18MCU14

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2023
(Third Semester)

Branch – **MATHEMATICS WITH COMPUTER APPLICATION**

MATHEMATICAL STATISTICS

Time: Three Hours | Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1 A number is selected from the first 20 natural numbers. Find the probability that it would be divisible by 3 or 7?
(i) 7/20 (ii) 24/67
(iii) 12/37 (iv) 19/46

2 If we have to sample the population, it's partitioned into units. Those are known to be?
(i) sampling units (ii) sampling gap
(iii) sampling frame (iv) sampling error

3 If X is A discrete random variable and f(x) is the probability of X, then the expected value of this random variable is equal to:
(i) $\sum f(x)$ (ii) $\sum[x+f(x)]$ (iii) $\sum f(x)+x$ (iv) $\sum xf(x)$

4 Parameter is a characteristic of
(i) Population (ii) Both (i) & (iii)
(iii) Sample (iv) Probability distribution

5 A sample which is free from error is called
(i) Positively biased (ii) Unbiased
(iii) Biased (iv) Negatively biased

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6. a) State and prove the multiplicative law of probability

OR

b) A Problem in statistics is given to three students A, B, and C whose chances of solving it are ½, 3/4, and ¼ respectively. What is the probability that the problem will be solved if all of them try independently?

7. a) Explain the systematic sampling method in detail.

OR

b) Fit a quadratic curve for the following data

X	1	2	3	4	5	6	7
Y	2.3	5.2	9.7	16.5	29.5	35.5	54.4

8. a) Let X be the random variable with probability mass function P(X=x) = 1/6,

x = 1,2,3,4 find the mean and variance.

OR

b) State and prove the addition theorem if A and B are any two events and are disjoint.

9. a) Explain type I error and type II error.

OR

b) After correcting 50 pages of the proof of a book, the proofreader finds that there are, on average 2 errors per 5 pages. How many pages would one expect to find with 0,1,2,3 errors in 1000 pages of the first print of the book?

Cont...

10. a) Explain the procedure for testing of equality of variance.

OR

b) A small component in an electronic device has two small holes where another tiny part is fitted. In the manufacturing process the average distance between the two holes must be tightly controlled at 0.02 mm, many units would be defective and wasted. Many times throughout the day quality control engineers take a small sample of the components from the production line, measure the distance between the two holes, and make adjustments if needed. Suppose at one time four units are taken and the distances are measured as 0.021, 0.019, 0.023, 0.020 Determine, at the 1% level of significance, if there is sufficient evidence in the sample to conclude that an adjustment is needed. Assume the distances of interest are normally distributed. (Table value = 5.841)

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11. a) State and prove Bayes theorem.

OR

b) A and B throw alternatively with a pair of balanced dice. A wins if he throws a sum of six points before B throws a sum of seven points, while B wins if he throws a sum of seven points before A throws a sum of six points. If A begins the game, show that his probability of winning is 30/61.

12. a) Explain the stratified random sample in detail.

OR

b) Fit an exponential equation $y = ae^{bx}$ for the following data

X	0	0.5	1	1.5	2	2.5
Y	0.1	0.45	2.15	9.15	40.35	180.75

13. a) What is the expectation of the number of failures preceding the first success in an infinite series of independent trials with constant probability p of success in each trial?

OR

b) Two ideal dice are thrown. Let X_1 be the score on the first die and X_2 the score on the second die. Let Y denote the maximum of X_1 and X_2 i.e., $Y = \max(X_1, X_2)$. (i) Write down the joint distribution of Y and X_1 and (ii) find the mean and variance of Y and covariance (Y, X_1).

14. a) A manufacturer who produces medicine bottles finds that 0.1% of the bottles are defective. The bottles are packed in boxes containing 500 bottles. A drug manufacturer buys 100 boxes from the producer of bottles. Using Poisson distribution find how many boxes will contain (i) no defective and (ii) at least two defective.

OR

b) Discuss the following topics in detail: a) Type I and Type II error, Critical region, and power of the test.

15. a) The husband's age and wife's age data in which the sample correlation based on n = 170 couples is $r = 0.939$. To test $H_0 = \rho = 0$ against the alternative $H_A = \rho \neq 0$.

OR

b) The means of two random samples of sizes 10 and 8 drawn from two normal populations are 210.40 and 208.92 respectively. The sum of squares of the deviations from their means is 26.94 and 24.50 respectively. Assuming that the populations are normal with equal variances, can samples be considered to have been drawn from normal populations having equal mean?

Z-Z-Z END