Lab Finding Data

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Welcome

Just like learning a new spoken language, you will not learn the language without practice. Labs are an important part of this course. Collaboration on labs is **extremely encouraged**. If you find yourself stuck for more than a few minutes, ask a neighbor or course staff for help. When you are giving help to your neighbor, explain the **idea and approach** to the problem without sharing the answer itself so they can figure it out on their own. This will be better for them and for you. For them because it will stick more and they will have a better understanding of the concept. For you because if you can explain it to other students, that means you understand it better too.

The Idea of this Lab

The idea behind this lab is to allow us to think about the differences and similarities between Experimental Design and Observational Study, and there importance in the field of Data Science. Data Science without data is incomplete, but fetching data from poor techniques is dangerous. Therefore, this lab is designed to explore the concepts of Experimental Design and Observational Studies. In addition, this lab will ask you to implement sampling methods in R. This is one of the more important statistical foundation labs we do as the topic covered today is a small but significant slice about data collection methods. In other words, this lab discusses the collection methods of the clay we will be making bricks out of.

"Collecting no data might be bad, but collecting data with poor techniques is a nightmare." - Woke Abhi

Problem 1: The Dr. Sheldon Cooper Test

Hi! My name is Dr. Sheldon Cooper and I am a theoretical physicist specializing in Quantum Physics. I will be testing you today as part of me returning a favor to Abhi. He made me a warm beverage when I was sick. Don't worry, I am more than qualified for testing you. I'm exceedingly smart. I graduated college at 14.

Anyways, this test will be about movies. Bazinga! You really thought you would get away with movies as being your test topic.

I am gonna ask 4 questions regarding what you learned today, and I want you to mingle among your group to figure out the answers to these questions.

Question 1: What is the conceptual difference between Experimental Design vs. Observational Studies? Your answer should have specific difference, but the overall difference in the concept of Experimental vs. Observational. Think big picture idea.

Answer: The biggest difference between Experimental Design and Observational Studies is that Observational Studies are static (the analyst is looking at data that has been collected already, and is only doing an analysis of what has already been done); however, Experimental Design is dynamic (experimental units are randomly selected and randomly sorted into treatment and control groups). Experiments can sometimes be better (because of randomization, which results in a more supported conclusion), but observational studies can be a lot more useful because of their relative inexpensiveness (in terms of money and time).

Question 2: A fertilizer company, Farmers Helpers Inc., is wanting to answer the question "Does our new product kill more weeds in farmlands?". They are running low on time and want to answer this question as soon as possible for the stakeholders. Luckily, Farmers Helpers Inc. has some data collected and stored on their databases. One of the lead analyst decides to use the data to answer the question. Would this be an experimental design or observational study?

Answer: This is an observational study, because the farmers are using data that has already been collected in order to draw conclusions - they aren't randomly assigning experimental units to treatments, so this isn't an experimental design.

Question 3: Abhi is having a hard time convincing that his pickup line is the best pickup line for his non-existent dating life. To prove it to his friends, he is thinking of walking on the street from 6pm - 8pm near the Irish Pub and randomly using his pickup line on 25 girls. He will repeat this for 7 days, and tally up the positive responses. He will then do the same process but with a common pickup line he found on Google. At the end, he will compare the positive responses for his pickup line and Google's pickup line. Would this be considered an observational study because Abhi is observing the reactions? Or would this be an experimental design? Justify your response.

Hint: DO NOT ASK ABHI FOR THE PICKUP LINE, IT WILL RUIN HIS EXPERIMENT ;)

Answer: This would be considered experimental design, because Abhi is assigning participants (the recipients of pickup lines) to treatment and control groups (his pickup line versus Google's pickup line). – Side Note: This isn't a very good experiment, since Abhi's only focusing on using a pickup line on girls from a specific Irish Pub from 6pm to 8pm; he may encounter different results if he went to a different type of pub, or if he went at a different time. To make this a better experiment, Abhi could cover a larger range of pubs and go during a wider duration of time. –

Question 4: Well, as a theoretical physicist, I will be performing an experiment and I am unsure if I want to use blocking at the moment. I usually do not ask anyone for help unless they have a PhD or is me from the future, but to return my favors to my friend... I will pretend I need your help. Can you tell me the reason why we use blocking in designing an experiment?

