**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) B

from scipy import stats

1-stats.norm.cdf (50,45,8)

>>0.26598552904870054

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,**

Mean=38, sd=6

**For older than 44=p(x>44)**

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

>>0.15865

**For older than between 38 and 44= p(38<x<44)**

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

>>0.3413447

As the probability of employees between age 38 and 44 is more than the probability of employees older than 44

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

Ans) **True**

No of employees=stats.norm.cdf(30,38,6) \*total no of the employees

stats.norm.cdf (30,38,6) \*400

>> 36.4844878

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 2X1 and X1 + X2 are same, if they are independent identically distributed and

Both are normal distribution.

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

Sol) D

from scipy import stats

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.

Sol) mean=12\*45=540, sd=5\*45=225

from scipy import stats

from scipy.stats import norm

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

(99.00810347848784, 980.9918965215122)

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

Sol) 5th percentile of profit is 170 (in Million Rupees)

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

Sol) 2nd division

Division 1: stats.norm.cdf(0,5,3)

>>0.0477903522728147

Division 2: stats.norm.cdf(0,7,4)

>>0.040059156863817086