

ADCA/MCA (II Yr.)
Term-End Examination
December, 2008

CS-07 : DISCRETE MATHEMATICS

Time : 3 hours

Maximum Marks : 75

Note : Question number 1 is compulsory. Answer any three questions from the rest.

1. (a) Show that the following is a tautology (use truth table) : 3
- $$(p \vee \sim q) \wedge (\sim p \vee \sim q) \vee q$$
- (b) Write the negation of following : 3
- (i) If it is raining, then the game is cancelled.
- (ii) He swims if and only if the water is warm.
- (c) Write Principal Disjunctive Normal Form (PDNF) of : 4
- (i) $\sim p \vee q$
- (ii) $\neg (P \wedge Q)$

- (d) Let $A = \{1, 2, 3\}$, $B = \{1, 2, 3, 4\}$. 4
 If $R_1 = \{(1, 1), (2, 2), (3, 3)\}$ and
 $R_2 = \{(1, 1), (1, 2), (1, 3), (1, 4)\}$ relation on A.
 Then find $R_1 \cup R_2, R_1 \cap R_2, R_1 - R_2, R_2 - R_1$?

- (e) Express $P \rightarrow Q$ using NAND only. 3

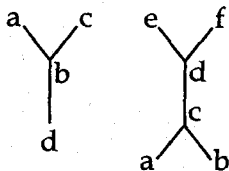
- (f) Let $A = \{1, 2, 3, 4\}$ and R, S be relation on A 3
 defined by

$$R = \{(1, 2), (1, 3), (2, 4), (3, 2)\}$$

$$S = \{(1, 4), (4, 3), (2, 3), (3, 1)\}$$

Find $S \circ R$.

- (g) Which of the following is/are not a Lattice 3
 and why ?



- (h) If $A = \{(x_1, 0.3), (x_2, 0.4), (x_3, 0.5)\}$ 3

$$B = \{(x_1, 0.2), (x_2, 0.6), (x_3, 0.7)\}$$

Find B^c and $A - B$?

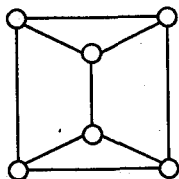
- (i) Draw the transition diagram of a finite state 4
 automaton that accepts the given set of
 strings over $\{a, b\}$

(i) even number of a's

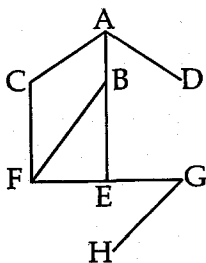
(ii) exactly one b

2. (a) Draw Circuit diagram of full adder using two half adder. Also write truth table for half adder and full adder. 4

(b) Show that following graph is bipartite. 3



(c) Apply Breadth First Search on the following graph and write the order of visiting the vertices. 4



(d) Let $f(x) = x + 2$, $g(x) = x - 2$, $h(x) = 3x$ for $x \in \mathbb{R}$ where \mathbb{R} is set of Real Numbers. Find gof , hog , $fogoh$? 4