Answer: We could use blocking in an experiment if we want to see the differences of effects of a treatment between certain groups within our sample. For example, if we were doing an experiment in which our population was a whole high school, but we thought that different grade levels would respond to our treatment differently, we could block the participants in our sample by their grade level (in this case, separating our high schooler sample into freshmen, sophomores, juniors, and seniors before conducting our experiment on each group individually).

Problem 2

Part 1: The Olivia Strategy

Question 1: Let us import the Data.csv over here, so we can get ready to answer further questions. Make sure to important any necessary libraries too!

Answer:

```
#Import Library
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.6     v purrr   0.3.4
## v tibble  3.1.7     v dplyr   1.0.9
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
#Read the CSV into a data frame
df <- Data_csv <- read.csv("~/Desktop/DPI 2022/Data.csv", stringsAsFactors=TRUE)
```

Question 2: Taylor's coworker, Olivia, who is known for taking short cuts, says she knows how to split the participants into two groups: take the first 11 people from the list and put them into the control group, then put the rest of them in the treatment group. Using Olivia's strategy assign the treatment and control groups.

Answer:

```
# Assign Control Group
control = head(df, 11)
control
```

```
##       Name                          Major.        Year. Cats.or.Dogs Siblings.
## 1    Jesse                      Undeclared     Freshmen         Dogs         1
## 2     Bing                      Psychology       Junior         Dogs         0
## 3   Jiayi                       psychology     freshman         cats         0
## 4    Tamun                      Psychology     Freshman         dogs         1
## 5    Gabby                      Undeclared    Sophomore         Dogs         1
## 6  Cecilia Agricultural Consumer Economics       Junior         Dogs         1
## 7  Jasmine                             MCB    Sophomore         Dogs         2
## 8  Pavitra               Ag Consumer Econ       Junior         Dogs         0
## 9    Brian                     Chemistry    Sophomore         Dogs         1
## 10   Kelly               Computer Scinece super senior         Cats         0
## 11     Ali                      Undeclared    Sophomore         Dogs         2
##    Shoe.Size.       Fav.Food    Fav..Color Phone. Mac.or.PC. Travel Fav.Subject
## 1         9.0           KBBQ          Blue iPhone         PC     No     Math/Cs
## 2         5.5   French Fries          Grey iPhone        Mac    Yes    Physics
## 3         7.0         hotpot          blue iphone         PC    yes  psychology
```

```
## 4         8.0    Indian Food Seafoam green iPhone        Mac    yes  psychology
## 5         8.5           Ribs    Periwinkle iPhone        Mac    Yes        Math
## 6         7.5        Brownie         White Iphone        Mac    Yes  Psychology
## 7         8.0          sushi          grey iphone         PC    yes         bio
## 8         7.5 mac and cheese        purple iphone        mac    yes        math
## 9         9.5          Tacos          Gold IPhone         PC    Yes   Chemistry
## 10        7.0      Guacamole        Purple iPhone        Mac   Nope        Math
## 11        9.0          Sushi          Blue iPhone        Mac    Yes          CS
##         Crocs.      Musical.Artist Pancakes.or.waffles Fav.Animal
## 1            ?                Dean            Pancakes    Turtles
## 2          For              Khalid            Pancakes   Manatees
## 3   no opinion                              pancakes      Panda
## 4          for              bazzi             waffles      koala
## 5          For       Fleetwood Mac             Waffles    Penguin
## 6      against          Bruno Mars             Waffles       Dogs
## 7          FOR          Rich Brian            pancakes    turtles
## 8      against               drake             waffles      horse
## 9  No opinion               Drake             Waffles       Wolf
## 10     why not Panic! at the Disco            Pancakes      Tiger
## 11     Against              Migos            Pancakes    Penguin
##               Fav.Car Do.You.Cook. Marvel.or.DC.                  Fav.Movie
## 1             No Clue  Dining Hall        Marvel                  Your name
## 2         Range Rover          Yes        Marvel Madea's Witness Protection
## 3                none dining hall        marvel                       none
## 4  one that functions          yes        Marvel             The Blind Side
## 5                   ?          Yes        Marvel Scott Pilgrim vs the World
## 6                 G63          Yes        Marvel                     X men
## 7                rav4          yes        Marvel       Grand Budapest Hotel
## 8                none          yes       neither                home alone
## 9                   ?          Yes            DC      Avengers Infinity War
## 10               Bike          Yes        Marvel                  Rush Hour
## 11            BMW M3           Yes        Marvel               Monsters Inc
##    Airpods                 Instrument    Fav.Store.IRL Pepsi.or.Coke
## 1      For                      Piano           Amazon          Coke
## 2      For    Violin, Piano, Clarinet    Trader Joe's          Coke
## 3       no                      piano           amazon          Coke
## 4      for Flute, Piccolo, Percussion       Forever 21       neither
## 5  Against              Bass Clarinet              REI        Pepsi!
