**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: Z = 0.625

P(X>50) = 0.26598552904870054

P(X<=50) = p-value = 0.7340144709512995

P(X>50) = 1 - P(X<=50) = 1 – 0.734 = 0.266

Option = B.

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

Ans: A). People above 44 age, p(X>44) = 0.15865525393145707 = 15.87% = 63 out of 400

People between 38 & 44 age, p(38<X<44) = 0.3413447460685429 = 34.13% = 137 out of 400

Hence More employees at the processing center are older than 44 than between 38 and 44. is F**ALSE**

B). Employees under the age of 30 years = 0.09121121972586788 = 9.12% = 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 - **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:

Both are normal with mean 2μ, but the variance of the sum is 2σ2 rather than 4σ2.

E(2X1) = 2E(X1) = 2μ and E(X1 + X2) = E(X1) +E(X2) = μ + μ whereas

Var(2X1) = 4Var(X1) =4σ2 and Var(X1 + X2) = Var(X1) + Var(X2) = 2σ2

Think of 2X1 = X1+X1 as the sum of two perfectly dependent normal random variables whereas X1 + X2 is the sum of two independent normal random variables.

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 = 48.483413902199 and b = 151.516586070978

So, the correct option is D

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: Mean = 540 Million, Standard Deviation = 315 Million

1. Range is Rs = (-77.38865513011706, 1157.388655130117) Million
2. 5th percentile of profit = 23.399999999999977 Million
3. Division 1 = 0.0477903522728147, Division 2 = 0.040059156863817086

Therefore, Division 1 > Division 2, Division is making more loss