

Basic Sample Types

Basic Sample Types

- What are the basic sample types?
 - What are their characteristics?
 - How do we create them?
- What makes a sample
 - *be a random sample?*
 - *not be a random sample?*

A Population is ...

A Population is ...

- The *entire* group being studied

A Samples is ...

A Samples is ...

- A subset of the population

Samples are used to ...

Samples are used to ...

- Determine the participants for a survey or research study

Members of a Sample

Members of a Sample

- Are referred to as
 - Participants
 - Subjects
 - Experimental units
 - Units

Members of a Sample

- Are referred* to as
 - Participants
 - Subjects
 - Experimental units
 - Units

**Respondents or participants is used in reference to a survey.*

Population Size

Population Size

- Number of members of the population

Population Size

- Number of members of the population
- N represents the *population size*.

Sample Size

Sample Size

- Number of units in a sample

Sample Size

- Number of units in a sample
- n represents the *sample size*.

Sample Size

- Number of units in a sample
- n represents the *sample size*.
- $N > n$
The population size (N) is greater than the sample size (n).

What makes a sample "Good"?

What makes a sample "Good"?

- A "good" sample is a small version of the population.

Basic Sample Types

Basic Sample Types

- Simple Random Sample
- Stratified Sample
- Cluster Sample
- Two-Stage Sample
- Multi-Stage Sample
- Systematic Sample
- Convenience Sample

Basic Sample Types

- Simple Random Sample
- Stratified *Random* Sample
- Cluster Sample
- Two-Stage Sample
- Multi-Stage Sample
- Systematic Sample *with Random Start*
- Convenience Sample

For Simple Random Sampling, ...

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- All samples which can be created of any size are considered to be *equally likely*
- All units have *the same likelihood of being selected* as members of the sample
- All pairs of units have *the same likelihood of being selected* as members of the sample
- All groups of three units have *the same likelihood of being selected* as members of the sample
- and so on ...

How do we create a

Simple Random Sample?

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Simple Random Sample?

- Create a list of the units in the population
- Number the units in the list, starting with 1.
- Use a chance device, a random digits table, or a pseudo-random number generator to choose units from the list, one at a time, until you have as many as needed

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*The *list* is also known as a *sampling frame* or *frame*.

Sampling Frame ...

Sampling Frame ...

- Can be as simple as a list or
- May contain details about members of the population, if available

Examples of a

Sampling Frame

- Class list
- Registrar's database of students
- Database of courses offered at a university
- Database of faculty members at a university
- Database of parts used by Apple
- Database of items for sale on Amazon

How do we create a

Stratified Sample?

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Stratified Sample?

- Create a sampling frame
- Determine the characteristics to be preserved in the sample
- Separate the units of the sampling frame based on these characteristics to form the strata
- Take simple random sample from each stratum

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Stratified Sample?

- Create a sampling frame
- Determine the characteristics to be preserved in the sample
- Separate the units of the sampling frame based on these characteristics to form the strata*
- Take simple random sample from each stratum*

*Note: A stratum is a group based on a characteristic in the population. The plural for stratum is strata.

Examples of Strata

Examples of Strata

- Surveys request information such as
 - Gender
 - Age
 - Location - State, Region, Country
 - Ethnicity
 - Marital status
 - Level of Education
 - Income Level

Why use a
Stratified Sample?

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- To preserve characteristics from the population in the sample

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Why use a

Stratified Sample?

- To preserve characteristics from the population in the sample
- How do we do this?

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Why use a Stratified Sample?

- To preserve characteristics from the population in the sample
- How do we do this?
 - Use the same percentage of members of each stratum *in the sample*

*Note: A stratum is a group based on a characteristic in the population. The plural for stratum is strata.

How do we create a
Cluster Sample?

How do we create a

Cluster Sample?

- Take a simple random sample of clusters
- All units in the selected clusters become units in the sample

How do we create a

Cluster Sample?

- Take a simple random sample of clusters*
- All units in the selected clusters become units in the sample

*Note: Clusters are non-overlapping groups in a population.

Examples of Clusters

Examples of Clusters

- Course sections at FSU
- Groups of people on Buses
- Groups of people on Airplanes
- Groups of people on MBTA cars
- Groups of people sitting around Tables
- The group of students living in rooms off Hallways in a dormitory
- Regions in a country

Stratum vs. Cluster

Stratum vs. Cluster

- Clusters are *not* strata.
 - Clusters are non-overlapping groups in a population
 - Strata are formed based on *characteristics of members* in a population

Stratum vs. Cluster

- Clusters are *not* strata.
 - Clusters are non-overlapping groups in a population *not be based on characteristics*
 - Strata are formed based on *characteristics of members in a population*

Systematic Sample

Systematic Sample

- *Systematic?*

Systematic Sample

- Methodical
- Regimented
- Created using a *procedure* which involves "counting-off"

How do we create a

Systematic Sample?

How do we create a

Systematic Sample?

- Create an ordered list or line-up members of population
- take every k^{th} member of the population
 - starting with a random member of the list or lined-up members of the population between the 1st and the k^{th} members, inclusive

How do we create a

Systematic Sample?

- Create an ordered list or line-up members of population
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* k is known as the *count-off number*.

How do we determine the
Count-Off Number?

How do we determine the

Count-Off Number?

- Take greatest counting number which is *less than or equal to* the quotient of the population size (N) and the sample size (n)

$k =$ greatest counting number less than or equal to $\frac{N}{n}$

What is the
Random Start Number?

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Random Start Number?

