

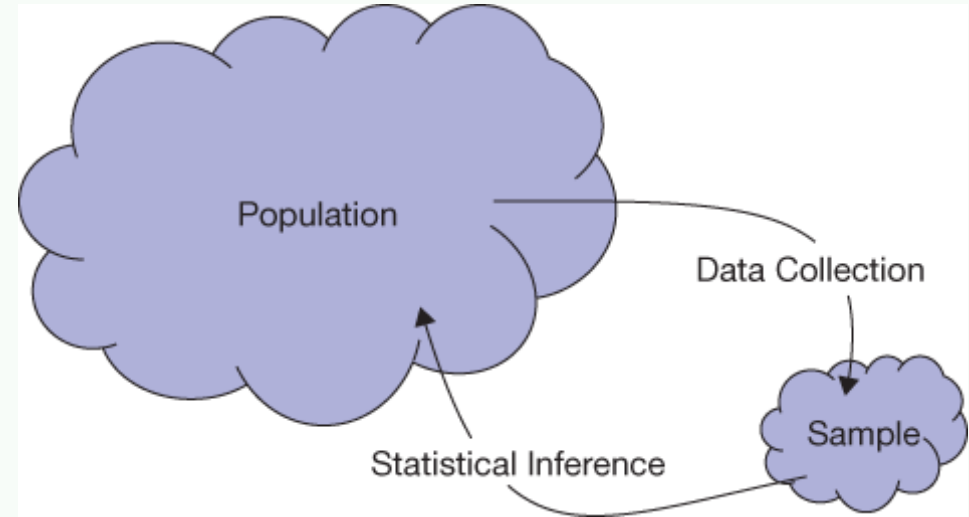
# Sampling

Stat 120

January 06 2023

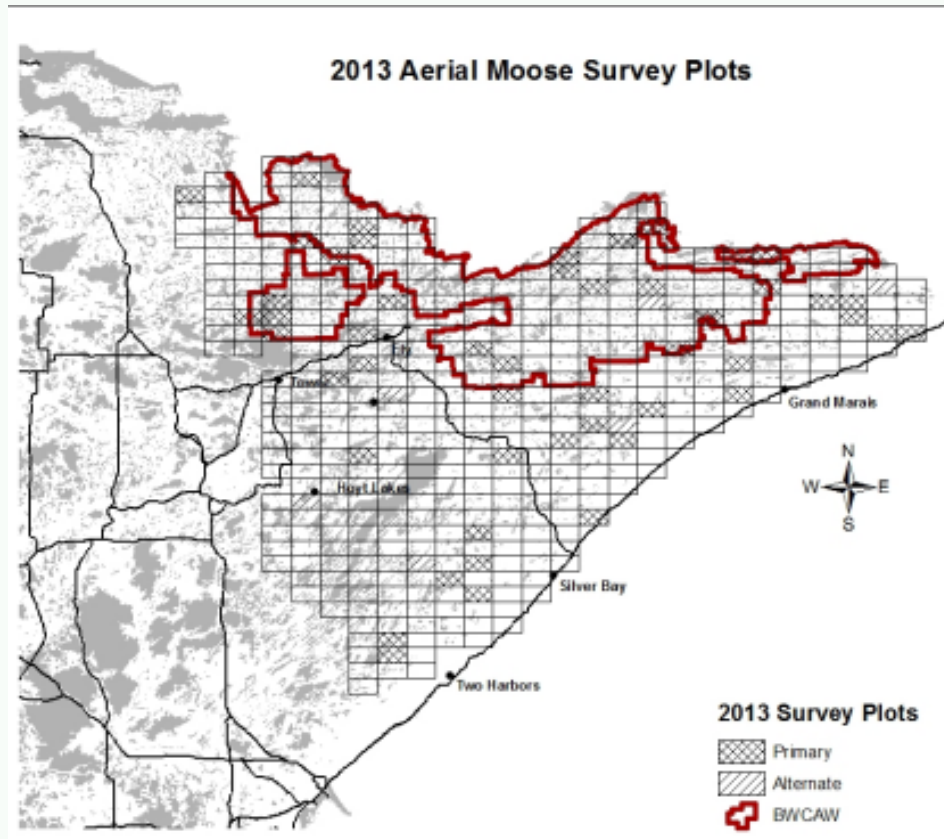
# Sampling and Inference

- A **population** includes all individuals or objects of interest.
- A **sample** is all the cases that we have collected data on (a subset of the population).
- **Statistical inference** is the process of using data from a sample to gain information about the population.



