R16

SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
PROBABILITY AND STATISTICS
(Civil Engineering)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Define discrete random variable. (2M)

    b) Define moment generating function for continuous random variable. (2M)

    c) Define population and sample with examples. (2M)

    d) Write normal equations to fit a straight line in least square sense (3M)

    e) Define simple correlation and write formula for simple correlation coefficient. (3M)

    f) Write the control line and three - sigma limits for the range chart. (2M)

PART -B

2. Find moment generating function for Binomial distribution and hence find its mean and variance. (14M)

3. a) A continuous random variable X has probability density given by $f(x) = \begin{cases} 2e^{-2x} & x > 0 \\ 0 & x \le 0 \end{cases}$ .Find (i) $E(X)$ (ii) $E(X^2)$. (7M)

    b) Define the Weibull distribution and find its mean and variance. (7M)

4. a) If a 1-gallon can of paint covers on the average 513.3 square feet with a standard deviation of 31.5 square feet, what is the probability that the mean area covered by a sample of 40 of these 1-gallon cans will be anywhere from 510.0 to 520.0 square feet? (7M)

    b) Find the value of $F_{0.99}$ for $v_1 = 6$ *and* $v_2 = 20$ degrees of freedom. (7M)

5. a) Explain briefly the following : (7M)
    (i) Null and Alternative Hypothesis (ii) Type I and Type II errors.

    b) A study shows that 64 of 180 persons who saw a photocopying machine advertised during the telecast of a baseball game and 75 of 180 other persons who saw it advertised on a variety show remembered the brand name 2 hours later. Use the $Z-$ statistic to test at the 0.05 level of significance whether the difference between the corresponding sample proportions is significant. (7M)

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6. a) Fit a second degree curve by the method of least squares to the following date: (8M)

Amount of varnish additive (grams) x	0	1	2	3	4	5	6	7	8
Drying time (hours) y	12.0	10.5	10.0	8.0	7.0	8.0	7.5	8.5	9.0

   b) Writ properties of regression coefficients.   (6M)

7. The following data give the means and ranges of 25 samples, each consisting of 4 compression test results on steel forgings, in thousands of pounds per square inch: (14M)

Sample	$\overline{X}$	R	Sample	$\overline{X}$	R
1	45.4	2.7	14	49.2	3.1
2	48.1	3.1	15	51.1	1.5
3	46.2	5.0	16	42.8	2.2
4	45.7	1.6	17	51.1	1.4
5	41.9	2.2	18	52.4	4.3
6	49.4	5.7	19	47.9	2.2
7	52.6	6.5	20	48.6	2.7
8	54.5	3.6	21	53.3	3.0
9	45.1	2.5	22	49.7	1.1
10	47.6	1.0	23	48.2	2.1
11	42.8	3.9	24	51.6	1.6
12	41.4	5.6	25	52.3	2.4
13	43.7	2.7			

(i) Use these data to find the central line and control limits for an $\overline{X}$ chart.

(ii) Use these data to find the central line and control limits for an R chart.

(iii) Plot the given data on $\overline{X}$ and R charts based on the control chart constants computed in parts (i) and (ii), and interpret the results.

Note :-Statistical tables and Control Chart Constants are required

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PART –A

1. a) Define moment generating function for discrete random variable. (2M)

   b) Define continuous random variable with example (2M)

   c) Define point estimator and unbiased estimator. (3M)

   d) Construct a one-way Classification of analysis of variance table. (3M)

   e) State the principle of lest-squares. (2M)

   f) Write the control line and three - sigma limits for the fraction-defective chart. (2M)

PART -B

2. a) Find the expectation of a discrete random variable X whose probability function is given by (6M)

   $$f(x) = \left(\frac{1}{2}\right)^x, x=1,2,3,-----.$$

   b) Define the Geometric distribution and find its mean and variance. (8M)

