**Topics: Normal distribution, Functions of Random Variables**

1. The time required for servicing transmissions is normally distributed with *μ* = 45 minutes and *σ* = 8 minutes. The service manager plans to have work begin on the transmission of a customer’s car 10 minutes after the car is dropped off and the customer is told that the car will be ready within 1 hour from drop-off. What is the probability that the service manager cannot meet his commitment?
2. 0.3875
3. 0.2676 **🡪 (Correct Answer)**
4. 0.5
5. 0.6987
6. The current age (in years) of 400 clerical employees at an insurance claims processing center is normally distributed with mean *μ* = 38 and Standard deviation *σ* =6. For each statement below, please specify True/False. If false, briefly explain why.
7. More employees at the processing center are older than 44 than between 38 and 44. 🡪 **We need to compare the areas under distribution curve for these ranges i.e 38 and 44.**

**For X=38; X=38; mean=38; std\_dev=6;**

**Z = 38-38/6 = 0**

**For X=44; X=44; mean=38; std\_dev=6;**

**Z = 44-38/6 = 6/6 = 1**

**In a normal distribution majority of data falls around the mean. Here, the range is 38 to 44 whereas there are more employees older than 44 and does not comes in the given range.**

**Therefore, statement A is False.**

1. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees. 🡪 **We can calculate the Zscore for X=30**.

**For X=30; mean=38; std\_dev=6;**

**Z = 30-38/6 = -8/6 = -1.3333**

**The P(Z < −1.3333) is approx 0.0912.**

**So, the expected number of employees under the age of 30 is 0.0912 \* 400 = 36.48 employees, which almost attract almost or more than 36 employees. Therefore, statement B is True if we consider the output as 36 & False if we consider the number after decimal.**

1. If *X1* ~ *N*(μ, σ2) and *X*2 ~ *N*(μ, σ2) are *iid* normal random variables, then what is the difference between 2 *X*1 and *X*1 + *X*2? Discuss both their distributions and parameters.

**The difference between 2X1 and X1 + X2 lies in their variance as they share the same mean. 2X1 has a variance four times of X1, while X1 + X2 has a variance two times of X1. They both have a normal distribution but they have different levels of variability due to which the variance combined when random variables are added or multiplied.**

1. Let X ~ N(100, 202). Find two values, *a* and *b*, symmetric about the mean, such that the probability of the random variable taking a value between them is 0.99.
2. 90.5, 105.9
3. 80.2, 119.8
4. 22, 78
5. 48.5, 151.5 🡪 **(Correct Answer)**
6. 90.1, 109.9
7. Consider a company that has two different divisions. The annual profits from the two divisions are independent and have distributions Profit1 ~ N(5, 32) and Profit2 ~ N(7, 42) respectively. Both the profits are in $ Million. Answer the following questions about the total profit of the company in Rupees. Assume that $1 = Rs. 45
8. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
9. Specify the 5th percentile of profit (in Rupees) for the company
10. Which of the two divisions has a larger probability of making a loss in a given year?

**Refer Jupyter Note Book**