

**ADCA / MCA (II Yr)**  
**Term-End Examination**  
**December, 2007**

**CS-07 : DISCRETE MATHEMATICS**

Time : 3 hours

Maximum Marks : 75

**Note :** Question no. 1 is **compulsory**. Answer any **three** questions from the rest.

1. (a) Explain the following equation 3  
 $\sim(\forall x P(x)) \equiv \exists x \sim P(x)$
- (b) Express  $P \leftrightarrow Q$  using  $\neg$  and  $\vee$  only. 4
- (c) Explain the following inference 3  

$$\begin{array}{r} p \rightarrow q \\ \hline \sim q \\ \hline \sim p \end{array}$$
- (d) Find the binary tree representation for  $(xy - 7z)$ . 2
- (e) Explain the concept of 2+1+2=5  
 (i) cut-set  
 (ii) bridge  
 (iii) cut-vertex  
 with suitable example.

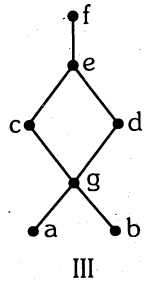
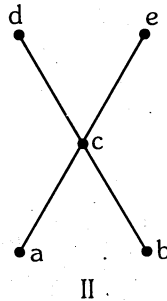
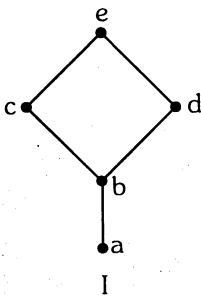
(f) Let  $A = \{1, 2, 3, 4\}$ .

Let  $R$  be a relation defined on  $A$  such that  $xRy$  iff  $x + y \leq 6$ . Check if this relation is reflexive, symmetric, asymmetric.

4

(g) Which of the following are lattices and which are not?

3



(h) Describe complemented lattice. Show that  $(D(105), \text{gcd}, \text{lcm})$  is a unique complemented lattice.

6

2. (a) Using truth table prove

$(P \vee Q) \vee (\neg P)$  is a tautology.

3

(b) Prove

$(\neg P \wedge \neg(\neg Q \wedge \neg R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$

4

(c) Find principal disjunctive normal form of

$\neg P \vee Q$

4

(d) Represent the following equation using NAND gates only :

$X \cdot \bar{Y}$

4

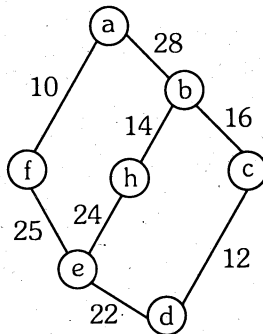
3. (a) Let  $A = \{a, b, c, d, e\}$ ,  $B = \{c, d, e, f, h, k, m\}$ .  
 Prove  $|A \cup B| = |A| + |B| - |A \cap B|$ . 3

(b) Let  $A$  be a set of divisors of 30 i.e.  
 $A = \{1, 2, 3, 5, 6, 10, 15, 30\}$ . Let  $|$  be divisibility operator i.e.  $a | b$  means  $b$  divides  $a$ . Show that  $(A, |)$  is poset and draw the Hasse diagram. 5

(c) Let  $A = \{a, b, c, d\}$ ,  $B = \{1, 2, 3\}$ .  
 Let  $R$  be a relation from  $A$  to  $B$  such that  
 (i)  $R = \{(a, 1), (b, 2), (c, 1), (d, 2)\}$   
 (ii)  $R = \{(a, 1), (b, 2), (a, 2), (c, 1), (d, 2)\}$   
 Check if  $R$  is a function. If yes, find its range. 4

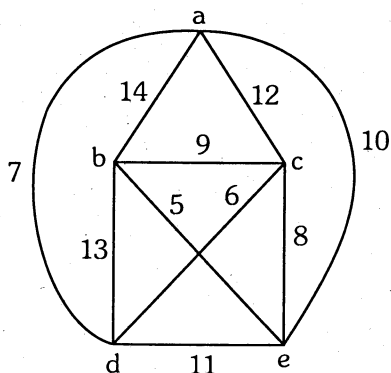
(d) What do you mean by diameter of a tree? Give an example. 3

4. (a) Use Prim's algorithm to find the minimum spanning tree of the following graph : 5



(b) State Konigsberg's 7 bridge problem and explain Euler's answer to this problem. 5

- (c) Find the solution to the following travelling salesman problem using closest insertion, starting vertex being a. 5



5. (a) Find  $37 - 49$  using 2's complement. (Use eight-bit arithmetic). 4
- (b) Give the design of 4-bit adder. 5
- (c) Solve the following equation using Karnaugh map : 6
- $$f(w, x, y, z) = \Sigma (0, 1, 2, 4, 6, 8, 11, 12, 14)$$