OR

8 a. 2% of the fuses manufactured by a firm are found defective. Find the probability that a box containing 200 fuses contains. i) no defective fuses ii) 3 or more defective fuses. **(06 Marks)**

b. In a test on 2000 electric bulbs. It was found that the life of a particular brand was distributed normally with an average life of 2040 hours and S.D 60 hours. Estimate the number of bulbs likely to burn $(P(0 < z < 1.83) = 0.4664 \ \ P(1.33) = 0.4082, P(2) = 0.4772)$ i) more than 2150 ii) less than 1960 iii) more than 1920 but less than 2160 hours. **(05 Marks)**

c. The joint probability distribution of two random variable X and Y given by the following table:

X \ Y	1	3	9
2	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$
4	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$

Find marginal distribution of X and Y and evaluate cov(XY). **(05 Marks)**

Module-5

9 a. Define: i) Null hypothesis ii) significance level iii) Type–I and Type–II error. **(06 Marks)**

b. Ten individual are chosen at random from a population and their height in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that mean height of the universe is 66 inches. Given that $(t_{0.05} = 2.262$ for 9d.f) **(05 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix :

$$A = \begin{bmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{bmatrix}$$

(05 Marks)

Module-4

7 a. Derive mean and variance of the binomial distribution. **(06 Marks)**

b. A random variable x has the following probability mass function.

x	0	1	2	3	4	5
P(x)	k	3k	5k	7k	9k	11k

i) find k ii) find $p(x < 3)$ iii) find $p(3 < x \le 5)$. **(05 Marks)**

c. The joint distribution of two random variable x and y as follows :

x \ y	−4	2	7
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
5	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

Compute : i) E(x) and E(y) ii) E(xy) iii) cov(xy). **(05 Marks)**

10 a. A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased. **(06 Marks)**

b. Four coins are tossed 100 times and following results were obtained :

No. of heads	0	1	2	3	4
Frequency	5	29	36	25	5

Fit a binomial distribution for the data and test the goodness of fit $\left(\chi^2_{0.05} = 9.49\right)$. **(05 Marks)**

c. A student's study habit are as follows. If he studies one night, he is 70% sure not to study the next night. On the other hand if he does not study one night he is 60% sure not to study the next night. In the long run how often does he study? **(05 Marks)**

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Module-4

7 a. Obtain mean and variance of the Poisson distribution. (05 Marks)

b. The probability mass function of a random variable x is :

x :	0	1	2	3	4	5	6
P(x) :	K	3K	5K	7K	9K	11K	13K

Find the : i) the value of K

ii) $P(x \geq 5)$, $P(3 < x \leq 6)$ and $P(x < 4)$. (05 Marks)

c. Find the joint distribution of x and y, which are independent random variables with the following respective distributions :

x_i	1	2
$f(x_i)$	0.7	0.3

y_j	–2	5	8
$g(y_j)$	0.3	0.5	0.2

Show that cov (x, y) = 0. (06 Marks)

OR

8 a. When a coin is tossed 4 times, find the probability of getting :

i) Exactly one head

ii) Atmost 3 heads

iii) At least 2 heads. **(05 Marks)**

b. The marks x obtained in mathematics by 1000 students is normally distributed with mean 78% and S.D. 11%. Determine :

i) How many students got marks above 90%?

ii) What was the highest mark obtained by the lowest 10% of students? **(05 Marks)**

Find : i) Marginal distributions f(x) and g(y)

ii) E(x) and E(y)

iii) cov(x, y) for the following joint distribution.

x \ y	–4	2	7
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
5	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

(06 Marks)

Module-5

9 a. Ten individuals are chosen at random from a population and their heights in inches are found to be 63, 63, 66, 67, 68, 69, 70, 71, 71. Test the hypothesis that the mean height of the universe is 66 inches. ($t_{0.05} = 2.262$ for 9 d.f.). **(05 Marks)**

b. The number of accidents per day (x) as recorded in a textile industry over period of 400 days is given below. Test the goodness of fit in respect to Poisson distribution of fit to the given data $\left(\chi^2_{0.05} = 9.49 \text{ for } 4\,\text{d.f}\right)$.

