Statistics

Lecture 03: |Sample of Convenience and Sampling Variation

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Sample of convenience

- In some cases, it is **difficult or impossible** to draw a sample in a truly random way.
- In these cases, the best one can do is to sample items by some convenient method. For example, imagine that a **construction engineer** has just received a shipment of **1000 concrete blocks**, each weighing approximately **50 pounds**. The blocks have been **delivered in a large pile**.
- The engineer wishes to **investigate** the **crushing strength** of the blocks by measuring the strengths in a sample of 10 blocks

Sample of convenience

- To **draw a simple random sample** would require **removing blocks** from the center and bottom of the pile, which might be quite difficult.
- For this reason, the engineer might construct a sample **simply by taking 10 blocks off the top of the pile**.
- A sample like this is called a **sample of convenience**
- A **sample of convenience** is a sample that is obtained in some convenient way, and not drawn by a well-defined random method

Sampling Variation

- **Simple random samples** always **differ** from their populations in some ways, and occasionally may be substantially different.
- Two different samples from the same population will differ from each other as well.
- This phenomenon is known as **sampling variation**. Sampling variation is one of the reasons that scientific experiments produce somewhat different results when repeated, even when the conditions appear to be identical

Sampling Variation

- A **quality inspector draws a simple random sample of 40 bolts** from a large shipment and measures the length of each. He finds that 34 of them, or 85%, meet a length specification. **He concludes that exactly 85% of the bolts** in the shipment meet the specification.
- The **inspector’s supervisor** concludes that the proportion of good bolts is **likely to be close to, but not exactly** equal to, 85%. Which conclusion is appropriate?

Sampling Variation

- Because of **sampling variation**, simple random samples don’t reflect the population perfectly.
- They are **often fairly close**, however. It is therefore appropriate to infer that the proportion of good bolts in the lot is likely to be close to the sample proportion, which is 85%.
- It is not likely that the population proportion is equal to 85%, however

Sampling Variation

- Another inspector **repeats the study** with a different simple random sample of 40 bolts. She finds that **36 of them, or 90%,** are good. The first inspector claims that she must have done something wrong, since his results showed that 85%, not 90%, of bolts are good. Is he right?

Sampling Variation

- Another inspector **repeats the study** with a different simple random sample of 40 bolts. She finds that **36 of them, or 90%,** are good. The first inspector claims that she must have done something wrong, since his results showed that 85%, not 90%, of bolts are good. Is he right?
- No, he is not right. This is **sampling variation at work**. Two different samples from the same population will differ from each other and from the population

Why is it important that sampling be done at random?

- Since simple random samples don’t reflect their populations perfectly, why is it important that sampling be done at random?
- The differences between the sample and its population are due entirely to random variation.
- Since the **mathematical theory of random variation** is well understood, we can use mathematical models to study the relationship between simple random samples and their populations.
- For a **sample not chosen at random**, there is generally **no theory available to describe the mechanisms** that caused the sample to differ from its population. Therefore, **nonrandom samples are often difficult to analyze reliably**.