

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

```
SET 2 - Q1

[1] from scipy import stats
    from scipy.stats import norm
    import numpy as np

▶ d =(1- stats.norm.cdf(50, 45,8))
  print('Probabilty:', d)

📄 Probabilty: 0.26598552904870054
```

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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%

```
SET 2- Q2

[3] # mean =38/// std dev = 6

[4] c = 1- stats.norm.cdf(44, 38, 6)
    print('Probabilty:', c)

    Probabilty: 0.15865525393145707

[5] x = stats.norm.cdf(44, 38, 6)-stats.norm.cdf(38, 38, 6)
    print('Probabilty:', x)

    Probabilty: 0.3413447460685429
```

- 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 $2X_1$ and $X_1 + X_2$? Discuss both their distributions and parameters.

ANS: If X_1 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

The screenshot shows a quiz interface with a dark background. At the top, it says 'SET2 - Q4'. Below this, there are two questions, each with a green checkmark icon to its left. Question [6] asks for the value of `norm.ppf(0.995, 100, 20)`, and the answer shown is 151.516586070978. Question [7] asks for the value of `norm.ppf(0.005, 100, 20)`, and the answer shown is 48.483413929021985.

```
SET2 - Q4
```

[6] `norm.ppf(0.995, 100, 20)`
151.516586070978

[7] `norm.ppf(0.005, 100, 20)`
48.483413929021985

-
5. Consider a company that has two different divisions. The annual profits from the two divisions are independent and have distributions $\text{Profit}_1 \sim N(5, 3^2)$ and $\text{Profit}_2 \sim N(7, 4^2)$ 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 5th 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?

SET 2 - Q5

```
8 Mean = 5+7  
  print(Mean *45)
```

```
540
```

```
[9] SD = np.sqrt((9)+(16))  
    print(SD * 45)
```

```
225.0
```

```
[10] stats.norm.interval(0.95,540,225)
```

```
(99.00810347848784, 980.9918965215122)
```

```
[11] # As the 5th Percentile is asked TAKING Z-SCORE OF 0.05 as 1.645  
     A = 540-(1.645)*225  
     A
```

```
169.875
```

```
[12] stats.norm.interval(0.95,100,50)
```

```
(2.0018007729972993, 197.99819922700271)
```

ANS: