**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

**>**

**Option B is Correct answer**

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.

**>**

**False ,**

**mean = 38 & SD = 6**

**means that, most of the ages are lying between 32 and 44**

**#Z-score for 44**

**from scipy import stats**

**round(1-stats.norm.cdf(44,loc=38,scale=6),4)**

**Output : 0.1587**

**i.e. 63 employees out of 400**

**#Z-score between 38 and 44**

**from scipy import stats**

**round(stats.norm.cdf(44,loc=38,scale=6) - stats.norm.cdf(38,loc=38,scale=6),4)**

**Output : 0.3413**

**i.e. 137 employees out of 400 therefore ,**

**137 > 63 hence given condition is false.**

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

**>**

**True ,**

**from scipy import stats round(stats.norm.cdf(30,loc=38,scale=6),4)**

**Output : 0.0912**

**i.e. 36 employees out of 400 hence given condition is 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.

**>**

**We know that ,**

**if X 1 ~ N(μ, σ2 ) and X2 ~ N(μ, σ2 ) are two independent random variables then ,**

**X1 + X2 ~ N(μ + μ , σ2 + σ2 )**

**Similarly if Z = aX1 + bX1 , where X and Y are as defined above, i.e Z is linear combination of X1 and X1 , then Z ~ N(aµ + bµ, a2 σ2 + b2 σ2 ).**

**Therefore from the question ,**

**2X1 ~ N(2 µ , 4 σ2 ) &**

**X1+X2 ~ N(2 µ, 2σ2 )**

**2X1 - (X1+X2) = N( 0,2σ2 )**

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.

1. 90.5, 105.9
2. 80.2, 119.8
3. 22, 78
4. 48.5, 151.5
5. 90.1, 109.9

**>**

**Option D is Correct Ans**

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.

**>**

**Mean Profit is Rs 540 Million**

**Standard Deviation is Rs 225.0 Million**

**Range is Rs (99.00810347848784, 980.9918965215122) in Millions**

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

**>**

**5th percentile of profit is 170 (in Million Rupees)**

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

**>**

**Making Loss ,i.e X<0**

**Devision 1:**

**Stats.norm.cdf(0,5,3)**

**Output: 0.047793**

**Devision 2:**

**Stats.norm.cdf(0,7,4)**

**Output : 0.04005**

**Hence,**

**Devision 2will Be Face More Loss**