**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:**

As per question the service manager will start work after 10 min, so the total time to complete the job is 50 min

Here *μ* = 45 minutes and *σ* = 8 minutes

IN Python:

from scipy import stats

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

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.

**Ans:**

Mean = 38

SD = 6

Z score = (Value - Mean)/SD

Z score for 44 = (44 - 38)/6

= 6/6

= 1

= 84.13 %

People above 44 age = 100 - 84.13

= 15.87% = 63 out of 400

Z score for 38 = (38 - 38)/6 = 0/6 = 0

= 50%

Hence People between 38 & 44 age = 84.13 – 50 = 34.13% = 137 out of 400

1. More employees at the processing center are older than 44 than between 38 and 44. **False**

Z score for 30 = (30 - 38)/6 = -1.33 = 9.15 %

                                  = 36 out of 400

1. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees. **True**
2. 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.

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
7. 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
8. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
9. Specify the 5th percentile of profit (in Rupees) for the company
10. Which of the two divisions has a larger probability of making a loss in a given year?

**Ans:**

**A.**

from scipy imports stats

#profit 1

A = stats.norm.ppf(0.975,5,3)

#profit 2

B = stats.norm.ppf(0.975,7,4)

## Total profit of both company in 95% probability

(A+B)\*45

1157.388655130117

**B.**

from scipy imports stats

#profit 1

A = stats.norm.ppf(0.05,5,3)

#profit 2

B = stats.norm.ppf(0.05,7,4)

## Total profit of both company in 5th percentile

(A+B)\*45

21.87110751028607