**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. 0.2676

In R = 1-pnorm(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.
2. More employees at the processing center are older than 44 than between 38 and 44.

ANS- mean=38 , std = 6

Z score = (value – mean)/sd

Z score for 44 = 44-38 / 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 = 50%

People between 84.13-50 = 34.13% = 137 out of 400

Hence above statement is false.

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

ANS- z score for 30 = 30-38 / 6 = -1.33 = 9.15% = 36 out of 400

Hence above statement is true.

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 – 2 is simply a large scale version of the random variable X2 if is normally distributed then 2X1 is also normally distributed

X1 and X2 are normal distributed the associated sums and random samples are exactly normal with the appropriate 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

ANS:- D. 48.5 , 151.5

Here we need range of 99% data which lies btwn 3\*std of the mean

M= 100 , std =20

From empire rule m+-3std =100+-3\*20 = (40,160)

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.
3. Specify the 5th percentile of profit (in Rupees) for the company
4. Which of the two divisions has a larger probability of making a loss in a given year?

ANS:- Let x is the sum of two random variables having normal dist.

E[x]=E[45\*(profit1+profit2)]=45\*(5+7)=540

SD[x] = SD[profit1+profit2] =225

ANS:- A. 95% data fall= m+-2std=540+-2\*225 = (90,990)

1. from 5% percentile from left we can use m-1.5std = 202.5
2. pnorm(0,5,3) = 0.04779035

pnorm(0,7,4) = 0.04005916

Profit 2 has a larger probability of making a loss in a given year.