**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?

**ANS:- (B)** Time taken to service a car is 50 minutes.

Pr(X > 50) = 1 - Pr(X ≤ 50).

Z = (X - 45)/8.0

Using the normal table to find

Pr(X ≤ 50) = Pr(Z ≤ (50 - 45)/8.0)

= Pr(Z ≤ 0.625)=73.4%

Probability that the service manager will not meet his demand will be:-

= 100-73.4 = **26.6% or 0.2676**



1. 0.3875
2. 0.2676
3. 0.5
4. 0.6987
5. 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.
6. More employees at the processing center are older than 44 than between 38 and 44.

**ANS:- False**

If more employees are older than 44, this will shift the*m*  towards 44 with considering sd. Which is not possible as *m* is given 38 with sd 6.

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

**ANS:- 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 both are independent normal random variables, X1 + X2 is normal with N(µ1+µ2,σ12+σ22). And 2X1 will just scale the normal distribution by 2 times.

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.

**Ans:** x=σ[z] + µThus "a" = 0.5th percentile for X = 20\*[-2.57] + 100 = **48.5** and "b" = 99.5th percentile for X = 20\*[+2.57] + 100 = **151.4**

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1. 90.5, 105.9
2. 80.2, 119.8
3. 22, 78
4. **48.5, 151.5**
5. 90.1, 109.9
6. 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
7. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
8. Specify the 5th percentile of profit (in Rupees) for the company
9. Which of the two divisions has a larger probability of making a loss in a given year?

**ANS:-**

1. Range containing 95% probability is **(99.008, 98,09)**
2. The 5th percentile of profit (in Rupees) for the company is **170.0**
3. **Division 1** has a larger probability of making a loss in a given year

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