**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?

**Plot C**

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

**Plot B and Plot D**

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

**Plot A, Plot B and Plot D**

1. Have outliers on both sides of the center?

**Plot A and Plot 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.

**False 🡪 The statement is not entirely accurate. The CLT allows to use a normal distribution of sample mean even if the weights of individual packages are not normally distributed as long as certain conditions are met. The CLT states that, for a sufficiently large sample size(n > 30), the sampling distribution will be almost normal as long as the population has finite mean and variance. Here, we have a sample size of 25. The manager can assume the sampling distribution of average package weights is almost normal even if the weights of individual packages are not normally distributed.**

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

**As SE(Standard Error) = sample standard deviation / Square root of (number of sample)**

**SE = 5 / (25)^1/2**

**SE = 1**

**The standard of error of the sample mean depends on population std\_dev and the sample size. Here, we have std\_dev = 5lbs and sample size(n) = 25. The standard error of the daily average is indeed 1lbs. So, the statement is True.**

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% **🡪 (Correct Answer)**
6. 50%

**t=(x-mean)/sigma/sqrt(n); t-test, because standard deviation is not given for the long term**

**=(45-50) or (55-50)/40/sqrt(100)  
=+/- 5/40/sqrt(100)  
=+/- 1.25  
The probability of z between those values is 0.7857, so probability of an investigation is 1-0.7887, or 0.214.**

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 **🡪 (Correct Answer)**
6. Not enough information

**value = (sample\_mean – pop\_mean)/(std\_dev/sqrt(n))   
1.96 = (5) \* (40/sqrt(n))**

**1.96 = 5 \* sqrt(n)/40  
((1.96 \* 40)/5) \* square = sqrt(n)**

**n = 245.8624**

**n = 246**

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.

**True 🡪 The average of the sample means across several samples should be close to the population mean i.e 720 assuming that the samples are selected randomly.**

1. The standard deviation of the mean across several samples will be 0.60