Registration Number:

Date & session:

**ST JOSEPH'S UNIVERSITY, BENGALURU -27**
**M. Sc (Statistics) – 2nd SEMESTER**
**SEMESTER EXAMINATION: APRIL 2024**
**(Examination conducted in May / June 2024)**
**ST8421: Linear Models and Regression Analysis**
**(For current batch students only)**

**Time: 2 Hours** **Max Marks: 50**

**This paper contains ONE printed page and ONE part**

## PART-A

**Answer any FIVE of the following** **10 X 5 = 50**

1. A) Prove that in full rank case, the MLE of $\hat{\beta}$ is unbiased estimate of $\beta$.
   B) What is ridge regression? Explain advantages and disadvantages of ridge estimator. (5+5)

2. A) Estimate the Parameters $(\beta, \sigma^2)$ of the general Linear model by using Maximum likelihood estimation method.
   B) Show that the variance covariance of $\hat{\beta}$ is $V(\hat{\beta}) = (X'X)^{-1}\sigma^2$. (5+5)

3. A) Write a short note on polynomial regression model.
   B) For the general linear model $Y = X\beta + \varepsilon$, the confidence interval for $\beta_j$is given
   $\left(\hat{\beta}_j - t_{(\frac{\alpha}{2}, n-k)}.\sigma\sqrt{C_{jj}}, \hat{\beta}_j + t_{(\frac{\alpha}{2}, n-k)}.\sigma\sqrt{C_{jj}}\right)$ (5+5)

4. A) Explain coefficient of Determination ($R^2$) and Adjusted $R^2$.
   B) Write the test procedure for the lack of fit test. (5+5)

5. A) Define Stepwise regression, its assumptions and limitations.
   B) Show that the necessary and sufficient condition for $l'\theta$ to be estimable is $Y = A\theta + \varepsilon$, that is rank of $A$'is equal to rank of $(A'; l)$
   C) Define model adequacy checking. (5+3+2)

6. A) Write Box-Cox transformation. Explain its computational procedure.
   B) What is multicollinearity and explain the consequences of multicollinearity. (5+5)

7. A) Define heteroscedasticity. Explain what are the reasons that the variance of error $(\varepsilon_i)$ is a variable. Again, show that $\hat{\beta}_{OLS}$ is unbiased and consistent but not an efficient estimator.

   B) What is Autocorrelation? Explain the procedure for Durbin–Watson test to detect autocorrelation. (5+5)

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