ED-2851

BCA (Part-I) Examination, 2021

Paper - I

Discrete Mathematics

Time : Three Hours] [*Maximum Marks* : 80
[*Minimum Pass Marks* : 27

Note : Answer any **two** parts from each question. All questions carry equal marks.

Unit-I

1. (*a*) Simplify the following

$$\sim (\sim P \wedge Q) \wedge (\sim P \vee Q) \wedge (P \vee Q)$$

and verify by truth table.

(*b*) Write the converse, inverse and contrapositive of the following direct statement :

If *ABCD* is a square, then *ABCD* is a rectangle.

(**2**)

(*c*) Define quantifiers, universal quantifiers and existential quantifiers by given an example.

Unit-II

2. (*a*) In a Boolean algebra, show that if $a + b = a + c$ and $ab = ac$ then $b = c$.

(*b*) A ball has 3 doors and a central lamp. At each door, a switch is provided. Design a circuit in which each of these three switches can control the lamp independently of the other.

(*c*) If *a* is any element of a Boolean algebra *B*, then to prove that

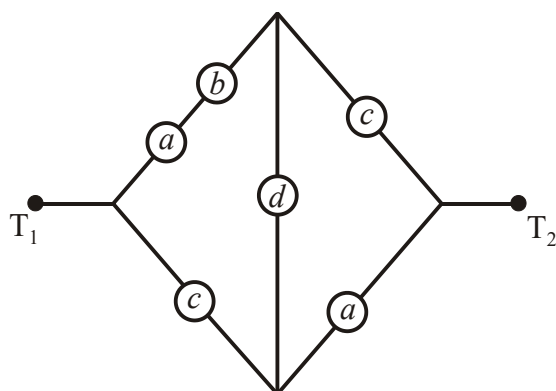(*i*) $a \leq 1$ and

(*ii*) $0 \leq a$

Unit-III

3. (*a*) Express the Polynomial

$$f(x, y, z) = [(xy')' + z'] \cdot [z + x']'$$

into disjunctive normal form.

(*b*) Find the Boolean function of the following circuit and simplify it, if possible :

(c) Draw a binomial network for the following function

$$a \cdot b \cdot c + a' \cdot b \cdot c + a \cdot b' \cdot c + a \cdot b \cdot c' + a' \cdot b' \cdot c'$$

Unit-IV

4. (a) If the ordered pairs $(x - 2, \; 2y + 1)$ and $(y - 1, \; x - 2)$ are equal. Find the values of x and y.

(b) If N is the set of natural numbers, then what is the domain of the relation
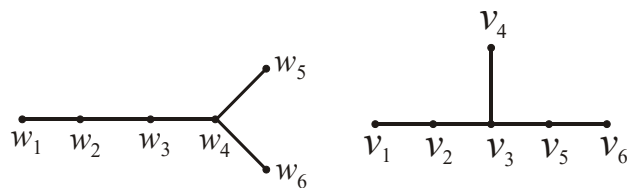
$$R = \{(x, \; y) \; : \; x + y = 7\}$$

where $x, \; y \in N$.

(c) If two mapping f and g are defined by

$f = \{(1, 2), (3, 6), (4, 5)\}$

$g = \{(2, 3), (6, 7), (5, 8)\}$

the find $g \circ f$.

Unit-V

5. (a) Show that the graphs given below are not isomorphic

(b) Draw the graph represented by the following adjacency matrix

$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

(c) Find the rank and nullity of the following graph G.

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