**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

**ANSWER :**

Here given that the work begins 10 minutes after the car is dropped, the time left to work is 60-10=50minutes. The probability that the service manager cannot meet his commitment =P(x>50) = 1-p(x<=50) here x is the time taken to complete the work

Convert 50 to z-score

Standard Normal Variable Z = (x- *μ)*/σ =(x-45)/8

P(x<=50)=P(z<=(50-45)/8)=probability(z<0.625)=0.7323 = 73.23%

Probability that the service manager will not meet his commitment is : 100-73.23= 26.77%= 0.2677

So the answer is **B**

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.

**ANSWER :**

*μ* = 38, *σ* =6

Probability of the employees > 44 =P(x<44) = 1-P(x<=44)

Z=(x-*μ)*/σ=(x-38)/6

P(x<=44) = P(z<=(44-38)/6) = P(z<=1)) = 0.8413 = 84.13%

Probability that employees will be greater than 44 = 100-84.13 = 15.87

Probability of employees between 38 & 44 = P(x<=44)-P(x>=38)

Here, P(x<=44) = 84.13

P(x>=38) = P(z>=(38-38)/6)= P(z>=0)=0.5

Therefore, P(x<=44)-P(x>=38) = 0.8413-0.5= 0.3413 = 34.13%

So, the statement ‘more employees at the processing center are older than 44 between 38 and 44’ is **TRUE.**

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

**ANSWER :**

Z=(x-*μ)*/σ = (30-38)/6

P(x<30) = P(z<(30-38)/6) = p(z<1.3333)=0.09176 = 9.176%

So, the number of employees with probability 0.09176 of them being under

30=400\*0.09176=36

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

**ANSWER :** NOT SURE

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

**ANSWER :**

The probability of getting value between a & b is 0.99

So, the probability of getting value outside a & b is 1-0.99=0.01

The probability towards left of a = 0.01/2 = 0.005

The probability towards right of b = 0.01/2 = 0.005

Since we have the probabilities of a & b, we need to calculate the probability of X= the random variable at a & b which has these probabilities

By finding standard normal variable , we need to calculate x

Z=(x- μ)/ σ

For a probability of 0.005, z value is -2.57

Z\*σ + μ=x

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

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

**D IS THE CORRECT ANSWER**

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?

**ANSWER : NOT SURE**