x	0	1	2	3	4	5
f	173	168	37	18	3	1

(05 Marks)

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C, C is just as likely to throw the B as to A. if C was the first person of throw the ball. Find the probabilities that after three throws :

i) A has the ball

ii) B has the ball

iii) C has the ball. **(06 Marks)**

OR

10 a. A coin is tossed 1000 times and it turns up head 540 times. Decide on the hypothesis that the coin is unbiased. **(05 Marks)**

b. Find the unique probability vector for the regular stochastic matrix :

$$A = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}.$$

(05 Marks)

c. A student's study habits are as follows :

If he studies one night, he is 60% sure not to study the next night ; on the other hand if he does not study one night, he is 80% sure to study the next night. In the long run how often does he study? **(06 Marks)**

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Module-4

7 a. Find the mean and standard deviation of Poisson distribution. **(05 Marks)**

b. In a test on 2000 electric bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D of 60 hours. Estimate the number of bulbs likely to burn for,

(i) more than 2150 hours.

(ii) less than 1950 hours

(iii) more than 1920 hours and less than 2160 hours.

[A(1.833) = 0.4664, A(1.5) = 0.4332, A(2) = 0.4772] **(05 Marks)**

c. The joint probability distribution of two random variables x and y is as follows:

x/y	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Determine:

(i) Marginal distribution of x and y.

(ii) Covariance of x and y

(iii) Correlaiton of x and y. **(06 Marks)**

OR

8 a. The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$. If 12 such pens are manufactured what is the probability that, (i) Exactly 2 are defective (ii) at least 2 are defective (iii) none of them are defective. **(05 Marks)**

b. Derive the expressions for mean and variance of binomial distribution. **(05 Marks)**

c. A random variable X take the values -3, -2, -1, 0, 1, 2, 3 such that $P(x = 0) = P(x < 0)$ and $P(x = -3) = P(x = -2) = P(x = -1) = P(x = 1) = P(x = 2) = P(x = 3)$. Find the probability distribution. **(06 Marks)**

Module-5

9 a. In 324 throws of a six faced 'die' an odd number turned up 181 times. Is it reasonable to think that the 'die' is an unbiased one? **(05 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results:

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

Test whether you can discriminate between the two horses. ($t_{0.05}$=2.2 and $t_{0.02}$=2.72 for 11 d.f) **(05 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix, $A = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}$ **(06 Marks)**

OR

10 a. Define the terms: (i) Null hypothesis (ii) Type–I and Type–II error (iii) Confidence limits. **(05 Marks)**

b. Prove that the Markov chain whose t.p.m $P = \begin{bmatrix} 0 & \frac{2}{3} & \frac{1}{3} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$ is irreducible. Find the corresponding stationary probability vector. **(05 Marks)**

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball find the probabilities that after three throws (i) A has the ball. (ii) B has the ball. (iii) C has the ball. **(06 Marks)**

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Module-4

7 a. Find the mean and standard deviation of Poisson distribution. **(05 Marks)**

b. In a test on 2000 electric bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D of 60 hours. Estimate the number of bulbs likely to burn for,

(i) more than 2150 hours.

(ii) less than 1950 hours

(iii) more than 1920 hours and less than 2160 hours.

[A(1.833) = 0.4664, A(1.5) = 0.4332, A(2) = 0.4772] **(05 Marks)**

c. The joint probability distribution of two random variables x and y is as follows:

x/y	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Determine:

(i) Marginal distribution of x and y.

