



## **BRAINWARE UNIVERSITY**

## **Term End Examination 2022** Programme – MCA-2022 **Course Name – Mathematical Foundation for Computer Science Course Code - MCA104** (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.]

15

|       | Grou   | o-A  |             |
|-------|--|--|-------------|
| 1.    | (Multiple Choice T<br>Choose the correct alternative from the following  | • •  | 1 x 15=1    |
| (i)   | Let p: It is cold and q: It is raining, then identify the symbolic form of the statement 'It is cold or it is not raining' is  |  |             |
| (ii)  | a) $p \lor q$<br>c) $\neg p \land q$<br>Let p: It is cold and q: It is raining, then ident is not raining and it is not cold'  | b) $\neg p \lor q$<br>d) $p \lor \neg q$<br>ify the symbolic form of the statement             | : 'It       |
| (iii) | a) $\neg q \land p$<br>c) $\neg (q \land p)$<br>If $f: A \rightarrow \eth$ $\mu$ where $B = \{0, 1, 4, 9\}$ and findentify for which set A is the one-to-one function. |  | $ abla^2$ . |
| (iv)  | a) $\{-1,0,1,2\}$<br>c) $\{-2,0,-1,2\}$<br>Identify the correct option: In a graph if $e=[u,v]$ ,  | b) {-3,-1,0,2,3}<br>d) {0,1,2,3}<br>Then u and v are called                                    |             |
| (v)   | <ul><li>a) Endpoints of e</li><li>c) Adjacent nodes</li><li>Choose the correct answer: A graph with no circuit</li></ul>   | <ul><li>b) Neighbors</li><li>d) All of these</li><li>and no parallel edges is called</li></ul> |             |
| (vi)  | <ul><li>a) Multi graph</li><li>c) Simple graph</li><li>If a graph has 6 vertices and 15 edges then we</li></ul>  | b) Pseudo graph d) None of these rite down the size of its adjacency mat                       | rix is      |
|       | a) 6X6 c) 15X6 Choose the correct option: Number of edges in   | b) 6X15<br>d) 15X15  |             |
|       | a) <sup>n</sup> C <sub>1</sub> c) <sup>n</sup> C <sub>2</sub>  | b) <sup>n</sup> C <sub>2</sub> d) <sup>n</sup> C <sub>n</sub>                                  |             |

| (VIII)   | choose the correct option. The root of a binar  | y tree is the vertex having degree      |          |  |  |
|--|---|---|----------|--|--|
|  | a) 1  | b) 2                                    |          |  |  |
|  | c) 3  | d) 4                                    |          |  |  |
| (ix)   | Write down the operation in which NFA is not closed   |   |          |  |  |
|  | a) Negation   | b) Kleene                               |          |  |  |
| ()   | c) Concatenation  | d) none of these                        |          |  |  |
| (X)  | Choose the correct statement  |   |          |  |  |
|  | a) All NFAs are DFAs  | b) All NFAs are not DFAs                |          |  |  |
| (vi)   | c) both a and b   | d) None of these                        |          |  |  |
| (^1)   | (xi) Select the right option: For a give Moore Machine, Given Input='101010', thus the output would be of length: |   |          |  |  |
|  | a)  Input +1  | b)  Input                               |          |  |  |
|  | c)  | d) Cannot be predicted                  |          |  |  |
|  | Input-1   |   |          |  |  |
| (xii)  | The Grammar can be defined as: $G=(V, \sum, p, S)$ represents?  | ). In the given definition, what does S |          |  |  |
|  | a)  | b) Starting Variable                    |          |  |  |
|  | Accepting State   |   |          |  |  |
|  | c) Sensitive Grammar  | d) None of these                        |          |  |  |
| (xiii)   | Choose the right option: The set $(A \cup B \cup C)$  | •                                       |          |  |  |
|  | a) $B \cap C'$  | b) $B \cup C$                           |          |  |  |
|  | c) $A \cap C$   | d) $A \cap B' \cap C'$                  |          |  |  |
| (xiv)  | (xiv) Let $A = \{(x, y) : y = 2x + 5, x \in R\}$ , $B = \{(x, y) : y = 4x + 9, x \in R\}$ then select the right   |   |          |  |  |
|  | option  | 4 - P                                   |          |  |  |
|  | a) $A \cap B = \varphi$   | b) $A \cap B \neq \varphi$              |          |  |  |
| /va.A  | c) $A \cup B = R$   | d) $A \cup B = A$                       |          |  |  |
| (xv) How many symmetric relations are possible on a set with n elements? Select the right option |   |   |          |  |  |
|  | a) 2 <sup>n</sup>   | b) $2^{n(n-1)}$                         |          |  |  |
|  | c) $2^{n(n+1)/2}$   | d) $2^{n+2}$                            |          |  |  |
| Group-B  |   |   |          |  |  |
|  | (Short Answer Ty  | •                                       | 3 x 5=15 |  |  |
| 2. In (D60, ) compute the join and meet of 6 and 10.   |   |   | (3)      |  |  |
| 3. Differentiate between one-to-one and many-to-one mapping.                                     |   |   |          |  |  |
| OR   |   |   |          |  |  |
|  | Show that the number of ways in which 7 different beads can be arranged to form a necklace is 360.                |   |          |  |  |

4. Explain infimum and supremum for a poset.

(3)

OR

Explain join and meet for a poset

(3)

5. Calculate the number of committees of 2 boys and 3 girls that can be formed out of 7 boys (3) and 6 girls.

OR

Illustrate that the sum of the degree of all vertices in a graph is twice the number of edges (3) in the graph

6. Relation R is defined on integers and R={a-b is divisible by 10 where a and b are integers}. Test whether R is an equivalence relation.

OR

Solve the minimum number of edges necessary in a simple planar graph with 15 regions. (3)

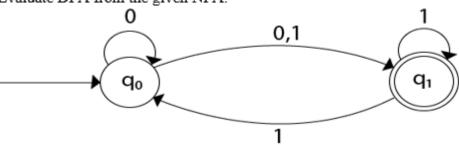
Group-C

(Long Answer Type Questions)

5 x 6=30

(5)

Evaluate DFA from the given NFA.

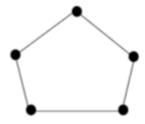


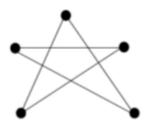
8. Examine if is an equivalence relation on  $\mathbb{Z}$ , where relation is defined on a set  $\mathbb{Z}$  by "a b (5) if and only if a-b is divisible by 5" for a,b  $\mathbb{Z}$ .

OR

(5)

Examine whether the following two graphs are isomorphic or not.





If R is a relation defined by

$$R = \{(x, y): x - y \text{ is divisible by 7}\}$$

Show that R is an equivalence relation.

OR

Explain the Konigsberg Bridge Problem and its solution.

(5)

(5)

10. Develop the following by using mathematical induction:  $1(1!) + 2(2!) + 3(3!) + \cdots + n(n!) = (n+1)! - 1$ 

(5)

OR

Determine the truth value of the quantifier  $\exists x, x^2 - 2x + 5 = 0$ ; set of all real numbers being the domain.

(5)

(5)

Without using truth table, Justify that ¬(P∨Q)∨(¬P∧Q)∨P is a tautology.

OR

Evaluate an NFA with  $\Sigma = \{0, 1\}$  in which double '1' is followed by double '0'

(5)

12. Explain the truth value of the universal quantifier of the propositional function P(x, y) stating " $x^2 + y^2 < 12$ " and the domain is  $\{1, 2, 3\}$ .

(5)

OR

Compare between Mealy M/C and Moore M/C.

(5)

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