## 6       No                      Piano            Hmart          Coke
## 7      yes                air guitar            uniqlo         pepsi
## 8      yes                     flute urban outfitters         pepsi
## 9      For                  Clarinet          Express          Coke
## 10      No                    Violin    Dunkin Donuts          Nope
## 11 Against                     None           Costco          Coke
##          The.Dress    Fav.Restaurant Least.Fav.Subject
## 1   Blue and Black        Spicy Food           History
## 2  White and Gold       Bangkok Thai           English
## 3   blue and black          sakanaya           physics
## 4   blue and black           Panera         Chemistry
## 5   Blue and Black The Stained Glass           English
## 6   Blue and Black        Basil Thai         Chemistry
## 7       blue/black          sakanaya         chemistry
## 8   white and gold      olive garden           english
## 9   White and Gold          Wingstop           Physics
```

```
## 10  white and gold     Dunkin Donuts           History
## 11  Blue and Black      Noodles & Co           Physics
##    McDonald.s.or.Burger.King Gym.Per.Week Birth.Month Stat.at.UIUC
## 1                 McDonald's            0           5            0
## 2                McDonald's             2           5            2
## 3                    neither            0           1            0
## 4                  McDonalds            4          12            1
## 5                    Neither            3          12            2
## 6                 McDonald's            0           2            1
## 7                  McDonalds            0           1            0
## 8                  mcdonalds            5           9            2
## 9                  McDonalds            0           6            0
## 10                McDonald's            4           2          0.5
## 11               Burger King            0           2            0
##    Programming.at.UIUC Credit.Hours. Ideal.Sleep.Hours Eat.Out.Per.Week
## 1                    1            15              10.0                1
## 2                    0            22               6.0                3
## 3                    0            17               7.0                2
## 4                    0            18               8.0                3
## 5                    0            17              10.5                1
## 6                    0            15               8.0                4
## 7                    0            18               7.0                3
## 8                    1            16               8.0                2
## 9                    0            16               7.0                2
## 10                   5            12              10.0                3
## 11                   1            15              10.0                2
##        Eye.Color Height...ft...in
## 1          Black                0
## 2          Brown               60
## 3          black               63
## 4          Brown               63
## 5  Brown & Green               64
## 6          Black               64
## 7          brown               64
## 8          brown               65
## 9          Brown               65
## 10         Hazel               65
## 11          Blue               66
```

```
#Assign Treatment Group
treatment = tail(df, nrow(df) - 11)
treatment
```

```
##      Name                        Major.     Year. Cats.or.Dogs Siblings.
## 12 Mariel               Global Studies  Freshman         Dogs         1
## 13  April              Human Nutrition    Senior         Dogs         0
## 14   Dean                    Economics Sophomore         Dogs         1
## 15 Hermon                        MCB   senior          Dogs         1
## 16  Karle                  Statistics       Old         Cats         2
## 17   Ming               Econ and Stats Sophomore         Cats         1
## 18  David                  Kinesiology Sophomore         Cats         2
## 19   Omri Lighting Design & Technology    Junior         Dogs         1
## 20   Nick                  Advertising  freshman         dogs         1
## 21  Pedro            Political Science  Sophmore         Dogs         1
```

```
## 22   Wade             Computer Scinece       Old         Dogs         2
##    Shoe.Size.     Fav.Food Fav..Color  Phone. Mac.or.PC. Travel
## 12        9.0        sushi       none  iPhone        Mac    yes
## 13        6.5       Hotpot       Blue  iPhone         PC    Yep
## 14        7.5        Ramen      Green Android         PC    Yes
## 15       10.0      Burrito        Red iPhone         Mac    Yea
## 16        8.5        Tacos       Pink  iPhone        Mac    Yes
## 17       10.0   KBBQ/Ramen       Blue Android         PC    Yes
## 18       10.0        Pizza     Purple  iPhone        Mac    Yes
## 19       10.0        Pasta       Blue  iPhone        Mac    Yes
## 20       10.0 Mac & Cheese       blue  iPhone        Mac    yes
## 21       13.0     BBQ Ribs       grey  Iphone        Mac    Yes
## 22       13.0          BBQ     Purple Android         PC    Yes
##                 Fav.Subject      Crocs. Musical.Artist Pancakes.or.waffles
## 12 History/Political Science         For        Solange            Pancakes
## 13                Chemistry Indifferent     Ed Sheeran               None
## 14              Anthropology  No opinion           Saba             Waffles
## 15                   Physics      Against    The Weeknd            Pancakes
## 16                      MATH Indifferent   Taylor Swift            Pancakes
## 17                      Econ  No opinion            BTS             Waffles
## 18                     Kines     Against   Simple Minds            Pancakes
## 19                   History     Against Punch Brothers            Pancakes
## 20                      math         for   Arcade FIre            Pancakes
## 21                   History     Against   Can't decide             Waffles
## 22                DISCOVERY!!        