**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:- B**

**X=60**

**μ=45**

**б =8**

**The work begin after 10 min, so the average time increase from 45min to 55min.**

**for normal distribution :-**

**z = (X-μ)/б**

**= (50-45)/8**

**= 0.625**

**In R for probability finding we use function called pnorm**

**As we want to find the probability of service manager cannot meet his commitment, So we should write below command.**

**1-pnorm(0.625)**

**=0.2659**

**Or**

**1-pnorm(50, mean=45 sd=8)**

**=0.2659**

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- False**

**Mean = 38**

**SD = 6**

**Z score = (Value - Mean)/SD**

**Z score for 44 = (44 - 38)/6 = 1 => 84.13 %**

**=> People above 44 age = 100 - 84.13 = 15.87% ≈ 63 out of 400**

**Z score for 38 = (38 - 38)/6 = 0 => 50%**

**Hence People between 38 & 44 age = 84.13 - 50 = 34.13 % ≈ 137 out of 400**

**Hence More employees at the processing center are older than 44 than between 38 and 44. is FALSE**

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

**Ans- True**

**Z score for 30 = (30 - 38)/6 = -1.33 = 9.15 % ≈ 36 out of 400**

**Hence A training program for employees under the age of 30 at the center would be expected to attract about 36 employees - 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- 2X1 basically define as 2 times normal distribution and X1 +X2 both are in independent normal variable in nature N(μ1+ μ2+ σ21+ σ22)**

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 : D 48.5 151.5**

**Confidennce interval for 99% is 2.576**

**Here µ=100, *σ* =20 z=2.576**

**X=σZ+μ =>20\*2.576+100=>151.52**

**X=σZ-μ=>20\*-2.576+100=>48.48**

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) let, X is the sum of two random variables having normal distribution.**

**E[X]= E[45\*(profit 1+profit 2)]= 45\*(5+7)=540 million rupees**

**SD[X]= SD[profit 1 +profit 2]=> 45\*()**

**= 45\*= 225 million rupees.**

**Therefore, X~ N(540,)**

1. **From the empirical rule, Approximately 95% of the data falls within two standard deviation of the mean.**

**μ ± 2σ = 540±2\*225=> (540-450, 540+450)=> (90,990)**

**B)**



**From the above normal distribution we can say that to find 5th percentile from the left side we can use the formula,**

**μ - 1.5σ => 540-(1.5\*225) =>202.5 million rupees.**

**c) This question concerns the original profit distributions.**

**For division1= Z score for a profit of zero: Z=(X-µ)/ *σ =>*  (0-5)/3 => -1.66=0.0485**

**(or)**

> pnorm(0,5,3)

[1] 0.04779035

**For division2= Z score for a profit of zero: Z=(X-µ)/ *σ*  =(0-7)/4 => -1.75= .0401**

> pnorm(0,7,4)

[1] 0.04005916

**Division2 has a higher probability of making a loss.**