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SEAT No. _____

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Sardar Patel University
 External Examination
 M.Sc. Statistics/M.Sc. Applied Statistics Semester II
 PS02CSTA22 /PS02CAST22: Linear Models and Regression Analysis
 March 20, 2019, Wednesday

Time: 10:00 a.m. to 01:00 p.m.

Marks: 70

Q1. Multiple Choice Questions.

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1. _____ is performed after rejecting the null hypothesis of equality of several treatments effect in ANOVA.

- (a) Test of priori contrast
- (b) Post Hoc test
- (c) F-test
- (d) Likelihood Ratio test

2. In simple linear regression model, $Var(\hat{y}/x_0) =$ _____.

- (a) $\frac{\sigma^2}{n}$
- (b) $\sigma^2 \left(\frac{1}{n} + \frac{\bar{X}^2}{S_{xx}} \right)$
- (c) $\sigma^2 \left(\frac{1}{n} + \frac{(x_0 - \bar{X})^2}{S_{xx}} \right)$
- (d) $\sigma^2 \left(\frac{1}{n} + \frac{(x_0 - \bar{X})^2}{\sqrt{S_{xx}}} \right)$

3. In usual notation, which one of the following is true?

- (a) $\underline{\lambda}' = \underline{u}'X$
- (b) $X = XH$
- (c) $S = SH$
- (d) All of them

4. In the context of multiple linear regression if $(TOL)_i$ for i -th regressor is near to zero suggests that presence of

- (a) No Multicollinearity
- (b) Low Multicollinearity
- (c) Severe Multicollinearity
- (d) Moderate Multicollinearity

5. In usual notation, the variance of linear function of observations belongs to error space is

- (a) σ_τ^2
- (b) σ_ε^2
- (c) $\sigma_\tau^2 + \sigma_\varepsilon^2$
- (d) None of them

6. The alternative form of $(\Lambda \hat{\beta} - \underline{d})' (\Lambda \bar{S} \Lambda')^{-1} (\Lambda \hat{\beta} - \underline{d})$ is

- (a) Condition SSE
- (b) $\frac{e'e}{n-r}$
- (c) $\sum_{i=1}^{n-r} (b'_i y)^2$
- (d) Condition SSE - Unconditional SSE

7. In context to full rank model, $\frac{(n-p)SSE}{\sigma_\varepsilon^2}$ is distributed as

- (a) χ_{n-p}^2
- (b) χ_{n-r}^2
- (c) χ_m^2
- (d) χ_r^2

8. _____ plot is used to study marginal relationship between the response variable and the regressor when other regressors held constant

- (a) Box plot
- (b) Partial regression plot
- (c) Scatter plot
- (d) Normal probability plot

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(P.T.O.)

Q2. Short Answer Type Question (Any Seven)

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1. In usual notation, define experiment wise error rate (E) in terms of comparison wise error rate (α). Further obtain the value of E when $\alpha = 0.05$.
 2. Define Estimation Space and Error Space.
 3. In usual notation, shows that $cov(\underline{\lambda}'\hat{\underline{\beta}}, \underline{b}'\underline{y}) = 0$.
 4. Define BLUE. Further give the name of method which will help to obtain BLUE of an estimable parametric function.
 5. Define relation between coefficient of Principal Component Regression (PCR) and coefficient of multiple linear regressions. Further give application of PCR.
 6. Define leverage point. Further, state how to identify an influential point in data.
 7. Give the reasons of Multicollinearity.
 8. List the Goodness of fit criteria. Write brief on criteria which is used for both nested as well as non nested model.
 9. In usual notation, derive $E(MS_{Reg.})$.
- Q3 (a) Explain linear statistical models discussed in literature with examples. 06
- (b) In context to General Linear Model, discuss the Projection Operator. 06
- [OR]
- (b) In usual notation, derive the distribution of $\frac{(\underline{\Lambda}\hat{\underline{\beta}} - \underline{d})'(\underline{\Lambda}\bar{S}\underline{\Lambda}')^{-1}(\underline{\Lambda}\hat{\underline{\beta}} - \underline{d})}{\sigma^2}$. 06
- Q4 (a) Discuss Lack of Fit Test. 06
- (b) Explain conditional sum of squares due to errors in detail. 06
- [OR]
- (b) In usual notation, state and prove any two necessary and sufficient conditions for parametric function is to be estimable. 06
- Q5(a) Explain various residuals used to detect outlier in data. 06
- (b) Explain stepwise regression method. 06
- [OR]
- (b) Write Analysis of Covariance Model. Further derive its ANCOVA table. 06
- Q6(a) Define multicollinearity. List various methods to detect it. Further explain any three of them. 06
- (b) Explain step by step procedure to fitting multiple linear regression model. 06
- [OR]
- (b) Discuss the ridge regression. 06