

**MCA 24101**  
**MCA DEGREE EXAMINATIONS**  
**FIRST SEMESTER**  
**DISCRETE MATHEMATICAL STRUCTURES**  
**(w.e.f. Admitted Batch 2024 - 25)**

**Time: 3 Hours**

**Max. Marks: 75M**

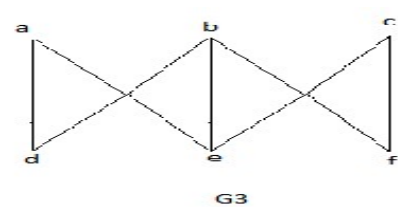
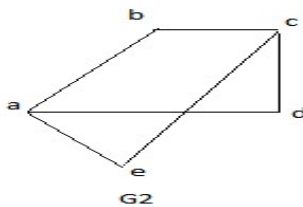
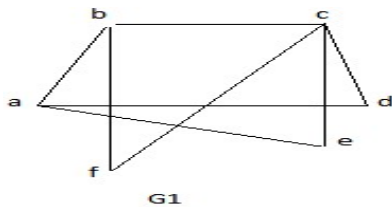
**SECTION - A**

**All Questions Carry Equal Marks**

Note :- All parts of the questions must be answered at one place only

**(4 X 15 = 60 M)**

1. a. Prove that  $\sqrt{2}$  is irrational by giving a proof using contradiction.  
 b. Obtain the PDNF and PCNF of the statement  $p \vee (\neg p \rightarrow (q \vee (\neg q \rightarrow r)))$   
 (OR)
2. a. For any three sets A, B, C  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$   
 b. Let  $X = \{1, 2, \dots, 7\}$  and  $R = \{ \langle x, y \rangle / x - y \text{ is divisible by } 3 \}$  show that R is an equivalence relation. Draw graph of R.
3. a. Using generating function, solve the difference equation  $y_{n+2} - y_{n+1} - 6y_n = 0$ ,  $y_1 = 1$ ,  $y_0 = 2$   
 b. Solve the recurrence relation of the Fibonacci sequence of numbers  $f_n = f_{n-1} + f_{n-2}$ ;  $n > 2$   
 (OR)
4. a. State Pigeonhole principle. In how many ways can all the letters in MATHEMATICAL is arranged.  
 b. How many integers between 1 and 1,000 inclusive have a sum of digits  
 (a) equal to 10 (b) less than 10
5. a. Prove that a simple graph with n vertices and k components can have at most  $(n-k)(n-k+1)/2$  edges.  
 b. Determine which of the following graph are bipartite & which are not. If a graph is bipartite, state if is completely bipartite.

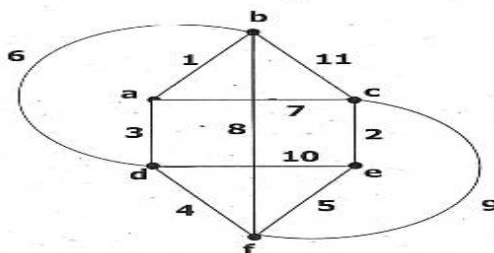


(OR)

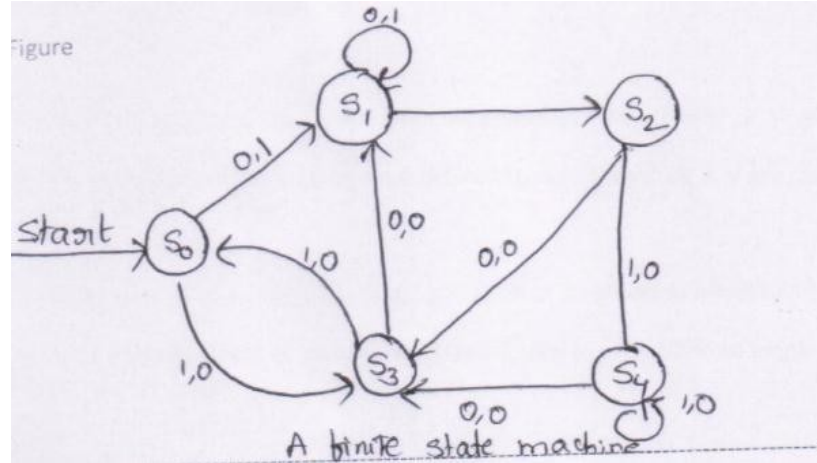
6. a. The adjacency matrices of two pairs of graph as given below. Examine the isomorphism of G and H finding a permutation matrix.

$$A_G = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \quad A_H = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

- b. How to finding a minimal spanning tree of kruskal's algorithm. Construct spanning and find its Weight.



7. a. Find the sum of products expansion for the function  $F(x,y,z)=(x+y)\bar{z}$   
 b. Construct circuits that produce the following outputs (i)  $(x+y)\bar{z}$  (ii)  $\bar{x}(\bar{y}+z)$   
 (OR)
8. a. Show that distributive law  $x(y+z) = xy + xz$  is valid.  
 b. Construct the state table for the finite state machine with the state diagram shown in the following Figure.



### SECTION-B

Answer **Any 5** of the Following.

(5 X 3 = 15 M)

9. Construct the truth table for  $p \wedge (\sim q \vee q)$
10. Write the following in symbolic form Every person is precious.
11. Compute  $\frac{20!}{18!}$
12. Prove  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
13. State and prove Hand shaking theorem
14. Define Hamilton circuit Hamiltonian graph give examples to each
15. Find the duals of  $x(y+0)$  and  $\bar{x}.1+(\bar{y}+z)$
16. Let  $A=\{1,00\}$ , find  $A^n$  for  $n = 0,1,2$  and  $3$ .

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