3. Find moment generating function for normal distribution and hence find its mean and variance. (14M)

4. a) Take 30 slips of paper and label five each -4 and 4,four each -3 and 3,three each -2 and 2, and two each $-1,0$ and 1.If each slip of paper has the same probability of being drawn , find the probability of getting $-4,-3,-2,-1,\ 0,\ 1,\ 2,\ 3,\ 4$ and find the mean and the variance of this distribution. (7M)

   b) Determine a 99% confidence interval for the mean of a normal distribution with variance $\sigma^2 = 9$, using a sample of $n = 100$ values with mean $\bar{x} = 5$. (7M)

5. a) Explain briefly the following : (6M)
   (i) Level of significance (ii) One tail and two-tail tests.

   b) A study of TV viewers was conducted to find the opinion about the mega serial 'Ramayana'. If 56% of a sample of 300 viewers from south and 48% of 200 viewers from north preferred the serial, test the claim at 0.05 level of significance that (i) there is a difference of opinion between south and north (ii) Ramayana is preferred in the south. (8M)

6. a) The following data pertain to the demand for a product (in thousands of units)　(7M)
and its price (in dollars) charged in five different market areas:

Price	x	20	16	10	11	14
Demand	y	22	41	120	89	56

Fit a power curve and use it to estimate the demand when the price of the
product is 12 dollars.

b)　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(7M)
Find the correlation coefficient between industrial production and export using
the following data and comment on the result.

Production (in crore tons)	55	56	58	59	60	60	62
Export (in crore tons)	35	38	38	39	44	43	45

7. The following data show the values of sample mean $\bar{X}$ and the range R of 20　(14M)
samples for The sample of size 4 each. Calculate the values for central line and
control limits for mean-chart and range chart and determine whether the
process is in control

Sample No.	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	1.75	1.32	1.18	0.18	2.30	1.25	1.52	1.78	1.90	1.72
R	1.0	1.3	0.4	1.3	1.4	1.9	1.0	1.3	2.4	2.0
Sample No.	11	12	13	14	15	16	17	18	19	20
$\bar{X}$	2.40	3.20	2.52	2.05	1.68	2.00	1.28	1.92	1.00	1.35
R	1.9	2.7	1.7	0.6	0.5	3.1	2.6	2.7	1.0	1.7

Note :-**Statistical tables and Control Chart Constants are required**

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SET - 3

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PART –A

1. a) Define Binomial distribution. (2M)

   b) Find moment generating function for a binomial distribution. (2M)

   c) Find the value of the finite population correction factor for n= 10 and N= 1000. (2M)

   d) Construct a two-way Classification of analysis of variance table. (3M)

   e) Write normal equations to fit the second degree parabola in least square sense (3M)

   f) Write the control line and three - sigma limits for the mean chart. (2M)

PART -B

2. a) Find the probability that in a family of 4 children there will be (i) at least 1 boy (ii) at least 1 Boy and at least 1 girl. Assume that the probability of a male birth is $\frac{1}{2}$. (7M)

   b) Find moment generating function for Poisson distribution and hence find its mean and variance. (7M)

3. a) Find the moment generating function of a random variable having density function $f(x) = \begin{cases} e^{-x}, & x \geq 0 \\ 0, & otherwise \end{cases}$ and determine the first four moments about the origin. (7M)

   b) Define the Gamma distribution and find its mean and variance. (7M)

4. a) (i) Find the value of $t_{0.025}$ when $\nu = 14$ degrees of freedom. (7M)
      (ii) Find $P(t < 2.365)$ when $\nu = 7$ degrees of freedom.

   b) Explain briefly the following : (7M)
      (i) Point Estimation
      (ii) Interval Estimation

5. a) Explain briefly the following : (7M)
      (i) Test of Hypothesis (ii) Type I and Type II errors.

   b) Explain the test procedure for large sample test concerning difference between two means. (7M)

6. a) Fit a Straight line $y = a + bx$ to the following data by the method of least squares: (7M)
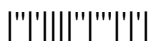
x	0	1	3	6	8
y	1	3	2	5	4

   b) Explain the correlation and regression.   (7M)