3. (a) Define the following : 5

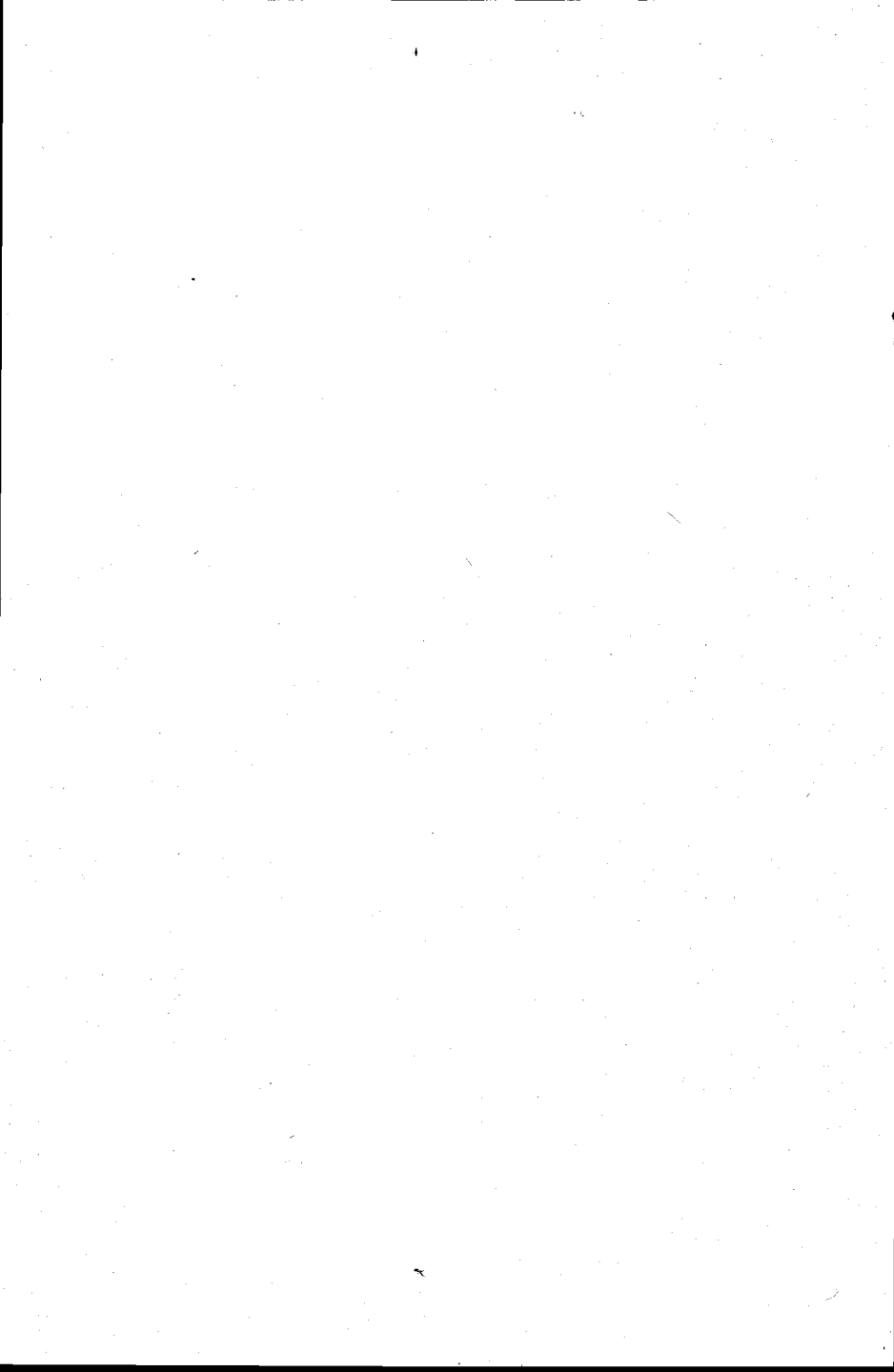
(i) Cut vertex

(ii) Bridge

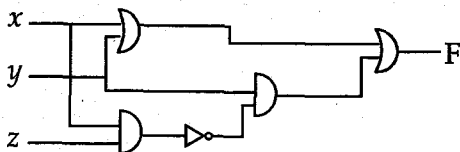
(iii) Path

(iv) Walk

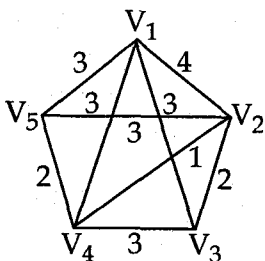
(v) Subgraph



- (b) Write the Boolean expression for the circuit. 3



- (c) Apply Prim's algorithm on following graph to determine a Minimal Spanning tree. 4



- (d) If 63% persons like Oranges where 76% like Apples. What percentage of persons who like both Oranges and Apples? 3

4. (a) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = ax + b$ 4
where $a, b, x \in \mathbb{R}$ and $a \neq 0$.

Show that f is invertible and find the inverse of f ?

- (b) Define lattice. Draw Hasse diagram of divisors of 81 with 'division' operation. 3
- (c) Let I is a set of all integers; $x \equiv y \pmod{5}$ is an equivalence relation in I . Find what is partition of I . 3

(d) The Lattice $b_1 \begin{array}{c} 1 \\ \diagdown \quad \diagup \\ b_2 \\ \diagup \quad \diagdown \\ 0 \end{array} b_3$ is not 3
 distributive. Prove it ?

(e) If $x = (1\ 2\ 3)$, $y = (2\ 4\ 3)$, $z = (1\ 3\ 4)$. Then 2
 show that $xyz = I$.

5. (a) Use Karnaugh Map to simplify 4
 $X = A'B'C' + AB'C'$.

(b) Write -7 using 1's complement and 2's 3
 complement.

(c) Write truth table of XOR. 3

(d) If R is transitive relation on a Set A then 3
 show that R^{-1} is also a transitive relation
 on A .

(e) Draw $K_2, 5$. 2

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