**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: z= (x-mu)/sigma

= (50-45)/8=0.62

Therefore P(z)= 0.7324 , This is the probability of completing the tak.

For not completing, 1-p(z)= 0.2676.

ANS: 0.26.76

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: P(44)=84.13%. ## this is probability for < 40.

1-P(44)= 15.86%. ## P for >40

P(38)=50%.

So, P(38<x<44)= pnorm(44,38,6)-pnorm(38,38,6)

= 34.14%.

Since P(38<x<44) is greater than 1-P(44)

FALSE.

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

ANS: As for age 30,

Z= (x-mu)/sigma=-1.333.

P(30)=9.18%.

So, no. of expected employees=9.18% of 400.

= 36.72

Approx= 37,

It should be 36.

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:

Please explain? Not clear.

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:

Since we need to find out the values of a and b, which are symmetric about the mean such that the probability of random variable taking a value between them is 0.99, we have to work out in reverse order.

The Probability of getting value between a and b should be 0.99.

So the Probability of going wrong, or the Probability outside the a and b area is 0.01 (ie. 1-0.99).

The Probability towards left from a = -0.005 (ie. 0.01/2).

The Probability towards right from b = +0.005 (ie. 0.01/2).

So since we have the probabilities of a and b, we need to calculate X, the random variable at a and b which has got these probabilities.

By finding the Standard Normal Variable Z (Z Value), we can calculate the X values.

Z=(X- μ) / σ

For Probability 0.005 the Z Value is -2.57 (from Z Table).

Z \* σ + μ = X

Z(-0.005)\*20+100 = -(-2.57)\*20+100 = 151.4

Z(+0.005)\*20+100 = (-2.57)\*20+100 = 48.6

**So, option D is correct.**

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: division 1 : mu= 5, sigma=3.

division 2 : mu= 7, sigma=4.

Not clear

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