**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

Given: mean- 45, std- 8, time- 60-10=50 min

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

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- **More employees at the processing center are older than 44 than between 38 and 44- False**

**Z score for 30 = (30 - 38)/6 = -1.33 = 9.15 %**

**= 36 out of 400**

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: - 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.

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.

1. 90.5, 105.9
2. 80.2, 119.8
3. 22, 78
4. **48.5, 151.5**
5. 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,

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.