

[Time:2.30 Hrs]

[Marks:75]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Figures to the right indicate full marks.

Q.1 Attempt any four of the following: 20

- A Find the expected value of the following probability distribution from the given probability distribution table

x	-1	-2	-3	0	1	2
P(x)	0.25	0.35	0.01	0.01	0.2	0.18

- B The p.d.f of random variable X is $f(x) = 6(x - x^2), 0 \leq x \leq 1$. Find Mean and variance?
- C Explain the properties of Normal distribution.
- D A bag contains 4 Red and 6 White balls. Two balls are drawn at random and get Rs.10 for each red and Rs.5 for each white ball. Find his mathematical expectation.
- E Find the binomial distribution of getting a six in three tosses of an unbiased dice.
- F Explain the properties of Chi-square distribution.

Q.2 Attempt any four of the following: 20

- A In a city, it is claimed that the average IQ of students is 102. The intelligence quotients (IQs) of 16 students from one area of a city showed a mean of 107 and a standard deviation of 10. Test the claim at 5% LOS. (t_c at 5% LOS = 2.144)
- B Two samples of sizes 10 and 15 are drawn from two normally distributed populations having variances of 40 and 60, respectively. If the sample variances are 90 and 50, determine whether the sample 1 variance is significantly greater than the sample 2 variance at significance levels of 0.05
- C There are two groups of students preparing for a competition: Group A and Group B. Group A has studied offline classes, while Group B has studied online classes. After the examination, the score of each student comes. Now we want to determine whether the online or offline classes are better. Assuming a 5% significance level, perform a two-sample z-test to determine if there is a significant difference between the online and offline classes.

- D A manufacturer of patent medicine claims that it is 90% effective in relieving an allergy for a period of 8 hours. 200 people that had an allergy were sampled and it was found that only 160 people received relief. Is the manufacture's claim legitimate?
- E Write a note ANOVA.
- F Individuals are chosen at random from a population and their height (in inches) is found to be: 63, 63, 64, 65, 66, 69, 69, 70, 71. Find students t by considering population mean to be 65.

Q.3 Attempt any four of the following:

20

- A In 30 tosses of a coin the following sequence of heads (H) and tails (T) is obtained:

H T T H T H H H T H H T T H T
H T H H T H T T H T H H T H T

- Determine the number of runs, V.
 - Test at the 0.05 significance level whether the sequence is random.
- B In an experiment to study the dependence of hypertension on smoking habits, the following data is taken from 180 individuals.

	No Smokers	Moderate Smokers	Heavy Smokers
Hypertension	21	36	30
No hypertension	48	26	19

Test the hypothesis at 5 % LOS that the presence or absence of hypertension is independent of smoking. ($\chi^2 = 5.99$)

- C In a manufacturing unit, four teams of operators were randomly selected and sent to four different facilities for machining techniques training. After the training, the supervisor conducted the exam and recorded the test scores. At 95% confidence level. Does the scores are same in all four facilities.

Facility1	Facility 2	Facility 3	Facility 4
88	77	71	52
82	76	56	65
86	84	64	68
87	59	51	81

- D A Bank of India West Palm Beach, A branch manager shows that the median number of savings account customers per day is 64. A clerk from the same branch claims that it was more than 64. The clerk found the number of savings accounts customers per day data for 10 random days. Can we reject the branch manager's claim at a 0.05 significance level?

Day	1	2	3	4	5	6	7	8	9	10
-----	---	---	---	---	---	---	---	---	---	----

Customers	60	66	65	70	68	72	46	76	77	75
-----------	----	----	----	----	----	----	----	----	----	----

- E Define sign test. Explain how to calculate paired sample sign test.
- F A high school track and field coach is interested in determining if his new training program will improve his athletes 400-meter sprint time and wishes to conduct an analysis. He obtains the permission of 7 athletes to record their sprint times both before and after his new training program which are shown below. According to a Wilcoxon signed-ranks test, at a 95% confidence level, do these scores provide evidence of an increase in median sprint time?

Athlete	Sprint time before (Seconds)	Sprint time after (Seconds)
1	63	58
2	61	57
3	62	59
4	58	57
5	59	58
6	56	55
7	61	55

Q.4 Attempt any three of the following:

15

- A Find the probability distribution of boys and girls in families with 3 children, assuming equal probabilities for boys and girls.
- B Explain the properties of t-distribution.
- C Explain one tailed and two tailed test.
- D Two samples of sizes 9 and 12 are drawn from two normally distributed populations having variances 16 and 25, respectively. If the sample variances are 20 and 8, determine whether the first sample has a significantly larger variance than the second sample at significance levels of 0.01.
- E Define non-parametric test. Explain the need of non-parametric test.
- F A data scientist carrying out research interviewed 10 people during a survey. We denote the genders of the people by M for men and W for women. Assuming the respondents were chosen as follows:
Scenario 1
 M M M M F F F F F F
Scenario 2
 F M F M F M F M F M
- a. Determine numbers of Runs, V.
- b. Test at the 0.05 significance level whether the sequence is random.