**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.

Ans: **FALSE**

Here, Probability of employees < 44 = P(x<44) = 0.8413 = 84.13 %

Probability of employees > 44 = P(x>44) = 0.1586 = 15.86 % ( 63 employees out of 400 )

Probability of employees > 38 = P(x>38) = 0.50 = 50 %

Probability of employee between 38 and 44 = P(x<44) – P(x>38)

= 84.13 – 0.5

= 0.3413 = 34.13 % ( 137 employees out of 400 )

Hence More employees at the processing center are older than 44 than between 38 and 44 is **FALSE.**

1. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.

Ans: **TRUE**

Probability of employees < 30 = P(x<30) = 0.0917 = 9.17 % ( 36 out of 400 )

Hence A training program for employees under the age of 30 at the center would be expected to attract about 36 employees is **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:

2 *X1* ~ *N*(2μ, 4σ2)

*X*1 + *X*2 ~ *N*((μ + μ), (σ2 + σ2))

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.

Ans: [ Rs. 99M, Rs. 981M ]

1. Specify the 5th percentile of profit (in Rupees) for the company

Ans: Rs. 170.1M

1. Which of the two divisions has a larger probability of making a loss in a given year?

Ans: for division 1 probability of loss = 4.77 % and for division 2 probability of loss = 4.00 %. So division 1 has a larger probability of making a loss in a given year.