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SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E-CSE
Title of the Paper: Discrete Mathematics — Max. Marks: 80
Sub. Code: 411503-611503 — Time: 3 Hours
Date: 10/11/2010 — Session: FN

PART - A (10 X 2 = 20)

Answer ALL the Questions

1. Define functionally complete set of connectives and give an example.

2. Write the following sentence in a symbolic form:
"Every one who is healthy can do all kinds of work".

3. Draw the Hasse diagram of $(X, \leq)$, where X is the set of positive divisors of 45 and the relation $\leq$ is such that
$\leq = \{(x, y); x \in A, y \in A \wedge (x \text{ divides } y)\}$

4. Find the partition A = {1,2,3,4,5,6} with minsets generated by $B_1 = \{1,3,5\}$ and $B_2 = \{1,2,3\}$.

5. In the group {2,4,6,8} under multiplication modulo 10, what is the identity element?

6. Show that the intersection of two normal subgroups is a normal subgroup.

7. Give an example of a lattice which is a modular but not a distributive.

8. A label identifier, for a computer system consist of one English alphabet in capital letter followed by two non-zero digits. If repetition of digits is allowed, how many label identifiers are possible?

9. Define a regular graph.

10. Find the minimum height of a 11-vertex binary tree.

PART – B (5 x 12 = 60)

Answer All the Questions

11. (a) Test whether the following formula:
$Q \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$ is a tautology or contradiction without constructing the truth table.
(b) Using rule CP, derive $P \rightarrow (Q \rightarrow S)$ from $P \rightarrow (Q \rightarrow R)$, $Q \rightarrow (R \rightarrow S)$.

(or)

12. (a) Obtain the principle conjunctive normal form of
$(\neg P \rightarrow R) \wedge (Q \rightleftarrows P)$
(b) Prove that $(\exists x)\ (P(x) \wedge Q\ (x)) \Rightarrow (\exists x)\ P(x) \wedge (\exists x)\ Q(x)$.

13. (a) Let a relation R be defined on the set of all real numbers by 'if x, y are real numbers, xRy $\Leftrightarrow$ x-y is a rational number' show that R is an equivalence relation.
(b) Draw the Hasse diagram of the relation $\subseteq$ on P(A), where
A = {a, b, c}

(or)

14. (a) Show that f: R $\rightarrow$ R defined by $f\ (x) = 2x-3$ is a bijection and find its inverse. Compute $f^{-1} \circ f$ and $f \circ f^{-1}$
(b) If f : A $\rightarrow$ B, g : B $\rightarrow$ C & h : C $\rightarrow$ D are functions then prove that ho (gof) = (hog) of.

15. State and prove Lagrange's Theorem.

(or)

16. (a) If $f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 1 \end{pmatrix}$ and $g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 1 & 4 & 2 \end{pmatrix}$, find f^{-1} gf and gfg^{-1}

(b) Prove that the cyclic group is abelian

17. (a) Solve the recurrence relation $a_n - 5a_{n-1} + 6a_{n-2} = 0$ where $a_0 = 2$ and $a_1 = 5$

(b) Prove by using induction that $a^n - b^n$ is divisible by $(a - b)$ for all $n \in N$.

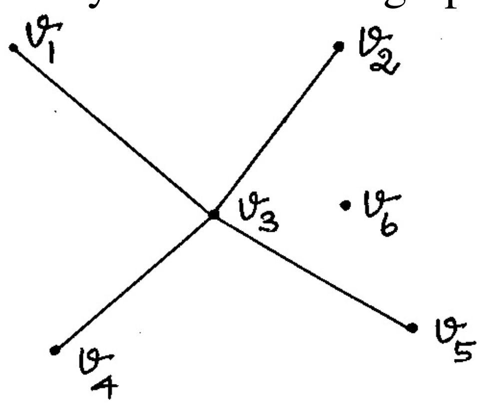
(or)

18. (a) Show that if L is a distributive lattice then for all $a,b,c \in L$,
$(a*b) \oplus (b*c) \oplus (c*a) = (a \oplus b)*(b \oplus c)*(c \oplus a)$.

(b) Find the minimum sum for the function.
$f(a,b,c,d) = a'b'c'd' + a'bc'd + a'b'cd + a'b'cd' + a'bcd$, by Karnaugh map method.

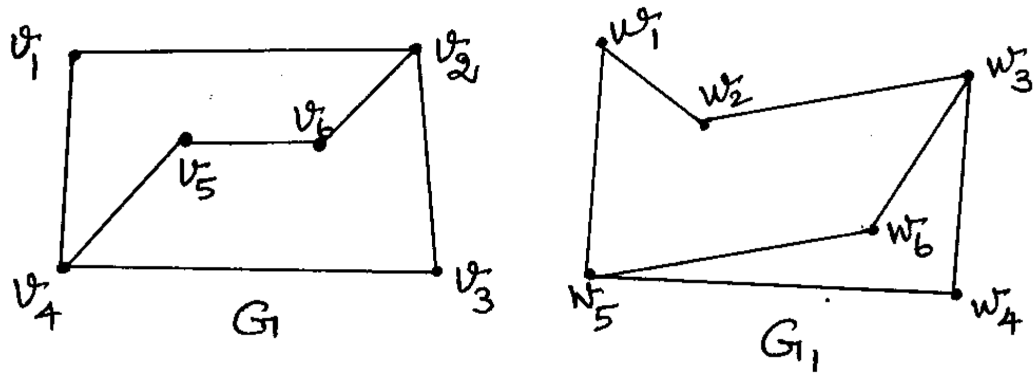
19. (a) Show that a simple graph with n vertices and k components can have at most $\dfrac{(n-k)(n-k+1)}{2}$ edges. (8)

(b) Write the adjacency matrix of the graph. (4)



(or)

20. (a) Verify if G and G_1 are isomorphic



(b) What is the postfix form of ((a+b)↑3) + ((a-b) /3)?