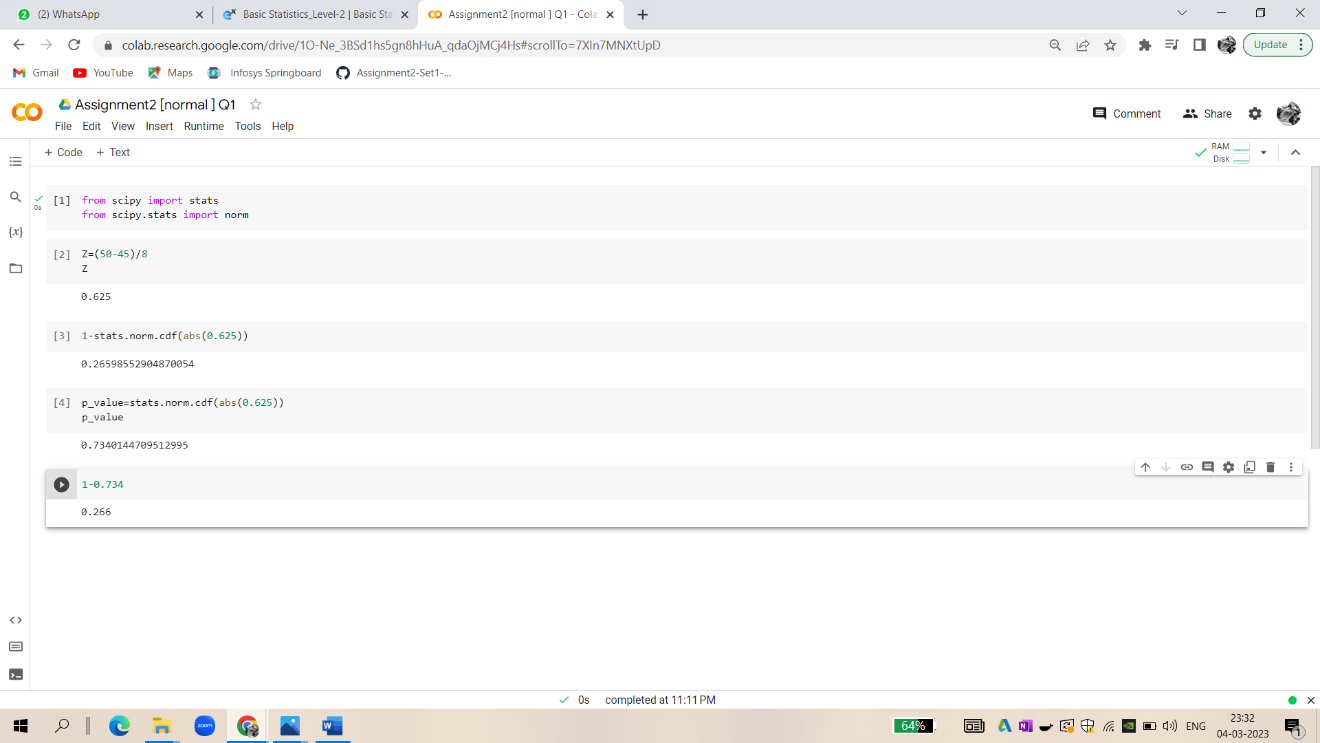
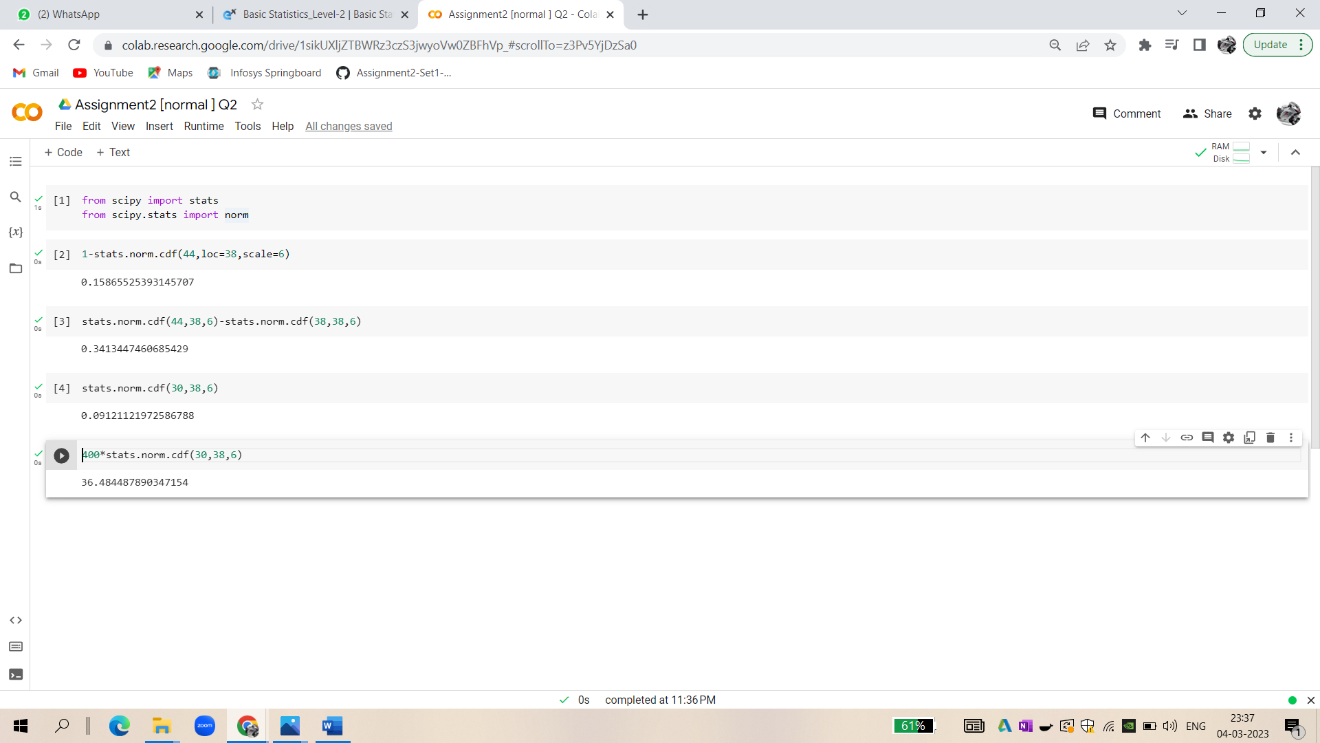
**Topics: Normal distribution, Functions of Random Variables**

