Sampling and Sampling Distributions Part I

EDP 613

Week 7

Two Types of Sampling

Nonprobability

Probability

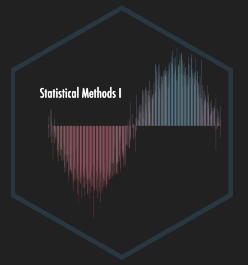
Nonprobability Sampling

- Probability is usually unknown
- Does not rely on numerical data
- Inability to generalize to any populous

Notions

> - *You get what you get and you don't throw a fit* method
> - Used when you want to say something about a discrete phenomena, a few select cases (people, places, objects, etc)

General Framework

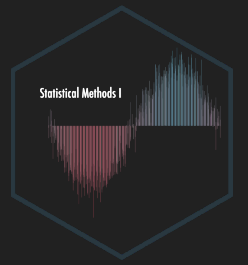


- Nonrandom selection
- Sampling bias is present, and samples are not considered representative of the populations from which they were drawn

Primary Types

- Convenience
- Purposive
- Quota
- Snowball

Convenience Sampling

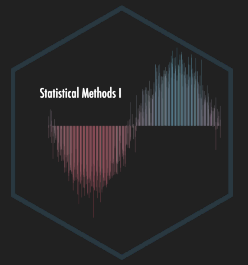


- Cases are selected based on their availability to the researcher
- Also called **haphazard** or **accidental** sampling
- Ideal for: **Exploratory or preliminary research** when trying to gain an initial sense of attitudes or an idea about a new setting

Purposive Sampling

- Sample elements are selected based on
  - elective criteria that define a unique group
  - targeting knowledgeable individuals (aka *key informants*)
- Ideal for: *Case Study Research*
- Sampling continues until
  - Data are comprehensive: **Completeness**
  - Little or no new knowledge is added: **Saturation**

Snowball Sampling



- Select one member of a population, and after speaking to him/her ask that person to identify others in the population
- Ideal for: *hard to reach populations* (e.g., criminalsm homeless, prostitutes, etc.)
- Targeted incentives may be used to ensure diversity in the sample

Quota Sampling

- Available cases are selected according to defined subgroups exhibit certain characteristics of interest
- A slight improvement over those who are simply available since sample proportions match the population on a particular feature
- The sample is not representative of the population by design

Why should I even care?

Because:

> - Any choice will limit the type of utilizable quantitative study
> - Not everything can be explained quantitatively
> - Some studies mandate mixed methods!

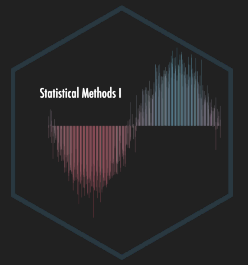
Probability Sampling

- Based solely on the idea that a population can be represented by a subset of it given some error: **Random selection**!
  - Example: $45\% \pm 3\%$ agree with...
- Ability to generalize to a certain populous
- Inability to describe individual phenomena at any great depth

Notions

- *You must have enough whatever* method
- Used when you want to say something about a large population (people, places, objects, etc)

General Framework



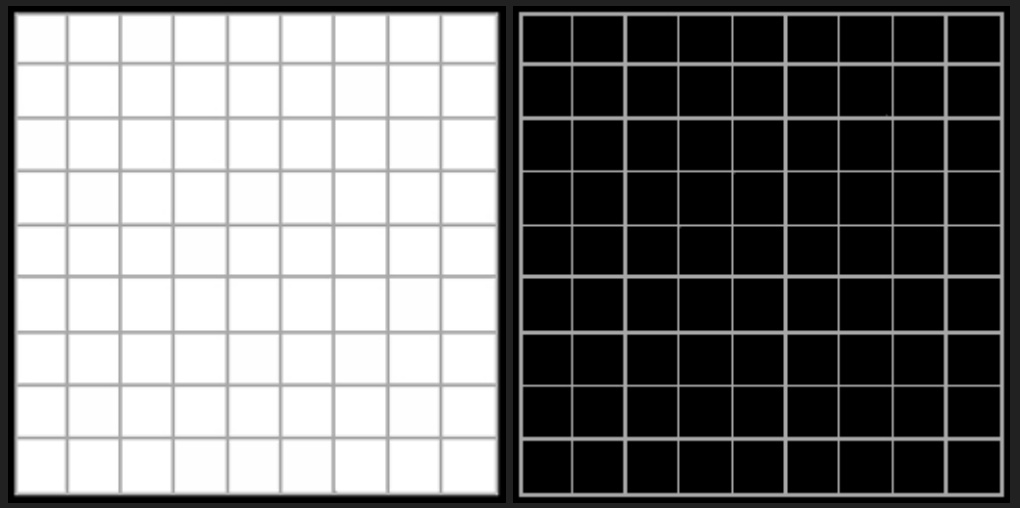
- Random selection.
- Sampling bias is minimal, and samples are considered representative of the populations from which they were drawn

Primary Types

- Census
- Simple Random Sample (SRS)
- Systematic
- Stratified
- Cluster

Census

- An official count or survey of a population, typically recording various details of individuals.



