Seat No. : _____

SJ-121

September-2020

B.Sc., Sem.-VI

CC-308 : Statistics

Sampling Techniques

(New Course)

Time : 2 Hours] **[Max. Marks : 50**

Section – I

Attempt any **three** :

1. (A) Write detailed note on simple random sample and explain different methods to draw a sample by using SRS technique. **7**

   (B) Derive variance for SRSWOR. **7**

2. (A) What is simple random sampling ? Give merits and demerits of simple random sampling.

   (B) For SRSWOR, show that $S^2 = \frac{1}{N-1} \sum_{i=l}^{n} (y_i - \bar{y})^2$ is an unbiased estimate of $S^2 = \frac{1}{N-1} \sum_{i=1}^{N} (y_i - \bar{y})^2$. **7**

3. (A) Derive the variance of stratified sampling using Neyman allocation. **7**

   (B) Show that for stratified random sampling the variance of estimate $\bar{y}_{st}$ is $V(\bar{y}_{st}) = \sum_{h=1}^{L} w_h^2 \frac{S_h^2}{n_h} (1 - f_h)$. **7**

4. (A) Write detailed note on estimating size of the sample by using stratified sampling. **7**

(B) If the cost function is of the form $C = C_o + \sum_{h=1}^{L} t_h \sqrt{n_h}$; where C_o and t_h are known numbers, show that in order to minimize $V(\bar{y}_{st})$ for fixed cost, the n_h must be proportional to $\left(\frac{w_h S_h^2}{t_h}\right)^{2/3}$. Also find n_h for fixed n. **7**

5. (A) Derive variance of systematic sampling in terms of S_w^2 and S_w. **7**

(B) A systematic sample has same precision as a corresponding stratified random sample with 1 unit per stratum if $S_{wst} = 0$. **7**

6. (A) What is systematic sampling ? Explain its merits and demerits. Give its application also. **7**

(B) If the population consists of linear trend, give the relationship between variance of stratified sampling, simple random sampling and systematic sampling. **7**

7. (A) Write a note on two stage sampling. **7**

(B) In two-stage sampling $V(\hat{\theta}) = V_1[E_2(\hat{\theta})] + G[V_2(\hat{\theta})]$. **7**

8. (A) In n units and m sub-units from each chosen units are selected by SRS then

$$V(\bar{y}) = \frac{N-n}{N}\frac{S_1^2}{n} + \frac{M-m}{M}\frac{S_2^2}{mn}.$$ **7**

(B) Explain : Sub sampling is regarded as incomplete sampling. **7**

Section – II

9. Attempt the following : (Any **Four**) **8**

(1) The number of possible samples of size n out of N population units without replacement is

(a) $\binom{N}{n}$ (b) $(N)_n$

(c) n^2 (d) n!

(2) An unordered sample of size n can occur in.

(a) n ways (b) n! ways

(c) one way (d) n^2 ways

(3) If we have a sample of size n from a population of N units, the finite population correction is

(a) $\frac{N-1}{N}$ (b) $\frac{n-1}{N}$

(c) $\frac{N-n}{N}$ (d) $\frac{N-n}{n}$

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

(a) $\frac{N}{n}$ (b) $\frac{1}{N}$

(c) $\frac{1}{n}$ (d) $\frac{n}{N}$

(5) Which of the following advantage of systematic sampling you approve ?

(a) easy selection of sample

(b) economical

(c) spread of sample over the whole population

(d) All of the above

(6) Selected units of a systematic sample are

(a) not easily locatable

(b) easily locatable

(c) not representing the whole population

(d) All of the above

(7) In what situation two stage sampling is better than single stage sampling ?

(a) When the elements in the same stage are positively correlated.

(b) When the elements in the same stage are negatively correlated.

(c) When the elements in the same stage are uncorrelated.

(d) None of the above.