Wut?   Taylor Swift             Waffles
##    Fav.Animal               Fav.Car     Do.You.Cook. Marvel.or.DC.
## 12   elephant                 Audi              Yes        Marvel
## 13       None           Lamborghini              Yes        Marvel
## 14    Penguin               No clue              Yes            DC
## 15   Cheetah                  Audi Cook or chipotle        Marvel
## 16      SLOTH                subaru              Yes        Marvel
## 17   Dolphins If it works I like it        Sometimes        Marvel
## 18       Cats              Wrangler              Yes        Marvel
## 19  Elephants               Hellcat              Yes            DC
## 20      Panda                 tesla  trying to learn        marvel
## 21       Wolf               Mustang               No            DC
## 22      Human  Anything that drives              Yes        Marvel
##              Fav.Movie     Airpods            Instrument    Fav.Store.IRL
## 12 Save the Last Dance          No                 Oboe           Target
## 13                None         For                Piano     Trader Joe's
## 14          Ocean's 11     Against                Cello           Costco
## 15              Thor 3         Nah                 None              H&M
## 16             Titanic Indifferent                Piano Charming Charlie
## 17      A Silent Voice          No              Clarinet           Amazon
## 18      Princess Bride         For              Clarinet           Costco
## 19       Monsters Inc.         For                Violin           Target
## 20 The social network      against                 piano         Best Buy
## 21      Reservoir Dogs          No              Saxophone           Costco
## 22                LOTR   Wired FTW Does a recorder count?      Whole Foods
##    Pepsi.or.Coke       The.Dress   Fav.Restaurant Least.Fav.Subject
## 12       Neither    Blue & Black   The Angry Crab        Chemistry
## 13         pepsi  White and gold       Basil Thai       engineering
## 14         Pepsi  White and Gold       McDonald's           Physics
## 15          Coke White and gold         Chipotle           Calculus
```

```
## 16          Coke  blue and black       Sushi Kame           English
## 17         Pepsi  Blue and Black Something Ramen?         Chemistry
## 18          Coke  White and Gold   The Briar Rose         Chemistry
## 19          Coke  White and Gold       Dos Reales           Physics
## 20          Coke    white & Gold        Five Guys          science
## 21          Coke      blue/black         Wingstop         Chemistry
## 22       None :( White and Gold         Black Dog           History
##    McDonald.s.or.Burger.King Gym.Per.Week Birth.Month Stat.at.UIUC
## 12                   Neither            4          10            1
## 13                   Neither            2           9            0
## 14                McDonald's            0           3            1
## 15                    McDees            0           4            2
## 16                   Neither            3          10          20+
## 17                 McDonalds            0           7            2
## 18                   neither            3           7            1
## 19                McDonald's            3           9            1
## 20                McDonald's            3          12            1
## 21               Burger King            0           2            1
## 22                      MCDs            0          11            0
##    Programming.at.UIUC Credit.Hours. Ideal.Sleep.Hours Eat.Out.Per.Week
## 12                   0            17                10                3
## 13                   0            22                 8                3
## 14                   0            16                10                4
## 15                   0            16                 7               ~4
## 16                   1             4                10                3
## 17                   1            18                10           3-Feb
## 18                   0            16                 7                0
## 19                   0            20                 8                3
## 20                   0            15                 8                2
## 21                   0            16                 9                2
## 22                   5            13                 8                2
##    Eye.Color Height...ft...in
## 12     Brown               67
## 13     Black               67
## 14     Brown               68
## 15     Brown               68
## 16     Green               70
## 17     Brown               70
## 18      Grey               70
## 19     Brown               70
## 20     brown               72
## 21     Brown               74
## 22     Brown               77
```

