**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

**Answer-‘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. 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.

**Answer- False.**

**Explain- Let Z be the standard normal variable, then for the interval older than 44:**

**Z = (44 - 38) / 6 = 1**

**Using a standard normal distribution table or calculator, we can find that the proportion of employees older than 44 is approximately 0.1587.**

**For the interval between 38 and 44:**

**Z1 = (38 - 38) / 6 = 0 Z2 = (44 - 38) / 6 = 1**

**The proportion of employees between 38 and 44 is the difference between the areas under the standard normal curve corresponding to Z1 and Z2:**

**P(38 ≤ X ≤ 44) = P(Z1 ≤ Z ≤ Z2) = P(0 ≤ Z ≤ 1) = 0.3413**

**Therefore, the proportion of employees older than 44 is 0.1587 and the proportion of employees between 38 and 44 is 0.3413.**

**So, the statement "More employees at the processing center are older than 44 than between 38 and 44" is FALSE. The proportion of employees between 38 and 44 is actually larger than the proportion of employees older than 44**

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

**Ans: True. q2b = stats.norm.cdf(30, loc = mean, scale = std1)100 print('A training program for**

**employees under the age of 30 at the center would be expected to attract**

**about',np.round((q2b400)/100,0),'employees') A training program for employees under**

**the age of 30 at the center would be expected to attract about 36.0 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

**Answer- D.**

**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
2. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.

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

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

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

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

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

**year**