**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: 1 – stats.norms.cdf(50,45,8) = 0.2676

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: False, p(x>44)=0.1586; p(38<x<44) = 0.3413

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

Ans: True, Expected employees = p(x>p(x<30)\*400 = 36.48 ~ 36

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: Given X1 and X2 distributions have same mean and standard deviation(SD)

When 2 is multiplied to a distribution then mean will become to twice, and SD will be become 4 times the orginal SD.

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: For normal distribution, 99% of data lies within 3 standard deviation from mean. So (a,b) = (100-60,100+60) = (40,160) ~ (48.5,151.5) {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.

Ans:

import numpy as np

From scipy import stats

m=(5+7)\*45

s=45\*np.sqrt(9+16)

(stats.norm.interval(0.95,m,s)#Rupee range for annual profit(99.00810347848784,98039918965215122)

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

Ans:

M+(s\*stats.norm.ppd(0.05))=169.9079339359186 ~ 170 million

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

Ans:

Area under curve gives the probability. For loss, the target value is less than zero.

stats.norm.cd(0,5,3) = 0.04779

stats.norm.cdf(0,7,4) = 0.04005

Therefore division 1 has larger probability of making loss