

QUESTION 2017

Group – A

(Multiple Choice Type Questions)

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

i) In how many ways can 5 questions be selected from 8 questions?

a) 20

b) 40

✓c) 56

d) 336

RCA MC-108

ii) Determine the type of grammar which consists of the productions,

$S \rightarrow aAB$, $AB \rightarrow bB$, $B \rightarrow b$, $A \rightarrow aB$

a) Type - 1 grammar

b) Regular

c) Type -3 grammar

✓d) Type - 2 grammar

iii) Express the following sentence in symbolic form :

It is raining but not cloudy.

a) $\sim p \wedge \sim q$

b) $\sim (\sim p \vee q)$

✓c) $p \wedge \sim q$

d) none of these

iv) Does there exist a simple graph with 5 vertices of the given degrees?

1, 2, 3, 4, 5.

✓a) No

b) Yes

c) Sometime it exists

d) Never exists.

v) If R_1 and R_2 are two regular expressions (R.E.) then $R_1 + R_2$ is

✓a) R.E.

b) CFS

c) CSG

d) Regular grammar

vi) 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

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

a) 120

b) 720

c) 386

✓d) 210

viii) The mathematical model of a Mealy Machine is a

✓a) 5 -tuple

b) 4 -tuple

c) 6- tuple

d) none of these

ix) A regular language is accepted by

a) every DFA

b) every NFA

c) no DFA

✓d) at least one DFA

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

a) 1

✓b) 2

c) 3

d) none of these

xi) If $n! = x (n-2)!$ then $x =$

a) n

b) $n-1$

c) $n(n-2)$

✓d) $n(n-1)$

xii) The proposition $p \wedge (q \wedge \sim q)$ is a

- ✓ a) contradiction
- c) both (a) and (b)

- b) tautology
- d) none of these

Group – B

(Short Answer Type Questions)

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

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

3. 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, Long Answer Type Question No. 3.

4. Find out the characteristic roots for $a_n + 4a_{n-1} + 3a_{n-2} = 0$ and hence solve it.

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

5. Find the generating function corresponding to the sequence $\{1, -1, 1, -1, 1, -1, \dots\}$.

See Topic: GRAPH THEORY, Short Answer Type Question No. 2(OR).

6. Prove that for a graph $G = (V, E)$, there can be even number of odd vertices.

See Topic: GRAPH THEORY, Short Answer Type Question No. 8(OR).

Group – C

(Long Answer Type Questions)

7. a) Write CNF & DNF of the following statement:

$$p \rightarrow (p \wedge (q \rightarrow p))$$

b) Verify whether the argument given below is valid or not:

If I like Mathematics then I will study.

Either I do not study or I pass the examination.

If I do not graduate then I did not pass Mathematics.

.....
.....If I like Mathematics, then I will graduate.

c) Prove the following equivalence:

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

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

8. a) Prove that the numbers of vertices of odd degree in a graph is always even.

b) Show that $(2n)! = 2^n \cdot n! \{1, 3, 5, \dots, (2n-1)\}$.

c) In how many ways can three prizes be distributed among 4 boys when,

i) no one gets more than one prize?

ii) a boy can get any number of prizes?

a) See Topic: GRAPH THEORY, Short Answer Type Question No. 8.

b) See Topic: COMBICOTRONICS, Short Answer Type Question No. 7.

c) See Topic: COMBICOTRONICS, Short Answer Type Question No. 5.

9. a) Find the Grammar on the set of terminals $\{a, b\}$ that generates the language $L = \{a, ab, ab^2, ab^3, \dots\}$.

b) Draw the transition diagram for the FSA with $I = \{a, b\}$, $Q = \{q_0, q_1, q_2\}$, $F = \{q_0, q_1\}$ and δ is given by

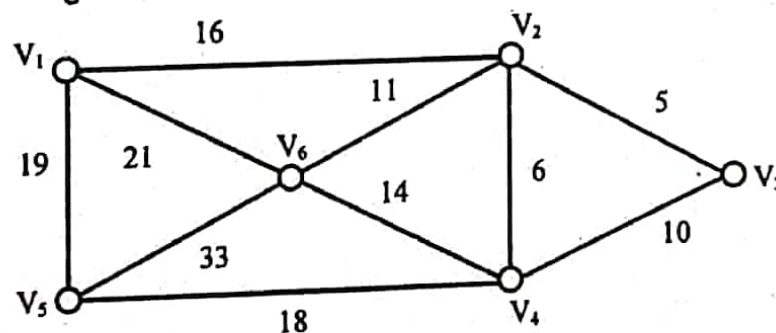
Δ	A	B
Q_0	Q_0	Q_1
Q_1	Q_0	Q_2
Q_2	Q_2	Q_2

a) See Topic: AUTOMATA AND GRAMMAR, Short Answer Type Question No. 1.

b) See Topic: FINITE AUTOMATA, Short Answer Type Question No. 1.

10. a) Write Kruskal's Algorithm for minimal spanning tree.

b) Find the minimal spanning tree of the following labeled connected graph by Kruskal's algorithm.



c) How many permutations can be made out of the letters of the word 'Basic' that

i) Begin with B?

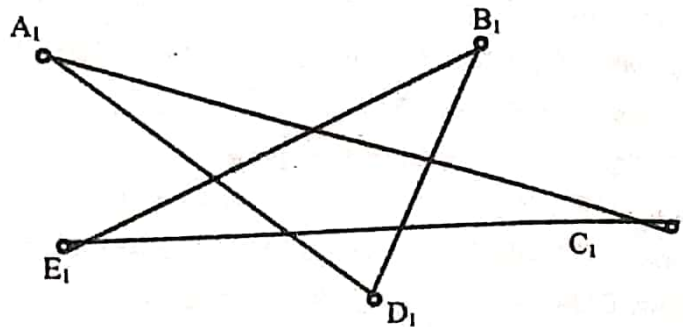
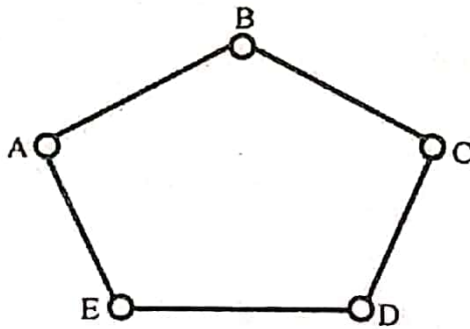
ii) End with C?

a) See Topic: TREE, Long Answer Type Question No. 3 (a).

b) See Topic: TREE, Short Answer Type Question No. 4.

c) See Topic: COMBICOTRONICS, Short Answer Type Question No. 6.

11. a) Examine if the following two graphs are isomorphic



b) Using generating function solve the recurrence relation

$$a_n - 7a_{n-1} + 10a_{n-2} = 0 \text{ for all } n > 1, \text{ and } a_0 = 3, a_1 = 3$$

c) Write short notes on any two of the following:

- i) Spanning Graph
- ii) Hamiltonian Graph
- iii) Digraph

a) See Topic: GRAPH THEORY, Short Answer Type Question No. 16.

b) See Topic: INDUCTION AND RECURSION, Long Answer Type Question No. 11.

c) (i) See Topic: GRAPH THEORY, Long Answer Type Question No. 13 (d).

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

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