WEST BENGAL STATE UNIVERSITY

B.Sc. Honours/Programme 3rd Semester Examination, 2021-22

STSHGEC03T/STSGCOR03T-STATISTICS (GE3/DSC3)

BASICS OF STATISTICAL INFERENCE

Time Allotted: 2 Hours   Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

GROUP-A

Answer any *four* questions from the following $5 \times 4 = 20$

1. Define consistent estimator. If $X_1, X_2, \cdots, X_n$ are random observations on a variable X taking the value 1 with probability θ and the value 0 with probability $(1-\theta)$, then show that sample mean is a consistent estimator of θ.   2+3

2. What are the basic principles of design of experiments?   5

3. (a) If $X_1, X_2, \cdots, X_k$ are k independent random variables distributed normally with mean 0 and variance 1, what is the distribution of $\sum_i^n X_i^2 (i = 1, 2, \cdots, k)$?   2+3

   (b) Explain why we call t, χ^2 and F as sampling distributions.

4. Write down the mathematical model, hypotheses and ANOVA table for randomized block design.   5

5. Discuss two applications of chi-square test.   5

6. Write down short note on: 5
    (i) level of significance
    (ii) concept of p-value

7. If X be a binomial variable with parameters n (known) and p (unknown), find unbiased estimators of p^2 and $p(1-p)$.   5

8. In a Bernoulli distribution with parameter p, testing $H_0 : P = \frac{1}{2}$ against $H_1 : p = \frac{2}{3}$ is rejected if more than 3 heads are obtained out of 5 throws of a coin. Find the probabilities of Type I and Type II errors.   5

GROUP-B

Answer any *two* questions from the following $10 \times 2 = 20$

9. (a) Define mean square error and bias of an estimator. When is an estimator called minimum variance unbiased estimator?   5+3+2

(b) For a random sample of size n from a Normal (μ, σ^2) population, show that the sample mean $\overline{X}$ is an unbiased estimator for μ.

(c) A value of the sample mean $\overline{X}$ calculated from 100 observations is better than that calculated from 10 observations. Discuss.

10. Describe sign test for testing the location of a population, stating all the assumptions made.   10

11. Describe the analysis of variance technique for one-way classified data under fixed effects model.   10

12. Describe a test procedure for testing $H_0 : \sigma = \sigma_0$ against all alternatives for a normal (μ, σ^2) population. State the difference between the two cases μ known and unknown. Also obtain a $100(1 - \alpha)\%$ confidence interval for σ^2 when μ is known.   5+3+2

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.*

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