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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - CARRY OVER THEORY EXAMINATION - APRIL 2023

Subject: Statistics and Probability

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C.** It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A

20

1. Attempt all parts:-

- 1-a. The algebraic sum of the deviation of all variates from their arithmetic mean is (CO1) 1
- (a) 0
- (b) Positive
- (c) Negative
- (d) None of these
- 1-b. Which of the following method is used to find the normal equation of a curve? (CO1) 1
- (a) Method of minimum
- (b) Method of least square
- (c) Method of maximum
- (d) None of these
- 1-c. A random variable assuming only a finite number of values is called (CO2) 1
- (a) Discrete random variable

(b) Continuous random variable

(c) Random variable

(d) None of these

1-d. If the probability distribution is

1

X	0	1	2	3	4
P(X)	0.5	k	-1	3k	k

of a random variable X, then $k = \underline{\hspace{1cm}}$. (CO2)

(a) 0.1

(b) 0.2

(c) 1

(d) 0.3

1-e. If 'X' is a random variable, taking values 'x', probability of success and failure being 'p' and 'q' respectively and 'n' trials being conducted, then what is the probability that 'X' takes values 'x'? Use Binomial Distribution.. (CO3)

1

(a) $P(X = x) = {}^nC_x p^x q^x$

(b) $P(X = x) = {}^nC_x p^x q^{(n-x)}$

(c) $P(X = x) = {}^xC_n q^x p^{(n-x)}$

(d) $P(x = x) = {}^xC_n p^n q^x$

1-f. If 'm' is the mean of a Poisson Distribution, then variance is given by _____ . (CO3)

1

(a) m^2

(b) $m^{1/2}$

(c) m

(d) $m/2$

1-g. 95% confidential limits of population mean are :(CO4)

1

(a) $\bar{x} \pm 3 S.E.$

(b) $\bar{x} \pm 2.58 S.E.$

(c) $\bar{x} \pm 1.96 S.E.$

(d) None of these

1-h. The Test statistics for significance of means of two large samples is given by (CO4)

1

(a)

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sigma \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

(b)

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{1}{n_1} - \frac{1}{n_2}}}$$

(c)

(d) None of these

1-i. Raj swims 26 km downstream in same time as 14 km upstream. What is his speed in still water if speed of stream is 3 km/hr? (CO5) 1

(a) 10 km/hr

(b) 12 km/hr

(c) 7 km/hr

(d) None of these

1-j. How many times do the hands of the clock coincide in a day? (CO5) 1

(a) 22

(b) 24

(c) 20

(d) None of these

2. Attempt all parts:-

2.a. Define Range and Inter quartile range. (CO1) 2

2.b. Six cards are drawn at random from a pack of 52 cards. What is the probability that there will be 3 red and 3 black cards? (CO2) 2

2.c. Find the mean of Binomial distribution. (CO3) 2

2.d. Explain the term Null hypothesis and Alternate hypothesis. (CO4) 2

2.e. Two pipes A and B can fill a tank in 20 and 30 minutes respectively. If both the pipes are used together, how long will it take to fill the tank? (CO5) 2

SECTION B

30

3. Answer any five of the following:-

3-a. From the following data of weight of 122 persons determine the Mode. (CO1) 6

Weight	100-110	110-120	120-130	130-140	140-150	150-160	160-170	170-180
No. of Persons	4	6	20	32	33	17	8	2

3-b. Fit a straight line for the data given below: (CO1) 6

X	0	5	10	15	20	25
Y	12	15	17	22	24	20

3-c. A random variable has the following probability mass function: (CO2) 6

x	0	1	2	3	4	5	6	7
f(x)	0	k	2k	2k	3k	k^2	$2k^2$	$k+7k^2$

I. Find k

II. Evaluate $P(X < 6)$, $P(X \geq 6)$ and $P(0 < X < 5)$.

III. If $P(X \leq a) > 1/2$ find the minimum value of a .

3-d. State the theorem of additional probability. A bag contains 7 white, 6 red and 5 black balls. Two balls are drawn at random. Find the probability that they will both be white. (CO2) 6