Population and Sample

# MN Department of Natural Resources



Population and Sample

- **Population:** all plots (grid cells) on the map
- **Sample:** the cross-hatched plots on the map
- **Variable:** number of moose counted in a plot
- **Inference:** estimated 2,760 moose in the entire population

# Sampling Bias

- Sampling bias occurs when the method of selecting a sample causes the sample to differ from the population in some relevant way
- If sampling bias exists, we cannot trust generalizations from the sample to the population

To eliminate sampling bias always take a RANDOM SAMPLE!

# Lincoln's Gettysburg Address

“Four score and seven years ago our fathers brought forth, on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. But, in a larger sense, we cannot dedicate—we cannot consecrate—we cannot hallow—this ground. The brave men, living and dead, who struggled here, have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember what we say here, but can never forget what they did here. It is for us the living, rather, to be dedicated to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they here gave the last full measure of devotion—that we here highly resolve that these dead shall not have died in vain—that this nation, under God, shall have a new birth of freedom—and that government of the people, by the people, for the people, shall not perish from the earth.

# Lincoln's Gettysberg Address: What is the average word length?

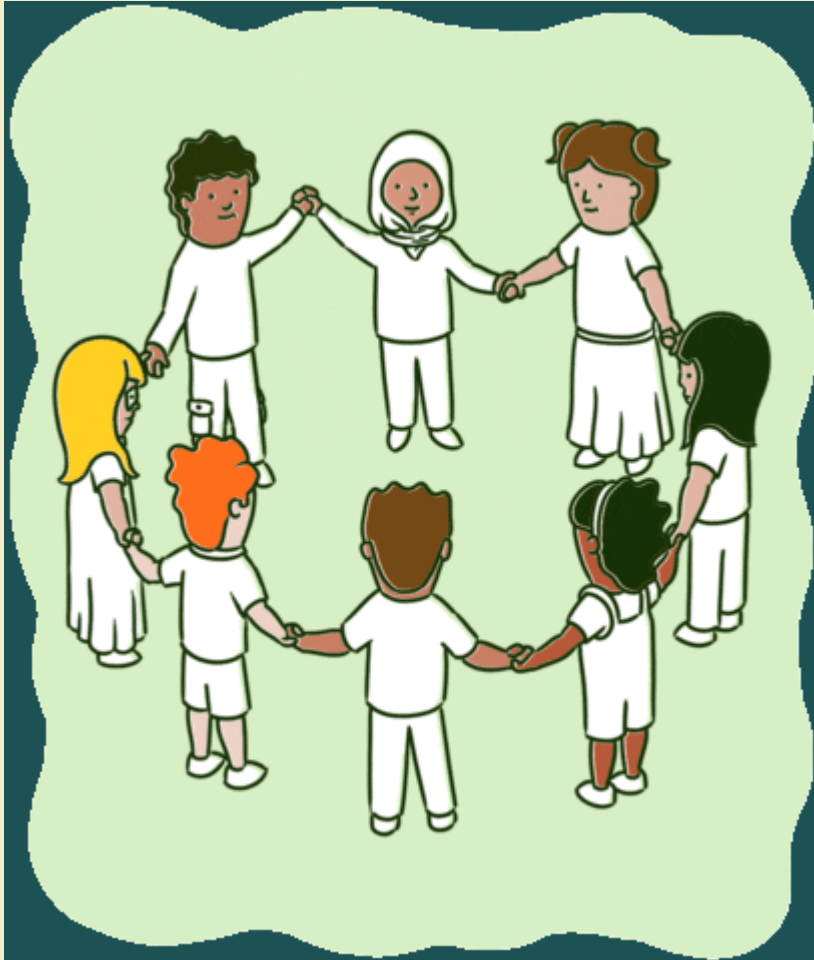
**Task:** Select a sample of 10 words to estimate average word length of entire address

- Population? (describe cases of interest)
- Sample?
- pick your sample...
- variable measured?
- compute average word length

Actual average is 4.29 letters

# Group Work 1

10:00



- Go to the appropriate forms:
  - google form section 02
  - google form section 04
- Find the average word length and enter your answer

## Bias in data

*Even with a random sample, data can still be biased, especially when collected on humans*



## Some forms of bias

Some forms of bias to watch out for in data collection:

- Question wording
- Question order
- Context
- Non-response Bias

# Question wording

A random sample was asked: "Should there be a tax cut, or should money be used to fund new government programs?"

Tax Cut	Programs
60%	40%

A different random sample was asked: "Should there be a tax cut, or should money be spent on programs for education, the environment, health care, crime-fighting, and military defense?"

