**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

Sol: 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.

Sol: Mean = 38

SD = 6

Z score = (Value - Mean)/SD

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

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 centre are older than 44 than between 38 and 44. is F**ALSE**

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

Sol: 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 centre 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.

Sol: Here X1 and X2 are two independent variables so

X1+X2= N(μ+ σ2+ μ+ σ2)

=N(2 μ+2 σ2)

2X1=N(2 μ+2 σ2)

2X1 – (X1+X2)=0

where I’ve assumed you meant σ1 to apply to x1 and σ2 to x2 (and not that they were the same).

It’s conventional to specify mean and width, so I’ve assumed that what you meant to express. Anyway, means add, widths add in quadrature.

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

Sol:48.5, 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.

Sol: Range

Min = 99.00810347848784

Max = 980.9918965215122 in Millions

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

Sol: 170 (in million Rupees)

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

Sol: Division 1