**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:** B. 0.2676

**#For code section refer Basic Statistics Level 2 Assignment 2 Set 2 .ipynb file.**

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.

**Answer:** A. False

B. True

**#For code section refer Basic Statistics Level 2 Assignment 2 Set 2 .ipynb file.**

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:** In 2 X1 : 2 X1~N(2µ,4σ²) normally distributed with mean: 2\*mean(X) = 2µ and

variance : var(2\*X1) = 4\*var(X1) = 4σ²

In X1+X2 : X1+X2~N(2µ,2σ²) normally distributed with mean

mean(X)+ mean(Y) = µ+µ = 2µ and variance σ²+σ² = 2σ²

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:** D. 48.5, 151.5

**#For code section refer Basic Statistics Level 2 Assignment 2 Set 2 .ipynb file.**

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

**Solution:**

Given: Profit1 ~ N(5, 32) and Profit2 ~ N(7, 42)

Total Profit= Profit1 + Profit2 ~ N(5 +7,9+16)

Mean = 5+7 = 12

Standard Deviation = sqrt(9+16)

= sqrt(25)

= 5

Mean in Rs = 12 \* 45 = 540

Standard Deviation in Rs = 45 \* = 225

1. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.

**Answer**: From the empirical rule, 95% of data falls within 2 standard deviations from the mean - between *μ*−2*σ* and *μ*+2*σ*.

* (μ−2σ , μ+2σ)
* (540-2\*225 , 540+2\*225)
* (540-450 , 540+450)
* (Rs. 90 , Rs. 990) in Millions

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

**Answer:** The 5th percentile of profit (in Rupees) for the company

=> 5th percentile from the left side we can use the formula,

=> μ - 1.5σ

=> 540-(1.5\*225)

=> 202.5 million rupees.

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

**Answer:**

For division 1= Z-score for a profit of zero:

=> Z=(X-µ)/ *σ*

*=>*  (0-5)/3

=> -1.66

=> 0.0485

For division 2= Z-score for a profit of zero:

=> Z=(X-µ)/ *σ*

=> (0-7)/4

=> -1.75

=> 0.0401

Division 1 has a larger probability of making a loss in a given year.