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

(a) SRSWOR (b) SRSWR

(c) Both (a) and (b) (d) None of (a) & (b)

Seat No. : _____

SJ-121

September-2020

B.Sc., Sem.-VI

CC-308 : Statistics
Statistical Inference and Design of Experiment – II
(Old Course)

Time : 2 Hours] **[Max. Marks : 50**

Section – I

Attempt any **three** :

1. (A) Explain with example type-I and type-II errors which occurs in problems of testing of hypothesis. Suggest the ways of minimizing them. **7**

   (B) Define the following terms : **7**

   (i) Statistics and Parameters.

   (ii) Null and alternative hypothesis.

   (iii) Level of significance and power of the test.

2. (A) State and prove Neyman-Pearson Lemma. **7**

   (B) Describe likelihood ratio test in detail. State its properties. **7**

3. (A) Explain fully randomized block design. State its merits and demerits. **7**

   (B) What is factorial experiment ? Explain 2^3 factorial experiment in detail. **7**

4. (A) How would you derive efficiency of randomized block design over completely randomized design ? **7**

   (B) Derive the formula for estimating missing observation for m × m LSD. Give its statistical analysis. **7**

5. (A) Obtain most powerful critical regions for testing $H_0 : \theta = \theta_0$ v/s $H_1 : \theta = \theta_1 > \theta_0$ and $\theta = \theta_1 < \theta_0$ in case of a normal population $N(\theta, \sigma^2)$ where σ^2 is known. Hence find the power of the test. **7**

   (B) Let x_1 and x_2 be $N(\mu_1, \sigma^2)$ and $N(\mu_2, \sigma^2)$ respectively where the means and variance are unspecified. Develop LR test for testing $H_0 : \mu_1 = \mu_2$ v/s $H_1 : \mu_4 \neq \mu_2$. **7**

6. (A) Explain the difference between parametric and non parametric tests in detail. **7**

(B) Write a note on Mann-Whitney test. **7**

7. (A) Write a note on Wilcoxon signed rank test. **7**

(B) Write a note on median test. **7**

8. (A) Let $x_1, x_2, --, x_n$ be a random sample from $N(\theta,1)$. Obtain B.C.R to test $H_0 : \theta = \theta_0$ v/s $H_1 : \theta = \theta_1$. **7**

(B) Let $x_1, x_2, --, x_n$ be independent observation obtained from $N(\mu, \sigma^2)$ where $\sigma = 10$. Find B.C.R of size $\alpha = 0.05$ from testing $H_0 : \mu = 100$ v/s $H_1 : \mu = 110$. Obtain power of the test. **7**

Section – II

9. Answer the **four** : **8**

(1) The formula for obtaining a missing values in randomized block design by minimizing the error mean square was given by

(a) W.G. Cochran (b) T. Wishart

(c) F. Yates (d) J.W. Turkey

(2) Full form of LRT is

(a) Likelihood ratio test (b) Log ratio test

(c) Likelihood revenue test (d) Loglikelihood ratio test

(3) Most of the non-parametric methods utilize measurements on

(a) Interval scale (b) Ratio scale

(c) Ordinal scale (d) Nominal scale

(4) A test procedure δ for testing a hypothesis about a parameter θ whose risk is not more than the risk of any test procedure δ^1 for all θ and is definitely less for some θ is called

(a) minimal test (b) admissible test

(c) most powerful test (d) optimum test

(5) The idea of testing of hypothesis was first set forth by

(a) R.A. Fisher (b) J. Neyman

(c) E.L. Lehman (d) A. Wald

(6) Whether a test is one sided or two-sided depends on

(a) alternate hypothesis (b) composite hypothesis

(c) null hypothesis (d) simple hypothesis

(7) If θ is a true parameter and β the type-II error, the function $\beta(\theta)$ is known as

(a) Power of the test (b) Power function

(c) Operating characteristic function (d) None of the above.

(8) Area of the critical region depends on

(a) Size of type-I-error (b) Size of type-II-error

(c) Value of the statistics (d) Number of observations