PG (CBCS) Even Semester Examination, May 2025

STATISTICS

2nd Semester

Course No. : STSCC - 201

(Linear Models and Regression Analysis)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer five questions taking one from each unit)

Unit - I

1. Define regression analysis. Assuming two-variable regression model $y = \alpha + \beta x + u$, find the least square estimates of the parameters α and β . Also obtain the estimates of $v(\hat{\alpha})$ and $v(\hat{\beta})$. 2+4+4+4=14

2. (a) How will you check the assumption of regression model using residual plots? Explain. 10

   (b) Obtain coefficient of determination in case of two variables. 4

Unit - II

3. Explain the concept of inverse regression. Assuming 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. 4+10=14

4. (a) Define multiple linear regression model. Write down the assumptions of this model. 7

   (b) Let $Y = X\beta + u$ be the k-variable linear regression model with $E(Y) = X\beta$, where X is a (n x k) matrix of full rank and $v(Y) = \sigma^2 I_n$. Then show that

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

   is an unbiased estimator of σ^2. 7

Unit - III

5. (a) Discuss the method of ridge regression in estimating the parameters of a regression model when predictor variables are collinear. 6

   (b) Explain the various rules for detection of multicollinearity. 8

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 autoregressive

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

$$v(\hat{\beta})_{OLS} \propto v(\hat{\beta})_{AR(I)}$$

14

Unit - IV

7. Describe non-linear regression model and its assumptions. How it is different from linear model? 8+6=14

8. Describe the following growth models : 14
   a) Malthus Model
   b) Logistic Model
   c) Gompertz Model

Unit - V

9. Define two parameter Exponential Family and formulate it for Normal and Gamma distributions. 4+(2x5)=14

10. Define link function and derive it Binomial, Poisson and Negative Binomial. 5+(3x3)=14

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