BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – MCA-2024
Course Name – Mathematical Foundation for Computer Science
Course Code - MCA10102
(Semester I)

Full Marks : 60 **Time : 2:30 Hours**

[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 x 15=15

1. *Choose the correct alternative from the following :*

(i) Let R be a non-empty relation on a collection of sets defined by ${}_AR_B$ if and only if $A \cap B = \emptyset$, then, choose the correct option

a) R is reflexive and transitive
b) R is symmetric and not transitive
c) R is an equivalence relation
d) R is not reflexive and not symmetric

(ii) Choose the correct option: The number of committees of 2 boys and 3 girls that can be formed out of 7 boys and 6 girls is

a) 21
b) 20
c) 420
d) 5040

(iii) Determine the number of diagonals that can be drawn in a polygon of n sides

a) $\frac{n(n-1)}{2}$
b) $\frac{n(n+3)}{2}$
c) $\frac{(n-3)}{2}$
d) $\frac{n(n-3)}{2}$

(iv) Calculate the total number of words that can be formed from the letters of the word STUDENT.

a) 2520
b) 270
c) 4620
d) 5040

(v) Choose the correct one: Every vertex of a null graph is

a) Pendant
b) Isolated
c) Odd
d) None of these

(vi) Select the correct option: If the origin and terminus of a walk coincide then it is a

a) Path
b) Open walk
c) Circuit
d) Closed walk

(vii) Compute the maximum number of edges of a simple graph with 5 vertices and 2 components

a) 2 b) 7
c) 5 d) 6

(viii) For any given string $\alpha = abb^3a^2$, identify the value of $|\alpha|$

a) 5 b) 6
c) 7 d) 8

(ix) Identify the correct option: A grammar generates a

a) Grammar b) Alphabet
c) Automata d) Language

(x) Choose the correct option: The minimum number of states required in a DFA to accept the language consisting of all strings of even length over the alphabet {0,1} is:

a) 1 b) 2
c) 3 d) 4

(xi) Choose the correct option: The key difference between a DFA and an NFA is

a) DFA can have multiple transitions for the same input symbol
b) NFA accepts a string by visiting only one possible state
c) NFA can have ε (epsilon) transitions, while DFA cannot
d) None of these

(xii) Choose the correct answer: A finite automaton accepts a string if

a) It visits all the states in the automaton
b) It ends in an accepting state after reading the string
c) It completes the transition table
d) It has an infinite number of states

(xiii) Choose the correct option: A complete graph with 8 vertices has

a) 24 edges b) 26 edges
c) 29 edges d) 28 edges

(xiv) Choose the number of vertices of a complete graph with 15 edges

a) 6 vertices b) 12 vertices
c) 5 vertices d) 7 vertices

(xv) Select the correct option: A minimal spanning tree of a graph G is

a) A spanning sub graph b) A tree
c) Minimum weights d) All of these

Group-B

(Short Answer Type Questions) 3 x 5=15

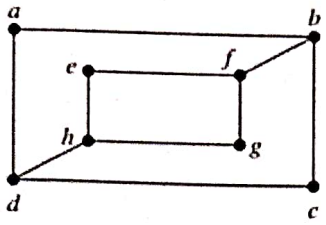
2. Define a partial ordering relation and provide an example of a partially ordered set (Poset). (3)

3. Write the truth table for $p \wedge q$ and $p \vee q$. (3)

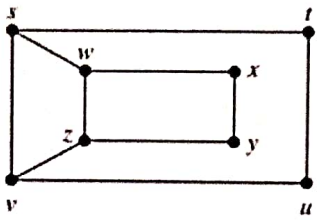
4. Suppose that a department contains 10 men and 15 women. Evaluate the number of ways to form a committee with six members if it must have the same number of men and women. (3)

5. Describe the graph $K_{1,5}$ and $K_{3,2}$. (3)

6. Justify that the following graphs G and H are isomorphic. (3)



G



H

OR

Distinguish DFS and BFS with example. (3)

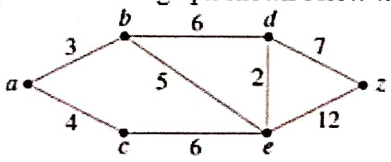
Group-C

(Long Answer Type Questions) 5 x 6=30

7. Construct a truth table for the compound proposition $(p \rightarrow q) \vee (\neg p \rightarrow r)$. (5)

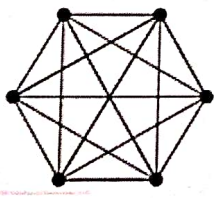
8. Evaluate the value of n if ${}^{n-1}P_3 : {}^{n}P_4 = 1:9$. (5)

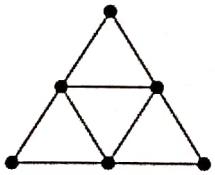
9. Illustrate the shortest path and shortest distance using Dijkstra's shortest path algorithm for the graph shown below with starting vertex a. (5)

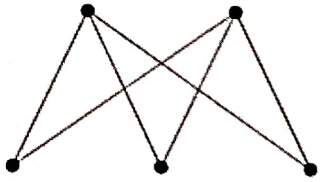


10. Show that the cube of any integer is of the form $9k, 9k \pm 1, k \in Z$. (5)

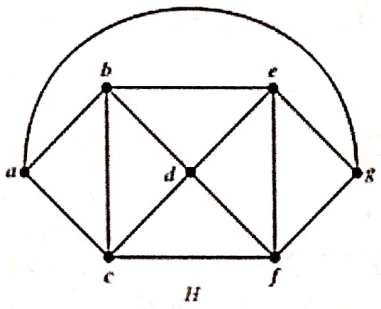
11. Estimate the chromatic number of the graphs below: (5)







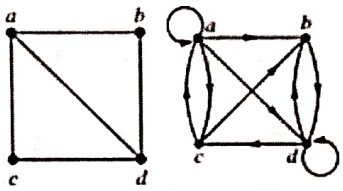
12. Estimate the chromatic numbers of the graph G shown below: (5)



H

OR

Evaluate the adjacency matrix of the following graphs. (5)



G H

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