**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**

**Explanation :–**

* μ=45min, σ=8min
* μ=10min after = 45+10=55
* Car will be ready in 1hr=60min(x)
* Z=x- μ/σ
* 60-55/8
* 0.625
* 1=stats.norm.cdf(z)
* 1=stats.norm.cdf(0.625)
* 0.2659
* P value for z score is 0.2659 approx to 0.2676

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.

**Ans**. **False.**

**Explanation–**

* µ = 38

*σ* = 6

* Z score µ = 38

*σ* = 6

* Z score = (X- µ)/ *σ*
* Z score for 44  = (44 - 38)/6  = 1
* In python- stats.norm.cdf(1) =>  84.13 %
* People above 44 age = 100 - 84.13 =  15.87%
* Given 400 clerical employes, that is calculating 15.87% of 400=336.52 out of 400
* 400 - 336.52
* 63.49≈63(approx)
* Z score for 38  = (38 - 38)/6 = 0
* In python- stats.norm.cdf(0) => 50%

**Hence, People between 38 & 44 age = 84.13 - 50 = 34.13 % ≈ 137 out of 400**

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

**Ans.** Zscore for 30 = (30 - 38)/6 = -1.33 = 9.15 %   ≈ 36 out of 400.

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**.

* As both are independent normal random variables, X1+X2 is normal with *N* (μ1+ μ2, σ21+ σ22). And 2X1 will just scale the normal distribution by 2 times

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**. **48.5, 151.5**

**Explanation;–**

* p(a<x<b) = 0.99, µ=100, σ = 20
* To Find:
* Identify symmetric values for the standard normal distribution such that the area enclosed is 0.99
* Using Python
* stats.norm.interval (0.99, 100, 20)
* Two values symmetric about mean for the given standard normal distribution are [48.5,151.5]

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.

* Refer **Nihit** Assignment – 2 Python File

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

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

* Refer **Nihit** Assignment – 2 Python File

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

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

* Refer **Nihit** Assignment – 2 Python File

Probability of Division 1 making a loss P(X<0)

**0.047**

Probability of Division 2 making a loss P(X<0)

**0.040**