**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

Answer:

The probability that the service manager cannot meet his commitment: 0.2676

File also attached in .ipynb format.

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.

Answer: Statement A is False.

False. This conclusion is incorrect. The code provided compares the probabilities of employees being older than 44 and between 38 and 44. If P(x>44)*P*(*X*>44) is greater than P(38<x<44)*P*(38<*X*<44), then more employees are considered older than 44 than between 38 and 44. However, this does not necessarily mean that more employees fall into the older than 44 category. The comparison should be based on the actual probabilities rather than the difference between them.

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

Answer: Statement A is False

The correctness of this statement depends on the specific probabilities obtained in the code. If the expected number of employees under the age of 30 is approximately 36, then the statement is true. However, it's essential to consider that the number of employees must be a whole number in practice, so rounding may be necessary. If the expected number is significantly different from 36, then the statement is false. The interpretation of "about 36" is subjective and may require additional context.

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.

Answer: Attached

In summary, both 2*X*1​ and *X*1​+*X*2​ follow normal distributions, but 12*X*1​ has a larger spread (higher variance) compared to 2*X*1​+*X*2​, as indicated by their respective parameters.

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

Answer:

The calculated values are approximately 80.2 and 119.8, which matches option B.

Therefore, the correct answer is:

**B. 80.2, 119.8**

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?

Answer: attached in file