Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA - SEMESTER– I• EXAMINATION – SUMMER 2016

Subject Code: 610003 **Date: 09-05-2016**
Subject Name: Discrete Mathematics for Computer Science
Time: 02.30 pm To 05.00 pm **Total Marks: 70**
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** **i)** Consider the statement, "If today is Monday, then I will go for a walk". Write converse, inverse and contrapositive for the given statement. **04**
ii) Test whether the given arguments are logically valid or not. **03**
"If it rains, the prices of vegetables go up. The prices of vegetables go up. So it rains."

(b) 1.Let A= {1, 2, 3} then show that the inclusion relation $\subseteq$ on A is a partial ordering. **03**
2. Define Direct Product and draw the Hasse diagrams of <S,D>, <L,D> and <S X L, D> for S = {1,3,6} and L = {1,2,4}. **03**
3. State the Lagrange's theorem. **01**

Q.2 **(a)** Draw hasse diagram for the following. **07**
(i) (S_{60}, D) (ii) (S_{100}, D).
Here S_n is the set of divisors of n.

(b) Using indirect proof technique, show that if a^2+3 is odd, then a is even. Where a is an integer. **07**

OR

(b) Show that < S30,*, $\oplus$ > and <P(A), $\cap$,$\cup$> are isomorphic lattices for A = {a,b,c}. **07**

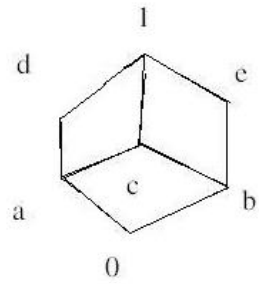
Q.3 **(a)** 1. Consider lattice < S_{10}, *, $\oplus$ >, where S10 = {1,2,5,10}. Find the complements of the elements of S10. **02**
2. Write the following Boolean expression in an equivalence sum-of products canonical form in three variables x1,x2 and x3.
I) x1 $*$ x2. **02**
II) x1 $\oplus$ x2. **03**

(b) 1. Show that (Using laws) the following Boolean expressions are equivalent. **02**
(i) [a * (b' $\oplus$ c)]' * [b' $\oplus$ (a * c')']' = a * b * c' **02**
(ii) (x $\oplus$ y) * (x' $\oplus$ y) = y
2. By constructing the truth table that prove that p $\wedge$ (~q $\rightarrow$ ~p) $\rightarrow$ q is a tautology **03**

OR

Q.3 **(a)** Define: Sub-Lattice. Show that S_6 is sub lattice of lattice <S_{30}, D>. **07**

(b) Define: Join-irreducible, Meet-irreducible, Atoms and Anti-Atom. **07**
Determine the join-irreducible, meet-irreducible, atoms and anti-atoms for given lattice.



Q.4 **(a)** Use the Quine McClusky method to simplify the SOP expansion, **07**
$F(a,b,c,d) = \Sigma\ (0, 2, 4, 6, 8, 10, 12, 14)$ and draw the circuit diagram of the minimized function.

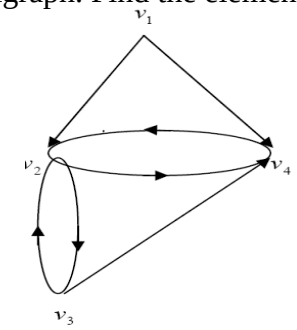
(b) Prove that $<Z_{11}^*, *_{11}>$ forms a group with respect to multiplication modulo 11. **07**

OR

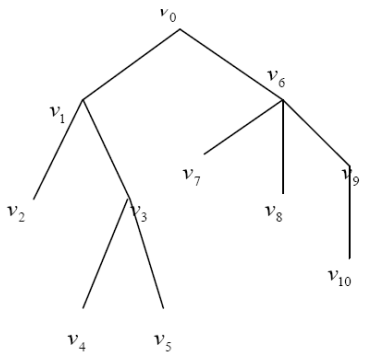
Q.4 **(a)** Prove that the relation "Congruence modulo n" given by {<x,y> | x-y is divisible by n} is an equivalence relation. **07**

(b) i)Show that $(Z_6, +_6)$ is a cyclic group of order 6 and also find its generators. **05**
ii) In any Boolean algebra, show that **02**
$a \leq b \Rightarrow a \oplus (b * c) = b * (a \oplus c)$

Q.5 **(a)** i) Define Multigraph. **01**
ii) Define adjacency matrix of a digraph. Obtain the adjacency matrix A of the given digraph. Find the elementary paths of lengths 1 and 2 from v_1 to v_4. **06**

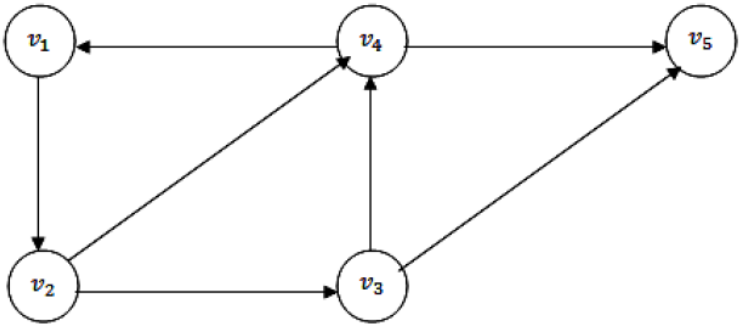


(b) Define directed tree. Draw different representation of the following tree. **01**
06



OR

Q5. **(a)** Find the strong components of the following diagraph. Also find its unilateral and weak components. **07**



(b) Define Sub group. Find the subgroups of $(Z_{10}, +_{10})$ **02**
05