**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

* *μ* = 45 , *σ* = 8
* The probability that the service manager cannot meet his commitment

from scipy import stats

= 1-stats.norm.cdf(x= 50,loc= 45,scale= 8)

= 0.26598552904870054

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,

Here, the age of clerical employees at an insurance claim processing center

Is normally distributed. So, if at the processing center employees are older than 44 than between 38 and 44 , the data will not be normal and there will be skewness.

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

= stats.norm.cdf(x= 30,loc= 38,scale= 6)

= 0.0912112197

=0.0912 \* 400

= 36. 49

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

* X1+X2 are two sample independent normal distribution
* 2X1 will only 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

* qnorm(0.995,100,20) = 151.516
* qnorm(0.005,100,20) = 48.483
* Ans. D 🡪 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.

* > qnorm(0.025,45\*5,3)

[1] 219.1201

* > qnorm(0.975,45\*5,3)

[1] 230.8799

* > qnorm(0.025,45\*7,4)

[1] 307.1601

* > qnorm(0.975,45\*7,4)

[1] 322.8399

* Rupees Range will be [219.12,230.87 ] + [307.1601, 322.8399] = [526.2801 ,553.7099]

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

* > qnorm(0.05,45\*7,4)

[1] 308.4206

* > qnorm(0.05,45\*5,3)

[1] 220.0654

* 5th percentile of profit (in Rupees) = 308.4206+ 220.0654 = 528.486

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

* 2nd division N(7, 42) has larger probability of making a loss in a given year because of high variance compare to other one.