Benefits

- *"Easy"* to administer
- Self-Weighting. (i.e. no sample element is worth more than another element)
- No error associated with a result
- Data analysis is simple

Drawbacks

- Extremely expensive
- Time consuming
- Typically infeasible

When to use

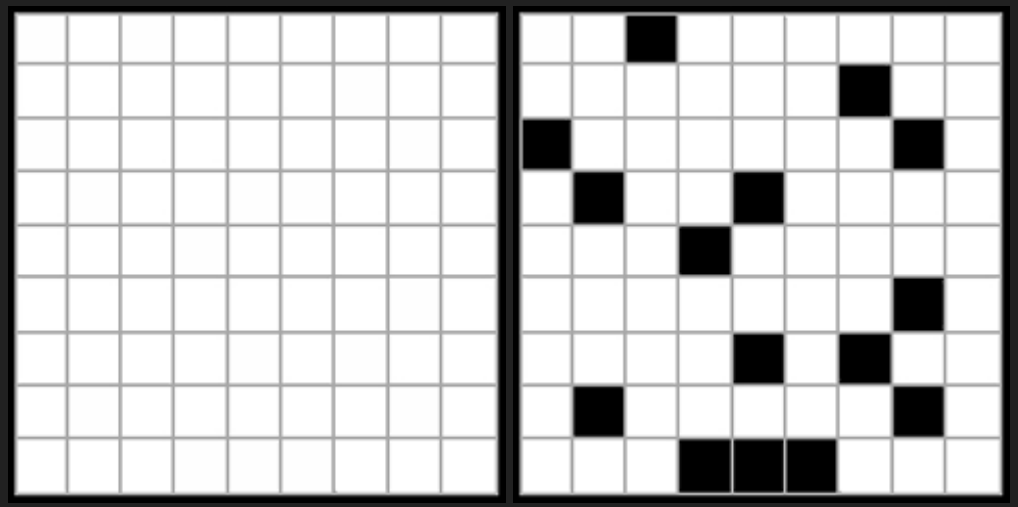
- Small sample
- Generalize to an overall populous

Example

- Population: 81 healthcare institutions in a county that perform surgery
- What to do
  - Create a list of all healthcare institutions in the county that perform surgery
  - Number them 1, 2, . . . , N where N is the total number of healthcare institutions (So $N = 81$)

Simple Random Sample (SRS)

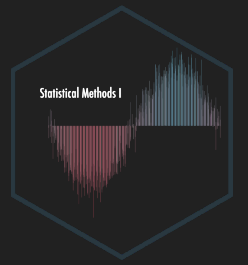
- Each element of the frame is given an equal probability of selection



Benefits

- *"Easy"* to administer
- Self-Weighting. (i.e. no sample element is worth more than another element)
- Error is easy to calculate
- Data analysis is simple

Drawbacks



- Vulnerable to sampling errors
- Possible underrepresentation of subgroups
- Often tedious, costly, and possibly impractical

When to use

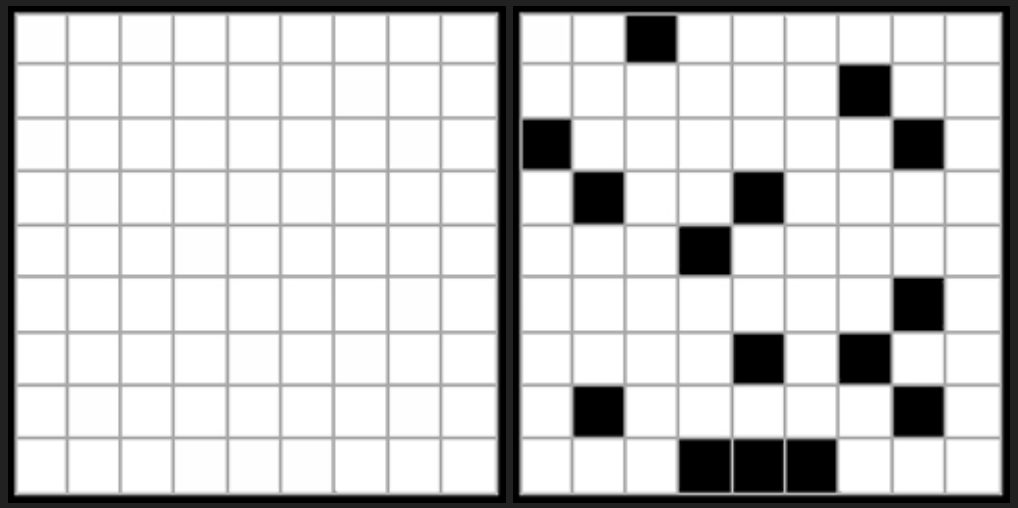
- Large sample
- Complete sampling frame: Known *population*, *needed characteristics* and *setting*
- Generalize to a specific populous
- Not a great deal of information is available about the population
- Data collection can be efficiently performed on randomly distributed items
- Low cost of sampling

