**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: B

The probability that the service manager cannot meet his commitment is approximately: 0.2660

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

Probability of being older than 44: 0.1587

Probability of being between 38 and 44: 0.3413

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

Ans: True

Expected number of employees under the age of 30= 36.48

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:

* Distribution of 2 *X*1:

Mean=2 μ

Variance = 4 σ2

* Distribution of *X*1 + *X*2:

Mean= μ + μ =2 μ

Variance = σ2+ σ2 = 2 σ2

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: D

The values [a, b] symmetric about the mean with a 0.99 probability are: [48.5, 151.5]

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:

Mean: 54.0 Crore Rupees

Standard Deviation: 22.5 Crore Rupees

Rupee range (centered on the mean) for 95% probability: [9.90 Crore Rupees , 98.10 Crore Rupees']

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

Ans:

The 5th percentile of profit for the company is: 16.99 Crore Rupees

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

Ans:

D1 probability loss: 4.78 %

D2 probability loss: 4.01 %

The division with a larger probability of making a loss is: Profit1