

Chapter 9 Section 2

MA1020 Quantitative Literacy

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Sample Survey Design

- Independent Sampling
- Systematic Sampling
- Quota Sampling
- Stratified Sampling
- Cluster Sampling

Independent Sampling

Definition

In **independent sampling**, each member of the population has the same *fixed chance* of being selected.

- Customer example
- 50% independent sample

Example

Find a 20% independent sample of the letters of the alphabet ($A = 1, B = 2, \dots, Z = 26$).

Systematic Sampling

Definition

In **systematic sampling**, we decide ahead of time what proportion of the population we wish to sample.

- 1-in-10 systematic sample
- 1-in-k systematic sample

Example

Pick a sample of letters of the alphabet using 1-in-3 systematic sampling.

Quota Sampling

Definition

Quota sampling forces the sample to be representative for known important variables by requiring that quotas are filled for respondents in various categories.

Example

In 2002, approximately 288,369,000 people were living in the US. The following table contains population information listed by race. if you plan to construct a quota sample of size 5000 such that the percentages of each race in the sample is the same as the percentages in the general population, then how many people of each race should you include in the sample?

| Race | Population |
|--------------------------------------|-------------|
| African American | 36,746,000 |
| American Indian and Alaska Native | 2,752,000 |
| Asian | 11,559,000 |
| Caucasian | 232,647,000 |
| Native Hawaiian and Pacific Islander | 484,000 |
| Two or more races | 4,181,000 |

Stratified Sampling

Definition

In **stratified sampling**, the population is subdivided into two or more nonoverlapping subsets, each of which is called a **stratum**. A **stratified random sample** is obtained by selecting a simple random sample from each stratum.

Example

An obstetrician has 156 expectant patients. Of the obstetrician's patient 75 are expecting their first child, 54 their second, and 27 their third. The doctor would like to take a stratified random sample of 25 of her patients to ask their opinion about a new type of pain relief drug available to women in labor.

- 1 Identify the strata in this sample and comment on the likelihood that members of each stratum will have opinions that are more homogeneous than the general population.
- 2 The doctor wants the proportion of each stratum in the sample to be the same as in the population. How many patients should be selected from each stratum?
- 3 Number the patients who are expecting their first child from 1 to 75, and the other patients similarly. Select the samples.

Cluster Sampling

- clusters/sampling units
- frame
- sample

Definition

In **cluster sampling**, a simple random sample determines the clusters to be included in the sample.

Example

As part of a research project, you will investigate how many chocolate chips are in Moonbeam Chocolate Chip Cookies. The nearby convenience store has 30 packages of these cookies, and each package contains 12 cookies. You will examine a total of 72 cookies. Use cluster sampling to select the sample.

- 1 Identify the clusters and determine how many sampling units will be selected.
- 2 Number the packages 1 to 30. Which packages are selected in the sample?

Summary

| Type of Sample | Description | Fixed Sample Size? |
|--------------------------|---|-------------------------------------|
| Simple random sample | Draw a sample of a given size from the entire population using a predetermined random method—similar to “drawing names from a hat.” | Yes |
| Independent sample | Select a sample so that each member of the population has the same predetermined chance of being selected. | No |
| 1-in-k systematic sample | Order the population into groups of size k and then select the member in the same position of each group. | Yes, if population size is known |
| Quota sample | Establish quotas so the sample models the population on one or more important characteristic. | Yes |
| Stratified random sample | Divide population into strata based on some characteristic and take a simple random sample of each stratum | Yes |
| Cluster sample | Divide population into clusters, select a sample of clusters, and measure all members of those clusters. | Depends on makeup of sampling units |