

QUESTION 2014

Group – A **(Multiple Choice Type Questions)**

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

i) Maximum number of edges with n vertices in a completely connected graph is

a) $(n-1)$

b) $\frac{(n-1)}{2}$

c) $\frac{n}{2}$

✓d) $\frac{n(n-1)}{2}$

ii) Prim's algorithm is used to find the minimal spanning tree of a

a) dense graph

b) sparse graph

c) null graph

✓d) normal graph

iii) A Simple graph has

a) no self loops

b) no parallel edges

✓c) both (a) and (b)

d) none of these

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iv) The generating function of $\{1, 1, 1, \dots\}$ is

✓a) $\frac{1}{(1-x)}$

b) $\frac{1}{(1+x)}$

c) $\frac{1}{(1-x)(1+x)}$

d) none of these

v) A Grammar is said to be regular if it is of

a) type 0

b) type 1

c) type 2

✓d) type 4

vi) The mathematical model of Mealy machine is a

a) 5 tuple

b) 4 tuple

✓c) 6 tuple

d) none of these

vii) If $n! = x(n-2)!$ Then $x =$

a) n

b) $n-1$

c) $n(n-2)$

✓d) $n(n-1)$

viii) Number of four digit numbers formed by digits 3, 1, 3, 1 is

a) 5

b) 10

c) 20

✓d) 6

ix) The proposition $P \wedge (Q \wedge \neg Q)$ is a

✓a) contradiction

b) tautology

c) both (a) and (b)

d) none of these

x) Number of elements contained in an incidence matrix of a digraph is

a) 1

b) 2

✓c) 3

d) none of these

xi) A pseudo graph

a) Must have loops

✓b) Does not have loop

c) Must have parallel edges

d) None of these

xii) Choose the correct statement:

✓a) path is an open walk

b) every walk is a trail

c) every trail is a path

d) a vertex cannot appear twice in a walk

Group – B
(Short Answer Type Questions)

2. In an examination a minimum is to be secured in each of the 5 subjects for a pass. In how many ways can a student fail?

See Topic: COMBINATORICS, Short Answer Type Question No. 12.

3. Find the sequence from the generating function $\frac{(3+7x)}{(1-x)(1+4x)}$.

See Topic: INDUCTION AND RECURSION, Short Answer Type Question No. 11.

4. Prove that $((P \wedge \neg Q) \rightarrow R) \rightarrow (P \rightarrow (Q \vee R))$ is a tautology.

See Topic: MATHEMATICAL LOGIC, Short Answer Type Question No. 1.

5. Write a short note on Moore machine.

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

6. Show that a tree with n vertices has $(n - 1)$ edges.

See Topic: TREE, Short Answer Type Question No. 2.

Group – C
(Long Answer Type Questions)

7. a) Solve the following recurrence relation by generating function method:

$$a^n - 2a_{n-1} + a_{n-2} = 2^{n-2} \text{ for } n \geq 2 \text{ and } a_0 = 1, a_1 = 5$$

b) What is a Deterministic Finite Automata (DFA)? Explain with suitable example.

c) Write CNF and DNF of the following statement: $p \vee \{\neg p \rightarrow (q \vee (q \rightarrow \neg r))\}$

a) See Topic: INDUCTION AND RECURSION, Long Answer Type Question No. 1.

b) See Topic: FINITE AUTOMATA, Short Answer Type Question No. 2.

c) See Topic: MATHEMATICAL LOGIC, Short Answer Type Question No. 9.

8. a) Find the grammar of the terminals $\{a, b\}$ that generates the language $L = \{a, ab, ab^2, ab^3, \dots\}$.

b) Let Z be a set of all integers and a binary relation ρ is defined on Z by the rule, $m \rho n$ means $m - n$ is divisible by 5 such that ρ is an equivalence relation on Z and identify the equivalent classes.

c) Show that $\lfloor 2n = 2n \{1, 3, 5, \dots, (2n-1)\} \rfloor n$

- a) See Topic: AUTOMATA AND GRAMMAR, Short Answer Type Question No. 1.
 b) See Topic: COMBICOTRONICS, Short Answer Type Question No. 2.
 c) See Topic: COMBICOTRONICS, Short Answer Type Question No. 7.

9. a) Find out the characteristic roots of the recurrence relation $a_n + 4a_{n-1} + 3a_{n-2} = 0$ and hence solve it.

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

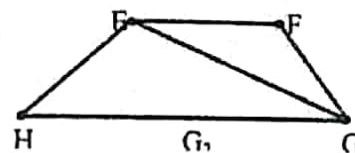
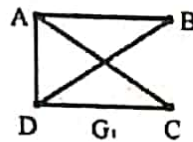
c) Prove the following equivalence: $\neg p \wedge q \Leftrightarrow \neg(p \vee (\neg p \wedge q))$.

a) See Topic: INDUCTION AND RECURSION, Short Answer Type Question No. 8.

b) See Topic: GRAPH THEORY, Long Answer Type Question No. 2.

c) See Topic: MATHEMATICAL LOGIC, Long Answer Type Question No. 6(c).

10. a) Find whether the following two graphs are isomorphic or not:



b) How many integral solutions are there of $x_1 + x_2 + x_3 + x_4 + x_5 = 30$ where $x_1 \geq 2$, $x_2 \geq 3$, $x_3 \geq 4$, $x_4 \geq 2$, $x_5 \geq 0$.

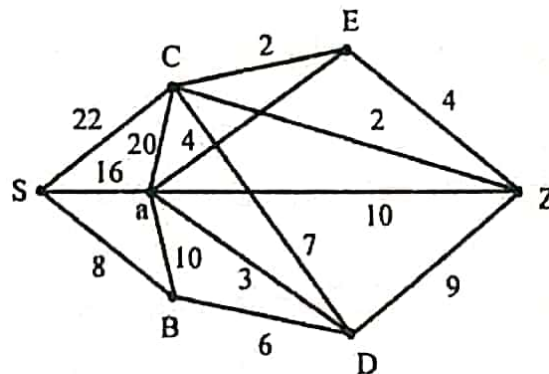
c) Determine the value of n if $4 \times {}^nP_3 = {}^{n+1}P_3$

a) See Topic: GRAPH THEORY, Short Answer Type Question No. 20.

b) See Topic: COMBICOTRONICS, Long Answer Type Question No. 1(b).

c) See Topic: COMBICOTRONICS, Short Answer Type Question No. 10.

11. a) Using Kruskal's algorithm find the minimal spanning tree from the following graph from S to Z.



b) Write short note on Hamiltonian Graph.

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c) Using the principle of mathematical induction prove that

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

a) See Topic: GRAPH THEORY, Short Answer Type Question No. 21.

b) See Topic: GRAPH THEORY, Long Answer Type Question No. 13(a).

c) See Topic: INDUCTION AND RECURSION, Short Answer Type Question No. 11.