

QUESTION 2013

Group – A (Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

i) A statement T is called a tautology if

- ✓a) T is true for all possible values of its variables
- b) T is false for all possible values of its variables
- c) T is true as well false for few possible values of its variables
- d) none of these

ii) The type-3 Grammar in relation to the automata theory is known as

- a) Context sensitive grammar
- b) Context free grammar
- ✓c) Regular grammar
- d) none of these

iii) Solution of the recurrence relation $a_n = 2a_{n-1} + 1$ with $a_0 = 0$ is

- a) $1 - 2^n$
- b) $2^n - 2$
- ✓c) $2^n - 1$
- d) none of these

iv) How many bit strings of length 10 contain exactly four's 1's?

- a) 130
- b) 720
- ✓c) 210
- d) none of these

v) A spanning tree of a connected graph contains

- ✓a) all the vertices of the graph
- b) all the vertices and edges of the graph
- c) a few vertices of the graph
- d) none of these

vi) If ${}^{16}C_r = {}^{16}C_{2r+1}$, then $r =$

- a) 6
- ✓b) 5
- c) 4
- d) 3

vii) A binary tree has exactly

- ✓a) one root
- b) two roots
- c) three roots
- d) none of these

viii) Let L be a language given by $L = \{a^n b^n : n \geq 0\}$, then L^2 is equal to

- ✓a) $L = \{a^n b^n a^m b^m : n, m \geq 0\}$
- b) $L = \{a^{2^n} b^{2^n} : n \geq 0\}$

c) $L = \{2a^n b^n : n \geq 0\}$

d) none of these

x) If the length of input string processed on a Moore Machine is 15, then the length of the output string is
 a) 14 b) 15 ✓c) 16 d) 17

x) If a graph has 5 vertices and 7 edges then the size of its incidence matrix is
 ✓a) 5×7 b) 7×7 c) 5×5 d) 7×5

xi) If a language L is accepted by an automata M then
 ✓a) every string in L is accepted by M
 b) at least one string in L is accepted by M
 c) no string of L is accepted by M
 d) only one string of L is accepted by M

xii) Suppose you have four friends; in how many ways can you invite them for dinner?
 ✓a) 15 b) 16 c) 24 d) 10

Group – B

(Short Answer Type Questions)

2. Show that $\sim \{p \vee (\sim p \wedge q)\} \equiv (\sim p \wedge \sim q)$.

See Topic: MATHEMATICAL LOGIC, Short Answer Type Question No. 8.

3. Prove by mathematical induction $3^{2n} - 8n - 1$ is divisible by 64.

See Topic: INDUCTION AND RECURSION, Short Answer Type Question No. 10.

4. There are 50 students in each of the senior or junior classes. Each class has 25 male and 25 female students. In how many ways can an eight student committee be formed so that there are four females and three juniors in the committee?

See Topic: MATHEMATICAL LOGIC, Short Answer Type Question No. 3.

5. Write short notes on Mealy Machine.

See Topic: MOORE MEALY MACHINE, Long Answer Type Question No. 4. (c).

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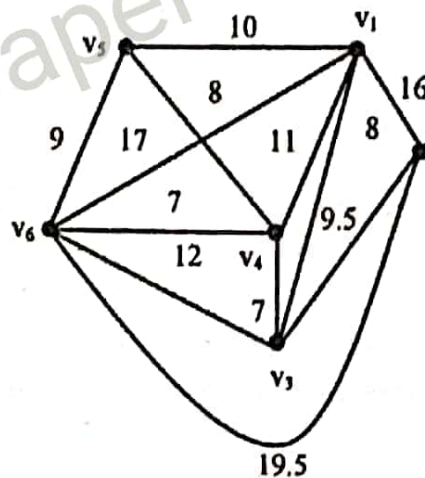
6. Draw the graph represented by the given incidence matrix:

	e_1	e_2	e_3	e_4	e_5
v_1	0	0	1	-1	2
v_2	-1	1	0	0	0
v_3	0	0	0	0	0
v_4	1	0	0	0	0
v_5	0	1	0	0	0
v_6	0	0	-1	1	0

See Topic: GRAPH THEORY, Short Answer Type Question No. 17.