Example

- Population: 81 healthcare institutions in a county that perform surgery
- What to do
  - Create a list of all healthcare institutions in the county that perform surgery
  - Number them 1, 2, . . . , N where N is the total number of healthcare institutions (So $N = 81$)
  - Use a random method to obtain n (say $n = 51$)

Simple Random Sample (SRS)

- Each element of the frame is given an equal probability of selection



Benefits

- *"Easy"* to administer
- Self-Weighting. (i.e. no sample element is worth more than another element)
- Error is easy to calculate
- Data analysis is simple

Drawbacks

- Vulnerable to sampling errors
- Possible underrepresentation of subgroups
- Often tedious, costly, and possibly impractical

When to use

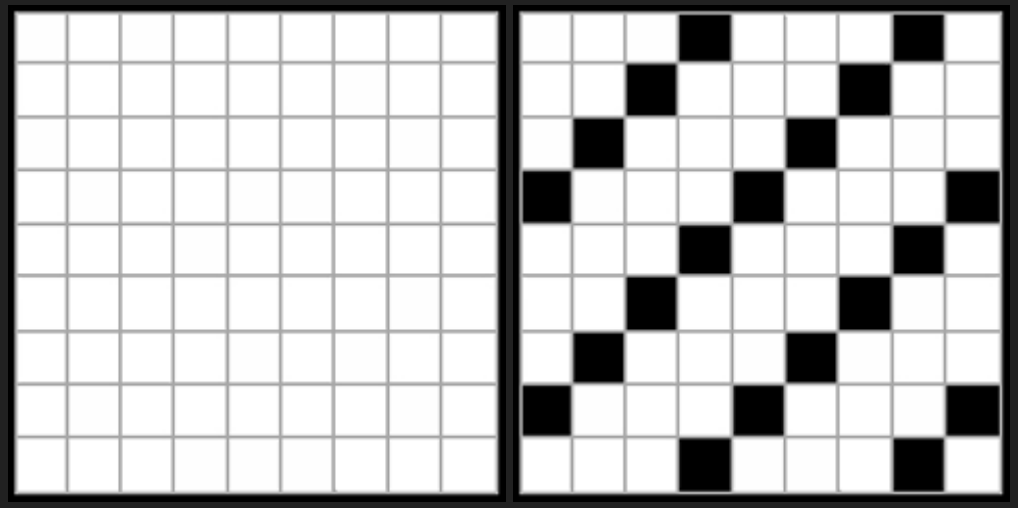
- Large sample
- Complete sampling frame: Known *population*, *needed characteristics* and *setting*
- Generalize to a specific populous
- Not a great deal of information is available about the population
- Data collection can be efficiently performed on randomly distributed items
- Low cost of sampling

Example

- Population: 81 healthcare institutions in a county that perform surgery
- What to do
  - Create a list of all healthcare institutions in the county that perform surgery
  - Number them 1, 2, . . . , N where N is the total number of healthcare institutions (So $N = 81$)
  - Use a random method to obtain n (say $n = 51$)

Systematic Sample

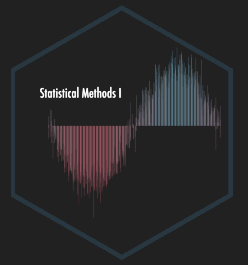
- An arranging of a population according to some ordering pattern and then the selection of elements at regular intervals from that that ordered list



Benefits

- *"Easy"* to administer
- Simple selection process
- Less subjective to selection error than SRS
- Most likely will provide a more robust information set per unit cost than an SRS
- May provide more information about a population than an SRS

