PRESIDENCY UNIVERSITY
BENGALURU   SET B

SCHOOL OF INFORMATION SCIENCE
END TERM EXAMINATION - JAN 2024

Semester : Semester III - 2022

Course Code : MAT1008

Course Name : Probabilty and Inferential Statistics

Program : B.Sc. Data Science

Date : 03-JAN-2024

Time : 1:00 PM - 4:00 PM

Max Marks : 100

Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS   (5Q X 4M = 20)

1. Distinguish between point and interval estimates of a parameter with suitable examples.

   (CO2,CO1) [Knowledge]

2. An automobile manufacturer is concerned about a fault in the braking mechanism of a particular model. The fault can, on rare occasions, cause a catastrophe at high speed. The distribution of the number of cars per year that will experience the catastrophe is a Poisson distribution with a mean of 5. What is the probability that more than 1 car per year will experience a catastrophe?   (CO1) [Knowledge]

3. The mean and standard deviation of weights of a sample of 100 men in a city are found to be 67.45 kg and 2.92 kg respectively. Find the 99% confidence interval for estimating the population mean (given that the critical value of Z is $Zc = 2.58$ at 99% level).

   (CO2) [Knowledge]

4. A coin is tossed 400 times and it shows up heads 216 times. Test the hypothesis that the coin is unbiased (given that the table value of Z is 1.96 at 5% level of significance).   (CO3) [Knowledge]

5. The standard deviation of a sample of size 50 is 6.3. Could this sample have come from a normal population with standard deviation 6? (given that the table value of Z is 1.96 at 5% level of significance).   (CO3) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS   (5Q X 10M = 50M)

6. Salaries of employees of a certain organization are normally distributed with a mean of 7 LPA and standard deviation of 3 LPA. What is the probability that, for a randomly selected employee of this organization, the salary would be (a) at least 5 LPA (b) at most 5 LPA (c) between 6 LPA and 8 LPA (given that $P(Z \leqslant 0.33) = 0.6293 \ and \ P(Z \leqslant 0.67) = 0.7486$).   (CO1) [Comprehension]

7. (a) In a city 325 men out of 600 men were found to be smokers. Can this information support the conclusion that majority of men in this city are smokers? (given that the table value of Z is 1.96 at 5% level of significance).

(b) A sample of 400 students is found to have a mean height of 171.38 cm. Can it be reasonably regarded as a sample from a large population with mean height of 171.17 cm and standard deviation of 3.3 cm? (given that the table value of Z is 1.96 at 5% level of significance).

(CO3) [Comprehension]

8. (a) A machine produced 20 defective articles in a batch of 400. After overhauling it produced 10 defective articles in a batch of 300. Has the machined improved? Test the hypothesis at 5% level of significance (given that the table value of Z is 1.96 at 5% level of significance).

(b) A college conducts both day and night classes intended to be identical. A sample of 100 day students yields examination results with a mean of 72.4 and standard deviation 14.8. On the other hand, a sample of 200 night students has the mean 73.9 and standard deviation 17.9. Are the two means statistically equal at 1% level? (given that the table value of Z is 2.58 at 1% level of significance).

(CO3) [Comprehension]

9. (a) The mean life time of a sample of 25 fluorescent light bulbs produced by a company is 1570 hours with a standard deviation of 120 hours. The company claims that the average life of the bulbs produced by the company is 1600 hours. Is the claim acceptable at 5% level? (given that the table value of t is 2.06 at 5% level of significance).

(b) A random sample of size 20 from a population has the mean of 42 and variance 25. Test the hypothesis that the population standard deviation is 8 at 5% level of significance (given that the table value of chi-square is 30.14 at 5% level of significance).

(CO4) [Comprehension]

10. (a) The average number of articles produced by two machines per day are 200 and 250 with standard deviations 20 and 25 respectively. On the basis of records of 25 days production, can we regard both machines as equally efficient at 1% level of significance? (given that the table value of t is 2.58 at 1% level of significance).

(b) It is known that the mean diameter of rivets produced by two firms A and B are practically the same, but the standard deviations may differ. The standard deviation is 2.9 mm for 22 rivets produced by firm A, while for 16 rivets manufactured by firm B, the standard deviation is 3.8 mm. Test whether the products of firm A have the same variability as those of firm B (given that the table value of F is 2.31 at 5% level of significance).

(CO4) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS   (2Q X 15M = 30M)

11. (a) It has been observed that 2 out of 10 bulbs manufactured by a company are defective. If 10 bulbs are selected, find the probability that (i) exactly three are defective (ii) at most three are defective (iii) none will be defective (iv) If 50 bulbs are picked up, what is the expected mean number of defective bulbs?

(b) It is found that the time it takes a student to finish a quiz is uniformly distributed between 6 and 15 minutes. Find the probability that a randomly selected student needs at least 8 minutes to complete the quiz.

(CO1) [Application]

12. (a) The standard deviations of two random samples of sizes 150 and 250 were calculated as 15.3 and 13.8 respectively. Can we conclude that the samples are drawn from the populations with same standard deviation? (given that the table value of Z is 1.96 at 5% level of significance).

(b) The number of automobile accidents per week in a certain community are as follows: 14, 18, 12, 11, 15 and 14. Use the Chi-Square test of goodness-of-fit to test whether the accidents are uniformly distributed over the 6 week period (given that the table value of chi-square is 11.05 at 5% level of significance).

(CO4,CO3) [Application]