

B.Tech II Year I Semester (R20) Supplementary Examinations April/May 2024

PROBABILITY & STATISTICS FOR CIVIL ENGINEERING

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

1 Answer the following: (10 X 02 = 20 Marks)

- (a) List the properties of correlation. 2M
- (b) Define: Arithmetic median for grouped and ungrouped data. 2M
- (c) Calculate expectation of X, if the probability distribution of the random variable X is given by; 2M
- | | | | | | |
|---|-----|-----|-----|-----|-----|
| X | -1 | 0 | 1 | 2 | 3 |
| f | 0.3 | 0.1 | 0.1 | 0.3 | 0.2 |
- (d) Define: Conditional probability. 2M
- (e) If a variance of Poisson variate is 3, then find the probability the $0 < x \leq 3$. 2M
- (f) Define: Exponential distribution with an example. 2M
- (g) Write about (i) Null hypothesis, (ii) alternative Hypothesis. 2M
- (h) For two tailed test if $|z| < 1.96$ then accept-----at -----level of significance. 2M
- (i) Write the test statistic for student t-test. 2M
- (j) What are the Normal equation to fit the quadratic curve. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

- 2
- | | | | | | | | | | |
|-----------|----|----|----|----|----|----|----|----|----|
| Price x: | 14 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| Demand y: | 84 | 78 | 70 | 75 | 66 | 67 | 62 | 58 | 60 |
- 10M

Compute the coefficient of correlation and the two lines of regression for the above data.

OR

- 3 The following are the weights (in ounces), at birth, of 30 babies born in Lawrence Memorial Hospital in May 2000. 10M

94 105 124 110 119 137 96 110 120 115
 104 135 123 129 72 121 117 96 107 80
 96 123 124 124 134 78 138 106 130 97

- (i) Compute the mean weight, at birth, of the babies.
 (ii) Compute the median weight, at birth, of the babies.

- 4 (a) A card is drawn from a well shuffled pack of cards. What is the probability that it is either a spade or an ace? 3M
- (b) In a bolt factory machines A, B, C manufacture 20%, 30% and 50% of the total of their output and 6%, 3% and 2% are defective. A bolt is drawn at random and found to be defective. Find the probabilities that it is manufactured from Machine A. 7M

OR

- 5 Let X denote the minimum of the two numbers that appear when a pair of fair dice is thrown once. Determine the (i) Discrete probability distribution, (ii) Expectation and (iii) Variance. 10M

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- 6 If a Poisson distribution is such that $P(x=1) \cdot \frac{3}{2} = P(x=3)$. Find (i) $p(x=1)$, (ii) $P(x \leq 3)$, (iii) $p(2 \leq x \leq 5)$. 10M

OR

- 7 In a sample of 1000 cases, the mean of a certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal, find (i) How many students score between 12 and 15? (ii) How many score above 18? 10M

- 8 A manufacturer claimed that at least 95% of the equipment which he supplied to a factory conformed to specifications. An examination of a sample of 200 pieces of equipment revealed that 18 were faulty. Test his claim at 5% level of significance. 10M

OR

- 9 An insurance agent has claimed that the average age of policy holders who issue through him is less than the average for all agents which 30.5 years. A random sample of 100 policy holders who had issued through him gave the following age distribution. 10M

Age	16-20	21-25	26-30	31-35	36-40
No. of persons	12	22	20	30	16

- 10 A sample analysis of examination results of 500 students was made. It was found that 220 students had failed, 170 had secured a third class, 90 were placed in second class and 20 got a first class. Do these figure commensurate with the general examination result which is in the ratio of 4:3:2:1 for the various categories respectively. 10M

OR

- 11 Fit a parabola for the following data. 10M

X:	1	2	3	4	5	6	7	8	9
Y:	2	6	7	8	10	11	11	10	9

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PART – A
 (Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- (a) Write couple of advantages and limitation of frequency distribution tables. 2M
 - (b) Define regression coefficients and give the equations of regression lines. 2M
 - (c) Write the axioms of probability. 2M
 - (d) Define a random variable and give some examples. 2M
 - (e) Define binomial distribution and give its constants. 2M
 - (f) Define exponential distribution and give its constants. 2M
 - (g) Define Null hypothesis and Alternative Hypothesis and give an example in each case. 2M
 - (h) Define level of significance and critical region. 2M
 - (i) Explain the test statistic for testing the equality of variances. 2M
 - (j) Explain the goodness of fit and its test statistic. 2M

PART – B
 (Answer all the questions: 05 X 10 = 50 Marks)

- 2 Define mean, mode and median for grouped data and ungrouped data and discuss their merits and demerits. 10M

OR

- 3 Find Karl Pearson's coefficient of correlation between sales and expenses of the following 10 firms: 10M

Firm	1	2	3	4	5	6	7	8	9	10
Sales	50	50	55	60	65	65	65	60	60	50
Expenses	11	13	14	16	16	15	15	14	13	13

- 4 (a) Two cards are drawn at random from an ordinary deck of 52 cards. What is the probability of getting two aces if 5M
- (i) the first card is replaced before the second card is drawn;
 - (ii) the first card is not replaced before the second card is drawn.
- (b) State and prove addition theorem for three events. 5M

OR

- 5 (a) Of the three, the chances that an IAS officer, IPS officer or an academican will be appointed as a vice-chancellor of a university are 0.7, 0.5, and 0.2 respectively. Probabilities that the outcome based education (OBE) is promoted by these if appointed are 0.2, 0.5, and 0.7 respectively. If outcome based education is promoted, what is the probability that vice-chancellor is an academican? 6M
- (b) Define probability density function and give its properties. 4M

Contd. In Page 2

- 6 (a) If a random variable X follows Poisson distribution such that $P(X=1) = P(X=2)$, find (i) the mean and variance of the distribution (ii) $P(X=0)$. 4M
- (b) Given a random variable having the normal distribution with mean 16.2 and variance 1.5625, find the probabilities that it will take on a value; 6M
- (i) greater than 16.8,
(ii) between 13.6 and 18.8.

OR

- 7 An automatic machine fills distilled water in 500 ml bottles. Actual volumes are normally distributed about a mean of 500 ml, and standard deviation 20 ml. 10M
- (i) What proportion of the bottles are filled with water outside the tolerance limit of 475 ml to 525 ml?
(ii) To what value does the standard deviation need to be adjusted if 99% of the bottles must be within tolerance limits?
- 8 The efficiency expert of a computer company tested 40 engineers to estimate the average time it takes to assemble a certain computer component, getting a mean of 12.73 minutes and S.D. of 2.06 minutes. 10M
- (i) Construct a 98% confidence interval for the true average time it takes to do the job.
(ii) With what confidence, we can assert that the sample mean does not differ from the true mean by more than 30 seconds?

OR

- 9 (a) In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample 1600 school boys had the same defect. Is the difference between the populations significant? 5M
- (b) To test the claim that the resistance of electric wire can be reduced by more than 0.050 ohm by alloying, 32 values obtained for standard wire yielded mean of 0.136 ohm and standard deviation 0.004 ohm, and another 32 values obtained for alloyed wire yielded mean 0.083 ohm and standard deviation 0.005 ohm. At 0.05 level of significance, does this support the claim? 5M

- 10 Two horses A and B were tested according to the time (in seconds) to run a particular track with the following results. Test whether the two horses have the same running capacity? 10M

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	--

OR

- 11 Fit a least square line to the data given below, for (i) x as independent variable, estimate y when $x=10$. (ii) y as independent variable, estimate x when $y=6$. 10M

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

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