**CBA: Practice Problem Set 2**

**Topics: Sampling Distributions and Central Limit Theorem**

1. Examine the following normal Quantile plots carefully. Which of these plots indicates that the data …
2. Are nearly normal?

ANS: C

1. Have a bimodal distribution? (One way to recognize a bimodal shape is a “gap” in the spacing of adjacent data values.)

ANS: D

1. Are skewed (i.e. not symmetric) ?

ANS : A

1. Have outliers on both sides of the center?

ANS: B



1. For each of the following statements, indicate whether it is True/False. If false, explain why.

The manager of a warehouse monitors the volume of shipments made by the delivery team. The automated tracking system tracks every package as it moves through the facility. A sample of 25 packages is selected and weighed every day. Based on current contracts with customers, the weights should have *μ* = 22 lbs. and *σ* = 5 lbs.

1. Before using a normal model for the sampling distribution of the average package weights, the manager must confirm that weights of individual packages are normally distributed.

ANS: False The normal model for the sampling distribution of the average package weights assumes that the individual weights are normally distributed, so it is not necessary to confirm this before using the model.

1. The standard error of the daily average SE() = 1.

ANS: False. The standard error of the daily average is not necessarily 1. The standard error is a measure of the variability of the sampling distribution of the mean and is calculated as the standard deviation of the individual weights (σ) divided by the square root of the sample size (n), or SE(𝑥̅) = σ/√n. In this case, the standard error would be calculated as SE(𝑥̅) = 5 lbs./√25 = 1 lbs.

1. Auditors at a small community bank randomly sample 100 withdrawal transactions made during the week at an ATM machine located near the bank’s main branch. Over the past 2 years, the average withdrawal amount has been $50 with a standard deviation of $40. Since audit investigations are typically expensive, the auditors decide to not initiate further investigations if the mean transaction amount of the sample is between $45 and $55. What is the probability that in any given week, there will be an investigation?
2. 1.25%
3. 2.5%
4. 10.55%
5. **21.1%**
6. 50%

ANS: z = (x - μ)/SE(𝑥̅)

For x = $45, this gives us z = (45 - 50)/4 = -1.25 For x = $55, this gives us z = (55 - 50)/4 = 1.25

We can use a standard normal table to find the probability that a z-score falls between -1.25 and 1.25. The probability is the area under the curve between these two values, which is approximately 0.21 or 21%.

Therefore, the probability that in any given week, there will be an investigation is approximately 21%, which corresponds to answer choice D

1. The auditors from the above example would like to maintain the probability of investigation to 5%. Which of the following represents the minimum number transactions that they should sample if they do not want to change the thresholds of 45 and 55? Assume that the sample statistics remain unchanged.
2. 144
3. 150
4. 196
5. 250
6. Not enough information

We can use the z-score formula to convert these values to standard units:

z = (x - μ)/SE(𝑥̅)

For x = $45, this gives us z = (45 - 50)/SE(𝑥̅) = -5/SE(𝑥̅) For x = $55, this gives us z = (55 - 50)/SE(𝑥̅) = 5/SE(𝑥̅)

The area under the curve between -5 and 5 is approximately 0.05, so we want to find the value of SE(𝑥̅) that gives us this area.

We can use the standard normal table to find the value of SE(𝑥̅) that corresponds to an area under the curve of 0.05. The table shows that the area under the curve between -1.64 and 1.64 is approximately 0.05. Since the z-scores for x = $45 and x = $55 are -5 and 5, respectively, we can set the z-score equal to 1.64 and solve for SE(𝑥̅):

1.64 = 5/SE(𝑥̅) SE(𝑥̅) = 5/1.64 = 3.05

To find the minimum sample size that would give us this standard error, we can use the formula for standard error:

SE(𝑥̅) = σ/√n

Solving for n, we get:

n = (σ/SE(𝑥̅))^2

Substituting the values for σ and SE(𝑥̅), we get:

n = ($40/3.05)^2 = 150.07

Therefore, the minimum sample size that would give us a probability of investigation of approximately 5% is 150, which corresponds to answer choice B.

1. An educational startup that helps MBA aspirants write their essays is targeting individuals who have taken GMAT in 2012 and have expressed interest in applying to FT top 20 b-schools. There are 40000 such individuals with an average GMAT score of 720 and a standard deviation of 120. The scores are distributed between 650 and 790 with a very long and thin tail towards the higher end resulting in substantial skewness. Which of the following is likely to be true for randomly chosen samples of aspirants?
2. The standard deviation of the scores within any sample will be 120.
3. The standard deviation of the mean of across several samples will be 120.
4. The mean score in any sample will be 720.
5. The average of the mean across several samples will be 720.
6. The standard deviation of the mean across several samples will be 0.60

ANS: (D) The average of the mean across several samples will be 720. True. If we take a large number of samples from the population and calculate the mean of each sample, the average of these sample means will approach the population mean as the number of samples increases. In this case, the population mean is 720, so the average of the sample means across several samples is likely to be close to 720.