**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:**

**Mean = 45 mints**

**Sigma(SD)=8 mints**

**X = 60 - 10 = 50 mints (work begins after 10 mints of drop off)**

**Probability not to meet the commitment = 1 - Probability to meet the commitment**

**Z-score = X-Mean / Sigma = 50-45 / 8 = ⅝ = 0.625**

**Probability of Z-score 0.625 = 0.7324**

**Probability to meet the commitment = 0.7324**

**Probability not to meet the commitment = 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.
3. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.

ANS:

1. More employees at the processing center are older than 44 than between 38 and 44.

**False-More employees will between 32 & 44 than above 44 years as mean is 38 and Standard deviation is 6. Most of the data will be lying between Mean +- Standard Deviation**

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

**False-Most of the employees falls with age range 32 to 44. 36 employees are 9% of total populations. I dont think 36 employees will be under 30 years**

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:**

**X - Random variable**

**μ- Mean**

**N - Means data is normally distributed**

**Varience - σ2**

**Normal distributions of a random variable X is represented as *X* ~ *N*(μ, σ)**

**2 *X*1 = *X*1 + *X*2**

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**

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.
3. Specify the 5th percentile of profit (in Rupees) for the company
4. Which of the two divisions has a larger probability of making a loss in a given year?

**ANS:**

**Confidence Interval with 95% N(5, 32) = stats.norm.interval(0.95, loc = 5, scale = 3) = (-0.8798919536201621, 10.879891953620163)**

**into rupees (\*45\*10.00,000) = (-39150000, 489150000)**

**Confidence Interval with 95% N(7, 42) = stats.norm.interval(0.95, loc = 7, scale = 4) = (-0.8398559381602162, 14.839855938160216)**

**into rupees (\*45\*10.00,000) = (-37350000, 667350000)**

**B.**

**5th percentile = 5% = 0.05**

**z-score of 0.05 (0.0505) = -1.64**

**z = (x-μ)/σ**

**-1.64 = (x-5)/3 => x = 0.08 => X \* 45 \* 10,00,000 => 36,00,000**

**-1.64 = (x-7)/4 => x = 0.46 => X \* 45 \* 10,00,000 => 2,07,00,000**