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AAG-003-001662 Seat No. _____

B. Sc. (Sem. VI) (CBCS) Examination

April / May - 2016

Statistics

(Design of Experiment & Sampling Techniques) (New Course)

Faculty Code : 003
Subject Code : 001662

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (1) Q. No. 1 carries 20 marks.
(2) Q. No. 2 and Q. No. 3 each carries 25 marks.
(3) Write the answer of MCQ in answer sheet.
(4) Right side figure indicate marks of that question.

1 Multiple Choice Questions : **20**

(1) An experimental design is

(A) map (B) a plan of experiment

(C) an architect (D) All of these

(2) The factors like spacing, date of sowing and breeds are often used as :

(A) experimental unit (B) treatment

(C) replicates (D) None of these.

(3) Randomization in an experiment helps to eliminate

(A) Systematic influences

(B) human biases

(C) dependence among observations

(D) All of these

(4) Which of the following is a contrast?

(A) $2T_1 + T_2 - 2T_3 + T_4$

(B) $T_1 - 2T_2 - 2T_3 + T_4$

(C) $T_1 + T_2 + T_3 - T_4$

(D) $-3T_1 - T_2 + T_3 + 3T_4$

(5) The ratio of the number of replications required in CRD and RBD for the same amount of information is :

(A) 10 : 6 (B) 6 : 4

(C) 6 : 10 (D) 4 : 6

(6) The layout : $\begin{bmatrix} A & C & A & B \\ C & B & C & D \\ B & A & D & A \\ D & D & B & C \end{bmatrix}$ stands for

(A) completely randomized design

(B) randomized block design

(C) latin square design

(D) cross over design

(7) If in a randomized block design having t treatments and b replications, then error degrees of freedom is

(A) $(t - 1)(b - 1)$ (B) $(t - 2)(b - 1)$

(C) $(t - 1)(b - 2)$ (D) $(tb - 1)$

(8) If the same factorial effect is confounded in all the replications it is known as :

(A) partial confounding

(B) complete confounding

(C) conservative confounding

(D) None of these

(9) A latin square design process

(A) one way classification

(B) two way classification

(C) three way classification

(D) No way classification

(10) With the help of contrasts, one can estimate the

(A) linear effect (B) quadratic effect

(C) cubic effect (D) All of these

(11) The number of possible samples of size 4 out of 8 population units without replacement is :

(A) 64 (B) 70

(C) 16 (D) 32

(12) Probability of drawing a unit at each selection remains same in

(A) SRSWOR (B) SRSWR

(C) Both (A) and (B) (D) None of (A) and (B)

(13) A selection procedure of a sampling having no involvement of probability is known as :

(A) purposive sampling (B) judgment sampling

(C) subjective sampling (D) All of these

(14) The errors in a survey other than sampling error are called

(A) Formula error (B) Planning error

(C) Non-sampling error (D) None of these

(15) If n units are selected in a sample from N population units, the sampling fraction is given as

(A) N/n (B) $1/N$

(C) $1/n$ (D) n/N

(16) Stratified sampling comes under the category of :

(A) unrestricted sampling

(B) restricted sampling

(C) purposive sampling

(D) subjective sampling

(17) Variance of $\bar{x}_{st}$ under random sampling proportional allocation and optimum allocation hold correct inequality as :

(A) $V_{ran}(\bar{x}_{st}) \geq V_{prop}(\bar{x}_{st}) \geq V_{opt}(\bar{x}_{st})$

(B) $V_{ran}(\bar{x}_{st}) \leq V_{prop}(\bar{x}_{st}) \leq V_{opt}(\bar{x}_{st})$

(C) $V_{ran}(\bar{x}_{st}) \geq V_{opt}(\bar{x}_{st}) \geq V_{prop}(\bar{x}_{st})$

(D) All of these

(18) In sampling without replacement, the standard error of the sample mean vanishes if

(A) $n > N$ (B) $n = N$

(C) $n < N$ (D) $n \neq N$

(19) In simple random sampling without replacement, a sample of size n is drawn from a population of size N, then the sample mean $\bar{y}$ is an unbiased estimator of population mean $\bar{Y}$ and for $S^2 = \frac{N\sigma^2}{(N-1)}$ its sampling variance is given by

(A) $\left(1-\frac{n}{N}\right)\frac{S^2}{N}$ (B) $\left(1-\frac{N}{n+N}\right)\frac{S^2}{n}$

(C) $\left(1-\frac{n}{N}\right)\frac{S}{N}$ (D) $\left(1-\frac{n}{N}\right)\frac{S^2}{n}$

(20) If each and every unit of a population has equal chance of being included in the sample, it is known as :

(A) restricted sampling

(B) purposive sampling

(C) subjective sampling

(D) unrestricted sampling

2 (a) Give the answers : (any **three**) **6**

(1) Define Design of Experiment

(2) Write Cochran's theorem.

