**Date:** 7 September, 2015

**Experiment No. 3**

**Aim:**  To find the critical region of normal distribution using normal distribution.

**Experiment:**

**1.** Let X ~ N(μ, σ2) where μ is known, we wish to test

H0: Θ=Θ0 vs H1:Θ=Θ1 and (Θ0 U Θ1) = H

by means of Likelihood ratio test where

Θ0 :{(μ, σ2):μ=6, σ2=(2, 3)} and Θ:{(μ, σ2):μ=6, σ2=(1, 2, 3, 4)}

Obtain the critical region of the test.

**2.** Consider the LR test for

H0: Θ=Θ0 vs H1: Θ=Θ1 and (Θ0 U Θ1) = H

For a random variable X ~ N(μ, σ2) both μ and σ2 unknown. Here

Θ0:{(μ, σ2):μ=(1, 2),σ2=(4, 9)} and Θ:{(μ, σ2):μ=(1, 2, 3), σ2=(4, 9, 16)}

Verify that -2lnλ ~ χ2(k) for H0involving K parameters and for large sample sizes.

**Theory:**  For

H0: Θ=Θ0 vs H1: Θ=Θ1 and (Θ0 U Θ1) = H

Likelihood Ratio: λ(x) =

Critical region is given byλ(x)< C where P(λ(x)< Zα) = C.

Large sample theory: For large sample for any population, sample mean is approximately normally distributed.

~ χ2(1)

We obtain samples Y1, Y2 . . . . . . . . .Yn.

**Algorithm: Part 1**

1. Open the file “norm3.txt” to read the data and “normout3.txt” to write the results using pointers.
2. Use randomize function to generate random numbers.
3. Numbers generated will lie between 0 and 1, we will convert them into N(6, 2.5) sample using transformation.
4. Generate random sample form N(6, 1), N(6, 2), N(6, 3), N(6, 4).
5. Obtain the log likelihood function for each sample.
6. Using Excel compute the critical region.
7. Results are expected in the file “normout3.txt”.

**Part 2**

1. Open the file “3bin.txt” to read the data and “3bout.txt” to write the results using pointers.
2. Use randomize function to generate random numbers.
3. Numbers generated will lie between 0 and 1, we will convert them into N(2, 9.5) sample using transformation.
4. Generate random sample form N(1, 4), N(1, 9), N(1, 16), N(2, 4), N(2, 9), N(2, 16), N(3, 4), N(3, 9), N(3, 16).
5. Obtain the log likelihood function for each sample.
6. Repeat the procedure 40 times.
7. Obtain the mean of Y1, Y2 . . . . . . . . .Yn, it will follow chi-square distributon.
8. Results are expected in the file “3bout.txt”.

**Results:**

1. Critical region for the normal distribution is given by lambda(x)<= 0.998036
2. Verified that -2lnλ ~ χ2(k)  with 2 degrees of freedom.

**Conclusion:**

Hence we have obtained the critical region of normal distribution using likelihood ratio test.