LEARNING AS ONE NATION

Expanded Project

Stat & Prob_20

SHS LEARNING ACTIVITY

Name: _____ **Score/Mark:** _____

Grade and Section: _____ **Date:** _____

Strand: ☐ STEM ☐ ABM ☐ HUMSS ☐ ICT (*TVL Track*)

Subject: ***Statistics & Probability***

Type of Activity: ☐ Concept Notes ☐ Skills: Exercise/Drill ☐ Illustration ☐ Performance Task ☐ Essay/Report ☐ Others: _____

Activity Title: Sampling Distribution of Large Sample Size (n ≥ 30)

Learning Target: To define the sampling distribution of the sample mean when the sample size is large.

References: *(Author, Title, Pages)*
1) Belecina, R.R., et al. "Statistics and Probability" 1st Ed., pp. 110-135;
2) L.A Sajulga, CVIF Learning Activities

As stated by the Central Limit Theorem, a large sample size $(\boldsymbol{n \geq 30})$ taken from a population with mean μ and standard deviation σ has a sampling distribution of the sample mean $\bar{X}$ that approaches normal distribution. Therefore, we can standardize $\bar{X}$ using the defining equation:

$$\boxed{Z = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}} \quad .}$$

Note that the formula above is applicable when the population variance is known or unknown given that the sample size is large $(n \geq 30)$**.** If the population variance is unknown, then the sample standard deviation s can be used to replace σ.

On the other hand, if $n < 30$, the formula will still apply if we know that the population follows a normal distribution and the population variance is known.

Example: An electrical company manufactures LED light bulbs with a normally distributed life span, where mean $\mu = 900$ hours and $\sigma = 42$ hours. Determine the probability that if we take a random sample of 18 bulbs, the average life is less than 884 hours.

Solution: From the problem, $\mu = 900$, $\sigma = 42$, $n = 18$, and $\bar{x} = 884$. Though $n < 30$, we are given the population variance and told that the population is normally distributed. So,

$$P(X < 884) = P\left(Z < \frac{\bar{x}-\mu}{\sigma/\sqrt{n}}\right) = P\left(Z < \frac{884-900}{42/\sqrt{18}}\right) = P(Z < -1.62) = \boxed{0.0526}$$

Exercises:

A. Assume that a population is normally distributed; compute the z-value for each.
   a) $\mu = 100$, $\sigma = 2$, $n = 80$, and $\bar{x} = 100.5$
   b) $\mu = 46$, $\sigma^2 = 4$, $n = 20$, and $\bar{x} = 45.5$

B. Suppose at a research lab of the US National Aeronautics and Space Administration (NASA), the average time it takes for software developers to debug a program is 11.4 mins. If 60 randomly selected bug cases have a standard deviation of s = 5 mins, what is the probability that the mean is between 12.5 and 15 mins?