**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

**Solution :**

Time taken to service a car is 50 minutes.

Pr (X > 50) = 1 - P (X ≤ 50).

Z = (X - 45)/8.0

Thus the question can be answered by using the normal table to find

Pr (X ≤ 50) = Pr (Z ≤ (50 - 45)/8.0)

= Pr(Z ≤ 0.625)

=73.4%

Probability that the service manager will not meet his demand will be

= 100 - 73.4

= 26.6% (or) 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.

**Solution :**

**FALSE**

A shift toward 44 will occur when taking into account sd if there are more employees who are over 44. which, given that 38 with a sd 6 is given, is impossible.

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

**Solution :**

**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.

**Solution :**

2 *X1* will have a larger scale than *X1* + *X*2. The sum of the random sample will be the same if *X1* and *X*2 are normally distributed.

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

**Solution :**

**D. 48.5, 151.5**

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.

**Solution :**

qnorm(0.025,45\*5,3) # 219.1201

qnorm(0.975,45\*5,3) # 230.8799

qnorm(0.025,45\*7,3) # 309.1201

qnorm(0.975,45\*7,3) # 320.8799

The Rupee Range will be [219.12, 230.87] + [309.12, 320.87] = [528.24, 551.74]

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

**Solution :**

qnorm(0.05,45\*7,3) # 310.0654

qnorm(0.05,45\*5,3) # 220.0654

5th percentile of profit (in Rupees) = 310.0654+ 220.0654 = 530.1308

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

**Solution :**

2nd Division with Distribution N(7, 42).