**Date:** 20 October, 2015

**Experiment No. 10**

**Experiment:** The dispersion matrix of scores X1, X2, X3 and X4 of four tests is given below. The first two tests are based on English and the second two on mathematics. Sample obtained is of size 300. Test whether the scores in English and mathematics are independent or not. The dispersion matrix is as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| 51.121 | 23.86 | 1.793 | 0.998 |
| 23.86 | 54.756 | 3.633 | 3.511 |
| 1.793 | 3.633 | 18.255 | 21.122 |
| 0.998 | 3.511 | 21.122 | 60.516 |

Ʃ =

**Theory:**

The null hypothesis to be tested:

**H0:** The scores in English and mathematics are independent.

**H1:** The scores in English and mathematics are not independent.

Let X̲ represents the score vector and partitioned as X̲(1) and X̲(2) representing scores obtained in English and mathematics respectively. Let the dispersion matrix be partitioned as

Ʃ = Ʃ11 Ʃ12

Ʃ21 Ʃ22

X̲’ = (X1, X2, X3, X4), X̲’(1) = (X1, X2)’ and X̲’(2) = (X3, X4)’

**The test statistic under H0 is**:

Where

pi= number of components in ith sub-vector X̲(1) and X̲(2).

k= number of sub-vectors

n= order of the matrix

N= sample size Ʃ and

**Algorithm:**

1. Open the file “in10.txt” to read the data and “out10.txt” to write the results using pointers.
2. Find the determinant of the matrix Ʃ.
3. Extract the sub-matrices Ʃ11 and Ʃ22 and find determinant.
4. Calculate L, p, F, λ and hence calculate the test statistic.
5. Results are expected in the file “out10.txt”.

**Additional:**

Using MS-Excel we find the calculated value χ(4)2(0.05) for testing of null hypothesis in the problem. For this, the function used in the Excel is CHIINV with parameters (probability, degree\_freedom). Therefore, CHIINV(0.05,4) = 9.487729.

**Results:**

Determinant of given dispersion matrix = 1447935.875000

Determinant of sub matrix Ʃ11 = 2229.881592

Determinant of sub matrix Ʃ22 = 658.580627

The calculated value of test statistic = 4.192860

**Conclusion:**

Since, the calculated value of chi- square test is 4.192860 which is less than tabulated value χ(4)2(0.05), therefore we may accept the null hypothesis H0 at 5% level of significance and conclude that the scores in English and mathematics are independent.