MSMS 308 : Practical 05

Multivariate Analysis

Ananda Biswas

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Question

The following covariance matrix is estimated for a sample of 28 observations:

$$S = \begin{bmatrix} 128.72 & 61.4076 & -21.0211 \\ 61.4076 & 56.9259 & -28.2963 \\ -21.0211 & -28.2963 & 63.5344 \end{bmatrix}.$$

The calculated mean values are $(8.8591, 4.50, 0.8571)$ and test whether these values agree with the assigned values $(5, 1, 0.2)$.

R Program

```
S <- matrix(c(128.72, 61.4076, -21.0211,
              61.4076, 56.9259, -28.2963,
              -21.0211, -28.2963, 63.5344), nrow = 3, ncol = 3, byrow = TRUE)
```

⊡ The test statistic for testing $H_0 : \underset{\sim}{\mu} = (5, 1, 0.2)'$ against $H_1 : \underset{\sim}{\mu} \neq (5, 1, 0.2)'$ is

$$T^2 = n(\overline{\underset{\sim}{X}} - \underset{\sim}{\mu_0})' S^{-1} (\overline{\underset{\sim}{X}} - \underset{\sim}{\mu_0}).$$

Under H_0, $\dfrac{(n-p)T^2}{p(n-1)} \sim F_{p,n-p}$.

```
n <- 28; p <- 3
x_bar <- matrix(c(8.8591, 4.50, 0.8571), nrow = 3, ncol = 1, byrow = TRUE)
mu_0 <- matrix(c(5, 1, 0.2), nrow = 3, ncol = 1, byrow = TRUE)
```

```
observed <- (n %*% t(x_bar - mu_0) %*% solve(S) %*% (x_bar - mu_0)) * ((n-p)/(p*(n-1)))
observed
```

```
##          [,1]
## [1,] 2.883526
```

```
qf(0.05, p, n-p, lower.tail = FALSE)
```

```
## [1] 2.991241
```

Conclusion

Observed value of the test statistic is less than $F_{0.05,3,25} = 2.9912409$. So in light of the sample, we fail to reject H_0 at 5% level of significance.