

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2024
(Regular/Improvement/Supplementary)

STATISTICS
FMST2C07: REGRESSION ANALYSIS

Time: 3 Hours

Maximum Weightage: 30

Part A: Answer any four questions. Each carries 2 weightage.

1. Explain a simple linear regression model.
2. Consider the multiple linear regression model:
$$Y = X\beta + \varepsilon, E(\varepsilon) = 0, V(\varepsilon) = \text{diag}(\sigma_1^2, \sigma_2^2, \dots, \sigma_n^2)$$
 where y is a $n \times 1$ vector of observations on response variable, X is a $n \times k$ matrix of n observations on each of the k explanatory variables, β is a $k \times 1$ vector of regression coefficients and ε is a $n \times 1$ vector of random errors. Let h_{ii} be the i^{th} diagonal element of matrix $H = X(X'X)^{-1}X'$. Then find the variance of the i^{th} PRESS residual.
3. Explain Mallows C_p - statistics.
4. What is the basic idea of kernel smoothers in non-parametric regression?
5. Explain various link functions.
6. Define a general Gauss Markov linear model.
7. Explain the problem of variable selection.

(4 × 2 = 8 weightage)

Part B: Answer any four questions. Each carries 3 weightage.

8. Discuss the fitting of a straight line through origin. Estimate the parameters and obtain the confidence intervals.
9. Obtain an unbiased estimate of σ^2 in the Gauss-Markov setup $(Y, X\beta, \sigma^2 I_n)$.
10. What are outliers? What will happen to the regression models if the data contain outliers?
11. Distinguish between linear and non-linear regression models and offer your comments on the method of least squares applied on them.
12. What do you mean by residual analysis? Explain the analysis of residuals in fitting the GLM.
13. Describe logistic regression models. How do you estimate the parameters?
14. What are the important considerations that arise when fitting a polynomial in one variable?

(4 × 3 = 12 weightage)

(P.T.O.)

Part C: Answer any *two* questions. Each carries 5 weightage.

15. a) Explain the concept of estimability of a parametric function. Illustrate with an example.
b) State and prove Gauss-Markov theorem.
16. Explain the different methods for model adequacy checking.
17. a) Describe non-parametric regression.
b) Distinguish between bias due to under-fitting and bias due to over-fitting in a multiple regression model, giving an illustrative example.
18. a) Describe Poisson regression model.
b) Present a short account on prediction and estimation with the generalized linear model.

(2 × 5 = 10 weightage)