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Paper Code : BM-301

MATHEMATICS FOR COMPUTING

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) Solution of the recurrence relation $a_n = 2a_{n-1}$ with $a_0 = 1$ is

   a) 2^n

   b) 2^{n-1}

   c) 2^{n+1}

   d) 2^{n-2}.

ii) If the truth value of p and q are F and T respectively then the truth value of $p \leftrightarrow q$ is

a) T b) F

c) both T and F d) none of these.

iii) A grammar is said to be regular if it is of

a) Type-0 b) Type-1

c) Type-2 d) Type-3.

iv) $p \vee (p \wedge q) \equiv$

a) p b) q

c) $p \wedge q$ d) $p \vee q$.

v) How many ways can be letters of the word "LEADER" be arranged ?

a) 72 b) 144

c) 360 d) none of these.

vi) The generating function for the sequence $\frac{1}{3}, -\frac{1}{3}, \frac{1}{3}, -\frac{1}{3}$ ..... is

a) $\frac{1/3}{(1+x)}$ b) $\frac{1}{3(1-x)}$

c) $\frac{1}{\frac{1}{3}(1-x)}$ d) $\frac{-3}{(1-x)}$.

vii) What is the minimum no. of vertices necessary for a graph with 6 edges ?

a) 6 b) 5

c) 7 d) none of these.

viii) A simple graph has

a) no parallel edges b) no loops

c) both (a) and (b) d) no isolated vertex.

ix) The difference between Mealy and Moore Machine lies on

a) state transition b) output function

c) input function d) none of these.

x) Maximum number of edge with n vertices in a completely connected graph is

a) $(n-1)$ b) $n/2$

c) $(n-1)/2$ d) $n(n-1)/2$.

xi) If a binary tree has 20 pendant vertices, then the number of internal vertices of the tree is

a) 20 b) 21

c) 23 d) 19.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

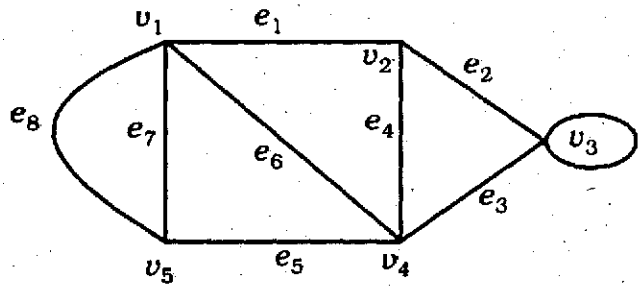
2. a) How may words can be made using all the letters in the word MONDAY ?

b) In how many ways can the letters of the word ALGEBRA be arranged, such that two As are never together. 2 + 3

3. Find the sequence for following generating function :

$3x(1-x)^5$.

4. Construct Incidence matrix from the following graph :



5. Write short notes on Moore Machine.

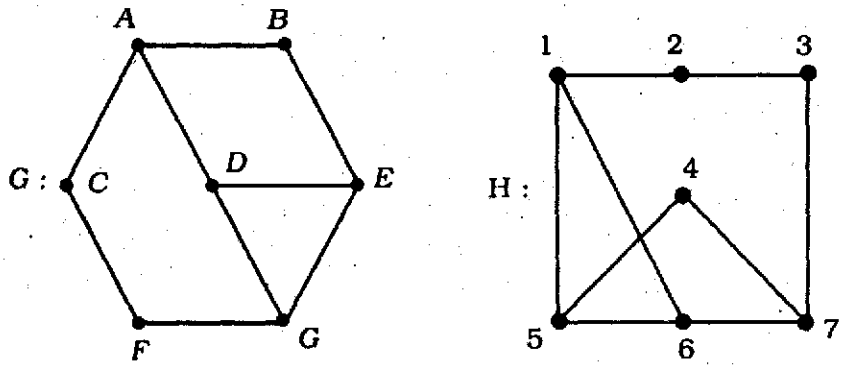
6. What is Deterministic finite automata (DFA) ? Explain with suitable example.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Examine Graphs *H* and *G* are isomorphic or not :



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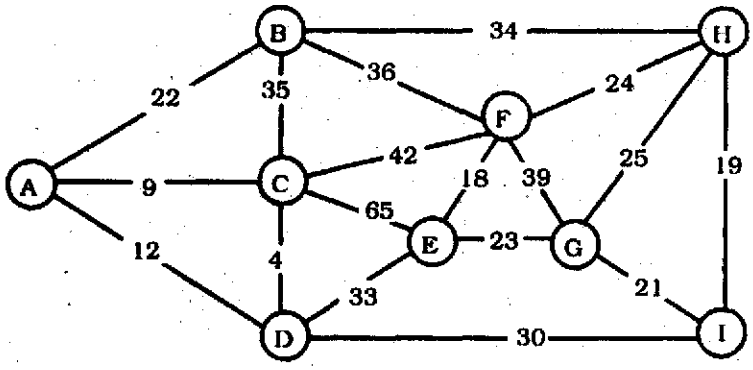
b) Prove that

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \ldots\ldots\ldots + \frac{1}{n(n+1)} = \frac{n}{(n+1)}$$ by using mathematical induction. 5

c) A graph has 21 edges, 3 vertices each of degree 4 and rest of the vertices are of degree 3. Find out the total number of vertices. 4

8. a) Using Kruskal's algorithm find minimal spanning tree of the following graph : 7



b) Prove that a simple graph with n vertices and k components has at most $\frac{(n-k)(n-k+1)}{2}$ edges. 8

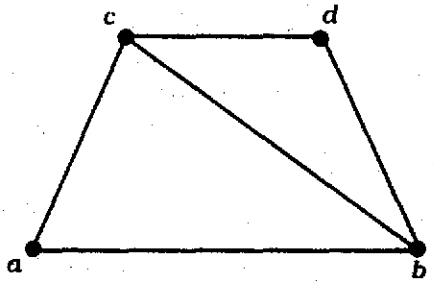
9. a) Solve the recurrence relation $a_{n+2} - 4a_{n+1} + 4a_n = 0$, $(n \geq 0)$ with $a_0 = 2$ and $a_1 = 1$ using generating function. 7

b) Convert the given Moore Machine to its equivalent Mealy Machine. 8

Present state	Next state		Output
	Input $a = 0$	Input $a = 1$	
$\rightarrow q_0$	q_3	q_1	0
q_1	q_1	q_2	1
q_2	q_2	q_3	0
q_3	q_3	q_0	0

10. a) Construct truth table and determine whether the following proposition is tautology or contradiction.
$\{ (p \wedge \sim q) \rightarrow r \} \rightarrow \{ p \rightarrow (q \vee r) \}$. 7

b) Find all spanning trees from the following graph G :



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11. a) Draw the graph whose incidence matrix is given below :

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

7

b) By Prim's Algorithm find a minimal spanning tree and the corresponding weight of the spanning tree in the following graph : 8