POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination
December, 2020

MST-005 : STATISTICAL TECHNIQUES

Time : 3 Hours   *Maximum Marks : 50*

Note : (i) *Question No. **1** is compulsory.*

(ii) *Attempt any **four** questions from the remaining Question nos. **2** to **7**.*

(iii) *Use of scientific calculator (non-programmable) is allowed.*

(iv) *Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.*

(v) *Symbols have their usual meanings.*

1. State whether the following statements are True *or* False. Give reasons in support of your answers :   5×2=10

(a) Error due to ill designed questionnaire is called sampling error.

Lot-I   **P. T. O.**

(b) The units belonging to a group are heterogeneous among themselves in stratified sampling.

(c) The error degrees of freedom in an analysis of variance of population means of 5 levels of a factor with total 25 observations will be 20.

(d) The experimental error is reduced by means of randomisation.

(e) Using the random number 15, the next generated random number obtained by middle square method will be 22.

2. (a) Distinguish between linear and circular systematic sampling with an example.   3

(b) One thousand cultivators' holding in Uttar Pradesh (India) were stratified according to their sizes. The number of holdings (N_i), mean area under wheat per holding $(\overline{Y}_i)$ and standard deviation of area under

wheat per holding (S_i) are given below for each stratum : 7

Stratum Number	N_i	$\overline{Y}_i$	S_i
1	300	5	8
2	500	16	12
3	200	24	18

(i) For drawing a sample of 100 holdings, determine the sample size drawn from each stratum under proportional allocation.

(ii) Also, estimate the sample mean and the variance of sample mean under given sampling scheme.

3. A company has designed three different boxes for packaging of a product. Each box was tested in five different stores for a period of a month to determine the sales of the product packaged in

the different designed boxes at different stores.

The data are given below :   10

	Store 1	Store 2	Store 3	Store 4	Store 5
Box 1	26	29	28	24	23
Box 2	24	23	24	25	24
Box 3	25	23	26	26	25

Test whether there is a significant difference between the average sales of the product due to (a) boxes and (b) stores at 5% level of significance.

4. A factorial experiment was conducted in a plant to study the factor thought to influence the filtration rate of the product. The two factors temperature (T) and pressure (P) were studied in a randomised block design with 4 replications each. The data are given as follows :

Blocks	(1)	t	p	tp
1	54	63	55	62
2	59	55	64	64
3	52	54	57	63
4	55	40	64	67

Determine the effect of temperature and pressure on filtration rate at $\alpha = 0.01$.   10

5. A production unit was started with an initial capital of ₹ 10 crores. Suppose the annual cash flow for the jth year in future is distributed normally with mean ₹ 5 crores and variance of ₹ 1 crore^2.

    For one simulation, obtain PW for $n = 1$ taking annual interest of 10% by using normal variates N (0, 1) :

    − 0.2, 0.4, 0.2, − 1.6, 1.7, 0.3, − 0.4, − 0.8, 0.6 and − 0.3.   10

6. (a) Generate 10 random numbers using LCG :

                                                                      5

    $$x_i = (17x_{i-1} + 3) \bmod 16$$

    with $x_0 = 15$.

    (b) Differentiate between simple and stratified random sampling schemes with examples.

                                                                      5

7. (a) Differentiate between fixed and random effects models in analysis of variance.   3

    (b) A company has three manufacturing plants. The data of the ages of five

                                                              P. T. O.

randomly selected workers at each plant are given in the following table :   7

Plant 1	Plant 2	Plant 3
29	32	25
27	33	24
30	31	24
27	34	25
28	30	26

Determine whether there is a significant difference between the average ages of workers of the three plants at 5% level of significance.