**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.0.2676**

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.

Mean = 38

SD = 6

Z score = (Value - Mean)/SD

Z score for 44 = (44 - 38)/6 = 1 => 84.13 %

=> People above 44 age = 100 - 84.13 = 15.87% ≈ 63    out of 400

Z score for 38 = (38 - 38)/6 = 0 => 50%

Hence People between 38 & 44 age = 84.13 - 50 = 34.13 % ≈ 137 out of 400

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

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

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 centre 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 =** 2 is simply a larger scale version of the random variable *X1.* If is normally distributed then 2X1 is also normally distributed.

*X*1 and *X*2 are normal distributed, the associated sums and random samples are exactly (and not just approximately) normal, with the appropriate parameters.

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

Here we need range of 99% data which lies between 3rd standard deviation of the mean.

Here µ=100, *σ* =20

From empirical rule, µ±3σ*= 100±3\*20=>(100-60, 100+60)=>(40,160).*

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.**

**ANS =** let, X is the sum of two random variables having normal distribution.

E[X]= E[45\*(profit 1+profit 2)]= 45\*(5+7)=540 million rupees

SD[X]= SD[profit 1 +profit 2]=> 45\*()

= 45\*= 225 million rupees.

**Therefore, X~ N(540,)**

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

**ANS =** from z table value for , 5 percentile = -1.645

X= 540+(-1.645)\*(225)= 170