**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

‘B’ the serving work will begin after 10 min of drop off so 45+10 which will now take more than the usual time so new mew is 55 minutes and the probability that it will take more than 1 hour to complete .mew = 55 std = 8 q1 = 1-stats.norm.cdf(60, loc = mew, scale = std) q1 = 0.2659 The probability that the service manager cannot meet his commitment is 0.2659

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: False

Around 70% of the data falls within one standard deviation of the mean (µ+= 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=(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

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

qnorm(0.995,100,20)

qnorm(0.005,100,20)

print("""The two values of a and b, symmetric about the mean, are such that the probability of the random variable taking a value between them is 0.99:""",np.round(stats.norm.interval(0.99, loc = 100, scale = 20),1)) The two values of a and b, symmetric about the mean, are such that the probability of the random variable taking a value between them is 0.99: [ 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

ANS:

A)

qnorm(0.025,45\*5,3) # 219.1201

qnorm(0.975,45\*5,3) # 230.8799

qnorm(0.025,45\*7,3) # 309.1201

qnorm(0.975,45\*7,3) # 320.8799

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

Rupee ranges in between [9.9 to 98.1] Crore Rupees, 95% of the time for the Annual Profit of the Company.

B)

qnorm(0.05,45\*7,3) # 310.0654

qnorm(0.05,45\*5,3) # 220.0654

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

The 5TH Percentile of profit for the company is 17 Crore Rupees

C)

2nd Division

The Division #2 (Profit2 ~ N(7, 42) ) has a larger probability of making a loss in a given year