**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
4. 0.5
5. 0.6987

**Ans: B) 0.2676**

1. 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.
2. More employees at the processing center are older than 44 than between 38 and 44.
3. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.
4. 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.

**Ans: From Central Limit Theorem,**

**We have some Rules:**

**-----------------------------------------------**

**X ~ N (M1, V1) and Y ~ N (M2, V2)**

**-SUM OF RANDOM VARIABLES: -**

**X + Y = N (M1 + M2, V1 + V2)**

**SUBTRACTION OF RANDOM VARIABLES: -**

**X - Y = N (M1 - M2, V1 + V2)**

**X1 ~ N (μ, σ2) and X2 ~ N (μ, σ2)**

**Let,**

**μ = 1**

**σ = 2**

**2X1 = X1 + X1 = N (1,4) + N (1,4) = N (2,8)**

**X1 + X2 = N (1,4) + N (1,4) = N (2,8)**

**FOR DIFFERENCE BETWEEN 2X1 AND X1+X2**

**2X1 - (X1+X2)**

**= N (2,8) - N (2,8)**

**= N (2-2, 8+8)**

**= N (0,16)**

**---> THE MEAN OF 2X1 AND (X1+X2) ARE SAME.**

**---> THE VARIANCE IS 2 TIMES MORE THAN THE VARIANCE OF EITHER 2X1 OR (X1+X2)**

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
6. 90.1, 109.9

**Ans: D) 48.5, 151.5**

1. 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
2. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
3. Specify the 5th percentile of profit (in Rupees) for the company
4. Which of the two divisions has a larger probability of making a loss in a given year?