Chapter 7: Sampling Distributions

(REQUIRED NOTES) Section 7.3: Sampling Distributions for Means

1) What are sample means? How do they differ from sample proportions? Give examples.
   - ***Sample proportions*** *arise most often when we are interested in* ***categorical variables****.* ***They are percents*** *(i.e. %males, %red M&M's, etc.)*
   - ***Sample means*** *are based on* ***quantitative variables****.* ***They are averages*** *(i.e. average age, average household income, etc.)*

2) Define the sampling distribution of a sample mean.
   - *A* ***sampling distribution of sample means*** *is a theoretical distribution of the values that the mean of a sample takes on in* ***all of the possible samples of a specific size*** *that can be made from a given population.*
   - *Said another way…* Suppose that we draw all possible samples of size *n* from a given population. Suppose further that we compute a statistic (e.g., a mean, proportion, standard deviation) for each sample. The probability distribution of this statistic is called a ***sampling distribution***.

3) The mean and standard deviation of a population are parameters.
   - What symbols are used to represent these parameters?
     - μ =*mean*
     - σ =*standard deviation*

4) The mean and standard deviation of a sample are statistics.
   - What symbols are used to represent these statistics?
     - $\bar{x}$ =*mean*
     - ***s or s_x=standard deviation***

5) What is the mean of the sampling distribution of $\bar{x}$, if $\bar{x}$ is the mean of an SRS of size n drawn from a large population with mean μ and standard deviation σ? No conditions for this formula.

The **mean** of the sampling distribution of $\bar{x}$ is $\mu_{\bar{x}} = \mu$

6) What is the standard deviation of the sampling distribution of $\bar{x}$, if $\bar{x}$ is the mean of an SRS of size n drawn from a large population with mean μ and standard deviation σ? Describe the condition for this formula.

The standard deviation of the sampling distribution of $\bar{x}$ is

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

as long as the *10% condition* is satisfied: $n \leq (1/10)N$.

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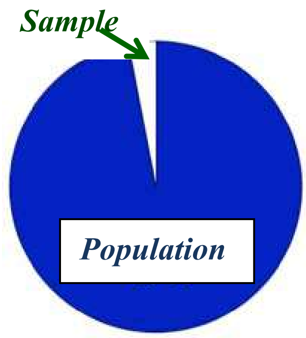
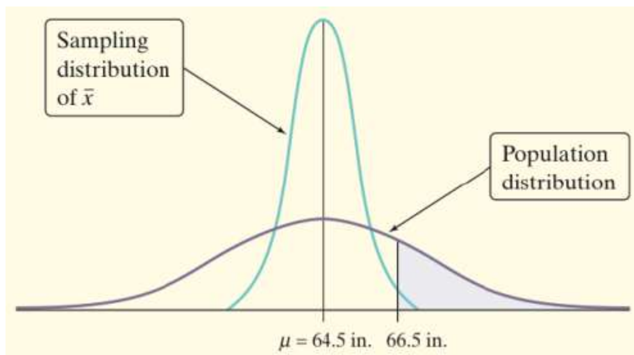


7) What is the 10% condition? When do you use it?
- *The 10% condition states that sample sizes should be **no more than 10% of the population**.*
- *This condition ensures independence whenever samples are draw without replacement.*
- *Check the 10% condition when you calculate standard deviations.*

8) The shape of the distribution of the sample mean depends on …
- *The **sampling distribution is approximately normal** if you are told the **population is normal**.*
- *The **sampling distribution is approximately normal** if you the **sample size is sufficiently large** based on the Central Limit Theorem. We use a rule of thumb **$n \geq 30$**.*

9) Because averages (from a sampling distribution) are less variable than individual outcomes(selecting an individual from the population),



- *The diagram compare the population distribution N(64.5,2.5); and the sampling distribution of sample means which is also normal with the same mean (64.5) but a much smaller standard deviation (about 1)*
- ***You can see the variability of average is much smaller**. The fact that averages of several observations are less variable than individual observations is important concept!*
- *EXAMPLE: It is a common practice to repeat measurements several times when working with, for example wood; and then average your measurements. This will have less variability than a single measurement. Think of the results of repeated measures as an SRS from a population. This average has less variability.*

   a. What is true about the standard deviation of the sampling distribution of $\bar{x}$?
      - o *The standard deviation of a **sampling distribution** is **much smaller** than the standard deviation of the **population**.*

   - How does the probability from a sampling distribution differ the probability of selecting an individual from the population?
      - o *The probability of selecting **1 individual** from the **population** will be much smaller the probability from a **sampling distribution**. As you can see by the tails in the diagram above.*

10) What is the Central Limit Theorem?
- *The Central Limit Theorem(**CLT**) states that given a distribution with a mean μ and variance σ^2, the sampling distribution of the mean **approaches a normal distribution** with a mean (μ) and a variance σ^2/N as N, the **sample size, increases**.*

11) What are the 2 conditions to check for a normal distribution for sample means?
- *Independence condition must be check*
- *Normal condition must be checked.*