**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) 1-stats.norm.cdf (50, loc=45, scale=8) = 0.2659

Where, Time remaining is 50 mins, Mean is 45 and Standard deviation is 8.

So, with help of python answer is 0.2676 option B

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

As it is normally distributed then most of the data will be near to the mean value only.

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

Ans) True

As, Z score comes near to 36 only.

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.

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) 99% Value which means 3sigma .

Here mean=100 and sigma=20 then 3sigma values = 100+60 and 100-60

Which means option D is right.

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

Ans) First calculating with both divisions as one:

Mean = 45(5+7) = 540 million rupees

Standard deviation = 45(under-root(9+16)) = 225 million rupees.

1. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.

Ans) 95% probability which means 2sigma distribution.

Value A = 540+(225\*2) = 990 Value B = 540-(225\*2) = 90

1. Specify the 5th percentile of profit (in Rupees) for the company
2. Which of the two divisions has a larger probability of making a loss in a given year?

Ans) With the help of python, the Z-Scores for profit of 0 are:

Division 1 = 0.0477 Division 2 = 0.4005

Form this we can conclude that Division 2 could make a loss.