Part 2: Taylor is Always Right

Question 1: Taylor believes that Olivia's method for assignment has problems. What is the possible issue with Olivia's strategy?

Answer: Olivia's method for assignment is flawed, because she doesn't use random sampling to assign her groups. This will end up introducing a significant amount of convenience bias, which can skew the data enormously, depending on how the dataframe was originally ordered.

Question 2: Taylor thinks she might have a better way than Olivia. She believes she can randomly sample 11 people and add them in Control and other half in Treatment. Using Taylor's strategy, randomly sample 11 people and assign them into control. The code for the treatment is more complicated so we will provide that for you. (This may be something to use in your project.)

Answer:

```
# Seed Value - DO NOT CHANGE THIS
set.seed(36241)
# Seed Value - DO NOT CHANGE THIS
taylor_control = df[sample(nrow(df), size = 11, replace = FALSE),]
taylor_control
```

```
##       Name                          Major.     Year. Cats.or.Dogs Siblings.
## 8  Pavitra                Ag Consumer Econ    Junior         Dogs         0
## 9    Brian                       Chemistry Sophomore         Dogs         1
## 1    Jesse                      Undeclared  Freshmen         Dogs         1
## 20    Nick                     Advertising  freshman         dogs         1
## 14    Dean                       Economics Sophomore         Dogs         1
## 6  Cecilia Agricultural Consumer Economics    Junior         Dogs         1
## 21   Pedro               Political Science  Sophmore         Dogs         1
## 16   Karle                      Statistics       Old         Cats         2
## 11     Ali                      Undeclared Sophomore         Dogs         2
## 2     Bing                      Psychology    Junior         Dogs         0
## 17    Ming                   Econ and Stats Sophomore         Cats         1
##    Shoe.Size.       Fav.Food Fav..Color  Phone. Mac.or.PC. Travel  Fav.Subject
## 8         7.5 mac and cheese     purple  iphone        mac    yes         math
## 9         9.5          Tacos       Gold  IPhone         PC    Yes    Chemistry
## 1         9.0           KBBQ       Blue  iPhone         PC     No      Math/Cs
## 20       10.0   Mac & Cheese       blue  iPhone        Mac    yes         math
## 14        7.5          Ramen      Green Android         PC    Yes Anthropology
## 6         7.5        Brownie      White  Iphone        Mac    Yes   Psychology
## 21       13.0       BBQ Ribs       grey  Iphone        Mac    Yes      History
## 16        8.5          Tacos       Pink  iPhone        Mac    Yes         MATH
## 11        9.0          Sushi       Blue  iPhone        Mac    Yes           CS
## 2         5.5   French Fries       Grey  iPhone        Mac    Yes     Physics
## 17       10.0     KBBQ/Ramen       Blue Android         PC    Yes         Econ
##         Crocs. Musical.Artist Pancakes.or.waffles Fav.Animal
## 8      against          drake             waffles      horse
## 9  No opinion          Drake             Waffles       Wolf
## 1            ?           Dean            Pancakes    Turtles
## 20         for   Arcade FIre            Pancakes      Panda
## 14  No opinion           Saba             Waffles    Penguin
## 6      against     Bruno Mars             Waffles       Dogs
## 21     Against   Can't decide             Waffles       Wolf
## 16 Indifferent   Taylor Swift            Pancakes      SLOTH
```

```
## 11     Against          Migos            Pancakes    Penguin
## 2          For         Khalid            Pancakes   Manatees
## 17  No opinion            BTS             Waffles   Dolphins
##                  Fav.Car    Do.You.Cook. Marvel.or.DC.
## 8                   none             yes       neither
## 9                      ?             