**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-score for 50 minutes using the formula: =(50−45)/8=0.625

Z-table:0.7357

1-0.7357 = 02643

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

A : True, The probability of employees being older than 44 is 15.86%, while the probability of employees between 38 and 44 is 34.13% . Therefore, more employees are older than 44 than between 38 and 44.

B: True.,The probability of attracting about 36 employees under the age of 30 is 36.48, which rounds down to 36 employees . Thus, a training program for employees under 30 would likely attract around 36 employees.

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.

The difference between 2X1 and X1 + X2 lies in their variances. While both have the same mean of 2u, the variance of 2X1 is four times that of X1, whereas the variance of X1 + X2 is twice that of each individual variable.

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
7. 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
8. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
9. Specify the 5th percentile of profit (in Rupees) for the company
10. Which of the two divisions has a larger probability of making a loss in a given year?

A. Rupee Range for 95% Probability:

Profit1: Rs. (225 ± 2 \* √32\*45)

Profit2: Rs. (315 ± 2 \* √42\*45)

B. 5th Percentile of Profit:

Profit1: Rs. (225 + (-1.645 \* 32 \* 45))

Profit2: Rs. (315 + (-1.645 \* 42 \* 45))

C. Probability of Making a Loss:

Profit1 has a larger probability of making a loss in a given year as its mean is closer to zero compared to Profit2.