**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 – The probability that the service manager cannot meet his commitment is 0.2676

To calculate the probability that the service manager cannot meet his commitment, we need to find the probability that the servicing time will exceed 50 minutes. We can standardize the servicing time using the z-score formula: **z=(x-µ)/ σ**

Plugging in the values, we get: z = (50 - 45) / 8 = 0.625.

We can then use a standard normal distribution table or calculator to find the probability that a z-score is greater than 0.625. This probability is approximately 0.2676.

So, The answer is 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 = false

1-stats.norm.cdf (44,38,6)

This means that 15.87% of employees are older than 44

Stats.norm.cdf (44,38,6) – stats.norm.cdf (38,38,6)

This means that 34.13% of the employees are between 38 and 44.

Here, 34.13% > 15.87%, there are more employees at the processing center between 38 and 44 than older than 44. Therefore A is false

B = True

Stats.norm.cdf (30,38,6)

This means that 9.12% of the employees are under the age of 30. Therefore, a training program for employees under the age of 30 would be expected to attract about 36 employees (9.12% \* 400 employees).

Therefore, the answer to B 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.

Ans – There will be a difference between the variance

2X1 will be a larger variable than X1+X2

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**: The area under the standard normal distribution curve between two z-scores can be found using a z-table or a calculator.

In this case, we want the probability to be 0.99. This corresponds to a z-score of 2.576. Therefore, we need to find two values, a and b, such that their z-scores are equal to ±2.576.

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

Therefore, the two values that satisfy the given condition are 48.48 and 151.52.

The answer 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**: Therefore,

mean=5+7

print ('Mean Profit is Rs', mean\*45,'Million')

Mean Profit is Rs 540 million

SD = np.sqrt((9)+(16))

print ('Standard Deviation is Rs', SD\*45, 'Million')

Standard Deviation is Rs 225.0 Million

1. print('Range is Rs',(stats.norm.interval(0.95,540,225)),'in Millions')

Range is Rs (99.00810347848784, 980.9918965215122) in Millions

B. X= 540+(-1.645)\*(225)

print('5th percentile of profit (in Million Rupees) is',np.round(X,))

5th percentile of profit (in Million Rupees) is 170.0

C. stats.norm.cdf(0,5,3)

0.0477903522728147

stats.norm.cdf(0,7,4)

0.040059156863817086