**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,

Since P(X>44) = 0.159 & P(38<X<44) = 0.341, we can conclude that more number of employees at the processing center are between 38 and 44.

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 being under the age of 30 is, P(X<30) = 0.0912

Then the number of employees under the age of 30 among the 400 employees are

400\*P(X<30) = 400\*0.0912 = 36.48 .

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:** If *X1* ~ *N*(μ, σ2) and *X*2 ~ *N*(μ, σ2) are independent identically distributed random variables then,

* The sum of normal random variables is given by

*X1 + X*2 ~ N(μ+ μ, σ2+ σ2 )

*X1 + X*2 ~ N(2μ, 2σ2 )

* For the property of multiplication, we get

2*X*1  ~ N(2μ, 4σ2 )

* Then the difference between 2 *X*1 and *X*1 + *X*2  is,

2*X*1 – (*X1 + X*2 ) ~ N(2μ, 2σ2 ) - N(2μ, 4σ2 )

2*X*1 – (*X1 + X*2 ) ~ N(0,6σ2 )

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:**

Rupee ranges in between 99 to 980.99 millions, 95% of the time for the profit of the company.

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

**Ans:**

5th percentile of profit (in Rupees) for the company is 170.

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

**Ans:**

Division 1 has a larger probability of making loss of 0.04779.