LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – STATISTICS

FIRST SEMESTER – NOVEMBER 2009

ST 1816 - APPLIED REGRESSION ANALYSIS

Date & Time: 11/11/2009 / 1:00 - 4:00 Dept. No. Max. : 100 Marks

SECTION A

Answer all the questions: (10 x 2 = 20 Marks)

1. Write the least square estimates of β_0 and β_1 for a simple linear regression model.
2. Define PRESS statistic.
3. Give an example for a logarithmic transformation.
4. Justify the need for dummy variables in a linear regression model.
5. Write a note non - linear regression.
6. Define variance inflation factor.
7. Define non-parametric regression.
8. Write the significance of extra sum of squares.
9. Define logit transformation.
10. What is a link function?

SECTION B

Answer any five questions: (5 x 8 = 40 Marks)

11. Write the properties of the least squares fit of a simple linear model
12. Derive the least square estimators of model parameters in a multiple regression model and state its properties.
13. Explain the procedure of obtaining confidence interval for regression coefficients in a multiple regression model.
14. Explain Box-Cox method used to transform the response variable in a linear model.
15. Briefly explain the sources of multicollinearity.
16. Explain the importance of categorical variables in regression analysis.
17. Differentiate between ridge and least square estimators.
18. Write a note on logistic regression models.

SECTION C

Answer any two questions: (2 x 20 = 40 Marks)

19. A rocket motor is manufactured by bonding an igniter propellant and a sustainer Propellant together inside a metal housing. The shear strength of the bond between the two types of propellant is an important quality characteristic. It is suspected that shear strength is related to the age in weeks of the batch of sustainer propellant. Twelve observations on shear strength and the age of corresponding batch of propellant have been collected and are shown in the

following table.

Shear Strength(psi)	:	2158.70	1678.15	2316.00	2061.30	2207.50	1708.30			
y_i		1784.70	2575.00	2357.90	2256.70	2165.20	2399.55			
Age of Propellant(weeks):		15	23	8	17	5	19	24	2	7
x_i		11	13	3						

(a) Fit a simple linear regression model to the given data. (8 marks)
(b) Perform and appropriate test for the following :
(i) $H_0 : \beta_0 = 0$ against $H_1 : \beta_0 \neq 0$ (ii) $H_0 : \beta_1 = 0$ against $H_1 : \beta_1 \neq 0$ at 5% level of significance. (6 marks)
(c) Construct 99 % confidence interval on β_0 and β_1. (4 marks)
(d) Compute the coefficient of determination. (2 marks)

20. (a) Give the ANOVA procedure to test the equality of k parameters of a multiple linear regression model. (8 marks)
(b) Explain the following methods used in variable selection:
(i) Forward selection (ii) Backward selection (iii) Step-wise regression (12 marks)

21. (a) Write in detail the criteria to evaluate subset regression models. (12 marks)
(b) Explain the methods proposed for dealing with multicollinearity. (8 marks)

22. (a) Write elaborately about the several important considerations that arise When fitting a polynomial in one variable. (10 marks)
(b) Explain orthogonal polynomials in fitting the model. (10 marks)
