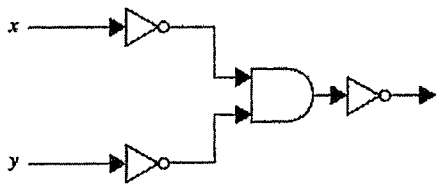


Figure (ii)

(7.5)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2597 **I**

Unique Paper Code : 2352201102

Name of the Paper : Elements of Discrete Mathematics (DSC-2)

Name of the Course : **B. A. (Prog.)**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll. No. on the top immediately on receipt of this question paper.
2. Attempt all questions by selecting two parts from each question.
3. Parts of question to be attempted together.
4. Use of Calculator not allowed.

1. (a) (i) Compute the truth table of the statement

$$\sim (p \Rightarrow q) \Rightarrow p$$

Is it a tautology?

(ii) If A = {3, 7, 2}, find $P(A)$, the Power set of A. (7.5)

(b) Show that the relation "is less than" in the set of real numbers is transitive and anti- symmetric, but not reflexive. (7.5)

(c) Show that the relation

$R = \{(a, b): a, b \in \mathbb{Z}$, and $a - b$ is divisible by 3$\}$.

where $\mathbb{Z}$ is the set of integer, is an equivalence relation. (7.5)

(b) Construct the circuit diagram corresponding to the Boolean function

(i) $f = (x_1 + x_2 + x_3)(x_1' + x_2)(x_1 x_3 + x_1' x_2)(x_2' + x_3)$

(ii) $g = x_1' x_2' x_3 + x_1' x_2 x_3 + x_1 x_2'$ (7.5)

(c) Determine the output of the symbolic representation in figure (i) and figure (ii)

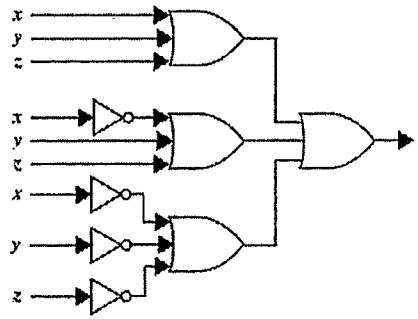


Figure (i)

5. (a) Define Disjunctive Normal Form. Convert the Boolean function

$(x' + y' + z').\ (x' + y + z).\ (x + y + z)$

in disjunctive normal form. (7.5)

(b) Use K-map to simplify the Boolean polynomial

$x_1\ x_2\ x_3 + x_1'\ x_2\ x_3' + (x_1 + x_2'\ x_3')\ (x_1 + x_2 + x_3)'$
$\cdot x_3\ (x_1' + x_2)$. (7.5)

(c) For all x, y in a Boolean algebra, we have:

$(x \wedge y)' = x' \vee y'$ and $(x \vee y)' = x' \wedge y'$. (7.5)

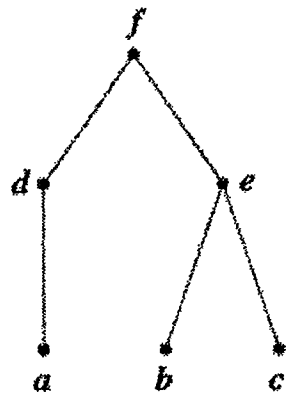
6. (a) Use Quine Mc-Cluskey to find the minimal form of f

$f=x'yz+x'yz' + x'y'z + xy'z' + xy'z$ (7.5)

2. (a) Show, by mathematical induction, that for all $n \geq 1$,

$$1+ 2+ 3.....+ n = \frac{n(n+1)}{2}$$ (7.5)

(b) Find the greatest element, least element, all maximal and minimal elements of the Poset whose Hasse diagram is given by:



(7.5)

(c) Let $A = B = C = \mathbb{R}$, and let $A \to B, g : B \to C$ be defined by

$f(a) = a + 1$ and $g(b) = b^2 + 2$.

Find $(g \circ f)(x)$ and $(f \circ g)(x)$. (7.5)

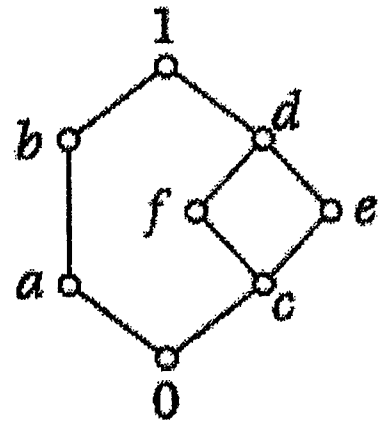
3. (a) Show that the relation of divisibility (a R b if and only if a/b) is a partial order on $\mathbb{Z}^+$, set of positive integers. (7.5)

(b) Let A= {1, 2, 3, 4}, R = {(1, 1), (1, 2), (2, 2), (2, 4), (1, 3), (3, 3), (3, 4), (1, 4), (4, 4)}, draw the Hasse diagram of the relation R. (7.5)

(c) Define a distributive lattice. Show that every chain is a distributive lattice. (7.5)

4. (a) Is complement of an element in a lattice always unique? Justify your answer. (7.5)

(b) Is the following lattice distributive? Justify your answer.



(7.5)

(c) Let A be the set $\mathbb{Z}^+$ of positive integers, and let $\leq$ be the usual partial order on A. Let A_1 be the set of positive even integers, and let $\leq_1$ be the usual partial order on A_1. Show that the function $f: A \to A_1$ given by:

$f(a) = 2a$ (7.5)

is an isomorphism from $(A, \leq)$ to $(A_1, \leq_1)$.