



# BRAINWARE UNIVERSITY

Course – MCA

Discrete Mathematics (MCA104)

(Semester – 1)

**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)

1. Choose the correct alternatives for any **ten** of the following: **1 x 10 = 10**
- i) If a set  $S = \{ 1, 2, 3 \}$ , then the power set of  $S$  is
- a)  $\{ \varnothing, S \}$       b)  $\{ \varnothing \}$
- c)  $\{ S \}$       d) None of the above .
- ii) If  $f(x) = \cos x$  and  $g(x) = x^3$  then ,  $(f \circ g)(x)$  is
- a)  $(\cos x)^3$       b)  $(\cos x^3)$
- c)  $\cos 3x$       d) None of the above.
- iii) What is the Cardinality of the Power set of the set  $\{0, 1, 2\}$ .
- a) 8      b) 6
- c) 7      d) 9
- iv) Solution of the recurrence relation  $a_n = 2\sqrt{2}a_{n-1} - 2a_{n-2}$  is
- a)  $A(2)^n + B(-2)^n$       b)  $(A + nB) 2^{n/2}$
- c)  $A(\sqrt{2})^n + B(-\sqrt{2})^n$       d) None of the above.
- v) How many onto (or surjective) functions are there from an  $n$ -element set to a 2-element set?
- a)  $2^n$       b)  $2^n - 1$
- c)  $2^n - 2$       d)  $2(2^n - 2)$

- vi)  $[\sim p \vee (p \rightarrow q)] \rightarrow \sim p$  is  
 a) Tautology                      b) Contingency  
 c) Contradiction                  d) Valid
- vii) In Prime's Algorithm, the weight of non-existing edge is taken as  
 a) 0                                      b)  $+\infty$   
 c) 1                                      d) None of the above
- viii) If a relation R defined on a straight line set S such that "aRb iff a is perpendicular to b" then the relation is  
 a) reflexive                          b) symmetric  
 c) transitive                         d) both a and c
- ix) Power set of empty set has exactly \_\_\_\_\_ element.  
 a) one                                    b) two  
 c) three                                 d) four
- x) Cardinality of the set of odd positive integers less than 10 is  
 a) 5                                        b) 3  
 c) 4                                        d) 6
- xi) The maximum degree of any vertex in a simple graph with n vertices is  
 a) n-1                                    b) n+1  
 c)  $n(n-1)/2$                           d) n

### Group – B

(Short Answer Type Question)

**3 x 5 = 15**

Answer any **three** of the following

2. Draw the Hasse diagram for the set  $S = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$  where the relation is divisibility.
3. Prove that  $A \times (B \cup C) = (A \times B) \cup (A \times C)$ . (Without using Venn diagram)
4. There are 30 players in a group. 10 play soccer, 12 play tennis, 15 play golf. 3 players play both soccer and tennis. 5 players play both tennis and golf. 4 players play both soccer and golf. 2 play all three games.
  - i) Find how many play only soccer, only tennis and only golf.
  - ii) Find how many play none.

5. Solve the following recurrence relation  $f(n) = f(n-2)$ ,  $f(0) = 1$  and  $f(1) = 6$

### Group – C

(Long Answer Type Question)

3 x 15 = 45

Answer any **three** of the following

6. i) A mapping function  $f: Q \rightarrow R$  is defined as  $f(x) = x/(x^2 - 2)$ ,  $x \in Q$  show that  $f$  is surjective but not injective.  
 ii) Solve the following system of equations by Matrix inversion method.

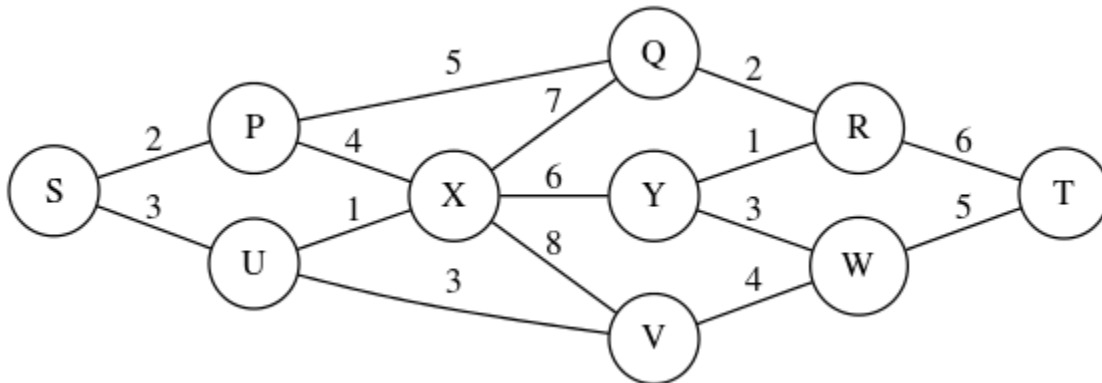
$$2x+3y+4z=5$$

$$x-y+2z=6$$

$$3x-5y-z=0$$

7+8

7. i) Consider the following graph and find the shortest path by Dijkstra's algorithm between S to T.



- ii) Find the rank of the following matrix.

$$\begin{bmatrix} 9 & 13 & 5 & 2 \\ 1 & 11 & 7 & 6 \\ 3 & 7 & 4 & 1 \\ 6 & 0 & 7 & 10 \end{bmatrix}$$

8 + 7

8. i) Solve the following recurrence relation  $f(n) = 4f(n-1) - 4f(n-2) - 3n + 4, f(0)=1$  &  $f(1)=4$   
ii) Find CNF for  $(\sim(p \rightarrow q) \leftrightarrow (\sim r \vee p)) \rightarrow q$  10 + 5
9. i) A relation R defined on a set Z such that “a R b iff  $5a + 7b$  is divisible by 12” show that R is equivalent.  
ii) Define minimal Spanning tree , Connected graph and Complete graph 6 + 9