**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: Let the prob of not meeting commitment be P(E). We have to calculate the z-score first for the given scenario Given : mean = 45 , std= 8 , time = 60 – 10 = 50 Minutes

Z-Score at 50 = (50-45)/8 = 0.625

Corresponding probability from Z-table=1 – 0.7324 = 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,the above statement is wrong because the data is deviates in between 32 to 44.so most of the data is present in 38 to 44 so the employees at processing center are less in (older than 44) cas as compared to employees of age inbetween 38 to 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

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: As both are independent normal random variables, X1 + X2 is normal with N(µ1+µ2,σ12+σ22). And 2X1 will just scale the normal distribution by 2 times.

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: x=σ[z] + µ

Thus a = 0.5th percentile for X = 20\*[-2.57] + 100 = **48.5**

and b = 99.5th percentile for X = 20\*[+2.57] + 100 = **151.4**

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: According sum of normal random variables rules, we can add up the profits.

Annual\_profit ~ N(5+7, 32 + 42 ) =&gt; N(12, 5 2 ) Rupee Range = [99008103.48,

980991896.52] Rupee Range ~ 99MillionRupees to 980MillionRupees.

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

Ans: We already have the upper and lower range of the Annual\_profit. We can

calculate the 5th percentile using python. 5 th percentile of profit = 143.1 Million

Rupees.

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

Ans: Division 1 will have larger probability for making a loss.