WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2020

STSACOR09T-STATISTICS (CC9)

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

Answer any *four* of the following questions 5×4 = 20

1. Define multiple and partial correlation coefficients in the context of multiple regression of X_1 on X_2, X_3. Why multiple correlation coefficient lies in (0, 1) only? 2+3

2. What is 'General Linear Model'? Find the estimates of the linear model parameters based on least square method. 2+3

3. Judge whether the parametric functions $(\theta_1+\theta_3+\theta_4)$ and $(\theta_2-\theta_3)$ are estimable, when $2\frac{1}{2}+2\frac{1}{2}$

$$X=\begin{pmatrix}1&1&0&0\\1&1&0&0\\1&0&1&0\\1&0&1&0\\1&0&0&1\\1&0&0&1\end{pmatrix} \quad \text{and} \quad \boldsymbol{\theta}=(\theta_1,\theta_2,\theta_3,\theta_4)'.$$

4. Write a short note on the 'Classification of Linear Model'. 5

5. In a Gauss-Markov setup of linear model, find the estimate of 'error variance' σ^2. 5

6. Define fixed, random and mixed effect model in the context of two-way ANOVA model. 5

Answer any *two* of the following questions 10×2=20

7. Consider the following model: 3+3+4

$$y_i=\beta_0+\beta_1x_{1i}+\beta_2x_{2i}+\cdots+\beta_kx_{ki}+e_i,\ \ i=1,2,\cdots,n.$$

(i) State the assumptions required by the model.

(ii) Test whether x_1 is insignificant in predicting y.

(iii) Test $H_0:\beta_1=\beta_2=\cdots=\beta_k=0$ *vs.* $H_1:$ not H_0.

8. The determination of visual acuity at three randomly chosen distances (say, D_1, D_2 & D_3) was the subject of a recent experiment. 8+2

   (i) Set up an appropriate model for the data, write down the hypothesis to be tested and carry out the test.

   (ii) Show that the following is a consistent estimator of the intra-class correlation coefficient $\rho = \sigma_b^2 \big/ \sigma_y^2$, where σ_b^2 and σ_y^2 respectively denote the variances of the random effects and the error components.

9. (a) Differentiate between ANOVA and ANCOVA model through real life example. 3+7

   (b) Write down the ANCOVA model with one fixed concomitant variable. State the associated hypothesis and carry out the test.

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

——×——