7. Consider the following data taken on subgroups of size 5. The data contain 20 averages and ranges on the diameter (in millimeters) of an important component part of an engine. Display $\bar{X}$ and R Charts. Does the process appear to be in control?   (14M)

Sample	$\bar{X}$	R		Sample	$\bar{X}$	R
1	2.3972	0.0052		11	2.3887	0.0082
2	2.4191	0.0117		12	2.4107	0.0032
3	2.4215	0.0062		13	2.4009	0.0077
4	2.3917	0.0089		14	2.3992	0.0107
5	2.4151	0.0095		15	2.3889	0.0025
6	2.4027	0.0101		16	2.4107	0.0138
7	2.3921	0.0091		17	2.4109	0.0037
8	2.4171	0.0059		18	2.3944	0.0052
9	2.3951	0.0068		19	2.3951	0.0038
10	2.4215	0.0048		20	2.4015	0.0017

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PART –A

1. a) Define Poisson distribution. (2M)

    b) Define Expectation for continuous random variable. (2M)

    c) Find the value of the finite population correction factor for n= 100 and N= 5000. (2M)

    d) Write procedure for test concerning difference between two means for large sample. (3M)

    e) Write normal equations to fit the exponential curve. (3M)

    f) Define Quality control. (2M)

PART -B

2. a) A coin is tossed three times. If X is a random variable giving the number of heads that arise, construct a table showing the probability distribution of X. (7M)

    b) Find Moment Generating Function for Binomial distribution. (7M)

3. Define the Uniform distribution for continuous random variable and find its mean and variance. (14M)

4. a) For an $F-$ distribution find (7M)
    (i) $F_{0.05}$ with $v_1 = 7$ and $v_2 = 15$ degrees of freedom
    (ii) $F_{0.01}$ with $v_1 = 24$ and $v_2 = 19$ degrees of freedom
    (iii) $F_{0.95}$ with $v_1 = 19$ and $v_2 = 24$ degrees of freedom
    (iv) $F_{0.99}$ With $v_1 = 28$ and $v_2 = 12$ degrees of freedom.

    b) Explain briefly the following : (7M)
    (i) Maximum error of estimate
    (ii) Interval Estimation.

5. a) Explain briefly the following : (6M)
    (i)Level of significance (ii) One tail and two-tail tests.

    b) An urban community would like to show that the incidence of breast cancer is higher than in a nearby rural area. If it is found that 20 of 200 adult women in the urban community have breast cancer and 10 of 150 adult women in the rural community have breast cancer, can we conclude at the 0.01 level of significance that breast cancer is more prevalent in the urban community? (8M)

6. a) Fit a power curve by the method of least squares to the following date and use it to estimate the demand when the price of the product is 12 dollars.   (7M)

Price (in dollars) x	20	16	10	11	14
Demand (in thousands of units) y	22	41	120	89	56

   b) Writ properties of correlation coefficient.   (7M)

7. The following means and ranges, obtained in 20 successive random samples of size 5.   (14M)

Sample	$\overline{X}$	R	Sample	$\overline{X}$	R
1	4.24	0.09	11	4.20	0.21
2	4.18	0.12	12	4.25	0.20
3	4.26	0.14	13	4.25	0.17
4	4.21	0.24	14	4.21	0.07
5	4.22	0.15	15	4.19	0.16
6	4.18	0.28	16	4.23	0.16
7	4.23	0.06	17	4.27	0.19
8	4.19	0.15	18	4.22	0.20
9	4.21	0.09	19	4.20	0.12
10	4.18	0.15	20	4.19	0.16

(i) Use these data to find the central line and control limits for an $\overline{X}$ chart.

(ii) Use these data to find the central line and control limits for an R chart.

(iii) Plot the given data on $\overline{X}$ and R charts based on the control chart constants computed in parts (i) and (ii), and interpret the results.

Note :-Statistical tables and Control Chart Constants are required

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