**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:**

Given mean= 45 min ; standard deviation = 8min ; X= ready within 1 hour = 60 min

Average of transmission is 10min. so, 45 min to 55 min.

Z=(X-µ)/σ

= (60-45)/8 = 1.875

= (60-55)/8 = 0.625

From a standard normal table or calculator, we can find that P(Z > 0.625) = 0.2660.

= **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.

**Answer:**

more employers are older than 44

# u = 38 , std = 6

# P(X>44):

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

Output

0.15865525393145707

# 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

Therefore, the statement "More employees at the processing center are older than 44 than between 38 and 44" is false

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

**Answer:**

under the age of 30 expected to attract about 36 empolyees

# 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 employees under the age of 30 at the center would be expected 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.

**Answer:**

if X 1 ~ N (μ, σ 2 ) and X 2 ~ N (μ, σ 2 ) are two given variables identical and independent

distribution.

The difference between 2X 1 and X 1 +X 2 is N(0,6σ 2 ).

According to the Central Limit Theorem, any large sum of independent, identically

distributed(iid) random variables 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

**Answer:**

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)

**Option 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.

**Answer:**99980

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

**Answer:**170

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

**Answer:** Division 1 making loss P(X&lt;30) = 0.0477.

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