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**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

z = (X-μ)/б = (60-55)/8 = 0.625

1 - stats.norm.cdf(60,55,8) = 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.
3. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.

**Ans)**

1. False. Clearly no. of employees older than 44 yrs of age is lesser than no. of employees between 38 & 44yrs of age
2. True.

No. of employees under the age of 30: 36.484487890347154

Which is approximately equal to 36

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)**

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|  | |
| As we know that if If *X1* ~ *N*(μ, σ2), and *X*2 ~ *N*(μ, σ2) are two independent  random variables. | | |
|  |
|  | Therefore in the question, |
|  | 2 *X1* ~ N(2μ, 2σ2)and |
|  | X1+X2 ~ N(µ + µ, σ^2 + σ^2 ) ~ N(2 u, 2σ^2 ) = N(2μ, 2σ2) |
|  | Hence, 2 *X1* = *X1* + *X*2 |
|  | |  |

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. 48.5, 151.5

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.
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)**

1. Range in Rs. (99.00810347848784, 980.9918965215122) Million.
2. 5th percentile of profit (in Rupees) is 170.0
3. First division of the company has larger probability of making a loss in a given year.