(ii) Covariance of x and y

(iii) Correlaiton of x and y. **(06 Marks)**

OR

8 a. The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$. If 12 such pens are manufactured what is the probability that, (i) Exactly 2 are defective (ii) at least 2 are defective (iii) none of them are defective. **(05 Marks)**

b. Derive the expressions for mean and variance of binomial distribution. **(05 Marks)**

c. A random variable X take the values -3, -2, -1, 0, 1, 2, 3 such that $P(x = 0) = P(x < 0)$ and $P(x = -3) = P(x = -2) = P(x = -1) = P(x = 1) = P(x = 2) = P(x = 3)$. Find the probability distribution. **(06 Marks)**

Module-5

9 a. In 324 throws of a six faced 'die' an odd number turned up 181 times. Is it reasonable to think that the 'die' is an unbiased one? **(05 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results:

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

Test whether you can discriminate between the two horses. ($t_{0.05}=2.2$ and $t_{0.02}=2.72$ for 11 d.f) **(05 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix, $A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$ **(06 Marks)**

OR

10 a. Define the terms: (i) Null hypothesis (ii) Type–I and Type–II error (iii) Confidence limits. **(05 Marks)**

b. Prove that the Markov chain whose t.p.m $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is irreducible. Find the corresponding stationary probability vector. **(05 Marks)**

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball find the probabilities that after three throws (i) A has the ball. (ii) B has the ball. (iii) C has the ball. **(06 Marks)**

Module-4

7 a. If the mean and standard deviation of the number of correctly answered questions in a test given to 4096 students 2.5 and $\sqrt{1.875}$. Find an estimate of the number of candidates answering correctly,
   (i) 8 or more questions
   (ii) 2 or less
   (iii) 5 questions (07 Marks)

b. Derive mean and standard deviations of binomial distributions. (06 Marks)

c. The joint probability distribution for two random variables X and Y is as follows :

X \ Y	−3	2	4
1	0.1	0.2	0.2
2	0.3	0.1	0.1

Determine : (i) Marginal distribution of X and Y (ii) COV (X, Y)
(iii) Correlations of X and Y. (07 Marks)

OR

8 a. Derive mean and standard deviations of Exponential distribution. (06 Marks)

b. X and Y are independent random variables. X takes values 2, 5, 7 with probability $\frac{1}{2}, \frac{1}{4}, \frac{1}{4}$ respectively. Y take values 3, 4, 5 with the probability $\frac{1}{3}, \frac{1}{3}, \frac{1}{3}$.
   (i) Find the Joint probability distribution of X and Y.
   (ii) Show that the covariance of X and Y.
   (iii) Find the probability distribution of $Z = X + Y$ (07 Marks)

c. In 800 families with 5 childrens each how many families would be expected to have, (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys (iv) atmost 2 girls by assuming probabilities for boys and girls to be equal. (07 Marks)

Module-5

9 a. A survey was conducted in a slum locality of 2000 families by selecting a sample size 800. It was revealed that 180 families were illiterates. Find the probable limits of the illiterate families in the population of 2000. **(07 Marks)**

b. Ten individuals are choosen at random from a population and their heights in inches are found to be 63, 63, 64, 65, 66, 69, 69, 70, 70, 71. Discuss the suggestion that the mean height of the population is 65 inches given that $t_{0.05} = 2.262$ for 9 d.f. **(07 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix,

$$A = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}.$$

(06 Marks)

OR

10 a. Four coins are tossed 100 times and the following results were obtained. Fit a binomial distribution for the data and test the goodness of fit ($\chi^2_{0.05} = 9.49$ for 4 d.f) **(07 Marks)**

No. of heads	0	1	2	3	4
Frequency	5	29	36	25	5

b. The transition probability matrix of a Markov chain is given by,

$$P = \begin{bmatrix} \frac{1}{2} & 0 & \frac{1}{2} \\ 1 & 0 & 0 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \end{bmatrix}$$

and the initial probability distribution is $P^{(0)} = \left(\frac{1}{2}, \frac{1}{2}, 0\right)$. Find $P_{13}^{(2)}$, $P_{23}^{(2)}$, $P^{(2)}$ and $P_1^{(2)}$. **(06 Marks)**

c. A man's smoking habits are as follows. If he smokes filters cigarettes one week, he switches to non filter cigarettes the next week with probability 0.2. On the other hand if he smokes nonfilter cigarettes one week there is a probability of 0.7 that he will smoke non filter cigarettes the next week as well. In the long run how often does he smoke filter cigarettes? **(07 Marks)**

