**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 work begin after 10 min, so the average time increase from 45min to 55min.**

**for normal distribution -:**

**z = (X-μ)/б**

**= (60-55)/8**

**= 0.625**

**Find probability**

**=round(1-stats.norm.cdf(abs(0.625)),5)**

**= 0.26599**

**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. Because the probability for employees at the processing center**

**are more between 38 and 44 than older than 44.**

**Employees older than 44 yrs of age**

**= 1-stats.norm.cdf(44,loc=38,scale=6)**

**= 0.15865525393145707**

**Employees between 38 to 44 yrs of age**

**= stats.norm.cdf(44,38,6)-stats.norm.cdf(38,38,6)**

**= 0.3413447460685429**

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

**Answer -: True**

**Employees under 30 yrs of age**

**= stats.norm.cdf(30,38,6)**

**= 0.09121121972586788**

**No. of employees attending training program from 400 nos. is**

**N\*P(X<30)**

**= 400\*stats.norm.cdf(30,38,6)**

**= 36.484487890347154**

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.

**Answer -:**

**The Normal Distribution has its link with the Central Limit Theorem, which states that ‘Any large sum of independent identically distribution random variables are approximately Normal then (X1 + X2) and (2X1) tends to have Normal distribution only If X1 and X2 are i.i.d and n is Large.**

**The Difference between 2X1 and (X1 + X2) is the magnitude they hold of two different sample subsets (X1 and X2) from the same source(population). X1 and X2 can be a different subset of a sample from a similar source (population) but If X1 ~ N(µ, s2) then, 2 X1 ~ N(2 µ, 4 s2 ) If X1 ~ N(µ, s2) and X2 ~ N(µ, s2) are iid normal random variables then (X1 + X2)N(µ+ µ, s2+ s2)(2 µ, 2 s2) Hence, 2X1 – (X1+X2) ~(2 µ – 2 µ, 4 s2 + 2s2 ) The distribution remains the same for every sample subset of similar source, it tends to fall under Normal distribution and slight deviations in** **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

**Answer -: D**

**= stats.norm.interval(0.99,100,20)**

**= (48.48341392902199, 151.516586070978)**

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**