**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:- Mean=45 & St. Deviation=8

Work will commence after 10mins so mean would be 45+10=55

Car will be ready within 1hr=60

So,60-55/8=0.62 , from the z value table=0.723

Probability of service manager can’t meet his commitment would be 1.

1-0.723= 0.267

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:- Mean=38 & St. Deviation=6

Probability of employees older then 44

(44,38,6)=1-0.841 = 0.158

Probability of employees b/w 38&44

(38,38,6)=0.5

0.841-0.5 = 0.341

As we can see probability of employees b/w 38&44 is more, so therefore this statement 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:-Mean=38 St. Deviation=6,x=30

Probability of employees under the age 30

(30,38,6)= 0.091

Total no of employees 400\*0.091 = 36.4,so therefore this statement 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.

1. Let X ~ N(100, 20 2). 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:- Mean=100 & std.deviation=20

Probability of random variable taking a value b/w them is 0.99

(0.99)= 2.32

2.32\*20+100=146.4

-2.32\*20+100=53.48

Hence D option would be the nearest value.

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:- annual profit=proft1 + profit2

Mean=profit1 (mean) +profit2(mean) = (5+7)=12

St. Deviation=sqrt of 3&4

=(9+16) = 25 = 5.

12\*45= 540- Mean

5\*45=225-Std.deviation

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

ANS:- Range= 95%

(0.95,540,225) = 99.00 , 980.99.

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

ANS:- 5th percentile, for that we need to find the z score value

0.5000-0.050= 0.4500

Z score value of 90% = 1.645

Mean+(-1.645)\*St. Deviation

540-1.645\*225 = 169.87

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

ANS:- Probability of making loss 1st =(0,5,3) = 0.0477

Probability of making loss 2nd =(0,7,4) = 0.040

1st division made more loss compare to 2nd division.