

15 - Sampling distributions

On a scale of 1-10, how much do you like pineapple on pizza?

Our news channel surveyed **one** people. Here are the results:



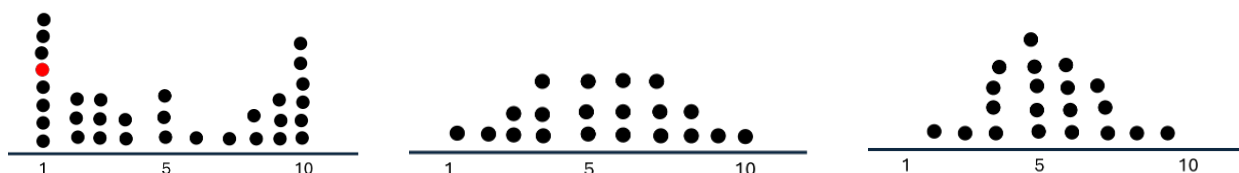
Our news channel surveyed **three** people. Here's their average:



Our news channel surveyed **five** people. Here's their average:



Moral: Average of a large SRS is often closer to the .



Moral 2: The distribution of average of samples of size n approaches as $n \rightarrow \infty$.

This distribution is called the **sampling distribution** of \bar{x} of size n .

10% Condition. We sample without replacement via SRS. If the population size N is at least times the sample size n , then sampling without replacement is approximately like .

Facts about sampling distribution of \bar{x} :

Suppose \bar{x} is the mean of an SRS of size n drawn from a population with mean μ and standard deviation σ . Then this sampling distribution of \bar{x} has:

- Mean
- Standard deviation if the 10% condition holds.
- Normal if the population distribution is normal.
- Approximately Normal if the population distribution is and .
(Central Limit Theorem)

Example 1. Studies find the minimum sulfur compound DMS odor threshold of adults follows a distribution with pop. mean 25 mg./L and pop. sd 7 mg/L. We take an SRS of 10 adults and determine the mean odor threshold \bar{x} for the individuals in the sample.

(a) What is the mean of the sampling distribution of \bar{x} ?

(b) What is the standard deviation of the sampling distribution of \bar{x} ?

Example 2. The height of young women follows a Normal distribution with mean $\mu = 64.5$ inches and standard deviation $\sigma = 2.5$ inches.

(a) Probability a randomly selected young woman is taller than 66.5 inches:

(b) Probability the mean height of an SRS of 10 young women exceeds 66.5 inches:

Example 3. Your company has a contract to perform maintenance on thousands of air-conditioning units. Based on service records from the past year, the time (in hours) that a technician requires to complete the work follows a strongly right-skewed distribution with $\mu = 1$ hour and $\sigma = 1$ hour. This week, your company will service an SRS of 70 AC units in the city. You plan to budget an average of 1.1 hours per unit for a technician to complete the work. Will this be enough? Find the probability the average maintenance time for 70 units exceeds 1.1 hours.

Facts about sampling distribution of proportion \hat{p} :

Choose an SRS of size n from a population of size N with proportion p of successes. Let \hat{p} be the sample proportion of successes. Then this sampling distribution of has:

- Mean
- Standard deviation if the 10% condition holds.
- Approximately Normal if the Large Counts Condition is satisfied:

Example 4. A poll finds: of an SRS of 1500 first-year college students, 35% of all first-year students attend college within 50 miles of home. Find the probability that the random sample of 1500 students will give a result within 2% of the true value.