**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?

Ans –**The work begin after 10 min ,time increases from 45 to 55**

**In r code 1-pnorm = (60,55,8)= 0.2676**

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

**Ans-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-As we know that *X* ~ *N*(μ1, σ1^2) and *Y*~ *N*(μ2, σ2^2) are two independent random variables then X+Y~N(μ1+ μ2, σ1^2 + σ2^2) and X-Y~N(μ1- μ2, σ1^2 + σ2^2)**

**Similarly if Z = aX + bY , where X and Y are as defined above,i.e z is**

**linear combination of X and Y , then Z ∼ N(aµ1 + bµ2, a^2σ1^2 + b^2σ2^2 ).**

**Therefore in the question 2X1~ N(2 u,4 σ^2) and**

**X1+X2 ~ N(µ + µ, σ^2 + σ^2 ) ~ N(2 u, 2σ^2 )**

**2X1-(X1+X2) = N( 4µ,6 σ^2)**

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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 **Ans- using python,**

**stats.norm.ppf(0.005) = -2.578**

1. 22, 78  **stats.norm.ppf(0.995) = 2.578**
2. 48.5, 151.5 **a = -(20\*2.578+100) = 48.48**
3. 90.1, 109.9  **b = (20\*2.578+100) = 151.52**

**Ans- C is correct**

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 – Not Sure**