**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 : Given µ=45,σ=8,**

**Let time takenfor servicing transmission=X (Normally Distributed)**

**Time Delay=10, Time available to finish work=60-10=50**

**Using z-table Z=(X- µ)/ σ**

**P(X<=50)=P(Z<=(50-45)/8)=P(Z<=0.625)=0.7324**

**But P(X>50)=1-P(X<=50)=1-0.7324=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.

**False (because 68% data falls within one std dev of the mean. Here µ+σ=44)**

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

**True here X=30**

**Z=(X- µ)/ σ = P(x<=30)=P(Z<=(30-38)/6) P(Z<=-1.33)=0.0918 (using z-table)**

**Expected count=0.0918\*400=36.72**

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.

**2X1 is simply large scale version of the random variable X1. If X1 is ND then 2X1 also ND.**

**X1 and X2 are ND the associated sum and random sample are exactly Normal.**

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**

**We see 99% of the data which lies between 3rd std dev of the mean.**

**Here µ=100,σ=20**

**From empirical rule µ+-3σ=100+-3\*20=(100-60,100+60)=(40,160)**

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?