**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 scannot meet his commitment?
2. 0.3875
3. 0.2676
4. 0.5
5. 0.6987

Ans: B

Service time = 60 – 10 mins = 50 mins

Mean = 45, standard deviation = 8

Probability that serviceman cannot fulfil the task = 1 – stats.norm.cdf(50,loc=45,scale=8)

= 0.26598

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. – False

No. of employees with age>44 =

(1-sc.norm.cdf(44,loc=38,scale=6))\*400 = 63

No. of employees with 38<Age<44 =

(sc.norm.cdf(44,loc=38,scale=6)-sc.norm.cdf(38,loc=38,scale=6))\*400 = 136

1. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees. - True
2. 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 *X*1 will have mean = 2 μ , and standard deviation = 2 σ

*X*1 + *X*2 will have mean = 2 μ, standard deviation =

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

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.

Range (in Rs) = 981 million – 99 million = 882 million

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

Z-score for 5th percentile = -1.645

X = 12 + (-1.645 x 5) = 3.775

Value in rupees = 3.775 x 45 = 169.875 million

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

Probability of loss from first division = sc.norm.cdf(0,loc=5,scale=3) = 4.7%

Probability of loss from second division = sc.norm.cdf(0,loc=7,scale=4) = 4.0%