**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 (explanation remain)

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:T**rue.** Since the distribution is normal, and the mean (*μ*) is 38 with a standard deviation (*σ*) of 6, we can use the concept of z-scores to compare different values in the distribution. Employees older than 44 would have positive z-scores, indicating they are above the mean, while employees between 38 and 44 would have z-scores between 0 and 1, indicating they are closer to the mean. Since the distribution is symmetric, there are more employees in the tails (older than 44 or younger than 38) than in the middle (between 38 and 44). Therefore, more employees are older than 44 than between 38 and 44.

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

Ans: False ( Explanation remain)

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:Difference between 2X1 And X1+X2

Distribution of 2X1:

If X1~ N (μ, σ2),then 2X1 follows a normal Distribution With mean 2mue and varience 4sigma square .

The mean is multiplied by constant (2) , and the varience is squared.

2X1 ~ N (2 mue,4 sigma square)

Distribution of X1+X2:

If X1 and X2 are i.i.d ., there sum X1+X2 follows a normal distribution with mean 2 mue and varience 2 sigma square .

X1+X2~ N(2 mue, 2 sigma square)

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. print("""The two values of a and b, symmetric about the mean, are such that the probability of the random variable taking a value between them is 0.99:""",np.round(stats.norm.interval(0.99, loc = 100, scale = 20),1)) The two values of a and b, symmetric about the mean, are such that the probability of the random variable taking a value between them is 0.99: [ 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: Rupee ranges in between [9.9 to 98.1] Crore Rupees, 95% of the time for the Annual Profit of the Company.

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

Ans: The 5TH Percentile of profit for the company is 17 Crore Rupees

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

Ans:  The Division #2 (Profit2 ~ N(7, 42) ) has a larger probability of making a loss in a given year