

BCA 02 Discrete Mathematics

SET: 1

Section-A

(Very Short Answer Questions)

- 1
 - (i) Explain the significance of base/radix of a number system.
 - (ii) What does EBCDIC stands for?
 - (iii) What is tautology?
 - (iv) Explain inverse of a relation, with suitable example.
 - (v) 'Every lattice is a poset but converse need not necessarily be true'. Justify the statement.
 - (vi) Explain the term Complex of a group.
 - (vii) Tell in brief about Cancellation laws in a ring.
 - (viii) If $a' + b = 1$ then, what is value of ab' ?
 - (ix) What is meant by complement of a Boolean function?
 - (x) Write Boolean expression for two input XNOR gate.

Section-B

(Short Answer Questions)

2. How positional and non-positional number systems are different from each other, explain with example?
3. Explain with example, Roster and Set builder form to represent a set.
4. Write the following compound propositions in symbolic form
 - a) It is not hot
 - b) It is hot or it is not raining
 - c) He is dark but tall
 - d) It is false that it is raining or it is cold
 - e) Laxman is neither tall nor intelligent.
5. Differentiate between reflexive and non reflexive relation, with suitable example.
6. Show that the set $N \times N = \{(a, b) \mid a, b \in N\}$ is a monoid with the binary operation $*$ defined by $(a_1, b_1) * (a_2, b_2) = (a_1a_2, b_1b_2)$ for $(a_1, b_1), (a_2, b_2) \in N \times N$.
7. If R is a ring such that $a^2 = a$, for all $a \in R$. Prove that
 - a) $a + b = 0 \Rightarrow a = b$, for all $a, b \in R$
 - b) R is commutative ring
8. In the Boolean algebra B , prove that for elements $a, b, c \in B$
 - a) $(a + b)(a' + c)(b + c) = ac + a'b + bc$
 - b) $(a + b)' + (a + b')' = a'$
 - c) $ab + a'b' = (a + b')(a' + b)$
9. Explain in brief about POS and SOP forms to represent Boolean expressions, with suitable example.

Section-C
(Long Answer Questions)

10. Perform following conversions

- a) $(39.625)_{10} = (?)_2$ b) $(100.101)_2 = (?)_{10}$ c) $(101101.01)_8 = (?)_{10}$
d) $(347.12)_{16} = (?)_{10}$ e) $(567)_{10} = (?)_8$ f) $(110010)_2 = (?)_8$
g) $(43215)_8 = (?)_2$ h) $(111011)_{16} = (?)_2$ i) $(111011)_2 = (?)_{16}$

11. Let \approx be a relation on $A \times A$ defined as follows

$(a,b) \approx (c,d)$ whenever $ad=bc$

where A is set of non zero integers. Determine whether \approx is an equivalence relation or not.

12. Solve following

a) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ and $g: \mathbb{R} \rightarrow \mathbb{R}$ be two functions such that

$f(x) = x-1, g(x) = x/2$

Then find fog and gof

b) Find the inverse of function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined as

$f(x) = 3x+8$

c) Let $A = \mathbb{R} - \{3\}, B = \mathbb{R} - \{1\}$, show that function $f: A \rightarrow B$, such that

$f(x) = (x-4)/(x-3)$ is one-one onto.

d) Let $A = \{-2, 1, 3, 4\}$. A function $f: A \rightarrow A$ is defined such that

$f(x) = x^2 - 2x + 2$

Find range of $f(x)$ and pre-image of 5.

13. Prove the following theorem

If N is a normal subgroup of G and G/N is the set of all right cosets of N in G, then G/N is a group under the binary operation defined as $N_x N_y = N_{xy}$ for all $N_x, N_y \in G/N$.

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BCA 02 Discrete Mathematics

SET: 2

Section-A

(Very Short Answer Questions)

- What would be octal equivalent of $(953)_{10}$?
 - Explain cardinality of a set.
 - Explain contradiction.
 - What is meant by Domain and Range of relation?
 - Define Poset.
 - Specify the condition, when a group G is said to be Simple group.
 - Prove that in a ring, an invertible element cannot be a divisor of zero.
 - Write the dual of the expression $ab+ac$.
 - Justify the statement that 'Number of switches involved in the bridge-circuit is always less than that of number of switches involved in equivalent(corresponding) series-parallel switching circuit.'
 - Which logic gate is also called inverter?

Section-B

(Short Answer Questions)

- Explain the method of subtraction of binary numbers using complement method. Illustrate by subtracting 1010 from 11001 using complement method.
- State and prove De-Morgan laws for sets.
- What do you mean by Partition of a set, explain with suitable example? Also, examine whether the following is partition of the set N of natural numbers
 $P = [\{n \mid n > 3\}, \{1, 2, 3, 4\}]$
- Draw Hasse diagram of poset $(A, |)$
where $A = \{1, 2, 3, 4\}$; $a R b$ if $a \mid b$.
- Let $S = N \times N$. If $*$ is a binary operation on S defined by
 $(a_1, b_1) * (a_2, b_2) = (a_1 + a_2, b_1 + b_2)$ for $(a_1, b_1), (a_2, b_2) \in S$
 - Show that $(S, *)$ is a semigroup.
 - $(S, *)$ is not a monoid.
- Show that the set
 $F = \{a + b\sqrt{2} : a, b \in Q\}$
is a field.
- Minimize following Boolean expressions
 - $x_1 x_2 + x_1' + (x_1 x_2)'$
 - $(x_1 + x_2)(x_1 + x_2')(x_1' + x_2)$
- 'NOR gate and NAND gate are universal gates.' Justify the statement, with suitable example.

Section-C
(Long Answer Questions)

10. Explain with example, following computer codes

- a) BCD b) EBCDIC c) ASCII d) UNICODE

11. Describe following terms, with suitable example

- a) Equivalent Sets b) Equal Sets c) Null Set d) Singleton Set
e) Sub Sets f) Proper Subsets g) Improper Subsets h) Power Set
i) Universal Set j) Complement of Set k) Disjoint Sets

12. Solve the following

- a) Transform Boolean function $E(x_1, x_2, x_3) = (x_1 + x_2)(x_2 + x_3)(x_1 + x_3)$, into conjunctive normal form.
b) Transform Boolean expression $E(x_1, x_2, x_3) = x_1 + x_1 x_2 + x_1 x_2 x_3$, into disjunctive normal form.
c) Simplify three variable Boolean expression $\prod(1, 2, 4, 7)$ using the Boolean algebra.
d) Simplify three variable Boolean expression $\sum(1, 3, 5, 7)$ using Boolean algebra.

13. Perform tasks as specified in following questions

- a) Construct the logic circuit using only NAND gates for Boolean expression
 $E(x, y, z) = (x' + y)z + y' + xz$
b) Implement the Boolean expression for XNOR gate, using only NOR gates.
c) Draw the logic circuit for Boolean expression
 $E(x, y, z) = (x + yz)' + y$
d) Show that the Boolean expression $E(x, y, z) = x y z'$, can be implemented with one two input NOR gate and one two input NAND gate.

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