**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

stats.norm.sf(50,45,8) = 0.26598552904870054

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)  **False**

Around 70% of the data falls within one standard deviation of the mean (µ+*σ* = 38+6=44)

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

Ans) **True**

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 center would be expected to attract about 36 employees

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) 2 *X*1  will be greater scale version than *X*1 + *X*2 . If *X*1 and *X*2 are normally distributed then the sum of the random sample will be exactly same

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) D

stats.norm.ppf(0.005,100,20) #48.483413929021985

stats.norm.ppf(0.995,100,20) #151.516586070978

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)

stats.norm.ppf(0.025,45\*5,3) # 219.12010804637984

stats.norm.ppf(0.975,45\*5,3) # 230.87989195362016

stats.norm.ppf(0.025,45\*7,3) # 309.1201080463798

stats.norm.ppf(0.975,45\*7,3) # 320.8798919536202

The Rupee Range will be [219.12, 230.87] + [309.12, 320.87] = [528.24, 551.74]

B) stats.norm.ppf (0.05,45\*7,3) # 310.0654

stats.norm.ppf (0.05,45\*5,3) # 220.0654

5th percentile of profit (in Rupees) = 310.0654+ 220.0654 = 530.1308

C) 2nd Division