3.e. If 10% of screws produced in a certain factory turn out to be defective. Find the probability that in a sample of 10 screw chosen at random, exactly two will be defective. (CO3) 6

3.f. Prove that for binomial distribution with probability mass function $P(x) = {}^nC_x p^x q^{n-x}$, $x = 0, 1, 2, \dots, n$ the M.L.E. for p is x/n and also find its variance. (CO4) 6

3.g. A car travels the first one third of a certain distance with a speed of 10 km/hr, the next one third distance with a speed of 20 km/hr and the last one third distance with a speed of 60 km/hr. Find the average speed of the car for the whole journey? (CO5) 6

SECTION C

50

4. Answer any one of the following:-

4-a. An incomplete distribution of families according to their expenditure per week is given below. The median and mode for the distribution are 25/- and 24/- respectively. Calculate the missing frequencies. (CO1) 10

Expenditure	0-10	10-20	20-30	30-40	40-50
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No. of families	14	?	27	?	15
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- 4-b. Obtain the regression plane x on y and z by using multiple linear regression to the following data: (CO1) 10

Y	7	12	17	20
Z	4	7	9	12
X	1	2	5	8

5. Answer any one of the following:-

- 5-a. State Baye's theorem. There are three bags. Bag I contains 3 white and 5 black balls. Bag II has 5 white and 7 black balls while bag III contains 9 white and 6 black balls. One white ball is drawn from one of the bags. Find the probability that it is drawn from bag II, III? (CO2) 10

- 5-b. Obtained the moment generating function of the random variable having 10

$$f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 \leq x < 2 \\ 0, & \text{else where} \end{cases}$$

probability distribution

Also determine mean and first two moment about mean. (CO2)

6. Answer any one of the following:-

- 6-a. In 300 families with 4 children each, how many families would be expected to have 10

- I. 3 boys and 1 girls
 - II. 2 boys and 2 girls
 - III. No girl
 - IV. At most 2 girls. (Assume probabilities for boys and girls to be equal)
- (CO3)

- 6-b. Fit a Binomial and Poisson distribution to the set of observations: (CO3) 10

x	0	1	2	3	4
f	122	60	15	2	1

7. Answer any one of the following:-

- 7-a. Records taken of the number of male and female births in 800 families having four children are as follows 10

No. of male births	0	1	2	3	4
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No. of female births	4	3	2	1	0
No. of families	32	178	290	236	64

Test whether the data are consistent with the hypothesis that the Binomial law holds and the chance of male birth is equal to that of female birth, namely $p=q=1/2$. (Use Chi-square at 5% level of significance for 4 d.f. if 9.49) (CO4)

- 7-b. The following table gives monthly sales(in'000 rupees) of a certain firm in three States by its four salesman: 10

States	Salesmen				Total
	I	II	III	IV	
A	6	5	3	8	22
B	8	9	6	5	28
C	10	7	8	7	32
Total	24	21	17	20	82

Use the ANOVA to test whether there is a significant difference between (i) sales by the firm salesman (ii) sales in the three States.

Given $F_{5\%}(3,5) = 4.76$ and $F_{5\%}(2,6) = 5.14$. (CO4)

8. Answer any one of the following:-

- 8-a. (i) X and Y can do a piece of work in 20 days and 12 days respectively. X started the work alone and then after 4 days Y joined him till the completion of the work. How long did the work last? 10
- (ii) A man and a boy can do a piece of work in 24 days. If the man works alone for the last 6 days, it is completed in 26 days. How long would the boy take to do it alone? (CO5)
- 8-b. (i) How many rotations will the hour hand of a clock complete in 72 hours? 10
- (ii) Through what angle does the minute hand of a clock turn in 5 minutes? (CO5)