PG Even Semester Examination, September, 2023

STATISTICS

(2nd Semester)

Course No: STSCC-201
(Linear Model and Regression)

FM: 70
Pass Marks : 28
Time: 3 Hours

The figures in the right margin indicate full marks for the question.
Answer five questions, taking one from each unit.

UNIT-I

1. (a) Define a simple linear regression model. What are the assumptions of this model? 6

   (b) Show that least square estimators are best linear unbiased estimators. 8

2. (a) Briefly explain co-efficient of determination (r^2). 6

   (b) Consider a simple linear regression model $y_i = \alpha + \beta.x_i + \upsilon_i$. Dervise an expressions for standard error in case of individual prediction of y for a given value of x. Also explain how the confidence statements can be made about individual y from a given x. 8

UNIT-II

3. (a) Discuss K-variable linear regression model with assumptions. 7

   (b) If $E(Y) = X\beta$, where X is (n x k) matrix of full rank k and

   $V(Y) = \sigma^2 I$. then

   $$S^2 = \frac{(Y-x\hat{\beta})'\ (Y-x\hat{\beta})}{(n-k)}$$

   is an unbiased estimator of σ^2. 7

4. Explain the concept of inverse regression. Let us consider a simple linear regression model, derive expressions for upper and lower 100 (1–α)% Confidence limits for a given value of independent variable corresponding to a specified value of dependent variable. 10+4=14

UNIT-III

5. (a) Discuss the method of ridge regression in estimating the parameters of a regression model where predictor variable are collinear. 7

   (b) What are the consequences of multicollinearity. 7

6. (a) Let $Y_t = \beta_1 + \beta_2 x_t + U_t$ be a two variable regression model and U_t has first order auto regressive scheme.

   If $V(\hat{\beta}_2)_{AR(1)}$ be the variance of the estimator $\hat{\beta}_2$ under AR(1) scheme, show that

   $V(\hat{\beta})_{OLS} \propto V(\hat{\beta})_{AR(1)}$ 7

   (b) Define auto-correlation. What are the causes of auto correlaton? 7

UNIT-V

7. By using Talor series expansion estimate the parameters of the non-linear regression model.

   $Y_i = e^{-\theta Xi} + \varepsilon_i \qquad i=1(1)n$

   θ- denote the regression coefficient and ε_i - denote the error. 14

8. Describe the growth models and their limitations.

   (a) Malthus model (b) Logistic model

   (c) Gompertz model 5+5+4=14

UNIT-V

9. (a) Derive the link function for negative binomial and Gamma distributions.

   (b) Obtain their mean and variance by using the same link. 6+8=14

10. Describe the following with an example (a) Binomial logistic regression model, (b) Nominal regression model, (c) Ordinal regression model. 4+5+5=14

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