Indian Statistical Institute, Bangalore Centre

Documentation Research and Training Centre
M.S. (Library and Information Science)
2nd Semester Final Examination (2024-2026)

Paper 09: Elements of Mathematics and Statistics

Time: 10.00 AM - 1:00 PM   Max. Marks: 80   Date: 25-04-2024

INSTRUCTION: Read the question before you attempt.

Section A

Multiple Choice Questions (MCQs):   (18)

1) For a Poisson distribution   [1]
   a) Mean > Variance   b) Mean = Variance
   c) Mean < Variance   d) None of the above

2) In a normal distribution, skewness is   [1]
   a) one   b) zero
   c) greater than one   d) less than one

3) Which index number is called the ideal index number?   [1]
   a) Laspeyres   b) Paasches
   c) Fisher   d) None of the above

4) Two perfect dice are thrown. What is the probability that the sum of the numbers on the faces is neither 9 nor 10?   [3]
   a) 1/36   b) 5/36
   c) 29/36   d) 7/36

5) Company A produces 10% defective products, Company B produces 20% defective products, and Company C produces 5% defective products. If choosing a company is an equally likely event, then find the probability that the product chosen is defective: [4]
   a) 0.11   b) 0.12
   c) 0.21   d) 0.22

6) A fair coin is tossed thrice; what is the probability of getting all 3 same outcomes?   [3]
   a) 1/2   b) 1/4
   c) 3/4   d) 1/6

7) 'Goodness of Fit' of a distribution is tested by: [1]
   a) F-test
   b) Chi-square test
   c) T-test
   d) None of the above

8) Arrange the following steps in the process of hypothesis testing in proper sequence: [2]
   A: Select the level of significance
   B: Set up null and alternative hypotheses
   C: Establish the decision rule
   D: Performance computation
   E: Select test statistics
   F: Draw a conclusion
   a) A, B, C, D, E, F
   b) B, A, E, C, D, F
   c) A, B, E, D, C, F
   d) B, D, A, C, E, F

9) The choice of one-tailed test and two-tailed test depends upon: [1]
   a) Null hypothesis
   b) Alternative hypothesis
   c) Level of significance
   d) Confidence interval

10) Students' t-distribution has (n-1) d.f. (degrees of freedom) when all the n observations in the sample are: [1]
   a) Dependent
   b) Independent
   c) Maximum
   d) Minimum

Section B

Answer any seven of the following questions: (7*6=42)

1) Give an example of a relation. Which is
   a) Symmetric and transitive but not reflexive.
   b) Reflexive and symmetric but not transitive.

2) The occurrence of a disease in an industry is such that the workers have a 20% chance of suffering from it. Using the binomial distribution, what is the probability that 4 or more out of 6 randomly selected workers will suffer from the disease?

3) Show that the relation R in the set A of all the books in a library of a college, given by R = {(x, y): x and y have the same number of pages}, is an equivalence relation.

4) Two dice, with faces numbered 1 to 6, are thrown and their points are added. The thrower is given Rs 40 for a score of 12, but he has to pay Rs 2 if the score is less than 12. Find his expectation per throw.

5) In national use, a vocabulary test is known to have a mean score of 68 and a standard deviation of 13. A class of 19 students takes the test and has a mean score of 65. Is there evidence that the average of this class is significantly different from the national average? [Assume a significance level of 0.05]

6) What do you mean by time series data? Explain the necessity of analysing time series data. Describe the different components of time series data.

7) The arithmetic mean and standard deviation of a binomial distribution are 4 and $(2\sqrt{6})/(3)$, respectively. Find the values of q and p.

8) Find the equation of the regression line for the following seven data points with variables/observation in x and y, respectively.

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	5.3	5.7	6.3	7.2	8.2	8.7	8.4

Section C

Answer any two questions: (2*10=20)

1) a) Prove that the correlation coefficient does not depend on the origin or scale of the observation.   [5]

   b) The regression equations calculated from a given set of observations are x = -0.2y + 4.2, y' = -0.8x' + 8.4. Calculate the values of (i) means, (ii) correlation coefficient, and (iii) the estimated value of y' when x' = 4.   [5]

2) a) The probability that an entering college student will graduate is 0.4. Determine the probability that out of 5 entering students, (i) none, (ii) one, (iii) at least one student, will be a graduate. [5]

b) In a bolt factory, the machines A, B, C manufacture respectively 25, 35, and 40 percent of the total product. Of their output, 5, 4, 2 percentages respectively are defective bolts. One bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine C? [5]

3) a) A professor wants to know if her introductory class has a good grasp of basic math. Six students are chosen at random from the class and given a math proficiency test. The professor wants the class to be able to score above 70 on the test. The six students get scores of 62, 92, 75, 68, 83, and 95. Can the professor have 90% confidence that the mean score for the class on the test would be above 70? [5]

b) Samples of 2 electric bulbs were tested for length of life, and the following data were obtained. [5]

	Size	Mean	Standard deviation
Sample 1	8	1234 hr	36 hr
Sample 2	7	1036 hr	40 hr

Is the difference in the means sufficient to warrant that type 1 bulbs are superior to type 2 bulbs?