

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



M.Sc. DEGREE EXAMINATION – STATISTICS

FIRST SEMESTER – NOVEMBER 2019

16/17/18PST1MC02 /PST 1502 – APPLIED REGRESSION ANALYSIS

Date: 01-11-2019

Dept. No.

Max. : 100 Marks

Time: 01:00-04:00

Section A: Answer ALL the questions:

(10 X 2 =20)

- 1 Write down the multiple linear model equation and intercept of the model coefficients based on the following information

$$(X'X)^{-1} = \begin{bmatrix} 2 & 6 & -2 \\ 6 & 7 & -4 \\ -2 & -4 & 3 \end{bmatrix}, X'Y = \begin{bmatrix} 3 \\ 7 \\ 10 \end{bmatrix}$$

- 2 If the R^2 of a model with 3 regressors built with 25 observations is 0.65, find the Adjusted R^2 of the model.
- 3 Identify the linearizing transformations for the relation $Y = \beta_0 X^{\beta_1}$
- 4 Define PRESS residuals.
- 5 Write a note on the 'Model Respecification' method of handling multicollinearity.
- 6 Explain dummy variable trap.
- 7 Distinguish between hierarchical and non-hierarchical polynomial models.
- 8 Explain Non Parametric regression.
- 9 Describe Unit Root Test for stationarity of a time series.
- 10 Explain the AR(1) scheme for the error terms of a regression model.

Section B: Answer ANY FIVE the questions:

(5 X 8 = 40)

- 11 Explain 'General Linear Hypothesis' and develop the F-test for it. For a linear model $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$, develop the test for the linear hypothesis $H_0: \beta_2 = \beta_3$.
- 12 Obtain the Least squares estimator of Multiple Linear Regression coefficients.
- 13 A model with five independent variables was built with the following Y values were 1.7, 3.5, 2.9, 3.1, 2.5 and the data matrix was $X = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 4 & -1 & 3 & 2 & -2 \end{bmatrix}$. Compute the vector of residuals by computing the 'Hat' matrix.
- 14 Depict five different scenarios that can show up in plotting residuals versus the fitted values and explain how these plots help in detecting model inadequacies.
- 15 In building a model with four regressors, the singular values analysis and variance

decomposition proportions were carried out to detect multicollinearity and the part of output obtained in the analysis is provided below.

Eigen values Of X'X	Singular values of X	Condition Indices	Variance decomposition proportions				
			Intercept	X ₁	X ₂	X ₃	X ₄
2.63287	1.622612			0.0568	0.0329	0.0036	0.0049
1.03335		1.596214	0.0001	0.1473	0.0696	0.1159	
	0.778287	2.084852	0.0032	0.6325	0.0869		0.0027
		2.300062	0.0001		0.1074	0.2196	0.2105
0.00093	0.030496		0.9964	0.0588		0.0205	0.6645

Fill up the missing entries and identify the variables that are entangled in collinear relationship.

- 16 Describe Cubic Spline fitting and discuss the issues in the approach.
- 17 Bring out any four specific aspects considered in fitting polynomial regression models
- 18 Explain Box Jenkins methodology of constructing an ARIMA model.

Section C: Answer ANY TWO Questions:

(2 X 20 = 40)

- 19 a) (i) State the assumptions of an OLS regression model. 6
 (ii) Explain the method of testing for overall significance of model coefficients 6
- 19 b) A linear regression model with an intercept term and 4 independent variables was built using 100 observations. It was reported that $\sum_{i=1}^n y_i = 540$, $\sum Y_i^2 = 8100$, $\sum \hat{Y}_i^2 = 6750$. Construct the ANOVA table and carry out the test for the overall significance of the model. 8
- 20 a) Explain the Box-Cox class of power transformations. Discuss the analytical method of choosing the power. 10
- 20 b) What do you mean by indicator variable? Illustrate different intercepts and different slopes for three classes. 10
- 21 a) Describe the 'Backward Model Building' algorithm clearly specifying the partial-F statistics and tests applied. 5
- 21 b) Apply Kolmogorov Smirnov statistic and test whether the following data are from the normal distribution. Use 5% level of significance. 15

200 215 231 242 242 245 250 255 255 265 270 270
- 22 a) In building a model, the OLS residuals are: 12

0.12, -0.35, 1.24, 2.05, 1.68, -2.03, 0.87, -0.63, -1.41, 0.06, -0.73, 0.03, -1.38, 0.55, -0.07. Carry out the Durbin-Watson test at 5% significance level and draw your conclusion on the presence of autocorrelation [It is given that $dL = 1.08$, $dU = 1.36$]

22 b) The residuals from a model arranged in time-order had the following signs: 8

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Carry out the Run Test for randomness of the sequence.

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