Yes            DC
## 1                No Clue     Dining Hall        Marvel
## 20                 tesla trying to learn        marvel
## 14               No clue             Yes            DC
## 6                    G63             Yes        Marvel
## 21               Mustang              No            DC
## 16                subaru             Yes        Marvel
## 11                BMW M3             Yes        Marvel
## 2           Range Rover             Yes        Marvel
## 17 If it works I like it       Sometimes        Marvel
##                      Fav.Movie     Airpods              Instrument
## 8                   home alone         yes                   flute
## 9       Avengers Infinity War         For                Clarinet
## 1                    Your name         For                   Piano
## 20        The social network      against                   piano
## 14                 Ocean's 11     Against                   Cello
## 6                       X men          No                   Piano
## 21             Reservoir Dogs          No                Saxophone
## 16                   Titanic Indifferent                    Piano
## 11               Monsters Inc     Against                    None
## 2  Madea's Witness Protection         For Violin, Piano, Clarinet
## 17             A Silent Voice          No                 Clarinet
##       Fav.Store.IRL Pepsi.or.Coke       The.Dress   Fav.Restaurant
## 8  urban outfitters         pepsi  white and gold     olive garden
## 9            Express          Coke  White and Gold         Wingstop
## 1             Amazon          Coke  Blue and Black       Spicy Food
## 20          Best Buy          Coke    white & Gold        Five Guys
## 14            Costco         Pepsi  White and Gold       McDonald's
## 6              Hmart          Coke  Blue and Black       Basil Thai
## 21            Costco          Coke      blue/black         Wingstop
## 16 Charming Charlie          Coke  blue and black       Sushi Kame
## 11            Costco          Coke  Blue and Black     Noodles & Co
## 2     Trader Joe's           Coke White and Gold      Bangkok Thai
## 17            Amazon         Pepsi  Blue and Black Something Ramen?
##    Least.Fav.Subject McDonald.s.or.Burger.King Gym.Per.Week Birth.Month
## 8            english                 mcdonalds            5           9
## 9            Physics                 McDonalds            0           6
## 1            History                McDonald's            0           5
## 20           science                McDonald's            3          12
## 14           Physics                McDonald's            0           3
## 6          Chemistry                McDonald's            0           2
## 21         Chemistry               Burger King            0           2
## 16           English                   Neither            3          10
## 11           Physics               Burger King            0           2
## 2            English               McDonald's             2           5
## 17         Chemistry                 McDonalds            0           7
##    Stat.at.UIUC Programming.at.UIUC Credit.Hours. Ideal.Sleep.Hours
## 8             2                  1           16                8
## 9             0                  0           16                7
```

```
## 1              0                   1            15                10
## 20             1                   0            15                 8
## 14             1                   0            16                10
## 6              1                   0            15                 8
## 21             1                   0            16                 9
## 16           20+                   1             4                10
## 11             0                   1            15                10
## 2              2                   0            22                 6
## 17             2                   1            18                10
##    Eat.Out.Per.Week Eye.Color Height...ft...in
## 8                 2     brown               65
## 9                 2     Brown               65
## 1                 1     Black                0
## 20                2     brown               72
## 14                4     Brown               68
## 6                 4     Black               64
## 21                2     Brown               74
## 16                3     Green               70
## 11                2      Blue               66
## 2                 3     Brown               60
## 17            3-Feb     Brown               70
```

```
#Treatment Group Code
taylor_treatment = df[!(df$Name %in% taylor_control$Name),]
taylor_treatment
```

```
