**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: -

Done in excel sheet (set-2 answer)

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: -

FALSE, as the mean value is 38, which signifies that maximum values will be around 38, so it cannot be 44, it should be *(μ* = 38) +-(*σ* =6) i.e. [44 & 32]

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

Answer: -

TRUE

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: -

iid= (independent identically distributed)

Normal Distribution (mean, variance)

X~N (μ, σ2 )

Here we have given:

X1~N (μ, σ2 )

X2~ N (μ, σ2 )

Are two independents identically distributed random variables.

* SUM= X1+X2

X1+X2~ N(μ+σ2 +μ+ σ2 ) ~ N (2μ+2σ2 )~ N(2\*(μ ,σ2 )

* MULTIPLICATION= 2\*X1

2X1~ N (2μ ,22σ2) ~ N(2μ ,4σ2)

* DIFFERENCE=2X1 & X1+X2

2X1 – (X1+X2)

N(2μ ,4σ2)- N (2μ+2σ2 )

N(2μ-2μ, 4σ2+2σ2 )

N(0,2σ2 )

2 X1 and X1+X2 is same but the var(\sigma^2) of  2X1 is 2 times more than the variance of  X1+X2 .

That means these variables are identical and independently distributed.

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: -

Done in python notebook

norm.ppf(0.995,100,20)

151.516586070978

norm.ppf(0.005,100,20)

48.483413929021985

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: -

Done with python notebook