**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

(1-pnorm(50,45,8)) = 0.265985529048701

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

Around 70% of the data falls within one standard deviation of the mean (µ+= 38+6=44)

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

ANS: True

Z=(X-µ)/ *σ*

P(X≤30)=p(Z≤(30-38)/6)=p(Z≤-1.33)= 0.0918(using z table)

Expected count=0.0918\*400= 36.72

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: 2 *X*1  will be greater scale version than *X*1 + *X*2 . If *X*1 and *X*2 are normally distributed then the sum of the random sample will be exactly same

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

qnorm(0.995,100,20)

qnorm(0.005,100,20)

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: A) The corresponding z-scores of 2.5th percentile is -1.96 & 97.5th percentile is 1.96

Therefore

The rupee range centered on the mean (540 million) is

Lower limit = 540 – (1.96 \* 387) = 197.32 million

Upper limit = 540 + (1.96 \* 387) = 1277.32 million

Thus the Rupee range centered in the mean contains 95% probability is [ 197.32 M to 1277.32 M]

B) z-scores corresponding to the 5th percentile of the SND is -1.645

In dollar’s = 5th percentile = mean + z-score \* STD DEV

= 12 – 1.645 \* 5.167

= 3.162 million $

In rupees = 5th percentile= 3.162 \* 45

= 142.29 million rupees

Therefore the 5th percentile of the total profit of the company in Rupees is 142.29 million rupees

C) for 1 division the probability of making loss is 8.08 %

And for 2 division the probability of making loss is 0.21 %

Therefore Division 1 has more likely to make loss in a given year.