**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

**Solution:**  Given that,

*μ* = 45 minutes, *σ* = 8 minutes

and x=60mins

We know that,

Z=x-µ/*σ*

*=60-45/8*

***=1.875***

*import pandas as pd*

*from scipy import stats*

*data=stats.norm.cdf(1.875)*

*data*

0.9696036382347386

1-data

**0.030396361765261393**

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**:  **FALSE**.

(Because,38 is the least value.so,large number of people are more than 44 years.)

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

**ANSWER: TRUE.**

3.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: Both are independent random variables.**

4.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.

1. 90.5, 105.9
2. 80.2, 119.8
3. 22, 78
4. 48.5, 151.5
5. 90.1, 109.9

**ANSWER:** we know that,

i, e X = *\* (z) + µ*

Normal distribution: -2.57 to +2.57

for X=0.5%

Therefore data,

20,z=-2.57, *µ=100*

*X=20\*(-2.57)+100*

**~48.60**

for X=99.5%

X=*20\*(2.57)+100*

**~151.4**

5.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

1. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
2. Specify the 5th percentile of profit (in Rupees) for the company
3. Which of the two divisions has a larger probability of making a loss in a given year?

**ANSWER:**

1. From given data,

5\*45=225 and 7\*45=315

import pandas as pd

import NumPy as np

from SciPy import stats

profit1= stats.norm.interval(0.95,loc=225,scale=3)

profit1

**output:** (219.12010804637984, 230.87989195362016)

profit2= stats.norm.interval(0.95,loc=315,scale=4)

profit2

**output:** (307.1601440618398, 322.8398559381602)

Total profit of the company for 95% rupees range probability,

= profit1 + profit2

=(219.12, 230.87) +(307.16, 322.83)

**= [526.28 553.71]**

**B .**

profit1= stats.norm.ppf(0.05,loc=225,scale=3)

profit1

**output:** 220.0654391191456

profit2= stats.norm.ppf(0.55,loc=225,scale=3)

profit2

**output:** 225.37698404056522

**C.** N(7,4²)