Chapter 7: Notes

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Section 7.1

Sampling Error

Sampling error is the error resulting from using a sample to estimate a population characteristic.

Sampling Distribution of the Sample Mean

For a variable x and a given sample size, the distribution of the variable $\bar{x}$ is called the sampling distribution of the sample mean. The sampling distribution of the sample mean is the distribution of all possible sample means for the samples of a given size.

Sample Size and Sampling Error

The larger the sample size, the smaller the sampling error tends to be in estimating a population mean, μ, by a sample mean. $\bar{x}$. The possible sample means cluster more closely around the population mean as the sample size increases.

Section 7.2

Mean of the Sample Mean

For samples of size n, the mean of the variable $\bar{x}$ equals the mean of the variable under consideration. In symbols,

$$\mu_{\bar{x}} = \mu$$

For any sample size, the mean of all possible samples equals the population mean.

Standard Deviation of the Sample Mean

For samples of size n, the standard deviation of the variable $\bar{x}$ equals the standard deviation of the variable under consideration divided by the square roots of the sample size. In symbols,

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

For each sample size, the standard deviation of all possible sample means equals the standard deviation divided bu the square root of the sample size.

Note:

In the formula for the standard deviation of $\bar{x}$, the sample size, n appears in the denominator. this explains mathematically why the standard deviation of $\bar{x}$ decreases as the sample size increases.

Section 7.3

Sampling Distribution of the Sample Mean for a Normally Distributed Variable

For a normally distributed variables, the possible sample means for samples of given size are also normally distributed. Suppose that a variable x of a population is normally distributed with mean μ and standard deviation σ. Then, for samples of size n, the variable $\bar{x}$ is also normally distributed and has mean μ and standard deviation $\sigma/sqrtn$.

The Central Limit Theorem (CLT)

For a relatively large sample size, the variable $\bar{x}$ is approximately normally distributed, regardless of the distribution of the variable under consideration. The approximation becomes better with increasing sample size.

Sampling Distribution of the Sample Mean

Suppose that a variable x of a population has mean μ and standard deviation σ. Then, for samples of size n.

- the mean of $\bar{x}$ equals the population mean, or $\mu_{\bar{x}} = \mu$;
- the standard deviation of $\bar{x}$ equals the population standard deviation divided by the square roo of the sample size, or $\sigma_{barx} = \frac{\sigma}{\sqrt{n}}$;
- if x is normally distributed, so is $\bar{x}$, regardless of sample size; and
- if the sample size large, $\bar{x}$ is approximately normally distributed, regardless of the distribution of x.

If a variable is normally distributed or the sample size large, then the possible sample means have, at least approximately, a normal distribution with mean μ and standard deviation $\sigma/sqrtn$.