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3 (Sem-4) /CBCS STA HC 2

2021

STATISTICS

(Honours)

Paper : STA-HC-4026

(Linear Models)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

GROUP - A

1. Answer the following questions as directed :
1×5=5

(a) A necessary and sufficient condition for the linear function $1'\beta$ of the parameters to be linearly estimable is $\text{rank}(A) = \text{_____}$.

(Fill in the blank)

(b) The coefficient of determination $r^2 = 0.80$. Interpret the result.

Contd.

(c) The equality of means is tested in analysis of variance.

*(State true **or** false)*

(d) Define fixed effects model.

(e) In the linear model of analysis of variance, the error part is assumed to be distributed as :

(i) $N(\mu, \sigma^2)$

(ii) $N(0, \sigma^2)$

(iii) $N(0, 1)$

(iv) None of the above.

(Choose the correct option)

2. Answer the following questions : $2 \times 5 = 10$

(a) Explain how you would test the significance for α in the two-variable linear model $y = \alpha + \beta x + u$.

(b) How would you test the null hypothesis $H_0 : \beta = 0$ using 95% confidence interval for β in case of simple linear regression model $y = \alpha + \beta x + u$?

(c) State the assumptions for analysis of variance test.

- (d) Write the linear model of two-way classified data, when there is a concomitant variable. Also give *one* example.
- (e) Consider the following incomplete analysis of variance table :

Source	SS	d.f	MS	Calculated of value <i>F</i>
Factor	48	—	—	
Error	—	15	—	
Total	84	17		

Complete the analysis of variance table and give conclusion. [Given that $F_{.05}(2,15)=3.68$]

3. Answer **any three** of the following :

$$5 \times 3 = 15$$

- (a) In simple linear regression model, how would you estimate the variance of disturbance term ?
- (b) Write about the effect of violation of the assumptions made in analysis of variance technique.

- (c) In ANOVA testing for one-way classification, if the null hypothesis is rejected, how will you perform the test of significance ?
- (d) Explain how analysis of variance can be used for testing the linearity of regression.
- (e) Prove that in analysis of variance with one-way classification, the mean sum of squares due to error provides an unbiased estimate of the population variance.

GROUP – B

4. Answer **any three** of the following questions : 10×3=30
- (a) State and prove Gauss-Markov theorem.
 - (b) What is ANOVA of a two-way classified data. Give its complete analysis with *one* observation per cell mentioning —
 - (i) the mathematical model (fixed effect model)
 - (ii) the assumptions used
 - (iii) the hypothesis to be tested

- (iv) the partitioning of various sum of squares and degrees of freedom
- (v) the test statistics to be used and
- (iv) the ANOVA table.
- (c) What is analysis of covariance ? Discuss the analysis of a one-way classified data with a concomitant variables.
- (d) Derive the expected values of mean squares for two-way classified data with one observation per cell under the fixed effect mathematical model. Also show that they provide unbiased estimate of error variance.
- (e) What is orthogonal polynomials ? Determine the coefficient of orthogonal polynomials as the ratio of two determinates.
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