**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: Let X be the random variable.**

**As work begins after 10 minutes.**

**Customer is told to collect by 60 minutes.**

**X=60-10=50 is the working time on car.**

**Now When this X is greater than 50min the**

**manager will not be able to deliver**

**X =50**

**Now z = X-u/sigma**

**=50-45\8**

**=0.625**

**Now P(z)=0.7324**

**For 50min not going to happen is**

**1-0.7324=0.2676 ANS**

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

**ANS: Let X be the age of employee.**

**A.**

**X=44**

**Now z = X-u/sigma**

**z=44-38/6**

**z=1**

**Now P(z)=0.8413**

**For age 44 not going to happen is**

**1-0.8413=0.1587 ANS: True**

**B.**

**X=30**

**z=X-u/sigma**

**z=30-38/6**

**z=-1.33**

**Now P(z)=0.1515**

**0.0918**

**Now multiplying the probability of under 30 age workers**

**400\*0.0918 = 36.72 ANS: 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.
2. 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.
3. 90.5, 105.9
4. 80.2, 119.8
5. 22, 78
6. 48.5, 151.5
7. 90.1, 109.9

**ANS: Let X be the age of employee.**

**P of getting a and b 0.99**

**Not getting = 1-0.99 = 0.01**

**As the value both side is same for a and b**

**0.001/2=0.005**

**Both side = -0.005 and 0.005**

**Z(-0.005)=2.58 Z(0.005)=-2.58 https://www.mathway.com/popular-problems/Algebra/899056**

**z = X-u/sigma**

**X =z\*sigma + u**

**a = -2.58\*20+100 = 48.5 ANS D**

**b = z(-0.005)\*20+100**

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?