**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 works beings 10 mins after the car dropped, the time left to complete work is 50 min.

P(x>50) = 1-P(x<=50) where x is the time taken to complete the work.  
 standard normal variable Z = (X-*μ)/σ*

= (X-45)/8

P(X<=50) P(Z<=(50-45)/8=P(Z<=0.623) = 0.7323=73.23% (the number in Z table)

Probability that service manager will not meet his commitment is = 100 – 73.237

= 26.763%

= 0.2676

**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:- Here *μ = 38 , σ* =6

1. Probability of employees > 44 = P(X<=44)

= P(Z<=(44-38)/6)

=p(Z<= 1)= 0.84134= 84.134%

Probability that employees will be greter than 44 = 100 – 84.134 = 15.866

= P(Z>=(38-38)/6) =p(Z>= 1) = 0.5

Probability of employees between 38 and 44 =p(X<=44)-P(X>=38)

=0.84134-0.5=0.34134=34.134%

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

1. Probability of employees less than 30 = P(X<30)

Z = (X-*μ)/σ = (30-38)/6*

P(X<30) P(Z(30-38)/6) = P(Z<-1.333) = 0.09176 = 9.17%

So the number of employees with probability 0.0917 of them being under

30 = 400\*0.0917 = 36.68 = 36.

**“A 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:- 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 = 0.05

The probability towards right of b = 0.01/ 2 = 0.05

Probability of X – the random variable at a & B which has these probabilities.

Z = (X-*μ)/σ*

P = 0.005 , z= -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…….