**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

Z=(x-u)/ σ

Average times increases , so it becomes= x=45+10=55 and σ=8

probability that the service manager cannot meet his commitment= 1 – ((60-55)/8) =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:- Probability that the employee will be greater than age of 44 = 100-84.1345 =15.86%

So the probability of number of employees between 38.44 years of age = pr(X<44)-0.5=84.1345-0.5 = 34.1345%

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

Ans:- So number of employees with probability 0.912 of them being under age 30=0.0912\*400=36.48 (36)

Therefore the statement B of the question is also 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:- *X1* ~ *N*(μ, σ2) and *X*2 ~ *N*(μ, σ2) then,

1. *X*1 ~ N(2u, 4 σ2 )

*X*1 + *X*2 ~N (2u+2 σ2 )

( 2 *X*1 – (*X*1 + *X*2 )) = 2 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

Z\*σ + µ = XZ(-0.005)\*20+100 = (2.57)\*20+100 = 151.4

Z(0.005)\*20+100 = (-2.57)\*20+100 = 48.6

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?

Total Profit = profit1 + profit2

Mean = profit1(mean) + profit2(mean)

5+7 =12

Std = sqrt(9+16)

= Sqrt(25)

= 5

Mean in rs = 12\* 45= 540

Std in rs = 5\*45 = 225

1. Stats.norm.interval(0.95,540,225)

Range is rs (99.008, 980.991) in millions

1. From z score we need to find the value of 0.5000-0.050 = 0.4500

We are getting a value of -1.645

The 5th percentile of profit = mean + (-1.645)\*std

= 540-(1.645\*225)

= 540 – 370.125= 169.87 = 170 in millions

1. Probability of 1st division making loss = stast.norm.cdf(0,5,3) = 0.0479

Probability of 2nd division making loss = stast.norm.cdf(0,7,4) = 0.04005

We can see that 1st division can make more loss compared to 1st division.