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Module-4

7 a. Find the mean and standard of Poisson distribution. **(06 Marks)**

b. In an examination 7% of students score less than 35 marks and 89% of the students score less than 60 marks. Find the mean and standard deviation if the marks are normally distributed given $A(1.2263) = 0.39$ and $A(1.4757) = 0.43$ **(07 Marks)**

c. The joint probability distribution table for two random variables X and Y is as follows:

X \ Y	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Determine:

i) Marginal distribution of X and Y

ii) Covariance of X and Y

iii) Correlation of X and Y **(07 Marks)**

OR

8 a. A random variable X has the following probability function:

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

Find K and evaluate $P(x \geq 6)$, $P(3 < x \leq 6)$. **(06 Marks)**

b. The probability that a pen manufactured by a factory be defective is 1/10. If 12 such pens are manufactured, what is the probability that

i) Exactly 2 are defective

ii) Atleast two are defective

iii) None of them are defective. **(07 Marks)**

c. The length of telephone conversation in a booth has been exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made

i) Ends in less than 5 minutes

ii) Between 5 and 10 minutes. **(07 Marks)**

Module-5

9 a. A die is thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Show that the dia cannot be regarded as an unbiased die. **(06 Marks)**

b. A group of 10 boys fed on diet A and another group of 8 boys fed on a different disk B for a period of 6 months recorded the following increase in weight (lbs):

Diet A:	5	6	8	1	12	4	3	9	6	10
Diet B:	2	3	6	8	10	1	2	8		

Test whether diets A and B differ significantly t.05 = 2.12 at 16df. **(07 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$ **(07 Marks)**

OR

10 a. Define the terms:
i) Null hypothesis
ii) Type-I and Type-II error
iii) Confidence limits **(06 Marks)**

b. The t.p.m. of a Markov chain is given by $P = \begin{bmatrix} 1/2 & 0 & 1/2 \\ 1 & 0 & 0 \\ 1/4 & 1/2 & 1/4 \end{bmatrix}$. Find the fined probabilities vector. **(07 Marks)**

c. Two boys B_1 and B_2 and two girls G_1 and G_2 are throwing ball from one to another. Each boy throws the ball to the other boy with probability 1/2 and to each girl with probability 1/4. On the other hand each girl throws the ball to each boy with probability 1/2 and never to the other girl. In the long run how often does each receive the ball? **(07 Marks)**

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Module-4

a. Derive the expressions for mean and variance of binomial distribution. (07 Marks)

b. The mean weight of 500 students at a certain school is 50kgs and the standard deviation is 6kgs. Assuming that the weights are normally distributed, find the expected number of students weighing :
i) between 40 and 50kgs
ii) more than 60kgs, given that $A(1.6667) = 0.4525$. (07 Marks)

c. Alpha particles are emitted by a radioactive source at an average rate of 5 in a 20 minutes interval. Using Poisson distribution, find the probability that there will be :
i) Exactly two emissions
ii) At least two emissions, in a randomly chosen 20 minutes interval. (06 Marks)

OR

8 a. The probability density function P(x) of a variate X is given by the following table :

x	−2	−1	0	1	2	3
P(x)	0.1	K	0.2	2K	0.3	K

Determine the value of K and find the mean, variance and standard deviation. Also find $P(-1 < x \leq 2)$. **(07 Marks)**

b. In a certain town the duration of a shower is exponentially distributed with mean equal to 5 minutes. What is the probability that a shower will last for :

i) Less than 10 minutes

ii) 10 minutes or more? **(07 Marks)**

c. The joint probability distribution of two random variables X and Y is given. Find the marginal distribution of X and Y and evaluate cov(x, y) and $\rho(x, y)$.

