**Topics: Normal distribution, Functions of Random Variables**

* The time required for servicing transmissions is normally distributed with = 45 minutes and = 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?
* 0.3875
* 0.2676
* 0.5
* 0.6987

Ans : ( B ) ( 0.2676 ) . The time that will take to complete the service is 45+10, where 10 is the taken in consideration of drop. The probability that it will take more than 1 hour to complete **mew = 55 std = 8 q1 = 1-stats.norm.cdf(60, loc = mew, scale = std) q1 = 0.2659** The probability that the service manager cannot meet his commitment is 0.2659

* The current age (in years) of 400 clerical employees at an insurance claims processing center is normally distributed with mean = 38 and Standard deviation =6. For each statement below, please specify True/False. If false, briefly explain why.
* More employees at the processing center are older than 44 than between 38 and 44.

Ans : **False**, Because The probability for employees at the processing center are more between 38 and 44 than older than 44.

Source Code:

mean = 38

std1 = 6

q2\_lessthan\_38 = stats.norm.cdf(38, loc = mean, scale = std1)

q2\_lessthan\_38 = 0.5

q2\_less\_than\_44 = stats.norm.cdf(44, loc = mean, scale = std1)

q2\_less\_than\_44 = 0.841

q2\_betweeen\_38\_and\_44 = q2\_less\_than\_44 - q2\_lessthan\_38

print(np.round(q2\_betweeen\_38\_and\_44,100,2))

The probability of employee age between 38 and 44 is 34.13 %

q2\_morethan\_44 = 1-stats.norm.cdf(44, loc = mean, scale = std1)

print(np.round(q2 \_morethan\_44,100,2))

The probability of employee age more than 44 is 15.87 %

Ans= (q2\_morethan\_44 > q2\_betweeen\_38\_and\_44)

print('Answer:',Ans)

Answer: False

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

Ans : **True**

q2b = stats.norm.cdf(30, loc = mean, scale = std1)100

print(np.round((q2b400)/100,0))

A training program for employees under the age of 30 at the center would be expected to attract about 36.0 employees

* 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 Normal Distribution has its link with the Central Limit Theorem, which states that ‘Any large sum of independent identically distribution random variables are approximately Normal then (X1 + X2) and (2X1) tends to have Normal distribution only If X1 and X2 are i.i.d and n is Large.

The Difference between 2X1 and (X1 + X2) is the magnitude they hold of two different sample subsets (X1 and X2) from the same source(population). X1 and X2 can be a different subset of a sample from a similar source (population) but If X1 ~ N(μ, σ2) then, 2 X1 ~ N(2 μ, 4 σ2 ) If X1 ~ N(μ, σ2) and X2 ~ N(μ, σ2) are iid normal random variables then (X1 + X2)N(μ+ μ, σ2+ σ2)(2 μ, 2 σ2) Hence, 2X1 – (X1+X2) ~(2 μ – 2 μ, 4 σ2 + 2σ2 ) The distribution remains the same for every sample subset of similar source, it tends to fall under Normal distribution and slight deviations in parameters.

* 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.
* 90.5, 105.9
* 80.2, 119.8
* 22, 78
* 48.5, 151.5
* 90.1, 109.9

Ans **: ( D )**

Source Code :

print(np.round(stats.norm.interval(0.99,loc = 100, scale = 20),1)

the probability of the random variable taking a value between them is 0.99

is [ 48.5 151.5]

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

Ans : Rupee ranges in between **[9.9 to 98.1]** Crore Rupees.

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

Ans: The 5th percentile of profit (in Rupees) for the company is **17 Croer Rupees**

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

Ans : The **Division #2 (Profit2 ~ N(7, 42) )** has a larger probability of making a loss.