**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 .:

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The correct answer is B. 0.2676.

The time required for servicing transmissions is normally distributed with mean = 45 minutes and standard deviation = 8 minutes. The customer is told that the car will be ready within 1 hour from drop-off, which is 60 minutes.

The probability that the service manager cannot meet his commitment is the probability that the servicing will take more than 60 minutes.

The z-score for 60 minutes is:

z = (60 - 45) / 8 = 1.75

The probability that a standard normal variable is greater than 1.75 is 0.0438. This is the probability that the servicing will take more than 60 minutes.

Therefore, the probability that the service manager cannot meet his commitment is 1 - 0.0438 = 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. True

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The probability that a randomly selected employee is older than 44 is:(1 - P(age < 44)) = 1 - 6827 = 0.3173

The probability that a randomly selected employee is between 38 and 44 is:P(38 < age < 44) = .1587

Therefore, more employees are between 38 and 44 than older than 44.

Statement B: True.

The percentage of employees under the age of 30 is:

P(age < 30) = 0.1587

Since there are 400 employees, the number of employees under the age of 30 is expected to be about:0.1587 \* 400 = 63

Therefore, the training program would be expected to attract about 63 employees

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 . The sum of two independent normal random variables is another normal random variable with mean equal to the sum of the means and variance equal to the sum of the variances.

In this case, the mean of X1 is μ and the variance of X1 is σ². The mean of X2 is also μ and the variance of X2 is also σ².

Therefore, the mean of the difference between 2 X1 and X1 + X2 is:

μ - μ + μ - μ = 0

The variance of the difference between 2 X1 and X1 + X2 is:

σ² + σ² + σ² + σ² = 4σ²

Therefore, the difference between 2 X1 and X1 + X2 is a normal random variable with mean 0 and variance 4σ².

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(Solved in Python\_Normal+Distribution\_Functions\_of+\_random\_variables.ipynb)

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 :Solved in Python\_Normal+Distribution\_Functions\_of+\_random\_variables.ipynb

1. (99, 981)
2. 169.875
3. Division 1