**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) 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.

Ans: More employees at the processing center are older than 44 and in between 38 and 44.

mu=38, sigma=6, x=44

z score = (44-38/6) = 1

by normal table =0.8413

people above 44 age =100-84.13=15.87%

63 out of 400

Z score for 38 = (38-38)/6=50%

Hence people between 44 and 38 age=84.13-50=34.13%

137 out of 400

More employees at the processing center are older than 44 than between 38 and 44 is false

b. A training program for employees under the age of 30 at the center would be expected to

attract about 36 employees.

Solu: Z score for 30 = (30-38)/6=-1.33=9.15%

the training program for employees under the age 30 at the Centre would be expected to

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.

Ans: As we know that if X ∼ N(µ1, σ1^2 ), and Y ∼ N(µ2, σ2^2 ) are two independent random

variables then X + Y ∼ N(µ1 + µ2, σ1^2 + σ2^2 ) , and X − Y ∼ N(µ1 − µ2, σ1^2 + σ2^2

Similarly, if Z = ax + bY , where X and Y are as defined above, i.e. Z is linear combination of X and

Y, then Z ∼ N (aµ1 + bµ2, a^2σ1^2 + b^2σ2^2).

Therefore, in the question

2X1~ N (2 u,4 σ^2) and

X1+X2 ~ N (µ + µ, σ^2 + σ^2) ~ N (2 u, 2σ^2)

2X1-(X1+X2) = N (4µ,6 σ^2

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: A = Probability toward the left =-0.01/2=0.005

B = probability toward the right = 0.01/2=0.005

Z= (x- μ)/ σ

X=z\* σ+ μ

X= (-0.005) \*20+200=-(-2.57) \*20+100=151.4

Y== (-0.005) \*20+200= (-2.57) \*20+100=48.6

D) 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.
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?

Ans: A. Specify a Rupee range (centered on the mean) such that it contains 95% probability

for the annual profit of the company.\]hg

Profit 1+profit 2=N (11,7^2)

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

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