**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:

*μ* = 45 minutes; *σ* = 8 minutes; X=Ready within one hour =60min

Average transmission is 10 min, so 45 min to 55 mins

Z.=(X-*μ)/σ*

= (60-45)/8🡺1.875

= (60-55)/8🡺0.625

We can find that P(Z>0.625)🡺0.2660

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:  *μ* = 38, *σ* =6

P(X>44): 1-stats.norm.cdf (44,36,6)

Output:0.15865525393145707

For P(38<X<44):

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

400\*Stats.norm.cdf (44,38,6) -Stats.norm.cdf (38,38,6)

Output:

336.0378984274172

The statement “more employes at the processing center would be expected to attract about 36 employees

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

Ans:

Under the age of 30 expected to attract about 36 employees

# P(X<30):

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

Output

0.09121121972586788

The current age (in years) of 400 to be added to norm

400\*(Stats.norm.cdf (44,38,6) -Stats.norm.cdf (38,38,6)

Output:

136.53789842741716

Therefore, the statement “a Training program for the employees under the age of 30 at the center would expect to attract about 36 employees “is false

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:

if X1~ *N* (μ, σ2 ) and *X*2 ~ *N*(μ, σ2) are the given variable identical independent

The difference between 2X1 and X1+X2 is N (0,6 σ2)

According to the central limit theorem, any large sum of independent, identically distributed random variable is approximately Normal

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:

Import pandas as pd

Import numpy as np

From scipy import stats

From scipy. stats import norm

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

(48.48341392902199,151.516586070978)

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: (99,980)

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

Ans: 170

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

Ans: Division 1 making loss P(X&lt;30) =0.0477

Division 2 making loss P(X&lt;30) =0.0400