



BRAINWARE UNIVERSITY

BTECH (CS)

Discrete Mathematics (M201)

(Semester – 2)

Time allotted: 3 Hours

Full Marks : 70

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Question)

10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) How many symmetric relation on set with n elements are possible?

a. $2^{n(n+1)/2}$

b. $2^{n(n-1)}$

c. 2^n

d. 2^{n+2}

(ii) The chromatic number of a cycle (C_n) with n vertices (where n is even) is

a. 2

b. 3

c. 4

d. 1

(iii) Solution of recurrence relation $S_n = 3 \times S_{n-1}$ with $S_0 = 1$ is $S_n = ?$

a. 3^n

b. 3^{n-1}

c. 3^{n+1}

d. None of these

(iv) If sum of degree of all vertices of a graph is 40 then find its number of edges .

a. 10

b. 25

c. 20

d. 40

(v) What will be maximum no. of edges in a connected simple graph with n vertices?

- | | |
|----------------------------|-------------------|
| a. $2 \times \binom{n}{2}$ | b. $\binom{n}{2}$ |
| c. $n-1$ | d. n |

(vi) The number of elements in the Power set , $P(S)$ of the set $S = \{1,2,3,4\}$ is

- | | |
|-------|-------|
| a. 32 | b. 16 |
| c. 4 | d. 8 |

(vii) How many spanning tree can a complete undirected graph with n nodes have?

- | | |
|--------------|--------------|
| a. n^{n-2} | b. n^2 |
| c. n^n | d. n^{n+2} |

(viii) If p : "Anil is rich" and q : "Ajay is poor", then what will be symbolic form of the statement "Either Anil or Ajay is rich".

- | | |
|---------------------|--------------------|
| a. $p \vee q$ | b. $\sim p \vee q$ |
| c. $\sim(p \vee q)$ | d. $p \vee \sim q$ |

(ix) Write the generating sequence for 0,0,0,1,1,1,1,.....

- | | |
|------------------|----------------|
| a. $1/(1-x)$ | b. $1/(1-x^3)$ |
| c. $x^3/(1-x)^3$ | d. $x^3/(1-x)$ |

(x) $p \rightarrow (p \vee q)$ is

- | | |
|------------------|----------------|
| a. tautology | b. contingency |
| c. contradiction | d. converse |

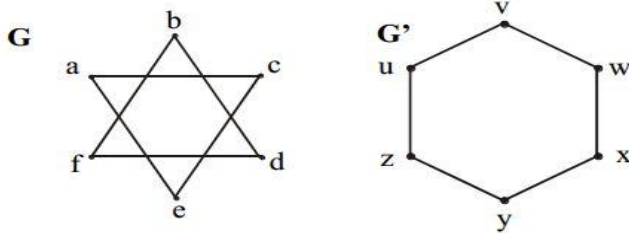
Group – B

(Short Answer Type Questions)

3 x 5 = 15

Answer any *three* from the following:

2. Let ' $/$ ' be the 'divides' relation R on a set N of positive integers i.e for all $a, b \in N$, a/b implies $b=k*a$ for some integer k . Prove that ' $/$ ' is a partial relation on N . [5]
3. Write DNF of the following statement without using truth table:
 $p \rightarrow (p \wedge (q \rightarrow p))$ [5]
4. Determine whether the following graphs are isomorphic or not:



- [5]
5. Determine the generating function for the sequence $a_n = (x+1) \times 3^n$. [5]
6. Define Peterson graph and find its chromatic number. [5]

Group – C

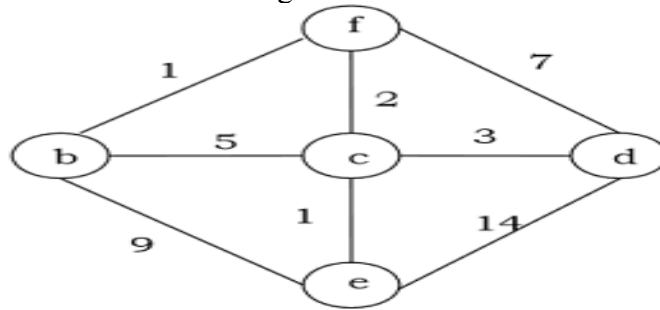
(Long Answer Type Questions)

3 x 15 = 45

Answer any *three* from the following:

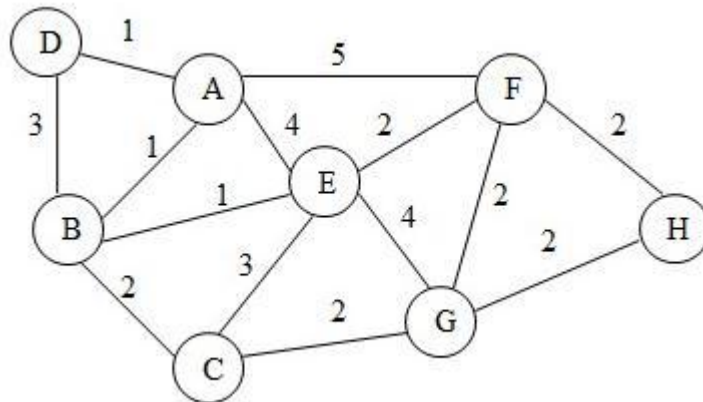
7. (a) Show that the number of vertices of odd degree in a simple graph is always even. [3]

- (b) Find minimum spanning tree for the following graph using Prim's algorithm and calculate its weight:



[5]

- (c) Find the shortest path for the given graph from A to H using BFS algorithm.



[7]

8. (a) Solve $a_n = a_{n-1} + a_{n-2} + 3n + 1$ for $n \geq 2$ with $a_0 = 2$ and $a_1 = 3$ using generating function. [8]

- (b) Solve the recurrence relation $a_n = -a_{n-1} + 4a_{n-2} + 4a_{n-3}$, with $a_0=8$, $a_1=6$ and $a_2=26$ using characteristic method. [7]

9. (a) Prove validity of the following arguments:
 “If I get a job and work hard then I will get promoted. If I get promoted then I will be happy. I will not be happy. Therefore either I will not get job or I will not work hard”. [5]
- (b) Show that the following statement is a tautology:
 $((p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)) \rightarrow r$ [5]
- (c) Show that $(p \leftrightarrow q) \equiv (p \vee q) \rightarrow (p \wedge q)$. [5]
10. (a) There is a group of 80 persons who can drive scooter or car or both. Out of these, 35 can drive scooter and 60 can drive car. Find how many can drive both scooter and car? How many can drive scooter only? How many can drive car only? [2+2+2]
- (b) Prove that $\sim(A \cap B) = \sim A \cup \sim B$. [5]
- (c) If $A = \begin{pmatrix} 2 & 5 \\ 3 & 1 \end{pmatrix}$ then find $A^2 - 3A - 13I$. [4]
11. (a) Let R be a binary relation defined as $R = \{(a,b) \mid R^2 : (a-b) \leq 3\}$. Determine whether R is antisymmetric and reflexive. [2]
- (b) Draw a connected graph with 10 vertices having
 (i) 7 edges (ii) 50 edges [2]
- (c) If $A = \begin{pmatrix} 3 & 2 \\ 7 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 6 & 7 \\ 8 & 9 \end{pmatrix}$ then verify that $(AB)^{-1} = B^{-1}A^{-1}$. [6]
- (d) Define maximum matching. C_9 is a cycle (i.e. a circular chain) with nine vertices a,b, c, d, e, f, g, h, i. How many distinct matching of size five in C_9 contain edge ab? [5]