**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.

They have provided two different distributions with the normal random variable equations. You need to evaluate if there are any differences. More details are provided in the Key File.

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?