(3) Define ANOVA

(4) Mention in brief the objective of sampling.

(5) What is meant by sampling frame ?

(6) Obtain variance of simple random sample mean if

$$N = 500,\ n = 30,\ \sum_{i=1}^{30} y_i = 565,\ \sum_{i=1}^{30} y_i^2 = 13413$$

(b) Give the answers : (any **three**) **9**

(1) Write the set of orthogonal contrasts for main effect and interaction in 2^3-experiment.

(2) Explain types of confounding and also define its difference.

(3) Explain Randomize Block Design.

(4) Prove that $E\left(S^2\right) = S^2$

(5) Prove that $Var\left(\bar{y}_n\right)_{ran} > V\left(\bar{y}_{sys}\right)$ if and only if $S^2_{wsys} > S^2$.

(6) Prove that if $N \to \infty$ then $V\left(\bar{y}_{st}\right) = \dfrac{\sum_{h=1}^{L} w_h^2 \, S_h^2}{n_h}$

where $w_h = \dfrac{N_h}{N}$.

(c) Give the answers : (any **two**) **10**

(1) Explain estimation of one missing plot in R.B.D.

(2) Explain analysis of LSD

(3) Explain analysis of one way classification.

(4) Prove that $V\left(\bar{y}_{ran}\right) \geq V\left(\bar{y}_{st}\right)_{prop} \geq V\left(\bar{y}_{st}\right)_{opt}$

(5) For studying the characteristics the observation of a population are 2, 3, 6, 8. How many random samples of size 2, without replacement can be taken from it ? Making a list of all the samples verify the following results :

(i) $E\left(\bar{y}\right) = \bar{Y}$

(ii) $V\left(\bar{y}\right) = \dfrac{N-n}{N}\dfrac{S^2}{n}$

(iii) $E\left(S^2\right) = S^2$

3 (a) Give the answers : (any **three**) **6**

(1) Define Simple Random Sampling.

(2) In what situations sampling is invetible ?

(3) Mr. X wants to determine on the basis of sample study the mean time required to complete a certain job so that he may be 95% confident that the mean may remain within ± 2 days of the true mean. As per the available records the population variance is 64 days. How large should the sample be for his study ?

(4) Write advantages of C.R.D.

(5) Define Symmetrical factorial experiment.

(6) Write the Yate's method for a 2^2-experiment.

(b) Give the answer : (any **three**) **9**

(1) Why Confounding ?

(2) Yate's Method for 2^3 - experiment.

(3) Explain layout of design of Latin Square Design.

(4) Prove that $V\left(\bar{y}_{sys}\right) = \frac{N-1}{N} S^2 - \frac{N-k}{N} S^2_{wys}$

(5) Prove that :

(i) $E\left(\bar{y}_{st}\right) = \bar{Y}$

(ii) $V\left(\bar{y}_{st}\right) = \frac{1}{N^2}\left\{\sum_{h=1}^{L} N_h \frac{N_h\left(N_h - n_h\right)S_h^2}{n_h}\right\}$

(6) 200 units of a population are divided into three strata. The numbers of units in the first stratum are 100, those in the second stratum are 60 and in the third stratum are 40. The variances of these strata are respectively 80, 72 and 56. If it is desired to take a sample of 40 units by proportional allocation, find how many units should be taken from each stratum and also find the variance of stratified sample.

(c) Give the answers : (any **two**) **10**

(1) Explain analysis of RBD.

(2) Explain estimation of one missing plot in L.S.D.

(3) Prove that $V\left(\bar{y}_{sys}\right)=\frac{N-1}{N}\frac{S^2}{n}\left[1+(n-1)\rho\right]$

(4) Prove that $V\left(\bar{y}_{st}\right)\leq V\left(\bar{y}_{sys}\right)\leq V\left(\bar{y}_{n}\right)_{ran}$ if population consists of a linear trend.

(5) A population is divided in three strata as follows :

Stratum	N_h	S_h
I	400	10
II	200	8
III	400	6

If 10% sample is to be taken then show that $V\left(\bar{y}_{st}\right)_{prop}\geq V\left(\bar{y}_{st}\right)_{opt}$.