NEW

Part–III 3-Tier

2019

STATISTICS

(Honours)

PAPER—VIIA

Full Marks : 50

Time : 4 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group—A

(Analysis of Variance & Covariance and Design of Experiments)

1. Answer any *four* questions. 4×5

(a) Show how the analysis of variance technique can be used to test for the significance of the multiple correlation co-efficient in a linear regression set up.

(b) Discuss the role of local control in designing an experiment.

(c) Why is a latin square design said to be incomplete ? For such a design, write down the hypothesis you will test and the corresponding analysis of variance table. 1+2+2

(d) What is meant by confounding in factorial experiments ? A 2^4 factorial experiment is carried out in 4 plot blocks with $5n(r \geq 1)$ replications. The principal block in each replicate is (1), ad, bc, abcd. Write down the factorial effect totals for AD and ABD and explain why the former is confounded but the later is not. 1+2+2

(e) Show that the efficiency of a RBD is always greater than that of CRD.

(f) What is a split plot design ? When do you use it ? 2½+2½

(g) Define linear hypothesis. Explain how valid error is selected in testing a linear hypothesis. 2+3

2. Answer any *two* questions. 2×10

(a) Describe the analysis of covariance for an experiment conducted in a randomised block design with one concomitant variable. How will you test whether the inclusion of the concomitant variable is worth while or not. 5+5

(b) Describe the missing plot technique in design of experiments. In an RBD, one observation is missing. Find an estimate of the missing value.

(c) Describe how on the basis of observed data set (x_i, y_i), $i = 1(1)n$ where Y is the dependent variable and X the independent variable, you will proceed step by step to test.

(i) presence of regression.

(ii) linearity of regression. 5+5

(d) With reference of a 23 experiment with the factors A, B and C, give the structure of the two blocks into which a replicate should be broken so that the effect ABC is confounded. Also show that the following differences of the effects $(A - BC)$, $(B - AC)$ and $(C - AB)$ are mutually orthogonal contrasts among the 4 treatments of the control block of the above (2^3, 2) design confounding ABC. 2+8

[Internal Assessment—10 Marks]

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NEW

Part–III 3-Tier

2019

STATISTICS

(Honours)

PAPER—VII (Group–B)

(PRACTICAL)

Full Marks : 50

Time : 4 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer *all* questions.

1. The length of life recorded in hours for 10 electron tubes were :
980, 1020, 995, 1015, 990, 1030, 975, 950, 1050 and 870

Assume that life times are distributed as

$$f(t)=\frac{1}{\theta}e^{-t/\theta};\ \theta>0\ ;0\le t<\infty$$

(i) Obtain maximum likelihood estimate of θ and the estimated standard error of this estimate. 6

(ii) Estimate also the probability that an electron tube will survive at least 100 hours. Give an estimate of the large sample standard error of this estimated probability. 6

2. For estimating the total cattle population in a given area, a sample of 24 villages was selected from the 1238 villages in that region by SRSWR. The number of cattle obtained in the survey is given for each sample village in the following table together with the corresponding census figure relating to a previous period. Using this information, compare the efficiency of the regression estimator with that of the ratio estimator and the mean per unit estimator. 10

Sample village	*No. of Cattle*	
	Census	*Survey*
1	*623*	*654*
2	*690*	*696*
3	*534*	*530*
4	*293*	*315*
5	*69*	*78*
6	*842*	*640*
7	*475*	*692*
8	*371*	*292*

Sample village	*No. of Cattle*	
	Census	*Survey*
9	*161*	*210*
10	*298*	*555*
11	*2045*	*2110*
12	*1069*	*592*
13	*706*	*707*
14	*1785*	*1890*
15	*1406*	*1123*
16	*118*	*115*
17	*330*	*375*
18	*218*	*212*
19	*160*	*147*
20	*210*	*297*
21	*262*	*401*
22	*204*	*252*
23	*185*	*199*
24	*574*	*564*

3. The following table shows Hamilton depression scale factor measurements in 9 patients suffering from depression, taken before (X) and (Y) a visit to a therapist :

X	1.83	0.50	1.62	2.48	1.68	1.88	1.55	3.06	1.30
Y	0.878	0.647	0.598	2.05	1.06	1.29	1.06	3.14	1.29

Perform a suitable (a) parametric, (b) non-parametric test to judge whether the therapy can be considered to be effective. 8

4. (a) Let X be a random variable with Bin $(5, p)$ distribution. Construct the UMP test of size $\alpha = 0.05$ for the testing

$$H_0 : p > \frac{1}{2} \text{ against } H_1 : p > \frac{1}{2}.$$ 5

(b) Find the power of the test for $p = 0.1(0.1)\ 0.9$ and hence draw the power curve of the test. 5

5. Practical Note Book and Viva-Voce. 5+5