Tax Cut	Programs
22%	78%

## Question order

*Depending on the order of questions we can see either a greater differences in responses or lesser difference in response. Respondents tend to provide answers consistent with their prior responses.*

# Danish study: Question order bias

## Abstract

Public decision-makers increasingly rely on satisfaction surveys to inform budget and policy decisions. Yet, our knowledge of whether, and under what conditions, this input from public service users provides valid performance information remains incomplete. Using a preregistered split-ballot experiment among government grant recipients in Denmark, this article shows that the ordering of survey questions can bias satisfaction measures even for highly experienced and professional respondents. We find that asking about overall satisfaction before any specific service ratings lowers overall user satisfaction, compared to the reverse order, while the correlations between specific ratings and overall satisfaction are relatively stable. Also, the question order effect outweighs that of a large-scale embezzlement scandal, which unexpectedly hit the investigated government agency during the data collection. Our results support rising concerns that subjective performance indicators are susceptible to bias. We discuss how practitioners should approach satisfaction surveys to account for the risk of question order bias.

## Danish Study

*Danish policy makers found out in the study that order bias exists in Danish Public Services*

- When asked about overall satisfaction before being asked about specific services, the overall satisfaction was low.
- When asked about overall satisfaction after being asked about specific services, then the overall satisfaction was high.

# Context

Ann Landers column asked readers “If you had it to do over again, would you have children?”

The first request for data contained a letter from a young couple which listed worries about parenting and various reasons not to have kids

30% said yes

The second request for data was in response to this number, in which Ann wrote how she was “stunned, disturbed, and just plain flummoxed”

95% said yes

## Non-response Bias

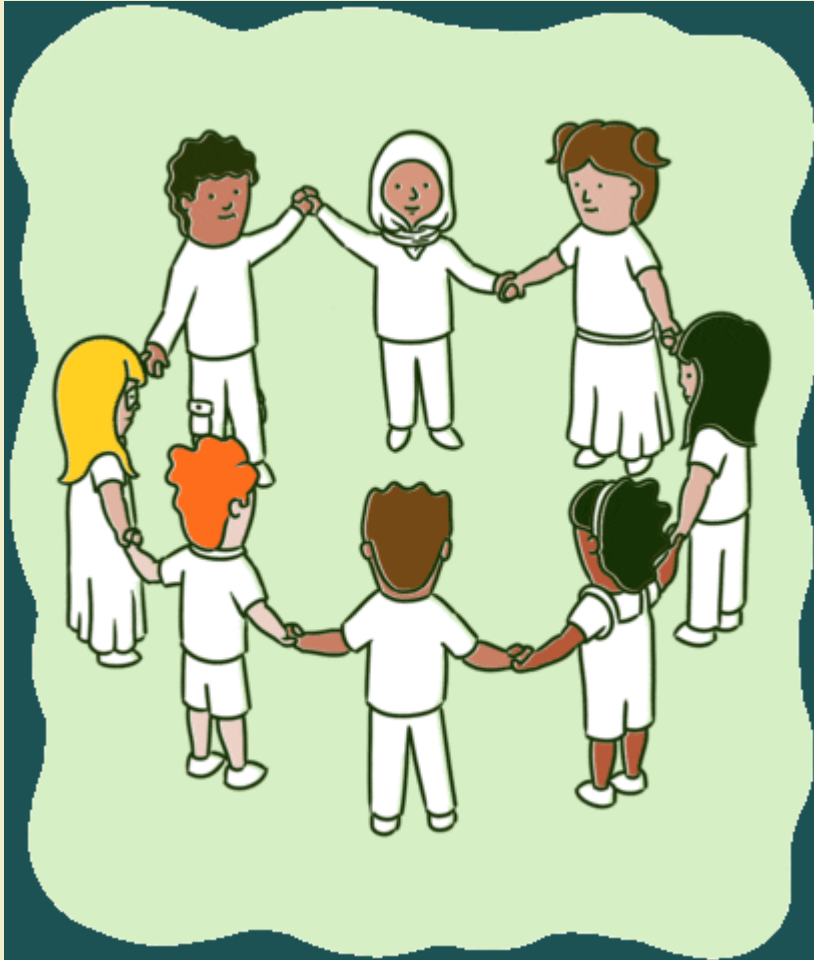
*When respondents are either unable or unwilling to respond to your survey, then this results in a non-response bias*

- Survey targeted to the wrong audience
- There is general unwillingness due to polar opposite opinions
- The survey did not reach the right respondent

e.g. A survey asking teenagers about best cigarette brands Spam emails is also a prime reason for non-response bias

## Group Work 2

10:00



- Go over to [moodle](#) to get the class activity .Rmd file
- Continue working with your neighbors and let me know if you have any questions