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

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-

1. More employees at the processing center are older than 44 than between 38 and 44. is False as value calculated in ,employees between 38 and 44 years of age is more.
2. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.The statement is true as per the calculation in line number 9 and output 9 is 36.48
3. 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- *X1* ~ *N*(μ, σ2) and *X*2 ~ *N*(μ, σ2) are *iid* normal random variables

difference between 2 *X*1 and *X*1 + *X*2

The Normal Distribution is defined by two parameters, the mean and the variance and written as X ∼N (μ, σ^2),

Given X1∼N (μ1, σ1^2) & X2∼N (μ2, σ2^2), are two independent identically distributed random variables. From the properties of Normal Random Variable if X1∼N(μ1, σ1^2 ) and X1∼N(μ1, σ1^2 ) are two independent identically distributed random variables then

X + Y ∼N (μ1 + μ2, σ1^2 + σ2^2) --- the sum of normal random variables

  X − Y ∼N (μ1 − μ2, σ1^2 + σ2^2) ---- the difference of normal random variables

 Z = aX, the product of X is given by

Z ∼N (aμ1, a^2 σ1^2),

Z = aX + bY, the Linear combination of X and Y is

  Z ∼N(aμ1 + bμ2, a^2σ1^2 + b^2σ2^2 ).

Given to find, 2X1,

2X1 ∼N(2μ, 2^2σ^2 ), ---🡪 2X1 ~N(2μ, 4σ^2 ),------ the property of multiplication

*X*1 + *X*2 ~ N(μ + μ, σ^2 + σ^2 ) ~ N(2μ, 2σ^2 ),------ property of addition,

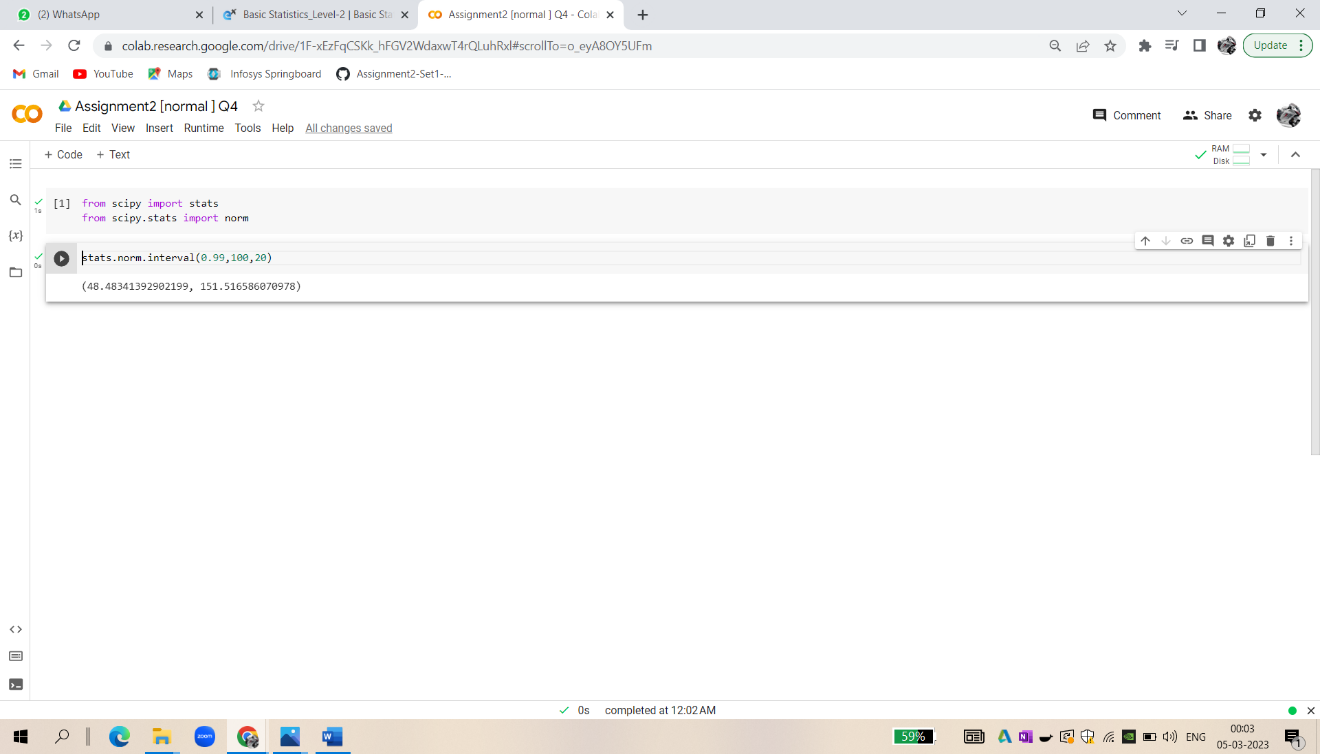
And the difference between the two is

 2X1 – ( *X*1 + *X*2) ~ N(2μ + 2μ, 2σ1^2 + 4σ2^2 ) ~ N(4μ, 6σ^2 ),

The mean of 2X1 and X1+X2 is same but the var(σ^2) of  2X1 is 2 times more than the variance of X1+X2.

The difference between the two says that the two given variables are identically 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- D

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-

1. Range is Rs (99.00810347848784, 980.9918965215122) in Millions
2. 5th percentile of profit (in Million Rupees) is 170.0
3. Division 1

