**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?

* Solution: Let X be the time required to service a transmission. We need to find the probability that the service manager cannot meet his commitment,

which means the transmission service time exceeds 1 hour (60 minutes) minus the time elapsed since drop-off (10 minutes).

So, we need to find P(X > 60 - 10) = P(X > 50).

To find this probability, we need to standardize X by subtracting the mean and dividing by the standard deviation:

Z = (X - μ) / σ

So, we have:

P(X > 50) = P[(X - μ) / σ > (50 - μ) / σ]

= P(Z > (50 - 45) / 8)

= P(Z > 0.625)

Using a standard normal distribution table or a calculator, we can find that the probability of Z being greater than 0.625 is approximately 0.2660.

Therefore, the probability that the service manager cannot meet his commitment is approximately 0.2660 or 26.60%.

1. 0.3875
2. 0.2676
3. 0.5
4. 0.6987
5. 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.
6. More employees at the processing center are older than 44 than between 38 and 44.
7. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.

* Solution : Attached the AssignmentSet2.ipynb, # Question No: 2

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.

* Solution : Attached the AssignmentSet2.ipynb, # Question No: 3

This program generates 10,000 random samples from two normal distributions with mean 5 and standard deviation 2. It then calculates the differences 2X1 - (X1 + X2) and X1 - X2 and plots their histograms on the same graph. We can see that the distributions of these differences are different, with the distribution of X1 - X2 centered around 0 and the distribution of 2X1 - (X1 + X2) centered around 3.

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

* Solution : Attached the AssignmentSet2.ipynb, # Question No: 4

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?

* Solution : Attached the AssignmentSet2.ipynb, # Question No: 5