**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

* B

Z=(50-45)/8

0.625-> from z table the probability will be 0.733

Now 1-0.733(because we want the probability of failing)

0.267 or 26.7%

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**

because the probability distribution between 38 and 44 is 34% whereas the Probability Distribution above 44 is only 16%

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

* **True**

Because if we check the z value for 30 and calculate the probability of <=30 from z table we will get 9.176% probability and considering we have 400 clients, the count will be approximately 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.

* 2X1 = N(2μ,4σ2 )

multiplying by scalar 2 on a variance, we cannot directly multiply it, so we bring the variance to same scale as mean i.e standard deviation then multiply by 2, after that we reconvert it into variance so that gives me 4σ^2

* X1 +X2=N(2μ,2σ2 )

We are adding same quantity without using scalar addition, this will give the same result as this and just shift the overall location of the plot in 2d plane.

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

* D

As we know z=xbar-mu/sigma

We can calculate xbar with this expressing and we calculate z value for 99% interval by using z table.

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?

* A) Addition and Subtraction between two graphs will be like a normal operation so we make a new graph with mean as 12 million usd and standard deviation as 5m usd

The 95% interval according to empirical formula will be +-2 std so the interval will be

[2M,22M] USD converting it into rupees-> [90,990]M rupees.

* B) To calculate 5 percentile of “Profit” we would need to know where does the company make equal profit and loss which is not possible with only the given data. We can calculate the 5% of the company profit/loss by checking z value for below 5% which is -🡪 -1.645 now converting this into rupees would be -74.025 M rupees
* C) we can check this by finding the probability using z score below 0 as the loss i.e

Z=0-mu/std for both the sections and check who has the most probability of making a loss.

Division 2 will have a higher probability of making a loss.