X \ Y	1	3	9
2	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$
4	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$

(06 Marks)

Module-5

9 a. Results extracts revealed that in a certain school, over a period of 5 years, 725 students had passed and 615 students had failed. Test whether success and failure are in equal proportion. **(06 Marks)**

b. Two types of batteries are tested for their length of life and the following results are obtained

Battery	n_1	$\overline{x_1}$	σ^2
A	10	560 hrs	100
B	10	500 hrs	121

Test whether there is a significant difference in two means. (Given $t_{0.05} = 2.101$ for 18 df). **(07 Marks)**

c. Find the fixed probability vector of the regular stochastic matrix :

$$A = \begin{bmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{bmatrix}.$$ **(07 Marks)**

OR

a. Define :

i) Null hypothesis

ii) Significance level

iii) Type I and Type II errors. **(06 Marks)**

b. The number of accidents per day (x) over a period of 400 days is given below. Test Poisson distribution is a good fit or not. $\left(\chi^2_{0.05} = 9.49 \text{ for } 4\text{d.f}\right)$.

x	0	1	2	3	4	5
f	173	168	37	18	3	1

(07 Marks)

c. A student's study habits are as follows. If he studies one night, he is 70% sure not to study the next night. On the other hand, if he does not study one night, he is 60% sure not to study the next night. In the long run, how often does he study? **(07 Marks)**

Module-4

7 a. In a sampling a large number of parts manufactured by a machine, the mean number of defectives in a sample of 20 is 2, out of 1000 such samples, how many would be expected to contain atleast 3 defective parts? **(06 Marks)**

b. If X is a normal variate with mean 30 and standard deviation 5, find the probabilities that
i) $26 \le X \le 40$ ii) $X > 45$ iii) $|X - 30| > 5$.
Given that $\phi(0.8) = 0.288$, $\phi(2.0) = 0.4772$, $\phi(3) = 0.4987$, $\phi(1) = 0.3413$. **(07 Marks)**

c. The joint density function of two continuous random variables X and Y is given by

$$f(x, y) = \begin{cases} K\,xy, & 0 \le x \le 4,\ 1 < y < 5 \\ 0, & \text{otherwise} \end{cases}$$

Find i) K ii) E(x) iii) E(2x + 3y). **(07 Marks)**

OR

8 a. Derive mean and standard deviation of the Poisson distribution. **(06 Marks)**

b. The joint probability distribution for two random variables X and Y as follows :

X \ Y	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.3	0

Find i) Expectations of X, Y, XY ii) SD of X and Y iii) Covariance of X, Y iv) Correlation of X and Y. **(07 Marks)**

c. In a certain town the duration of shower has mean 5 minutes. What is the probability that shower will last for i) 10 minutes or more ii) Less than 10 minutes iii) Between 10 and 12 minutes. **(07 Marks)**

Module-5

9 a. A group of boys and girls were given in Intelligence test. The mean score, SD score and numbers in each group are as follows : **(06 Marks)**

	Boys	Girls
Mean	74	70
SD	8	10
X	12	10

Is the difference between the means of the two groups significant at 5% level of significance? Given that $t_{0.05} = 2.086$ for 20 d.f.

b. The following table gives the number of accidents that take place in an industry during various days of the week. Test if accidents are uniformly distributed over the week.

Day	Mon	Tue	Wed	Thu	Fri	Sat
No. of accidents	14	18	12	11	15	14

Given that $X^2 = 11.09$ at 5% level for 5 d.f. **(07 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix.

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$ **(07 Marks)**

OR

10 a. Define the following terms :
i) Type I error and type II error.
ii) Transient state.
iii) Absorbing state. **(06 Marks)**

b. A certain stimulus administered to each of the 12 patients resulted in the following increases of blood pressure : 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded that the stimulus will be general be accompanied by an increase in blood pressure. Given that $t_{0.05} = 2.2$ for 11 d.f. **(07 Marks)**

c. If $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$. Find the corresponding stationary probability vector. **(07 Marks)**

Module-4

7 a. The probability density function of a variate x given by the following table:

X	−3	−2	−1	0	1	2	3
P(X)	K	2K	3K	4K	3K	2K	K

Find the value of K, mean and variance. **(06 Marks)**

b. In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S.D. of 60 hours. Estimate the number of bulbs likely to burn for, (i) more than 2150 hours, (ii) less than 1950 hours, (iii) more than 1920 hours and but less than 2160 hours.
Given : $A(0 < z < 1.83) = 0.4664$, $A(0 < z < 1.33) = 0.4082$ and $A(0 < z < 2) = 0.4772$ **(07 Marks)**

c. A joint probability distribution is given by the following table:

