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MST–005

POST GRADUATE DIPLOMA IN APPLIED STATISTICS / CERTIFICATE IN CONDITION MONITORING (PGDAST/CCOMO)

Term-End Examination

June, 2025

MST-005 : STATISTICAL TECHNIQUES

Time : 3 Hours *Maximum Marks : 50*

Note : *Question No. 1 is compulsory. Attempt any* ***four*** *questions from the remaining Question Nos. 2 to 7. Use of scientific (non-programmable) calculator is allowed. Use of Formulae and Statistical Tables Booklet for PGDAST is allowed. Symbols have their usual meanings.*

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

   (a) Suppose a researcher selected 5 study centre randomly from different study

centres of PGDAST programme and then 10 learners randomly from each selected study centre, then he is using stratified random sampling.

(b) In a 2^3-factorial experiment, there will be 4 first level treatment combinations.

(c) If a doctor gave five doses of a drug to four patients each and responses of these twenty patients were obtained, then the variation in the responses will be only through the doses of the drug.

(d) If one wants to convert random numbers from 0-99 to uniformly distributed U (0, 1) variables, then one has to divide them by 10.

(e) In a classroom, there are 10 rows and each row has 8 students. A teacher selects 3 rows randomly and then randomly selects 5 students from each selected row. It is an example of cluster sampling.

2. (a) The marks (out of 50) of MST-005 of 8 students from each of 5 study centres (A, B, C, D, E) of PGDAST programme are given as follows : 7

Students	Marks				
	A	B	C	D	E
1	40	50	40	35	26
2	36	46	26	32	32
3	25	45	42	42	40
4	20	20	30	25	28
5	18	25	45	35	40
6	26	36	26	42	32
7	20	40	22	37	35
8	10	42	30	40	42

(i) How many first stage sample of size 2 can be selected ? How many second stage samples of size 5 can be selected from each first stage selected samples ?

(ii) Select one sample of size as described in (i).

(iii) Determine the sample mean under this sampling scheme.

(iv) Select a cluster sample of 2 study centres from the given data and find sample mean.

(b) Describe systematic sample with an example. 3

3. A researcher wants to test four diets A, B, C and D on increase of weights of pigs. Twenty pigs of same age are equally divided into 5 groups on their breads and one of the diets is given at random to the pigs of each group. After two weeks, increase in weight (in pounds) is noted which is given as follows : 10

Group	Diet			
	A	B	C	D
I	12	10	15	8

II	14	12	18	6
III	15	8	14	6
IV	16	9	20	10
V	15	10	16	7

Perform a suitable ANOVA to test whether there is significance difference :

(i) between diets

(ii) between breads

4. Identify the design given in the following table and then carry out the analysis : 10

Column	Row			
	I	II	III	IV
I	A (18)	C (28)	B (11)	D (18)
II	C (14)	B (20)	D (17)	A (14)
III	B (14)	D (22)	A (16)	C (20)
IV	D (20)	A (19)	C (18)	B (26)

(**Note :** Do not do the pairwise comparison.)

5. (a) Generate six random numbers using the following LCG : 7

$x_i = (1573\ x_{i-1} + 25) \bmod 1000$ starting with $x_0 = 159$.

(i) Convert these generated random number to $y_i \sim U(0, 1)$.

(ii) If inter-arrival times of patients arriving at a clinic has an exponential distribution with rate $\alpha = 0 \cdot 1$ per minutes, simulate the times of six patients arriving at the clinic.

(b) Describe Monte-Carlo method of simulation. 3

6. (a) Explain various methods of simple random sampling. 6

(b) Explain 2^2-factorial experiment. 4

7. (a) Using the uniform random numbers given as follows, obtain three Poisson's random numbers when $\lambda = 1.5$: 7

0.196, 0.553, 0.393, 0.684
0.123, 0.578, 0.765, 0.051
0.068, 0.037

(b) Write the assumptions of ANOVA. 3

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