DEPARTMENT OF MATHEMATICS
NATIONAL INSTITUTE OF TECHNOLOGY KURUKSHETRA

Program: B.Tech. Semester-III (CS, IT)
Course Title: Discrete Mathematical and Statistical methods M.M. 50
Course Code: MAIC 201

Note: Attempt all the Questions. Each question carries equal marks.

1. Suppose 100 out of 120 Computer Science students study at least one of the following languages: French, German and Russian. It is given that 65 students study French, 45 students study German, 42 students study Russian, 20 students study French and German, 25 students study French and Russian, and 15 students study German and Russian. Find the number of students who study
   i. Only French and German, but not Russian
   ii. Only French and Russian, but not German
   iii. Only French
   iv. Only German
   v. None of these languages.

2. In a bolt factory, machine A, B and C manufacture 24%, 33% and 43% of the total. Out of their output 5%, 4% and 3% are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machines A, B or C?
3. There are three bags : first containing 1 white , 2 red , 3 green balls; second containing 2 white, 3 red, 1 green balls, and third, 3 white, 1 red, and 2 green balls. Two balls are drawn from a bag chosen at random. These are found to be one white and one red. Find the probability that the balls so drawn came from the second bag.
4. The following data are the number of seeds germinating out of 10 on a damp filter paper for 80 sets of seeds. Fit a binomial distribution to these data:

x :	0	1	2	3	4	5	6	7	8	9	10
f(x) :	6	20	28	12	8	6	0	0	0	0	0.

5. Solve the following linear homogeneous recurrence relation:

$$a_n = 7a_{n-1} - 10a_{n-2},$$

with initial conditions

$$a_0 = 1,$$

$$a_1 = 8.$$

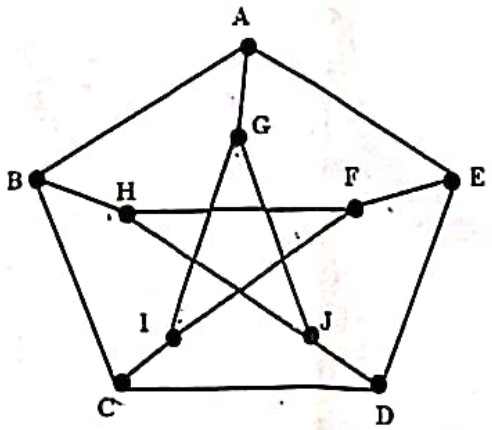
6. Solve the nonhomogeneous recurrence relation:

$$a_n - 5a_{n-1} = 3^n,$$

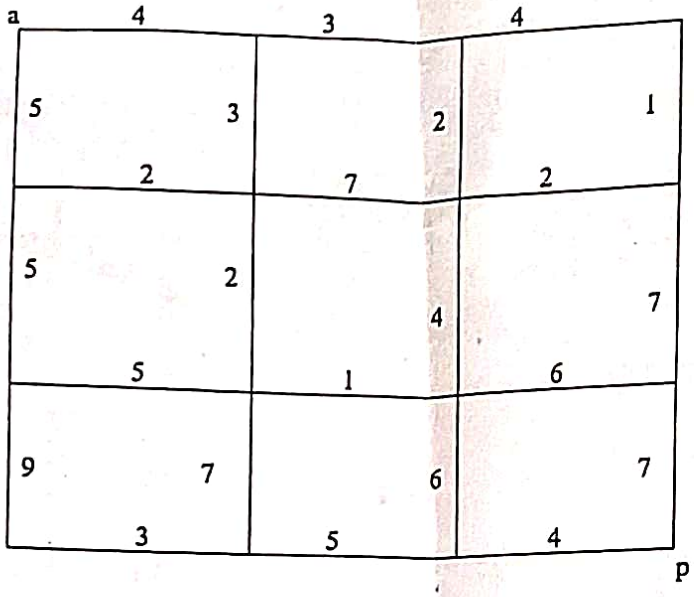
with initial conditions

$$a_0 = 1.$$

7. Check the planarity of the following graph and justify your answer.



8. Find the shortest path length and shortest path between 'a' and 'p'.



9. By constructing a truth table, show that $A = p \vee (q \wedge r) \leftrightarrow (p \vee q) \wedge (p \vee r)$ is a tautology, where p, q, r are prepositions.

10. Define a Poset and a Chain. Draw the Hasse diagram for the relation R on A ={1,2,3,4,5} whose relation matrix is given below:

$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}.$$

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