MST–005

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

June, 2024

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.*

P. T. O.

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

   (a) Error due to lack of correct responses furnished by the respondents in called the sampling error.

   (b) In a simple random sampling with replacement the probability of selecting a specified unit of the population of size 25 at the second draw is equal to 2/25.

   (c) There is one response variable in one-way ANOVA while two response variables in two-way ANOVA.

   (d) There will be 16 treatment combinations in a 2^4-factorial experiment.

   (e) The first Pseudo Random Number (PRN) using Linear Congruential Generator (LCG) method : $x_i = \left(1573 x_{i-1} + 19\right)$ mod (10^3) with $x_0 = 89$, will be 16.

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

(b) The following table consists of yield rate of rice in a district of Tamil Nadu which is divided into 6 graphs of 6 plots each : 5

Plot	Group					
	1	2	3	4	5	6
1	8	6	18	13	17	12
2	13	5	8	7	15	15
3	11	16	6	13	10	11
4	26	5	5	6	21	17
5	13	16	16	7	20	8
6	31	5	20	2	25	10

(i) Define the sampling scheme used in this example.

(ii) Select a sample of 3 groups from the given data.

(c) Describe different allocation methods of sample size. 3

3. (a) The average number of ball bearings produced per day by each of the four machines are given as follows :   8

Machine A	Machine B	Machine C	Machine D
18	19	17	16
16	18	18	15
17	19	19	17
18	17	19	
17		16	

Test whether there is any significant difference among the four machines at 5% level of significance.

(b) Define local control in design of experiment.   2

4. A factorial experiment was conducted in a plant to study the factor thought to influence the filtration rate of the product. Two factors temperature (T) and pressure (P) were studied in a randomized block design with 4

replications each. The data are given as follows :

Block	(l)	t	p	t_p
1	54	63	55	62
2	59	55	64	64
3	52	54	57	63
4	55	40	64	67

Analyse the given design at 1% level of significance. 10

5. (a) Explain lottery method of generation of random numbers with an example. 3

   (b) Generate a complete cycle for Linear Congruntial Generator given as follows : 7

$$x_i = (5x_{i-1} + 3) \mod (16), \text{ with } x_0 = 5$$

   Also obtain a sequence of heads and tails using first 10 of them.

6. (a) A sample of 30 students is to be drawn from a population consisting of 300 students belonging to colleges A and B.

The mans and standard deviations of their makes are given below :   7

	Number of Students (N_i)	Mean $(\bar{y_i})$	Standard Deviation (σ_i)
College A	200	30	10
College B	100	60	40

Compute the sample sizes for each stratum using proportional and Neyman allocation techniques. Also obtain the variance of estimate of population mean for proportional allocation using simple random sampling without replacement.

(b) Describe briefly the principal steps in simulations.   3

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

(b) The following data give the arrival times and service times that each customer will

require for first 13 customers at a single server system : 4

Arrival times	Service times
12	40
31	32
63	55
95	48
99	18
154	50
198	47
221	18
304	28
346	54
411	40
455	72
437	12

(i) Determine the waiting times of 13 customers.

(ii) Determine the average waiting time.

(c) Explain Monte-Carlo Method of simulation. 3

MST–005