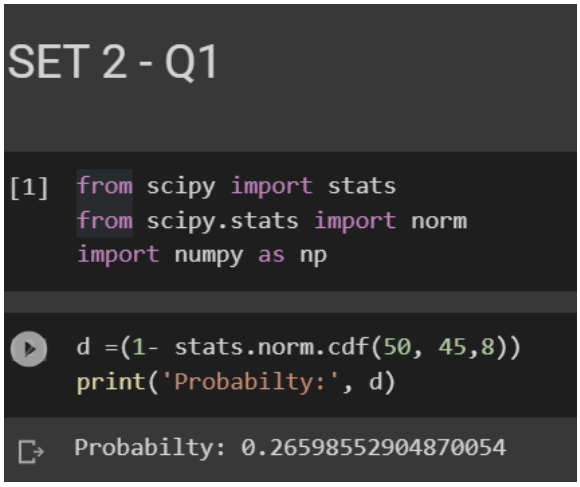
Topics: Normal distribution, Functions of Random Variables

1. The time required for servicing transmissions is normally distributed with $\mu = 45$ minutes and $\sigma = 8$ 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?

    A. 0.3875
    B. 0.2676
    C. 0.5
    D. 0.6987

ANS: B



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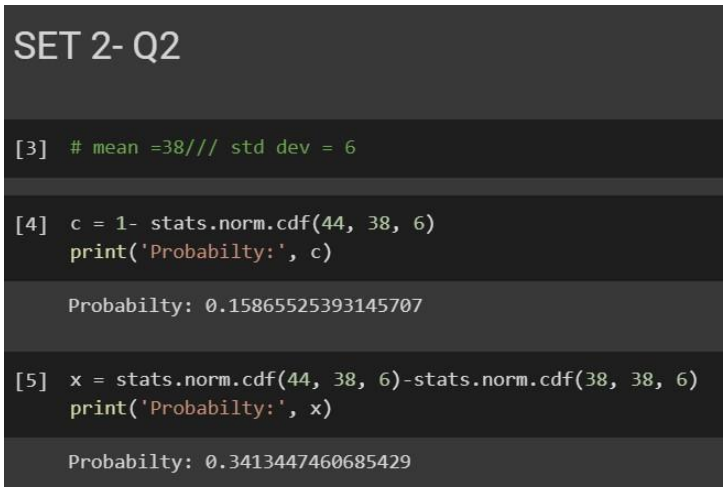
2. The current age (in years) of 400 clerical employees at an insurance claims processing center is normally distributed with mean $\mu = 38$ and Standard deviation $\sigma = 6$. For each statement below, please specify True/False. If false, briefly explain why.
    A. More employees at the processing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

ANS: 15.86%



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

ANS: TRUE

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3. If $X_1 \sim N(\mu, \sigma^2)$ and $X_2 \sim N(\mu, \sigma^2)$ 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: If X1 and X_2 are normally distributed then the sum of the random sample will be exactly same.

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4. Let $X \sim N(100, 20^2)$. 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.

   A. 90.5, 105.9
   B. 80.2, 119.8
   C. 22, 78
   D. 48.5, 151.5
   E. 90.1, 109.9

ANS: D

SET2 - Q4

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[6]  norm.ppf(0.995, 100, 20)

     151.516586070978

[7]  norm.ppf(0.005, 100, 20)

     48.483413929021985
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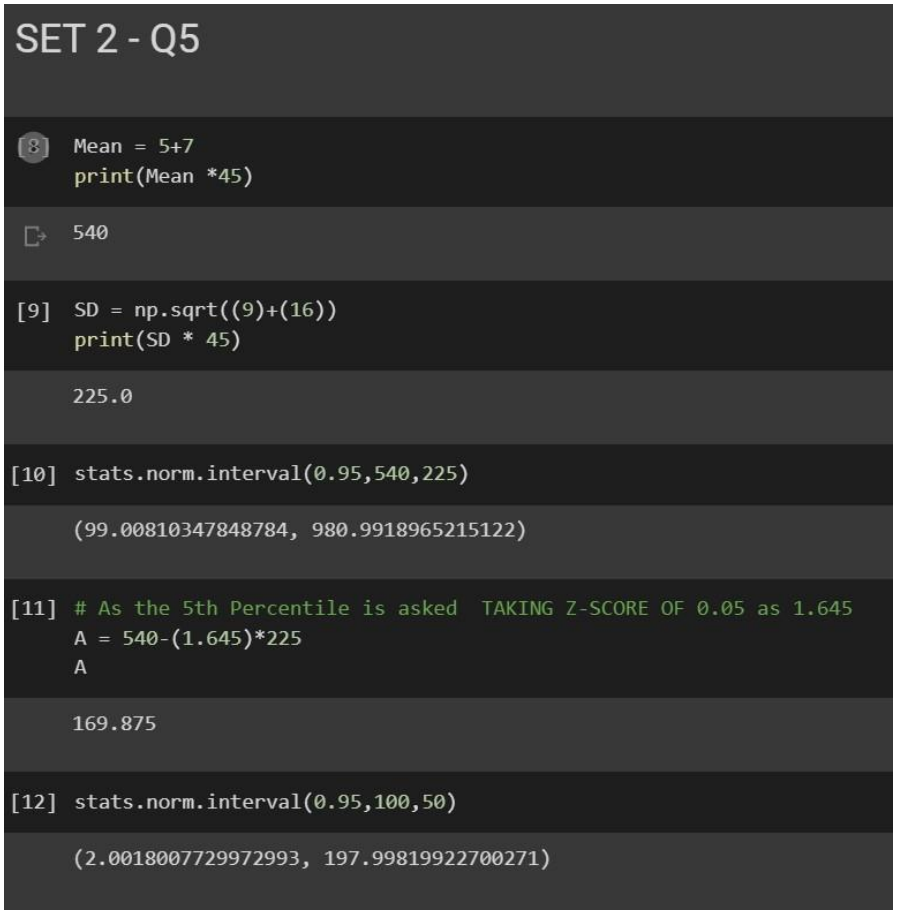
5. Consider a company that has two different divisions. The annual profits from the two divisions are independent and have distributions $Profit_1 \sim N(5, 3^2)$ and $Profit_2 \sim N(7, 4^2)$ respectively. Both the profits are in $ Million. Answer the following questions about the total profit of the company in Rupees. Assume that $1 = Rs. 45
   A. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
   B. Specify the 5^{th} percentile of profit (in Rupees) for the company
   C. Which of the two divisions has a larger probability of making a loss in a given year?

ANS:


SET 2 - Q5
Mean = 5+7
print(Mean *45)
540
SD = np.sqrt((9)+(16))
print(SD * 45)
225.0
stats.norm.interval(0.95,540,225)
(99.00810347848784, 980.9918965215122)
# As the 5th Percentile is asked TAKING Z-SCORE OF 0.05 as 1.645
A = 540-(1.645)*225
A
169.875
stats.norm.interval(0.95,100,50)
(2.0018007729972993, 197.99819922700271)