## Section 1.2 Random Samples

Objective: In this lesson you learned the importance of random samples, how to construct and simulate random samples, and describe types of sampling.

| **Important Vocabulary** | | |
|---|---|---|
| Simple Random Sample | Simulation | Stratified Sampling |
| Systematic Sampling | Cluster Sampling | Convenience Sampling |

### I. Simple Random Samples

Focus Points:
- Explain the importance of random samples
- Construct a simple random sample using random numbers
- Simulate a random process

A **simple random sample** of $n$ measurements: from a population is a subset of the population selected in such a manner that every sample of size $n$, has an equal chance of being selected.

Important features of a simple random sample are:

- Every sample of specified size $n$ from the population has an equal chance of being selected.
- No researcher bias occurs in the items selected for the sample
- A random sample may not always reflect the diversity of the population

An easy way to select random numbers is to use a(n) random-number table.

The term random should not be confused with haphazard!

How to draw a random sample:

1. Number all members of the population sequentially (meaning in order; i.e. 1, 2, 3, ...)
2. Use a table, calculator, or computer to select random numbers from the numbers assigned to the population members.
3. Create the sample by using population members with numbers corresponding to those randomly selected

Another important use of random-numbers is in simulation. The word simulation refers to: the process of providing numerical imitations of "real" phenomena.

**A simulation:** is a numerical facsimile (representation) of a real-world phenomenon.

Sampling with replacement means: although an item is selected for the sample, it is not removed from the population.

## II. Other Sampling Techniques

**Stratified sampling:**

Divide the entire population into distinct subgroups (strata). Draw random samples from each stratum.

Focus Point:

- Describe stratified sampling, cluster sampling, systematic sampling, and convenience sampling

**Systematic sampling:**

Number all members of the population sequentially. Then from a random starting point, include every $k^{th}$ member of the population in the sample.

The advantage of a systematic sample is that it is easy to get. However, one danger in using systematic sampling is: when the population is repetitive or cyclic in nature.

**Cluster sampling:**

Divide the entire population into pre-existing segments or clusters. make a random selection of clusters. Include every member of each selected cluster in the sample.

Cluster sampling is primarily used by:

government agencies and certain private research organizations

**Convenience sampling:**

Create a sample by using data from population members that are readily available.

In some cases, this may be all that is available, and in many cases, it is better than no information at all. However, convenience sampling does run the risk of being severely biased. It is good advice to be very cautious when the data come from the method of convenience sampling.

III. **Critical Thinking**

Define the following terms:

1. Sampling Frame – a list of individuals from which a sample is actually selected.

2. Undercoverage – results from omitting population members from the sample frame.

3. Sampling Error – the difference between measurements from a sample and corresponding measurements from the respective population. Caused when sample does not perfectly represent the population

4. Nonsampling Error – the result of poor sampling design, sloppy data collection, faulty measuring instruments, bias in questionnaires, and so on.

## Section 1.2 Examples – Random Samples

( 1 ) Is open space around metropolitan areas important? Players of the Colorado Lottery might think so because some of the proceeds of the game go to fund open space and outdoor recreational space. To play the game, you pay one dollar and choose six different numbers from the group of numbers 1 through 42. If your group of six numbers matches the winning group of six numbers selected by simple random sampling, then you are a winner of a grand prize of at least 1.5 million dollars.

a. Is the number 25 as likely to be selected in the winning group of six numbers as the number 5?

Yes, because the winning numbers constitute a simple random sample.

b. Could all the winning numbers be even?

Yes, since 6 even numbers is one of the possible groups of numbers.

c. Your friend always plays the numbers 1 2 3 4 5 6. Could she ever win?

yes, the listed group is equally as likely as any of the 5,245,786 possible groups.

( 2 ) Use a random-number table to simulate the outcome of tossing a balanced (that is, fair) penny 10 times.

a. How many outcomes are possible when you toss a coin once?

Two Heads Tails.

b. There are several ways to assign numbers to the two outcomes. Because we assume a fair coin, assign an even digit to the outcome heads and an odd digit to the outcome tails. Then starting at block 3 of row 2 of Table 1 in Appendix II, list the first 10 digits.

7 1 5 4 9 4 4 8 4 3

c. What are the outcomes associated with the 10 digits?

T T T H T H H H H T

d. If you start in a different block and row of Table 1 in Appendix II, will you get the same sequence of outcomes?

it is possible, but not very likely.