##       Name                       Major.        Year. Cats.or.Dogs Siblings.
## 3   Jiayi                    psychology     freshman         cats         0
## 4    Tamun                   Psychology     Freshman         dogs         1
## 5    Gabby                   Undeclared    Sophomore         Dogs         1
## 7  Jasmine                         MCB    Sophomore         Dogs         2
## 10   Kelly             Computer Scinece super senior         Cats         0
## 12  Mariel               Global Studies     Freshman         Dogs         1
## 13   April              Human Nutrition       Senior         Dogs         0
## 15  Hermon                         MCB      senior          Dogs         1
## 18   David                  Kinesiology    Sophomore         Cats         2
## 19    Omri Lighting Design & Technology       Junior         Dogs         1
## 22    Wade             Computer Scinece          Old         Dogs         2
##    Shoe.Size.    Fav.Food    Fav..Color  Phone. Mac.or.PC. Travel
## 3         7.0      hotpot          blue  iphone         PC    yes
## 4         8.0 Indian Food Seafoam green  iPhone        Mac    yes
## 5         8.5        Ribs    Periwinkle  iPhone        Mac    Yes
## 7         8.0       sushi          grey  iphone         PC    yes
## 10        7.0   Guacamole        Purple  iPhone        Mac   Nope
## 12        9.0       sushi          none  iPhone        Mac    yes
## 13        6.5      Hotpot          Blue  iPhone         PC    Yep
## 15       10.0     Burrito           Red iPhone         Mac    Yea
## 18       10.0       Pizza        Purple  iPhone        Mac    Yes
## 19       10.0       Pasta          Blue  iPhone        Mac    Yes
## 22       13.0         BBQ        Purple Android         PC    Yes
##                  Fav.Subject      Crocs.      Musical.Artist
## 3                 psychology  no opinion
## 4                 psychology         for              bazzi
## 5                       Math         For       Fleetwood Mac
```

```
## 7                       bio         FOR          Rich Brian
## 10                     Math     why not Panic! at the Disco
## 12 History/Political Science         For             Solange
## 13                Chemistry Indifferent          Ed Sheeran
## 15                  Physics      Against         The Weeknd
## 18                    Kines     Against        Simple Minds
## 19                  History     Against      Punch Brothers
## 22              DISCOVERY!!        Wut?        Taylor Swift
##    Pancakes.or.waffles Fav.Animal              Fav.Car     Do.You.Cook.
## 3             pancakes      Panda                 none     dining hall
## 4              waffles      koala   one that functions              yes
## 5              Waffles    Penguin                    ?              Yes
## 7             pancakes    turtles                 rav4              yes
## 10            Pancakes      Tiger                 Bike              Yes
## 12            Pancakes   elephant                 Audi              Yes
## 13               None        None          Lamborghini              Yes
## 15            Pancakes   Cheetah                 Audi Cook or chipotle
## 18            Pancakes       Cats             Wrangler              Yes
## 19            Pancakes  Elephants              Hellcat              Yes
## 22             Waffles      Human Anything that drives              Yes
##    Marvel.or.DC.                  Fav.Movie   Airpods
## 3         marvel                       none        no
## 4         Marvel             The Blind Side       for
## 5         Marvel Scott Pilgrim vs the World   Against
## 7         Marvel       Grand Budapest Hotel       yes
## 10        Marvel                  Rush Hour        No
## 12        Marvel        Save the Last Dance        No
## 13        Marvel                       None       For
## 15        Marvel                   Thor 3         Nah
## 18        Marvel             Princess Bride       For
## 19            DC              Monsters Inc.       For
## 22        Marvel                       LOTR Wired FTW
##                    Instrument Fav.Store.IRL Pepsi.or.Coke       The.Dress
## 3                       piano        amazon          Coke  blue and black
## 4  Flute, Piccolo, Percussion    Forever 21       neither  blue and black
## 5                Bass Clarinet           REI        Pepsi!  