**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

**ANS :** #z-score at z=50

z=(50-45)/8

z=0.625

from scipy import stats

from scipy.stats import norm

#probability of p(x>50)

1-stats.norm.cdf(abs(z))

o/p: 0.2659 ~=0.2676

correct option (**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.

**ANS:** from scipy import stats

from scipy.stats import norm

stats.norm.cdf(44,38,6)-stats.norm.cdf(38,38,6)

**o\p:**

0.34134474606854

Which is equal to 34% and therefore the statement is true

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

**ANS:**

stats.norm.cdf(30,38,6)

0.09121121972586788

The probability of 9.1% under age of 30 = 0.0912\*400 = 36.484 which is equal to 36 employees therefore the statement is 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.

**ANS:**



The difference between the two is that the variables are identically & 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

**ANS :**

stats.norm.interval(0.99,100,20)

**O/P :** (48.48341392902199, 151.516586070978)

Option “**D**” is correct

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.

**ANS :** mean = 5+7\*45=450 variance = 5\*45 = 225

stats.norm.interval(0.95,540,225)

O/P : (99.00810347848784, 980.9918965215122)

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

**ANS :** #To compute 5th Percentile, we use the formula X=μ + Zσ;

# where from z table, 5 percentile = -1.645

x=540+(-1.645)\*(225)

O/P : 169.875

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

**ANS :** stats.norm.cdf(0,5,3)

**O/P : 0.047790**

stats.norm.cdf(0,7,4)

**O/p : 0.0400591**