the column names should be `c("Team", "Payroll", "Average")`. You can see that these column names are actually in the first data row of each table, and that `tab_1` has an extra first column `No.` that should be removed so that the column names for both tables match.

Remove the extra column in `tab_1`, remove the first row of each dataset, and change the column names for each table to `c("Team", "Payroll", "Average")`. Use a `full_join()` by the Team to combine these two tables.

How many rows are in the joined data table?

Respuesta: *58*

```
tab_1 <- html_table(nodes[[10]],header = TRUE)[,-1]
tab_2 <- html_table(nodes[[19]],header = TRUE)
tab_1 %>% full_join(tab_2,"Team")
```

```
## # A tibble: 58 x 5
##    Team                 Payroll.x    Average.x  Payroll.y   Average.y
##    <chr>                <chr>        <chr>      <chr>       <chr>
##  1 New York Yankees     $206,333,389 $8,253,336 <NA>        <NA>
##  2 Boston Red Sox       $162,747,333 $5,611,977 <NA>        <NA>
##  3 Chicago Cubs         $146,859,000 $5,439,222 $64,015,833 $2,462,147
##  4 Philadelphia Phillies $141,927,381 $5,068,835 <NA>        <NA>
##  5 New York Mets        $132,701,445 $5,103,902 <NA>        <NA>
##  6 Detroit Tigers       $122,864,929 $4,550,553 <NA>        <NA>
##  7 Chicago White Sox    $108,273,197 $4,164,354 $62,363,000 $2,309,741
##  8 Los Angeles Angels   $105,013,667 $3,621,161 <NA>        <NA>
##  9 Seattle Mariners     $98,376,667  $3,513,452 <NA>        <NA>
## 10 San Francisco Giants $97,828,833  $3,493,887 <NA>        <NA>
## # ... with 48 more rows
```

Introduction: Questions 4 and 5

The Wikipedia page on opinion polling for the Brexit referendum , in which the United Kingdom voted to leave the European Union in June 2016, contains several tables. One table contains the results of all polls regarding the referendum over 2016:

Use the **rvest** library to read the HTML from this Wikipedia page (make sure to copy both lines of the URL):

```
library(rvest)
library(tidyverse)
url <- "https://en.wikipedia.org/w/index.php?title=Opinion_polling_for_the_United_Kingdom_European_Unio
```

Question 4

Assign `tab` to be the html nodes of the "table" class.

How many tables are in this Wikipedia page?

Respuesta: *41*

```
h <- read_html(url)
tab <- html_nodes(h, "table")
tab
```

```
## {xml_nodeset (42)}
##  [1] <table class="sidebar sidebar-collapse nomobile vcard"><tbody>\n<tr><td  ...
##  [2] <table style="width:100%;border-collapse:collapse;border-spacing:0px 0px ...
##  [3] <table style="width:100%;border-collapse:collapse;border-spacing:0px 0px ...
##  [4] <table class="wikitable sortable" style="text-align:center;font-size:95% ...
##  [5] <table class="plainlinks metadata ambox mbox-small-left ambox-notice" ro ...
##  [6] <table class="wikitable sortable" style="text-align:center;font-size:95% ...
##  [7] <table class="wikitable sortable collapsible" style="text-align:center;f ...
##  [8] <table class="wikitable sortable collapsible" style="text-align:center;f ...
##  [9] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [10] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [11] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [12] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [13] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [14] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [15] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [16] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [17] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## [18] <table class="box-More_citations_needed_section plainlinks metadata ambo ...
## [19] <table class="wikitable sortable collapsible" style="text-align:center;  ...
## [20] <table class="wikitable sortable collapsible" style="text-align:center;f ...
## ...
```

Question 5

Inspect the first several html tables using `html_table()` with the argument fill=TRUE (you can read about this argument in the documentation). Find the first table that has 9 columns with the first column named "Date(s) conducted".

What is the first table number to have 9 columns where the first column is named "Date(s) conducted"?

Respuesta: *6*

```
html_table(tab[[6]], fill = TRUE)
```

```
## # A tibble: 134 x 9
##    `Date(s) conduct~ Remain  Leave Undecided Lead  Sample `Conducted by`
##    <chr>             <chr>   <chr> <chr>     <chr> <chr>  <chr>
##  1 Date(s) conducted ""      ""    Undecided Lead  Sample Conducted by
##  2 23 June 2016      "48.1%" "51.~ N/A       3.8%  33,57~ Results of the United~
##  3 23 June           "52%"   "48%" N/A       4%    4,772  YouGov
##  4 22 June           "55%"   "45%" N/A       10%   4,700  Populus
##  5 20-22 June        "51%"   "49%" N/A       2%    3,766  YouGov
##  6 20-22 June        "49%"   "46%" 1%        3%    1,592  Ipsos MORI
##  7 20-22 June        "44%"   "45%" 9%        1%    3,011  Opinium
##  8 17-22 June        "54%"   "46%" N/A       8%    1,032  ComRes
##  9 17-22 June        "48%"   "42%" 11%       6%    1,032  ComRes
## 10 16-22 June        "41%"   "43%" 16%       2%    2,320  TNS
## # ... with 124 more rows, and 2 more variables: Polling type <chr>, Notes <chr>
```

Assessment: String Processing Part 1

Question 1

Which of the following is NOT an application of string parsing?

Respuesta: *Formatting numbers and characters so they can easily be displayed in deliverables like papers and presentations.*

Question 2

Which of the following commands would not give you an error in R?

Respuesta: *cat(" LeBron James is 6'8" ")*

Question 3

Which of the following are advantages of the stringr package over string processing functions in base R? Select all that apply.

Respuesta: *Functions in stringr all start with "str_", which makes them easy to look up using autocomplete. Stringr functions work better with pipes. The order of arguments is more consistent in stringr functions than in base R.*

Question 4

You have a data frame of monthly sales and profits in R:

```
      > head(dat)
# A tibble: 5 x 3
Month     Sales     Profit
<chr>     <chr>     <chr>
January   $128,568  $16,234
February  $109,523  $12,876
March     $115,468  $17,920
April     $122,274  $15,825
May       $117,921  $15,437
```

Which of the following commands could convert the sales and profits columns to numeric? Select all that apply.

Respuesta: *dat %>% mutate_at(2:3, parse_number) dat %>% mutate_at(2:3, funs(str_replace_all(., c("\$|,"), ""))) %>% mutate_at(2:3, as.numeric)*

Assessment: String Processing Part 2

Question 1

In the video, we use the function not_inches to identify heights that were incorrectly entered

```
not_inches <- function(x, smallest = 50, tallest = 84) {
  inches <- suppressWarnings(as.numeric(x))
  ind <- is.na(inches) | inches < smallest | inches > tallest
  ind
}
```

In this function, what TWO types of values are identified as not being correctly formatted in inches?

Respuesta: *Values that result in NA's when converted to numeric Values less than 50 inches or greater than 84 inches*

Question 2

Which of the following arguments, when passed to the function `not_inches()`, would return the vector `c(FALSE)`?

Respuesta: *c(70)*

```
not_inches(c(70))
```

```
## [1] FALSE
```

Question 3

Our function `not_inches()` returns the object `ind`. Which answer correctly describes ind?

Respuesta:

`ind` is a logical vector of TRUE and FALSE, equal in length to the vector `x` (in the arguments list). TRUE indicates that a height entry is incorrectly formatted.