Drawbacks



- Vulnerable to periodicities
- Dependence on a previous and next unit

When to use

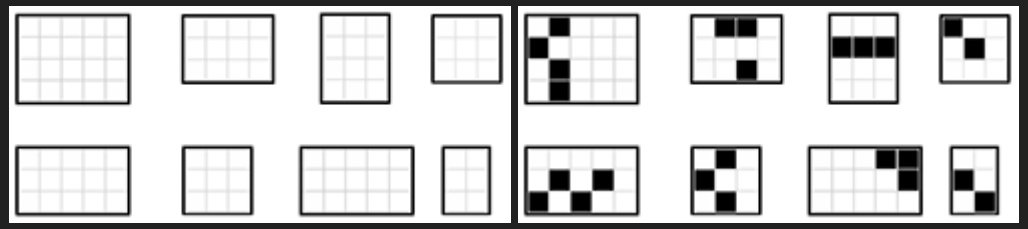
- Given population are of the same type - aka a **homogeneous population**
- Sample units are uniformly distributed over a population

Example

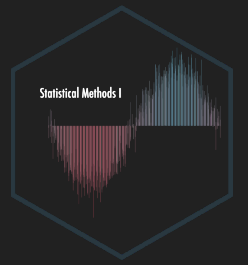
- Population: 81 healthcare institutions in a county that perform surgery
- What to do
  - Create a list of all healthcare institutions in the county that perform surgery
  - Number them 1, 2, . . . , N where N is the total number of healthcare institutions (So $N = 81$)
  - Use a random method to the first unit k (say $k = 3$)
  - Then choose every n unites afterwards (say $n = 5$)

Stratified Random Sampling

- Population can be divided and subdivided into distinct *categories* - aka **strata**
- Then simple random sampling or systematic sampling is applied within each stratum

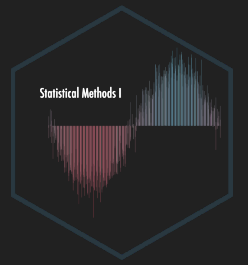


Benefits



- Reduced error and increases precision compared to SRS
- Reduced sampling error
- Less variability than an SRS

Drawbacks



- Can be expensive
- Stratifications must be implicitly defined

When to use

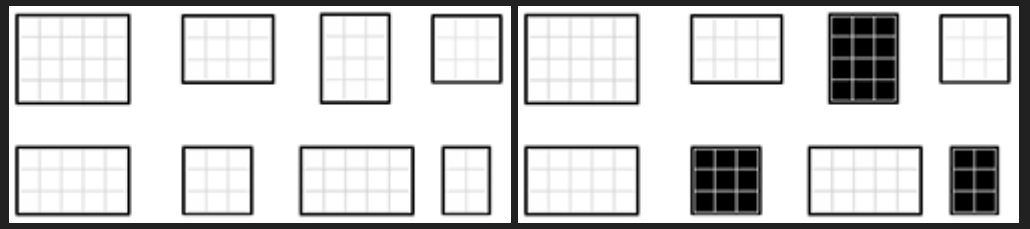
- Strata is mutually exclusive
- Strata are collectively exhaustive

Example

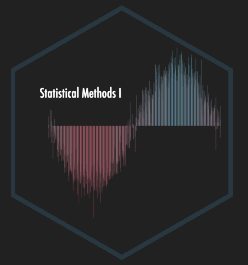
- Population: 81 healthcare institutions in a county that perform surgery
- What to do
  - Create a list of all healthcare institutions in the county that perform surgery.
  - Number them 1, 2, . . . , N where N is the total number of healthcare institutions (So $N = 81$)
  - Use a random method to the first unit k (say $k = 3$)
  - Divide them up into distinct M categories and use an SRS or systematic sampling method. (say $M = 8$ and $n = 24$)

Cluster Random Sampling

- Population can be divided and subdivided into distinct *groups* - aka **cluster**
- Then simple random sampling or systematic sampling is applied within each cluster

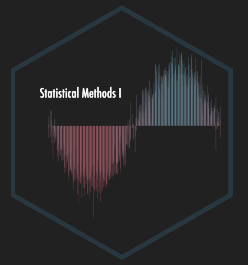


Benefits



- No need for a sampling frame
- Clusters can be stratified if necessary which results in increased precision
- Cost efficient since clusters are housed close together

Drawbacks



- Requires a larger sample size than SRS
- May not represent diversity within a populous
- May have high error due to sampling

When to use

- Clusters are mutually exclusive
- Clusters are collectively exhaustive
- Census can be administered on all selected clusters
- You do not have a full sampling frame

Example

- Population: 81 healthcare institutions in a county that perform surgery
- What to do
  - Create a list of all healthcare institutions in the county that perform surgery
  - Number them 1, 2, . . . , N where N is the total number of healthcare institutions (So $N = 81$)
  - Use a random method to the first unit k (say $k = 3$)
  - Divide them up into distinct M groups and use a census on each. (say $M = 8$ and $n = 24$)

That's it for part I! Let's take a break before moving to part II