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MST-005

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

01087

December, 2016

MST-005 : STATISTICAL TECHNIQUES

Time : 3 hours *Maximum Marks : 50*

Note :

*(i) Attempt **all** questions. Questions no. 2 to 5 have internal choices.*

(ii) Use of scientific calculator is allowed.

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

(iv) Symbols have their usual meaning.

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

   (a) In statistics, population means only population of human beings.

   (b) Quota sampling scheme comes under the category of probability sampling.

(c) If the null hypothesis $H_0 : \mu_1 = \mu_2 = \ldots = \mu_k$ is rejected, it always implies that $\mu_1 \neq \mu_2$ but $\mu_2 = \mu_3 = \mu_4 = \ldots = \mu_k$, where μ_i are means of k groups.

(d) In 2^3 factorial design, the number of factors are two each at three levels.

(e) 5 consecutive random numbers starting from 7698 by 'middle square method' are 7698, 2592, 7184, 6098, 1856.

2. (a) A population has 7 units 1, 2, 3, 4, 5, 6, 7. Write down all possible samples of size 2 (without replacement), which can be drawn from the given population and verify that the sample mean is an unbiased estimate of the population mean. Also calculate its sample variance and verify that

$$\text{Var}_{\text{SRSWR}}(\bar{x}) > \text{Var}_{\text{SRSWOR}}(\bar{x}).$$ *7*

(b) Differentiate between Sampling and Non-sampling errors. *3*

OR

(a) Describe Linear and Circular systematic sampling with examples. *4*

(b) A population of size 800 is divided into 3 strata. Their sizes and standard deviations (S.D.) are given below :

Stratum No.	I	II	III
Size	200	300	300
S.D.	6	8	12

A stratified random sample of size 120 is to be drawn from the population. Determine the sizes of samples from the three strata in case of (i) Proportional allocation, and (ii) Neyman's optimum allocation. *6*

3. An investigator is interested in finding the level of knowledge about the history of India of 4 different schools in a city. A test is given to 5, 6, 7, 6 students of 8^{th} class of the 4 schools respectively. Their scores out of 10 are given below :

School I (S_1)	8	6	7	5	9		
School II (S_2)	6	4	6	5	6	7	
School III (S_3)	6	5	5	6	7	8	5
School IV (S_4)	5	6	6	7	6	7	

Test the equality of average scores of the 4 schools at 5% level of significance. *10*

OR

An experiment was conducted to determine the effect of different months of planting and different methods of planting on the fields of sugarcane. The data on yield (in quintals) are given below :

Months of Planting				
Method of Planting	October	November	February	March
I	7·10	3·69	4·70	1·90
II	10·29	4·79	4·50	2·64
III	8·30	3·58	4·90	1·80

Test whether the data indicates a significant difference at 5% level of significance between

(i) Different months of planting, and

(ii) Different methods of planting. *10*

4. Consider the results given in the following table for an experiment involving 5 treatments in 4 randomised blocks. The treatments are indicated by numbers within parentheses.

Blocks	Treatments and Yields				
1	(1) 24	(3) 27	(2) 20	(4) 16	(5) 15
2	(2) 28	(3) 22	(1) 27	(4) 15	(5) 17
3	(4) 19	(1) 38	(3) 36	(2) 39	(5) 15
4	(5) 17	(2) 31	(1) 28	(4) 14	(3) 34

Test whether the treatments as well as blocks differ significantly at 5% level of significance. *10*

OR

In the following data, one value is missing. Identify the design, estimate the missing value, and analyse the given data : *10*

Row \ Column	I	II	III	IV	Row Totals (R_i)
I	A 12	C 19	B 10	D 8	49
II	C 18	B 12	D 6	A 7	43
III	B 22	D Y	A 5	C 21	48 + Y
IV	D 12	A 7	C 27	B 17	63
Column Totals (C_j)	64	38 + Y	48	53	203 + Y

5. (a) Using five uniform random numbers $U_1 = 0{\cdot}316$, $U_2 = 0{\cdot}087$, $U_3 = 0{\cdot}270$, $U_4 = 0{\cdot}129$, $U_5 = 0{\cdot}249$, generate 5 random numbers from binomial B(n, p) distribution, with n = 5 and p = 0·2. 5

(b) The inter-arrival times of patients arriving in a clinic has an exponential distribution with rate $\alpha = 0{\cdot}2$ per minute. Simulate the times of six patients arriving in the clinic. Also give the number of patients arriving in the first 20 minutes. 5

OR

(a) By generating 10 random numbers from uniform U(0, 1) distribution, estimate the integral

$$\theta = \frac{1}{\sqrt{2\pi}} \int_{-1}^{2} e^{-\frac{x^2}{2}} \, dx .$$

Recognizing this function as the probability density function of N(0, 1) distribution, compare the estimated value of θ with the tabulated value. 5

(b) The following data give the arrival times and service times that each customer will require for the first 13 customers at a single server :

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
537	12

Determine the waiting times of the 13 customers. *5*