**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 X is time required for work completion. 10 min late so remaining time is 50 min

Std normal variable Z= X-mu/sigma= X-45/8=0.625 = 0.73237 from Z table.

Probability for commitment=1-73.27=26.763%

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

ANS=

1. Z score of 44=44-38/6= 1=84.13 % from Z table.

People above age 44 i.e 40< =100-84.13= 15.87 % ie 63 out of 400

Z score of 38 = 38 - 38/6 = 0 => 50% from Z table.

Hence People between 38 & 44 age = 84.13 - 50 = 34.13 % ie137 out of 400

Hence More employees at the processing centre are older than 44 than between 38 and 44 is false.

B) Z score of 30 = 30 - 38/6 = -1.33 = 9.15 % ie 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.
2. 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.
3. 90.5, 105.9
4. 80.2, 119.8
5. 22, 78
6. 48.5, 151.5
7. 90.1, 109.9

Given:   p(a<x<b) = 0.99

Identify symmetric values for the standard normal distribution such that the area enclosed is .99

excluded area of .005 in each of the left and right tails.

we want to find the 0.5th and the 99.5th percentiles Z score values

from Python notebook

Z = (x - 100)/20 = > x = 20z+100

s

      a = -(20\*2.576) + 100= 48.5

      b = (20\*2.576)+100= 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.

Ans = total profit of company = N(5,32) and N(7,42)

=N(5+7, 32+42)

= N ( 12, 9+16) = N(12,25) = N(12,52)

95% of the probability lies between **1.96** standard deviations of the mean

Range = (12-1.96x5) and (12+1.96x5)

= (2.2,22.8) in $

=( 99,1026) in RS

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

Ans= Z value for 5th percentile = -1.644.

Formula X = µ + Z Sigma.

= 12+(-1.644 x 5)

= 12-8.22 = 3.78 in $

In RS 170.1.

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