**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**

**(1-pnorm(50,45,8)) = 0.265985529048701**

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: µ = 38 & σ = 6.**

**Probability of employees>44=Pr(x>44)=1-Pr(x>=44)**

**Z=(X-µ)/σ=(x-38)/6**

**Pr(x<=44)=Pr(z<=44-38)/6)=Pr(Z<=1)=0.84134=84.134%**

**Probability that employees will be greater than 44 = 100-84.134 = 15.866**

**Probability of employees between 38 & 44 = Pr(x>=44) – Pr(x>=38)**

**Here, Pr(x<=44) = 0.84134**

**Pr(x<=38) = Pr(z>=(38-38)/6)=Pr(z>=0) = 0.5**

**Therefore, Pr(x<=44)–Pr(x<=44)–Pr(x>=38)=0.84134-0.5 = 0.34134 = 34.134%**

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

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

**ANS: 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**

**he statement of “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:**

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: stats.norm.interval(0.99,100,20)**

**(48.48341392902199, 151.516586070978)**

**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.

**ANS: Rupee Ranges from 9.9 to 98.1 Crore Rupees in Annual profit of the Company 95% of the time.**

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

**ANS: Z\_5TH = stats.norm.ppf(0.05)**

**Fifth\_Percentile = (Z\_5TH\*STD)+Mean**

**The Fifth Percentile of Profit for the Company if 17.0 Crore Rupees**

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

**ANS: The Probability of Division #1 making a loss is 4.78 %**

**The Probability of Division #2 making a loss is 4.01 %**

**The Division 1 has a larger Probability of making a loss**