**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 :**

**Normal distribution with µ=45 and σ =8**

**Let us consider , X be The amount of time it takes to complete the repairing of car in one hour.**

**We have to calculate Pr( X > 50 )**

**Pr(X > 50) = 1- Pr(X ≤ 50)**

**Now,**

**Z = ( x -µ) / σ**

**=(X - 45) / 8**

**Pr (X ≤ 50 ) = Pr (Z ≤ (50 – 45)/8)**

**= Pr(Z ≤ 0.625)**

**Now by using normal distribution table we can say ,**

**Pr (Z ≤0.625 ) = 0.7324**

**= 733.24%**

**The probability that the service manager cannot meet his commitment will be,**

**= 100 – 73.24**

**= 26.76 %**

**= 0.2676**

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 :**

**Given statements is false.**

1. **If more employee are older than 44 , It means µ is trending towards 44 but it was 38.**
2. **If considering standard deviation , It is not possible as µ is given 38 with *σ = 6.***
3. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.

**Answer :**

**Given statements is True.**

**Z = (X – μ ) / σ**

**Pr(X ≤30 ) = Pr ( Z ≤ (30 -38 )/6)**

**= Pr ( Z ≤ -1.33)**

**= 0.09176 ………….. (From Z table )**

**Required or expected count = 0.09176 \* 400**

**= 36.704**

**= 37**

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 :**

1. **2X1 will just larger scale version of X1, so as X1 normally distributed 2X1 also normally distributed.**
2. **X1 and X2 both variables are independent normal random variable and hence**

**X1 + X2 are exactly normal with associate parameters.**

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 :**

**We have to find the value of a and b which are symmetric about the mean**

**The probability of getting value between a and b,**

**= 1 – 0.99**

**= 0.01**

**The probability towards left from a ,**

**= ( - ) 0.01 /2**

**= - 0.005**

**And probability towards right from b,**

**= (+) 0.001/2**

**= 0.005**

**Now we got the probabilities if a and b , we have to calculate random variable at a and b,**

**We know,**

**Z = (X - µ) / σ ………………..(1)**

**We are interested to calculate X,**

**( Z \* σ) + µ= X ……………….( from eq1)**

**For probability 0.005 the Z-value is -2.575829 ……………….(Taken from Z table )**

**X = ( Z \* σ ) + µ**

**For ( -0.005)**

**X = - ( -2.575829 ) \* 20 + 100**

**= 151.51658**

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.= Rang is (90,990)

**Answer :**

**The rupee range is 77.388 to 1157.388 in Millions.**

1. Specify the 5th percentile of profit (in Rupees) for the company

**Answer :**

**5%th percentile of the profit (in million rupees) is 202.**

1. Which of the two divisions has a larger probability of making a loss in a given year?

**Answer :**

**Probability of division 1 making a loss = 0.0477903522728147**

**Probability of division 2 making a loss P( X < 0) = 0.04005915**