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Roll No-12

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**Experiment No-04**

**Topic-** CONDITIONAL DISTRIBUTION, PARTIAL AND MULTIPLE CORRELATION

**Problem-** The estimate of the mean vector µ̰ and the covariance matrix of a 4 variate Normal Distribution based on 36 observations are as follows-

µ̰**=** =

(i) Find the estimates of the parameters of the conditional distribution of (X1,X2) given (X3,X4) and that of the conditional distribution of (X3,X4) given (X1,X2) .

(ii) Find the sample multiple correlation coefficient of X1 on (X2,X3,X4) and hence ,test the hypothesis H0:1.234=0 at 5% level.

(iii) Find the sample correlation coefficient of X3 and X4 (eliminating the effects of X1 and X2) and test forH0:34.12=0 at 5% level.

**Theory-**

(i) We first find the parameters of the conditional distribution of (X1, X2) given (X3, X4) by means of the following partitioning of µ and

X̰== ==

==

The estimates of the parameter of the conditional distribution of (X1, X2) given (X3, X4) are given by -

=+()

Where, = = - -122 21

The parameter of the conditional distribution of (X3,X4) given (X1,X2) then we found by means of the following partitioned vector is as follows:-

X̰== ==

==

The estimates of the parameter of the conditional distribution of (X3, X4) given (X1, X2) are given by-

34.12=µ(1)+1 (x(2)-µ̰(2))

Where, 1=12-122

22.1=22-21-11112

(ii) Here, we first partitioned X̰, and as follows: -

X̰== ==

==

The multiple correlation coefficient between X1 on (X2, X3, X4) denoted by R1.234 is given by-

R21.234=

To test the hypothesis H0:1.234=0(X1 is independent of (X2, X3, X4). We use the following to test the statistics under H0

)F(p,n-p-1)

Where, ‘n’ is the number of observations.

The calculated value is compared with the tabulated value and conclusions are done accordingly.

(iii) Let, 22.1=

Then r11.2=

=

Test the null hypothesis H0:1.234=0 , then test statistic under H0 is

Z=

Where, Z=(

ξ=(

=1=0

We compare this value with the tabulated value of Z at 5% level and draw the conclusions accordingly.

**Calculation-**

The R-Programming for obtaining the solution.

s=array(c(23.804,4.170,0.535,5.882,4.170,864.774,2.2428,31.148,0.535,2.2428,0.416,1.172,5.882,31.148,1.172,11.348),dim=c(4,4))

s

s11=array(c(23.804,4.170,4.170,864.774),dim=c(2,2))

s11

s12=array(c(0.535,2.2428,5.882,31.148),dim=c(2,2))

s12

s21=t(s12)

s21

s22=array(c(0.416,1.172,1.172,11.348),dim=c(2,2))

B1=s12%\*%solve(s22)

B1

s11\_2=s11-(B1%\*%s21)

s11\_2

B2=s21%\*%solve(s11)

B2

s22\_1=s22-(B2%\*%s12)

s22\_1

a1=s22\_1[1,1]

a1

a2=s22\_1[1,2]

a2

a3=s22\_1[2,2]

a3

r34\_12=a2/sqrt(a1\*a3)

r34\_12

z=1/2\*log((1+r34\_12)/(1-r34\_12))

z

n=36

p=4

Z=z/sqrt(1/(n-3))

Z

Z\_tab=1.96

w11=23.804

w12=array(c(4.170,0.535,5.882),dim=c(1,3))

w12

w21=t(w12)

w21

w22=array(c(864.774,2.2428,31.148,2.2428,0.416,1.172,31.148,1.172,11.348),dim=c(3,3))

w22

R1\_234=sqrt((w12%\*%solve(w22)%\*%w21)/w11)

R1\_234

t=(R1\_234^2/(1-(R1\_234^2)))\*((n-p-1)/p)

t

t\_tab=qf(0.95,4,31,0)

t\_tab

**Result and calculations-**

(i) The estimates of the parameters of the conditional distribution of (X1, X2) given (X3, X4) is

12..34= +

The estimates of the parameters of the conditional distribution of (X3, X4) given (X1, X2) is

34.12

(ii) The multiple correlation coefficient of X1 on (X2, X3, X4) denoted by R1.234 is given by

R1.234= 0.3700054

Since, the calculated value is < the tabulated value of F= 2.678667 at 5% loss, so we accept the null hypothesis and conclude that X₁ is independent of (X2, X3, X4).

(iii) The partial correlation coefficient between X3 and X4 (after eliminating the joint effect of X₁ and X2 from each of them) is r34.12= 0.5138664

Since, the calculated value of Z= 3.262736 > the tabulated value, therefore we reject our null hypothesis H0 and conclude that there exist partial correlation coefficient between X₃ and X₄.