X \ Y	−3	2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

Determine the marginal probability distributions of X and Y. Also find $COV(X, Y)$. **(07 Marks)**

OR

8 a. Derive mean and variance of the Poisson distribution. **(06 Marks)**

b. In a certain town the duration of a shower is exponentially distributed within mean 5 minute. What is the probability that a shower will last for,
(i) less than 10 minutes (ii) 10 minutes or more
(iii) between 10 and 12 minutes. **(07 Marks)**

c. Given,

X \ Y	0	1	2	3
0	0	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	0

(i) Find Marginal distribution of X and Y.
(ii) Find E(X), E(Y) and E(XY). **(07 Marks)**

Module-5

9 a. A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% level of significance. **(06 Marks)**

b. Five dice were thrown 96 times and number 1, 2 or 3 appearing on the face of the dice follows the frequency distribution as follows:

No. of dice showing 1, 2 or 3 :	5	4	3	2	1	0
Frequency :	7	19	35	24	8	3

Test the hypothesis that the data follow a binomial distribution at 5% level of significance $\left(\chi^2_{0.05} = 11.07 \text{ for d.f is } 5\right)$. **(07 Marks)**

c. A student's study habits are as follows:
If he studies one night, he is 70% sure not to study the next night. On the other hand if he does not study one night he is 60% sure not to study the next night. In the long run how often does he study? **(07 Marks)**

OR

10 a. If $p = \begin{pmatrix} 0 & \frac{2}{3} & \frac{1}{3} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$, find the fixed probabilities vector. **(06 Marks)**

b. A random sample of 10 boys had the following I.Q's : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Does this supports the hypothesis that the population mean of I.Q's is 100 at 5% level of significance? ($t_{0.05} = 2.262$ for 9 d.f) **(07 Marks)**

c. Explain : (i) Transient state (ii) Absorbing state (iii) Recurrent state. **(07 Marks)**

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Module-4

7 a. Find the constant c, such that the function $f(x) = \begin{cases} cx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$ is a p.d.f. Also compute $p(1 < x < 2)$, $p(x \le 1)$, $p(x > 1)$ **(05 Marks)**

b. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals, more than two will get a bad reaction. **(05 Marks)**

c. x and y are independent random variables, x take the values 1, 2 with probability 0.7; 0.3 and y take the values -2, 5, 8 with probabilities 0.3, 0.5, 0.2. Find the joint distribution of x and y hence find cov(x, y). **(06 Marks)**

OR

8 a. Obtain mean and variance of binomial distribution. **(05 Marks)**

b. The length of telephone conservation in a booth has been an exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made from this booth (i) ends less than 5 minutes, (ii) between 5 and 10 minutes. **(05 Marks)**

c. The joint distribution of two discrete variables x and y is $f(x, y) = k(2x + y)$ where x and y are integers such that $0 \le x \le 2$; $0 \le y \le 3$. Find: (i) The value of k; (ii) Marginal distributions of x and y; (iii) Are x and y independent? **(06 Marks)**

Module-5

9 a. Explain the terms: (i) Null hypothesis; (ii) Type I and type II errors; (iii) Significance level. **(05 Marks)**

b. A die thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Is it reasonable to think that the die is an unbiased one? **(05 Marks)**

c. Find the unique fixed probability vector for the regular Stochastic matrix:

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$ **(06 Marks)**

OR

10 a. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, −1, 3, 0, 6, −2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure. ($t_{0.05}$ for 11 d.f = 2.201) **(05 Marks)**

b. It has been found that the mean breaking strength of a particular brand of thread is 275.6 gms with $\sigma = 39.7$ gms. A sample of 36 pieces of thread showed a mean breaking strength of 253.2 gms. Test the claim at 1+.. and 5−*l*. level of significance. **(05 Marks)**

c. A man's smoking habits are as follows. If he smokes filter cigarettes one week, he switches to non filter cigarettes the next week with probability 0.2. One the other hand, if he smokes non filter cigarettes one week there is a probability of 0.7 that he will smoke non filter cigarettes the next week as well. In the long run how often does he smoke filter cigarettes? **(06 Marks)**