**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
6. 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.
7. More employees at the processing center are older than 44 than between 38 and 44.

**False** – From calculations the probability of employee greater than 44 (0.16) is less than that of probability of employee between 38 & 44 (0.35)

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

**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 –

2X1 = 2((μ, σ2)) = (2μ , (2σ)2)

2x1 = (2μ, 4σ2)

The sum of two independent normal random variables is also a normal random variable

X1 + X2 = (μ, σ2) + (μ, σ2)

X1 + X2 = (2μ, 2σ2)

The difference between 2X1 & X1+X2 lies in the standard deviation

There is a normal distribution in both cases due to iid normal random 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. **99.01 Rs, 980.99 Rs**
9. Specify the 5th percentile of profit (in Rupees) for the company **169.907**
10. Which of the two divisions ha s a larger probability of making a loss in a given year?

**Division 1 has a larger probability of making a loss.**