- The random number between 1 and the k , inclusive, used to determine the first unit in a systematic sample

What is the

Random Start Number?

- The random number between 1 and the k^* , inclusive, used to determine the first unit in a systematic sample

**k is the count-off number.*

What is the

Random Start Number?

- The random number between 1 and the k^* , inclusive, used to determine the first unit in a systematic sample
- p represents the *random start number*

* k is the *count-off number*.

What is the

Random Start Number?

- The random number between 1 and the k^* , inclusive, used to determine the first unit in a systematic sample
- p represents the *random start number*
- $1 \leq p \leq k$

* k is the *count-off number*.

Steps for Creating a

Systematic Sampling

with a Known Population Size

Steps for Creating a

Systematic Sampling

with a Known Population Size

- **Determine population size, N**
- **Determine sample size, n**
- **Calculate the *count-off number, k***
- **Select the *random start number, p***
- ***Sample consists of p^{th} unit and every k^{th} unit after that until you have obtained n units from population***

Steps for Creating a

Systematic Sampling

with a Known Population Size

- **Determine population size, N**
- **Determine sample size, n**
- **Calculate the *count-off number, k***
- **Select the *random start number, p***
- ***Sample consists of p^{th} unit and every k^{th} unit after that until you have obtained n units from population***
- ***Sample consist of units numbered as***
 $p, p+k, p+2k, p+3k, p+4k, \dots, p+(n-1)k$

Simple Random Sampling



Population

Sample

Stratified Sampling



Population



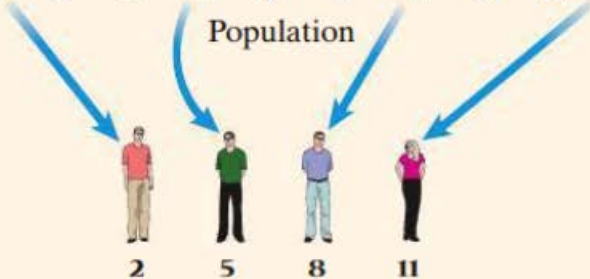
Strata

Sample

Systematic Sampling



Population

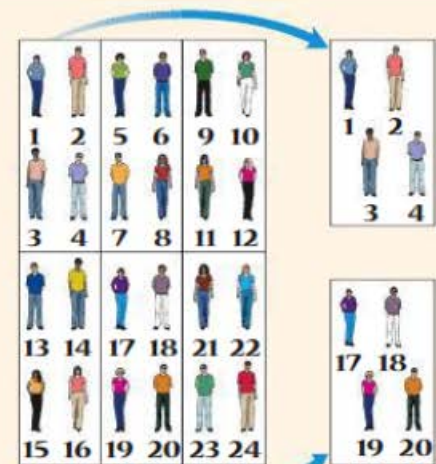


Sample (every 3rd person selected)

Cluster Sampling



Population



Cluster Population

Sample: Randomly Selected Clusters

How do we create a

Two-Stage Sample?

How do we create a

Two-Stage Sample?

- Take a cluster sample

followed by

- A simple random sample
from each cluster

How do we create a

Two-Stage Sample?

- Take a cluster sample [Stage 1]

followed by

- A simple random sample
from each cluster [Stage 2]

Cluster Sample vs. Two-Stage Sample

Cluster Sample vs. Two-Stage Sample

- For a cluster sample,
 - All units in the selected clusters become members of the sample
- For a two-stage sample
 - Only the units obtained via the simple random samples taken from the selected clusters become members of the sample

Cluster Sample vs. Two-Stage Sample

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 - All units in the selected clusters become members of the sample
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Multistage Sample

- An extension of two-stage sample

General Example of a
Multistage Sample
to Create a Sample of Students

General Example of a
Multistage Sample
to Create a Sample of Students

- **General example**
 - **Stratified Sample** to select regions
 - **Stratified Sample** from each region to select schools
 - **Cluster Sample** to select classes at each school
 - **Simple Random Sample** to select students in each selected class

Example of a
Multistage Sample
for a Cookie Study

Example of a

Multistage Sample

for a Cookie Study

- *Stratified Sample* of store types
- *Stratified sample* of regions
- *Simple Random sample* of stores in the selected regions
- *Simple Random Sample* of bags of cookies from each selected store
- *Simple Random Sample* of cookies from each bag

How do we create a

Convenience Sample?

- Take as units for the sample anyone who is available or willing to participate

Convenience Sample

Convenience Sample

- Worst type of sample!

Convenience Sample

- Worst type of sample!
- Not representative of the population in any way

Convenience Sample

- Worst type of sample!
- Not representative of the population in any way
- Research based on data obtained from a convenience sample is of no value and cannot be used to draw meaningful conclusions about a population

Summary of Sampling Methods

- **Simple Random Sample** - characterized by random selection of units (from a frame)
- **Stratified Random Sample** - preserves characteristics from the population into the sample; simple random sample from each stratum
- **Cluster Sample** - simple random sample of clusters within the population

Summary of Sampling Methods

- **Two-Stage Sample** - simple random sample of clusters in the population followed by a simple random sample from each selected cluster
- **Multi-Stage Sample** - multiple samples (beyond two) applied in sequence
- **Systematic Sample** - characterized by "counting-off"
- **Convenience Sample** - taking as units of the sample anyone willing to participate

Summary of Sampling Methods

- **Random Samples**
 - Simple Random Sample
 - Stratified Sample
 - Cluster Sample
 - Two-Stage Sample
- **Not Random Samples**
 - Systematic Sample
 - Convenience Sample