**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 (Answer)**
4. 0.5
5. 0.6987
6. 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.
7. More employees at the processing center are older than 44 than between 38 and 44.

**Answer: FALSE, since the data is normally distributed most of the value lie between 38 and 44(mean+std=38+6). Beyond 44 the data count will be less.**

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

**Total Employees=400\*stats.norm.cdf(30,38,6)=36.48(36 employees)**

**Answer: 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.

**Answer: 2X1 = 2N (μ, 2 σ2)**

**X1 + X2 = *N* (μ, σ2) + *N* (μ, σ2)**

**= 2N (μ, σ2)**

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: stats.norm.cdf (0.99,100,20) =48.5 and 151.5**

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.

**Answer: Mean profit = (7+5) \*45 = 12 \*45 = 540 million rupees**

**Std Dev = sqrt (9+16) \*45 = sqrt (25) \* 45 = 5 \* 45 = 225 million rupees**

**stats. norm. Interval (0.95,540,225) = (99.00810347848784, 980.9918965215122)**

**Rupee range lies between 99 million to 981 million**

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

**Answer: 5th percentile = z (-0.90) = -1.645**

**X= 540 + (-1.645) \* 225**

**X = 540 – 370.125**

**X = 169.87 = 170**

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

**Answer:**

**Loss = P(x<0)**

**Division 1 loss probability = stats.norm.cdf (0,5,3) = 0.04777**

**Division 2 loss probability = stats.norm.cdf (0,7,4) = 0.04005**

**Therefore Division 1 has more probability of loss**