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# CBC–4380-W

**B. A./B. Sc. (Third Semester)**

**(End Semester)**

**EXAMINATION, Dec., 2021**

STATISTICS

Paper–STAT-CC-311

**(Sampling Theory and Distribution)**

*Time : Three Hours* ] [ *Maximum Marks : 60*

**Note :** The question paper is divided into three Sections. Attempt the questions as per direction.







**Section—A**

**(Objective Type Questions)**

**Note :** Choose the correct answer. Each question carries 1 mark.

1. If sample $n$ is sufficiently large, then $\bar{x} \sim N\left(\mu, \frac{\sigma_2}{n}\right)$, even sample is not taken from normal population, by :
   (a) W. L. L.
   (b) S. L. L. N.
   (c) Central limit theorem
   (d) Chebyshev's inequality

2. Let $\{X_n\}$ be a sequence of random variables we say that $X_n$ converges almost surely to a random variable X if and only if :
   (a) $p\left[w : X_n(w) \to X(w) \text{ as } n \to \infty\right] = 0$
   (b) $p\left[w : X_n(w) \to X(w) \text{ as } n \to \infty\right] = 1$
   (c) $p\left[|X_n - X| > \varepsilon\right] \to 0 \text{ as } n \to \infty$
   (d) $p\left[|X_n - X| < \varepsilon\right] \to 0 \text{ as } n \to \infty$

3. Which among the following is true ?

(a) $X_n \xrightarrow{P} X, X_n \xrightarrow{P} Y$

$$\Rightarrow (Y_n - X)(X_n - Y) \xrightarrow{P} 0$$

(b) $X_n \xrightarrow{P} X,\ Y_n \xrightarrow{P} Y \Rightarrow X_n X_n$

(c) $X_n \xrightarrow{P} X \to X_n^2 \xrightarrow{P} X^2$

(d) All of the above are true.

4. The M. G. F. of $\chi^2$-distribution with $n$ d.f. is given by :

(a) $(1-t)^{-n/2}$

(b) $(1-2t)^{-n/2}$

(c) $(1-3t)^{-n/2}$

(d) $(1-2t)^{n/2}$





5. If X and Y are two independent Chi-square variates with $\nu_1$ and $\nu_2$ d. f., the F-statistics is defined by :

(a) $\dfrac{X/\nu_2}{Y/\nu_1}$

(b) $\dfrac{X/\nu_1}{Y/\nu_2}$

(c) $\dfrac{X/(\nu_1 - 1)}{Y/(\nu_2 - 1)}$

(d) None of the above

6. Null hypothesis is called when :

(a) P (Rejecting $H_0$ when it is true) = $\alpha$

(b) P (Rejecting $H_0$ when it is false) = $\alpha$

(c) P (Accepting $H_0$ when it is true) = $\beta$

(d) P (Accepting $H_0$ when it is false) = $\alpha$

7. Ratio estimator is more efficient than usual mean per unit estimator, if :

(a) $\rho = \frac{1}{2}\frac{c_x}{c_y}$

(b) $\rho < \frac{1}{2}\frac{c_x}{c_y}$

(c) $\rho > \frac{1}{2}\frac{c_x}{c_y}$

(d) $\rho < \frac{c_x}{c_y}$

8. Product estimator is used when :

(a) $\rho(XY) = 0$

(b) $\rho(XY)$ = negative

(c) $\rho(XY)$ = positive

(d) not concerned with $\rho$

9. Product estimator is more efficient than usual mean per unit estimator, if :

(a) $\rho = -\frac{1}{2}\frac{c_x}{c_y}$







(b) $\rho < -\frac{1}{2}\frac{c_x}{c_y}$

(c) $\rho > \frac{1}{2}\frac{c_x}{c_y}$

(d) $\rho < \frac{1}{2}\frac{c_x}{c_y}$

10. Auxiliary information was first used by :

(a) Searls S.

(b) Goodmen

(c) Cocharan, W. G.

(d) Fisher

## Section—B

## (Short Answer Type Questions)

**Note :** Attempt any *four* questions. Each question carries 5 marks.

1. Write a note on various modes of convergence.
2. Write a short note on regression estimator.
3. Explain the following :
   (i) Null and Alternative hypothesis
   (ii) First and second kind error
   (iii) Critical region and level of significance

4. State and prove Chebyshev's inequality.

5. If S be a sample, then prove that :

$$P(i \in S) = \frac{n}{N}$$

i. e. *i*th unit include in the sample is $\frac{n}{N}$.

6. If $X \sim \chi^2_{n_1}$ and $X_2 \sim \chi^2_{n_2}$, then prove that :

$$\frac{X_1}{X_2} \sim \beta_2\left(\frac{n_1}{2}, \frac{n_2}{2}\right).$$

## Section—C

## (Long Answer Type Questions)

**Note :** Attempt any *three* questions. Each question carries 10 marks.

1. State and prove central limit theorem using M. G. F. method.

2. Write a detailed note on Organisation of Survey Sampling.







3. If $(\bar{y}_n)_{WOR}$ be usual estimator, then prove that :

$$V(\bar{y}_n)_{WOR} = \left(\frac{1}{n} - \frac{1}{N}\right)S^2$$

Also compare its efficiency over $(\bar{y}_n)_{WR}$.

4. Explain the method of stratified random sampling and prove that :

$$V(\bar{y}_{st})_P \geq V(\bar{y}_{st})_N$$

5. Define ratio estimator and prove that its MSE is given by :

$$MSE(\hat{\bar{y}}) = \left(\frac{p - f}{n}\right)\bar{y}^2$$

$$\left[C_x^2 + C_y^2 - 2\rho C_x C_y\right]$$