

**(FOR THE CANDIDATES ADMITTED
DURING THE ACADEMIC YEAR 2022 ONLY)**

22UMS2A2

REG.NO. :

**N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI
END-OF-SEMESTER EXAMINATIONS : MAY-2023**

COURSE NAME: B.Sc.-MATHEMATICS **MAXIMUM MARKS: 50**
SEMESTER: II **TIME : 3 HOURS**

**PART - III
MATHEMATICAL STATISTICS-II
SECTION – A (10 X 1 = 10 MARKS)**

ANSWER THE FOLLOWING QUESTIONS.

MULTIPLE CHOICE QUESTIONS. (K1)

1. Two independent variables are _____.
 a) Correlated b) Uncorrelated c) both None of the above
2. Each unit of the population has an equal chance is known as _____.
 a) Simple Sampling b) stratified sampling c) Systematic sampling d) purposive sampling
3. Sample may be regarded as large if _____.
 a) $n < 30$ b) $n > 30$ c) $n < 40$ d) $n > 40$
4. Student's t- test is defined by _____.
 a) $t = \frac{\bar{x} + \mu}{s/\sqrt{n}}$ b) $t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$ c) $t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$ d) $t = \frac{\bar{x} + \mu}{s/\sqrt{n}}$
5. The correlation coefficient between a most efficient estimator and any other estimator with efficiency e is _____.
 a) e b) \sqrt{e} c) e^2 d) none of the above

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. Define Regression Coefficients.
7. Define stratified sampling.
8. Define mode of χ^2 distribution.
9. Write about assumptions for student's t-test.
10. What are the characteristics of good estimators?

SECTION – B (5 X 3 = 15 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) Can $y = 5 + 2.8x$ and $x = 3 - 0.5y$ be the estimated regression equations of y on x and x on y respectively?
 (OR)
 b) $f(x, y) = xe^{-x(y+1)}$, $x \geq 0, y \geq 0$, find the regression curve of y on x .
12. a) Write short notes on (i) purposive sampling (ii) Random sampling
 (OR)
 b) A random sample of 500 apples was taken from a large consignment and were found to be bad. Obtain the 98% confidence limits for the percentage of bad apples in the consignment. (CONTD.....2)

13. a) Test the hypothesis that $\sigma = 10$, given that $s = 15$ for a random sample of size 50 from a normal population.

(OR)

b) If X is a chi-square variate with n d.f., then prove that for large n , $\sqrt{2X} \sim N(\sqrt{2N}, 1)$.

14. a) The mean weekly sales of soap bars in departmental stores was 146.3 bars per store. After an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153.7 and showed a standard deviation of 17.2. Was the advertising campaign successful?

(OR)

b) The heights of 10 males of a given locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66 inches. Is it reasonable to believe that the average height is greater than 64 inches? Test at 5% significance level assuming that for 9 degrees of freedom $P(t > 1.83) = 0.05$.

15. a) Show that $\frac{[\sum x_i(\sum x_i - 1)]}{n(n-1)}$ is an unbiased estimate of θ^2 , for the sample x_1, x_2, \dots, x_n drawn on X which takes the values 1 or 0 with respective probabilities θ and $(1 - \theta)$.

(OR)

b) X_1, X_2 and X_3 is a random sample of size 3 from a population with mean value μ and variance σ^2 . T_1, T_2, T_3 are the estimators used to estimate mean value μ , where

$$T_1 = X_1 + X_2 - X_3, \quad T_2 = 2X_1 + 3X_3 - 4X_2, \quad \text{and} \quad T_3 = \frac{1}{3}(X_1 + X_2 + X_3)/3$$

(i) Are T_1 and T_2 unbiased estimators?

(ii) Find the value of λ such that T_3 is unbiased estimator for μ .

SECTION – C

(5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) Obtain the equations of two lines of regression for the following data. Also obtain the estimate of X for $Y = 70$.

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

(OR)

b) Fit an exponential curve of the form $Y = ab^X$ to the following data:

X	1	2	3	4	5	6	7	8
Y	1.0	1.2	1.8	2.5	3.6	4.7	6.6	9.1

17. a) A random sample of 500 pineapples was taken from a large consignment and 65 were found to be bad. Show that the S.E. of the proportion of bad ones in a sample of this size is 0.015 and deduce that the percentage of bad pineapples in the consignment almost certainly lies between 8.5 and 17.5.

(OR)

b) Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Test the hypothesis that proportions of men and women in favour of the proposal, are same against that they are not, at 5% level.

18. a) State and prove Fisher's lemma.

(OR)

b) Describe the applications of Chi-square distribution.

(CONTD.....3)

19. a) Show that for t -distribution with n d.f., mean deviation about mean is given by $\sqrt{n} \Gamma[(n-1)/2]/\sqrt{\pi} \Gamma(n/2)$.
(OR)

b) Samples of two types of electric light bulbs were tested for length of life and following data were obtained:

	Type I	Type II
Sample No.	$n_1 = 8$	$n_2 = 7$
Sample means	$\bar{x}_1 = 1,234 \text{ hrs.}$	$\bar{x}_2 = 1,036 \text{ hrs.}$
Sample S.D.'s	$s_1 = 36 \text{ hrs}$	$s_2 = 40 \text{ hrs}$

Is the difference in the means sufficient to warrant that type I is superior to type II regarding length of life?

20. a) If X_1, X_2, \dots, X_n are random observations on a Bernoulli variate X taking the value 1 with probability p and the value 0 with probability $(1-p)$, show that:
 $\frac{\sum x_i}{n} \left(1 - \frac{\sum x_i}{n}\right)$ is a constant estimator of $p(1-p)$.
(OR)

b) Suppose T_1 is an unbiased estimator of $\gamma(\theta)$ with variance σ_1^2 and an unbiased minimum variance estimate and T_2 is any other unbiased estimate with variance σ^2/e . Then prove that the correlation between T_1 and T_2 is \sqrt{e}

ETHICAL PAPER