Group - C (Long Answer Type Questions)

7. a) Find by Kruskal's algorithm, a minimal spanning tree with minimum weight of the following graph given below:



See Topic: TREE, Long Answer Type Question No. 6.

b) Prove that a complete graph with n vertices consists of $\frac{n(n-1)}{2}$ number of edges.

See Topic: GRAPH THEORY, Long Answer Type Question No. 6.

c) Prove that ${}^nC_r + {}^nC_{r+1} = {}^{n+1}C_{r+1}$.

See Topic: COMBINATORICS, Short Answer Type Question No. 3.

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

Present state	Next state		Output
	Input a = 0	Input a = 1	
→ 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

b) Construct the state diagram for finite state machine with state table as under.

State	Input		Output	
	0	1	0	1
→ S ₀	S ₁	S ₀	1	0
S ₁	S ₃	S ₀	1	0
S ₂	S ₁	S ₀	0	1
S ₃	S ₂	S ₁	0	1

See Topic: MOORE MEALY MACHINE, Long Answer Type Question No. 2 (a) & (b).

9. a) Write the DNF & CNF for $p \rightarrow (p \wedge (q \rightarrow r))$.

See Topic: MATHEMATICAL LOGIC, Short Answer Type Question No. 7.

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

See Topic: GRAPH THEORY, Short Answer Type Question No. 18.

c) In how many ways can the letter of the word ALGEBRA be arranged such that the two A's are never come together.

See Topic: COMBINATORICS, Short Answer Type Question No. 11.

10. a) Apply the Generating function technique to solve the recurrence relation:

$$a_n = 4a_{n-1} + 3, a_0 = 2$$

b) Solve the following recurrence relation using generating function:

$$a_n - 7a_{n-1} + 10a_{n-2} = 2, \forall n > 1 \text{ \& } a_0 = 3, a_1 = 3.$$

a) & b) See Topic: INDUCTION AND RECURSION, Long Answer Type Question No. 7 (a) & (b).

c) Prove the following equivalence:

$$p \Leftrightarrow (p \wedge q) \vee (p \wedge \sim p).$$

See Topic: MATHEMATICAL LOGIC, Long Answer Type Question No. 2 (c).

11. a) Write the short notes any two of the following:

i) Euler Graph

ii) CNF

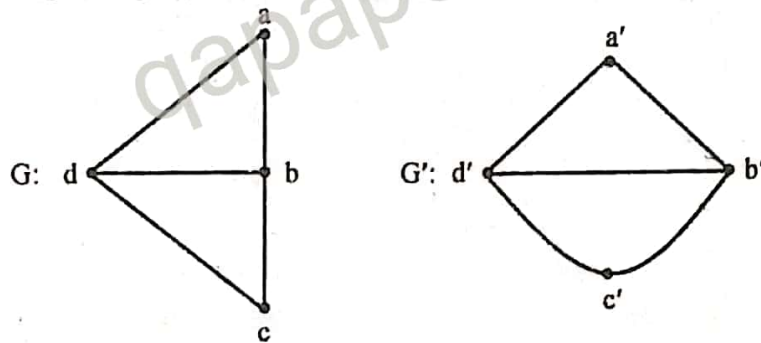
iii) Planar Graph

i) See Topic: GRAPH THEORY, Short Answer Type Question No. 1.

ii) See Topic: MATHEMATICAL LOGIC, Long Answer Type Question No. 8.

iii) See Topic: GRAPH THEORY, Long Answer Type Question No. 13(e).

b) Examine if the following two graphs are isomorphic:



See Topic: GRAPH THEORY, Short Answer Type Question No. 5.