**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**:

Since work begins 10 mins after the car is dropped, the time left to complete work is 50 mins.

Prob. that service manager can’t meet his commitment = P(X>50) = 1 – P(X<=50) (X is the time taken to complete work). Convert 50 to z-score

Standard normal variable Z = (X-*μ)/σ* = (X-45)/8

P(X<=50)=P(Z<=(50-45)/8)=PR(Z<=0.625)= 0.73237= 73.237% (the number in z-table)

Prob. That service manager will not meet his commitment is: 100-73.237=26.763%=0.2676

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

**Ans**:

*μ* = 38 & *σ* =6

1. Prob. Of employees >44 =Pr(x>44)= 1-Pr(x<=44)

Z = (X-*μ)/σ* = (X-38)/6

Pr(x<=44)=Pr(z<=(44-38)/6)=Pr(z<=1)=0.84134=84.134%

Prob. That employees will be greater than 44 = 100-84.134 = 15.866

Prob. Of employees between 38 & 44 = Pr(x<=44) = Pr(x>=38)

Here, Pr(x<=44) = 0.84134

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

Therefore, Pr(x<=44) - Pr(x>=38) = 0.84134 – 0.5 = 0.34134 = 34.134%

So, the statement “More employees at the processing center are older than 44 than between 38 and 44” is **TRUE**

1. Prob. Of employees less than 30 = Pr(x<30)

Z = (X-*μ)/σ* = (30-38)/6

Pr(x<30)=Pr(z<(30-38)/6)= Pr(z<-1.3333)=0.09176=9.17%

So, the number of employees with prob. 0.0917 of them being under 30=400\*0.0917=36.68=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.

**Ans: 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

**Ans**:

The Prob. Of getting value between a & b is 0.99

So, the prob. Of getting value outside a & b is 1-0.99 = 0.01

The prob. Towards left of a = -0.01/2 = -0.05

The prob. Towards right of b = 0.01/2 = 0.05

Since we have prob. Of a & b, we need to calculate the prob. Of X – the random variable at a & b which has these probabilities.

By finding std normal variable (z), need to calculate X:

Z = (X-*μ)/σ*

For a prob. Of 0.005, z values is -2.57

Z\* *σ+μ =* x

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

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

**Option 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?

**Ans: NOT SURE….**