**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- μ = 45, σ = 8, You have a normal distribution with mu = 45 and sigma = 8. Let X be the amount of time it takes to complete the repair on a customer's car. To finish in one hour, you must have X ≤ 50 so the first question is to find

Pr(X > 50)

P(x>50)=1-P(50)

Z=x-μ /σ = 50-45/8=5/8=0.625

P(50)=.73

P(x>50)=1-P(50)=1-0.73=0.267

**B is the correct option**

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.

**Solution:** Statement P(44>[44-38])

Z value for 44 is 1 and as per z table value is 0.84

1-0.84=0.16

Z value for 38 is 0 and as per z table value is 0.5

Probability the data between 38 and 44 is (0.5-0.16)=0.34

P(0.16>0.34)

**So 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.

**Solution:** Statement more than 36 employees under age of 30yrs

Z value for 30 is **-**1.33 and as per Z table value is .0918

400\*.0918=36.72(37 employees under age of 30yrs)

**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.

**Solution:** By the Property of normal distribution here both are normally distributed

If X1 and X2  both are iid normal random variables then their sum is also normally distributed .with mean it’s being the sum of the two mans and variance being the sum of the two variances.

If we multiply X1 with 2 then distance between two data points will be increase also mean of increase will decrease as variance increment. it will still follow a 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

**Solution:** D is the correct answer because it is largest range so we calculate the probability

Z=48.5-100/20 = -2.57=.00508

Z=151.5-100/20 =2.57= .99492

Area between 48-151.5=.99492-.00508=.989(.99)

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.

**Solution:** 95% of the data lies between +2and -2 standard deviation

1st Deviation:52(3) = (-1,11)=(0,495 rupees)

2nd Deviation:7±2(4)=(-1, 15)=(0,675 rupees)

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

**Solution:** 1st Division: [0 to 11]=0.5(12)=6\*45=240

2nd Division: [0 to 15]=0.5(16)=8\*45=360

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

**Solution:** Division-2