Blue and Black
## 7                   air guitar        uniqlo         pepsi      blue/black
## 10                  Violin Dunkin Donuts          Nope  white and gold
## 12                    Oboe        Target       Neither    Blue & Black
## 13                   Piano  Trader Joe's         pepsi  White and gold
## 15                    None           H&M          Coke White and gold
## 18                 Clarinet        Costco          Coke  White and Gold
## 19                  Violin        Target          Coke  White and Gold
## 22     Does a recorder count?   Whole Foods       None :( White and Gold
##       Fav.Restaurant Least.Fav.Subject McDonald.s.or.Burger.King Gym.Per.Week
## 3           sakanaya           physics                   neither           0
## 4            Panera         Chemistry                  McDonalds           4
## 5  The Stained Glass           English                    Neither           3
## 7           sakanaya         chemistry                  McDonalds           0
## 10     Dunkin Donuts           History                 McDonald's           4
## 12    The Angry Crab         Chemistry                    Neither           4
## 13        Basil Thai       engineering                    Neither           2
## 15         Chipotle           Calculus                     McDees           0
## 18    The Briar Rose         Chemistry                    neither           3
```

```
## 19        Dos Reales           Physics                McDonald's            3
## 22         Black Dog           History                     MCDs             0
##    Birth.Month Stat.at.UIUC Programming.at.UIUC Credit.Hours. Ideal.Sleep.Hours
## 3            1            0                   0            17               7.0
## 4           12            1                   0            18               8.0
## 5           12            2                   0            17              10.5
## 7            1            0                   0            18               7.0
## 10           2          0.5                   5            12              10.0
## 12          10            1                   0            17              10.0
## 13           9            0                   0            22               8.0
## 15           4            2                   0            16               7.0
## 18           7            1                   0            16               7.0
## 19           9            1                   0            20               8.0
## 22          11            0                   5            13               8.0
##    Eat.Out.Per.Week     Eye.Color Height...ft...in
## 3                 2         black               63
## 4                 3         Brown               63
## 5                 1 Brown & Green               64
## 7                 3         brown               64
## 10                3         Hazel               65
## 12                3         Brown               67
## 13                3         Black               67
## 15               ~4         Brown               68
## 18                0          Grey               70
## 19                3         Brown               70
## 22                2         Brown               77
```

Question 3: With your group, discuss which method is better (Taylor or Olivia). Give a valid reasoning of why you think their method is better.

Answer: Taylor's method is much better, because he uses random sampling to sort the participants instead of convenience sampling (which Olivia does). This helps Taylor maintain a lower level of bias, and is therefore more able to draw a better conclusion.

Question 4: Taylor still thinks that she might have high variability in her method. She wants to know what could be the potential reason and why? Help Taylor by giving a potential and why there could be high variability.

Hint: How many rows are there in the data frame

Answer: Taylor still has an extremely high variability because she doesn't have that many participants in the experiment. She only has 11 participants in her control and treatment groups. As a result, this doesn't represent the true values of the entire population. Taylor's experiment only has 11 data points for each group, so any discrepancies will stand out and contribute to increasing the variability of her data set.

Submission

Once you have finished your lab...

1. Go to the top left and click `File` and `Save`.
2. Click on the `Knit` button to convert this file to a PDF.
3. Submit **BOTH** the `.Rmd` file and `.pdf` file to Blackboard by 11:59 PM tonight.