# Chapter 7: Sampling Distributions

(REQUIRED NOTES) <u>*Section 7.3: Sampling Distributions for Means*</u>

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

2) Define the sampling distribution of a sample mean.
   - *A* ***<u>sampling distribution of sample means</u>*** *is a theoretical distribution of the values that the mean of a sample takes on in* ***<u>all of the possible samples</u>*** ***<u>of a specific size</u>*** *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 ***<u>sampling distribution</u>***.

3) The mean and standard deviation of a population are parameters.
   - What symbols are used to represent these parameters?
     - $\mu$ =*mean*
     - $\sigma$ =*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 <u>mean</u> 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 <u>standard deviation</u> 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* ≤ (1/10)*N*.**

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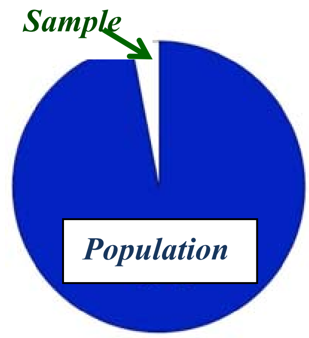
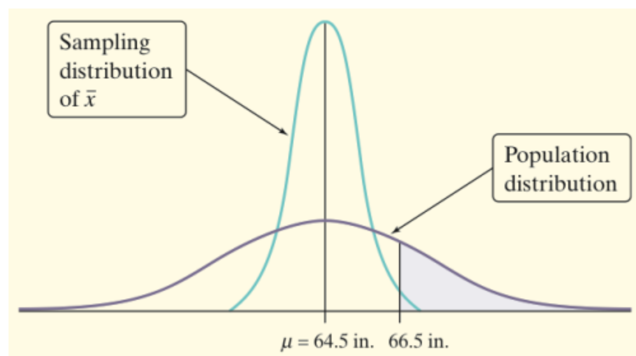



7) What is the 10% condition? When do you use it?
- *The 10% condition states that sample sizes should be* ***no more than 10% of the population****.*
- *This condition ensures independence whenever samples are draw without replacement.*
- *Check the 10% condition when you calculate standard deviations.*

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 ≥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 $\bar{x}$ ?
      - *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?
      - *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 σ², the sampling distribution of the mean* ***approaches a normal distribution*** *with a mean (μ) and a variance σ²/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.*