**Topics: Normal distribution, Functions of Random Variables**

1. The time required for servicing transmissions is normally distributed with *m* = 45 minutes and *s* = 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
6. The current age (in years) of 400 clerical employees at an insurance claims processing center is normally distributed with mean *m* = 38 and Standard deviation *s* =6. For each statement below, please specify True/False. If false, briefly explain why.
7. More employees at the processing center are older than 44 than between 38 and 44.

False. With a normal distribution, the data is symmetrically distributed around the mean. So, there would be an equal number of employees above and below the mean age of 38.

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.

* In the case of 2X1, the variance of the distribution increases by a factor of 4, indicating a greater spread of values. This is because multiplying the standard deviation by 2 (to obtain the standard deviation of 2X1) raises it to the power of 2 (to obtain the variance).
* On the other hand, for X1 + X2, the variance of the distribution remains the same, i.e., the standard deviation does not change. This is because adding two normal distributions together (to obtain X1 + X2) does not change the standard deviation.
* Additionally, for X1 + X2, the expected value or mean is equal to the sum of the expected values of X1 and X2, i.e., 2μ. However, for 2X1, the expected value is twice the expected value of X1, i.e., 2μ.

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.

= −8.85,32.85

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

= −2.14

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

= for both Profit1 and Profit2, the probability of making a loss is very low, and neither division is likely to experience a negative profit in a given year based on the distributions provided.