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MST-005

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

June, 2018

01705

MST-005 : STATISTICAL TECHNIQUES

Time : 3 hours *Maximum Marks : 50*

Note :

(i) *Question no. 1 is **compulsory**. 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 meanings.*

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

(a) In systematic sampling, first k units are selected randomly and remaining $(n - k)$ units are selected in a systematic way, where $N/n = k > 1$ is an integer.

(b) Using the

LCG : $x_i = (1573\ x_{i-1} + 19) \bmod 10^3$, the values of x_1 and x_2 will respectively be 16 and 18 when $x_0 = 89$.

(c) CRD is preferred to RBD when experimental material is heterogeneous with respect to one factor.

(d) When sample size n coincides with population size $N(N < \infty)$, then sampling error will be more than 95%.

(e) Judgment sampling is the best random sampling technique.

2. A population has 7 units 1, 2, 3, 4, 5, 6 and 7. Write down all possible random samples of size 2 (without replacement) which can be drawn from the given population and verify that sample mean is an unbiased estimator of the population mean. Also calculate its sample variance and compare the results of $Var_{SRSWR}(\bar{X})$ and $Var_{SRSWOR}(\bar{X})$. *10*

OR

(a) The information regarding production of wheat (in 1000 kg) in 25 districts are collected, for a particular season. Select a systematic random sample of 7 units from the data given below :

23, 20, 30, 37, 76, 36, 13, 36, 16, 58, 53, 83, 10, 15, 13, 17, 12, 16, 17, 21, 20, 18, 61, 31 and 71.

Also calculate mean and variance of the selected sample.

(b) A random sample of 60 persons is to be drawn from a population consisting of 600 persons belonging to two villages, A and B. The means and standard deviations of their daily wages (in ₹) are given below :

Villages	Strata Size (N_i)	Mean ($\bar{X}_i$)	Standard Deviation (σ_i)
A	400	60	20
B	200	120	80

Obtain the sample size from each village using proportional allocation. Also obtain its variance, the population mean and variance of estimated sample mean. *6+4*

3. The following figures relate to production in kg of three varieties P, Q and R of rice in 12 plots :

P	14	16	18		
Q	14	13	15	22	
R	18	16	19	15	20

Is there any significant difference in the production of these varieties ? *10*

OR

An experiment is performed to determine the effect of two advertising campaigns on three kinds of cake mixes. Sales of each mix were recorded after the first advertising campaign and then after the second advertising campaign. This experiment was repeated three times for each advertising campaign and the following results were obtained :

	Campaign I	Campaign II
Mix 1	574, 564, 550	1092, 1086, 1065
Mix 2	524, 573, 551	1028, 1073, 998
Mix 3	576, 540, 592	1066, 1045, 1055

Perform an analysis of variance technique to determine at 5% level of significance whether there is a significant difference

(a) between the cake mixes, and

(b) between the campaigns. *10*

4. For the given data, yield of the treatment C in the second block is missing. Estimate the missing value and analyse the data. *10*

Blocks	Treatments			
	A	B	C	D
I	105	114	108	109
II	112	113	Y	112
III	106	114	105	109

OR

An experiment was planned to study the effect of sulphate, potash and superphosphate on the yield of potatoes. All the combinations of 2 levels of superphosphate [0 cent (p_0) and 5 cent (p_1)/acre] and two levels of sulphate and potash [0 cent (k_0) and 5 cent (k_1)/acre] were arranged in a randomised block design with 4 replications each. The yields (in kg) obtained are as follows :

Blocks	Yields			
I	(1) 23	k 25	p 22	kp 38
II	p 40	(1) 26	k 36	kp 38
III	(1) 29	k 20	pk 30	p 20
IV	kp 34	k 31	p 24	(1) 28

Analyse the data and give your conclusions. *10*

5. (a) Using five random numbers from uniform U(0, 1) distribution, $U_1 = 0{\cdot}316$, $U_2 = 0{\cdot}087$, $U_3 = 0{\cdot}270$, $U_4 = 0{\cdot}129$ and $U_5 = 0{\cdot}249$, generate a random number from binominal distribution with $n = 5$ and $p = 0{\cdot}2$.

(b) Using PRN 16, 187, 170, 429, obtain four random numbers from uniform U(0, 1) distribution.

(c) Suppose $U_1 = 0{\cdot}0535$, $U_2 = 0{\cdot}5292$, $U_3 = 0{\cdot}1189$ and $U_4 = 0{\cdot}3829$ are all independent U(0, 1) random variables. Using these, generate four random numbers from discrete uniform distribution given $N = 50$.

4+2+4

OR

(a) Simulate a M/M/1 process with $\lambda = 0{\cdot}6$ and $\mu = 1{\cdot}0$ and find out average waiting time W_i by taking $N = 10$.

(b) Using four random numbers from normal N(0, 1) distribution :

$y_1 = -0{\cdot}249$, $y_2 = 0{\cdot}999$, $y_3 = 0{\cdot}276$ and $y_4 = 0{\cdot}396$,

obtain a random number from χ^2-distribution with four degrees of freedom. *8+2*
