

H-98-21

Roll No.

ANNUAL EXAMINATION, 2021

B.C.A. I

B.C.A. 101

Paper I

(Discrete Mathematics)

Time : 3 Hours]

[Maximum Marks : 80

Note : Attempt any two parts from each unit. All questions carry equal marks.

Unit-I

1. (a) Prove that :
 $(p \Leftrightarrow q) \wedge (q \Leftrightarrow r) \Rightarrow (p \Leftrightarrow r)$ is a tautology.
- (b) Show that :
 $\sim (p \Rightarrow q) \equiv p \wedge (\sim q)$.
- (c) Explain the universal and existential quantifiers and also explain its negation.

Unit-II

2. (a) Prove the following identity in a Boolean algebra $(B, +, \cdot, ', 0, 1)$
 $(a + b) \cdot (a' + c) = a \cdot c + a' \cdot b \quad \forall a, b, c \in B$.

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- (b) Draw the logic circuit for the following expression.

$$f \equiv (a + b) \cdot (a' + b' + c') \cdot (b' \cdot c).$$

- (c) Draw a circuit for the following Boolean function and replace it by a simpler one :

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

Unit-III

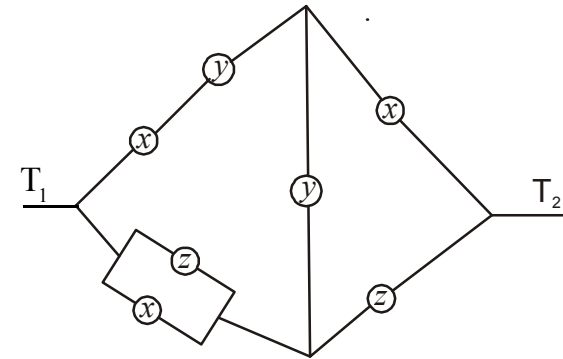
3. (a) Write the following functions into conjunctive normal form

$$f(x, y, z) = x \cdot y' + xz + xyz.$$

- (b) Change the following function to disjunctive normal form :

$$f(x, y, z, t) = [x' \cdot y + x \cdot y \cdot z' + xy' \cdot z + t].$$

- (c) Simplify the following circuit :



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Unit-IV

4. (a) Show that the relation “ $x R y \Leftrightarrow x - y$ is divisible by 3” where $x, y \in I$ defined in the set of integer I is an equivalence relation.
- (b) Let $A = \{-2, -1, 0, 1, 2\}$ and $f: A \rightarrow Z$ (set of integers) be given by $f(x) = x^2 - 2x - 3$ find (a) the range of f , (b) pre-images of 6, -3, -5.
- (c) Let $f: A \rightarrow B$ if function f is one-one onto, then show that f^{-1} is also one-one onto.

Unit-V

5. (a) Show that a complete graph with five vertices is not a planar graph.
- (b) Show that a simple graph with n vertices has $\frac{n(n-1)}{2}$ maximum number of edges.
- (c) Explain the spanning tree of a given graph.

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