**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.

Ans. A. False, as given distribution is normal with mean = 38 and standard deviation =6 we can consider it as symmetric distribution with 38 as the center of distribution so employees with the age 38 and greater would be 50% and as we know the Standard deviation is 6, employees with the age 38 to 44 would be 34.1% , hence employee with the age 44 and greater is (50-34.1) 15.9% which is less than the age group 38 to 44.

B. True

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.

Ans. i) 2 *X*1

Distribution: If *X*1 follows normal distribution 2 *X*1 will also follow normal distribution

Parameters: Mean: 2μ

Variance= 4σ2

ii) 2 *X*1

Distribution: If *X*1 and *X*2 follows normal distribution *X*1 + *X*2 will also follow normal distribution

Parameters: Mean: 2μ

Variance= 2σ2

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?

Ans. A. Rupee range with 95% probability: 99.008 to 980.992

B. 5th percentile of profit in Rupees: 169.9079339359186

1. Division with a larger probability of making a loss: Division 2