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

March / April - 2018

S - 601 : 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) Students can carry their own scientific calculator.

1 Filling the blanks :   **20**

(1) A subject receiving a treatment in an experiment is called _____

(2) Systematic influences likely to occur in an experiment can be removed through _____

(3) Replications provide a valid estimate of _____

(4) Greater homogeneity within the block in an experiment is better maintained through _____

(5) Statistical model considered for all designs is an _____ model.

(6) The linear combination $-3T_1 - T_2 + T_3 + 3T_4$ of four treatments is a _____

(7) Among k treatments, there can at most be _____ orthogonal contrasts.

(8) The design where only replication and randomization are used is _____

(9) Each treatment occurs _____ in a block of randomized complete block design.

(10) If there are t treatments and m blocks in a randomized block design, the error degrees of freedom in ANOVA table be _____

(11) In stratified random sampling, the variance of $\bar{x}_{st}$ for fixed total size of sample is minimum if n_j is proportional to _____

(12) With varying cost C_j per unit in stratified random sampling, the variance of $\bar{x}_{st}$ attains the smallest value if n_j is proportional to _____

(13) $V_{prop}\left(\bar{x}_{st}\right)$ lies in between $V_{opt}\left(\bar{x}_{st}\right)$ and _____

(14) The students in a college are awarded grades A, B and C. For estimating the average IQ of the college students, _____ will provide good estimate of average IQ.

(15) When a simple random sample is drawn from each stratum, it is known as _____

(16) The main disadvantage of systematic sampling is that _____ formula for estimating the standard error of sample mean is available.

(17) When the population size N is a multiple of sample size n, _____ systematic sampling appropriate.

(18) When the population size N is not divisible by the sample size n, _____ systematic sampling appropriate.

(19) Attaining maximum efficiency in estimating for a fixed cost is a part of principle of _____

(20) When stratification is done to minimize the selection of non-preferred samples, it is known as _____

2 (A) Give the answer : (Any **Three**)   6

    (1) Prove that $E\left(\bar{y}\right) = \bar{Y}$

    (2) Write assumptions of ANOVA.

    (3) Write ANOVA table for one way classification.

    (4) Mention in brief the objective of sampling.

    (5) What is meant by sampling frame?

    (6) For studying the characteristics the observation of a population are 3, 4, 7, 8. How many random samples of size 2, with replacement can be taken from it? Making a list of all the samples verify the results $E\left(\bar{y}\right) = \bar{Y}$

(B) Give the answer : (Any **Three**)   9

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

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

(2) A population is divided in three strata. The information regarding then is as follows :

Stratum	Number of units in the stratum	Stratum mean	Stratum variance
1	60	8	12
2	30	6	10
3	10	9	4.5

If 10, 6, 3 units are taken respectively from these strata, find the variance of stratified mean. Also find the population mean.

(3) Explain estimation of one missing value in CRD.

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

(C) Give the answer : (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 $V\left(\bar{y}_{st}\right) \leq V\left(\bar{y}_{sys}\right) \leq V\left(\bar{y}_n\right)_{ran}$ if population consists of a linear trend
(5) From the following data find $V\left(\bar{y}_{st}\right)$ under optimum allocation 10% stratified sample is to be taken.

Stratum	N_h	S_h
I	100	4
II	200	5
III	200	3

3   (A)   Give the answer : (Any **Three**)   6
(1) Define Simple Random Sampling
(2) In what situations sampling is invetible?
(3) Calculate sample size for estimating a proportion.

(4) It is know that the population standard deviation in waiting time for L.P.G. gas cylinder in Rajkot is 15 days. How large a sample should be chosen to be 95% confident, the waiting time is within 7 days of true average.

(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 is needed?

(2) Yate's Method for 2^3–experiment

(3) Explain layout of design of Latin Square Design

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

(5) Prove that :

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

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

(6) Obtain the population mean and variance of the stratified mean from the following data :

$N_1 = 40, N_2 = 30, N_3 = 30, \bar{Y}_1 = 5, \bar{Y}_2 = 7, \bar{Y}_3 = 6,$

$S_1^2 = 10, S_2^2 = 8, S_3^2 = 9 \; n_1 = 8, n_2 = 6, n_3 = 6$

(C) Give the answer : (Any **Two**)   **10**

(1) Explain analysis of RBD

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

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

(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, 4. 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) $E\left(S^2\right) = S^2$