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2nd Year 1st Semester B.Sc. Engg. Examination – 2013

Department of Computer Science and Engineering

Course No: MAT204 Course Title: Discrete Mathematics

Full Marks: 70 Time: 3 Hours

N.B.: i) Answer **SIX** questions, taking any **THREE** from each section.

ii) All questions are of equal values.

iii) Used separate answer script for each section.

Section –A

1. a) What do you mean by the terms contrapositive, converse and inverse? Find the contrapositive, converse and inverse of the conditional statement: The home team wins whenever it is raining. 5

   b) Construct a truth table for each of these compound propositions- 4

   i) $(p \leftrightarrow q)\ V\ (\neg q \leftrightarrow r)$ ii) $\big((p \rightarrow q) \rightarrow r\big) \wedge \neg p$

   c) How can these English sentences be translated into logical expression? $2\frac{2}{3}$

   i) You can access the Internet from campus only if you are a CSE major or you are not a freshman.

   ii) The user has paid the subscription fee, but does not enter a valid password.

2. a) Prove that if x is a real number, then $\lfloor 2x \rfloor = \lfloor x \rfloor + \left\lfloor x + \frac{1}{2} \right\rfloor$ 3

   b) Define relation. How can you represent a relation? 2

   c) Is divides relation on the positive integers reflexive and symmetric? 3

   d) Determine whether the relation for directed graph shown in fig(a) are reflexive, symmetric, antisymmetric and/or transitive. $3\frac{2}{3}$

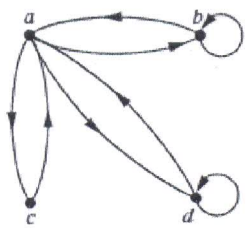
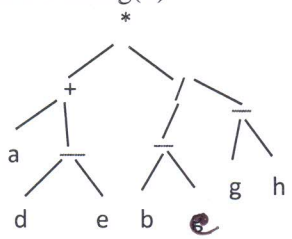


Fig: a

3. a) Consider the binary tree T in fig(b) 6



Simulate the inorder traversal algorithm with tree T and show the contents of STACK at each step.

   b) Write Huffman's algorithm. Suppose A, B, C, D, E, F, G, H and I are 9 data items, and suppose they are assigned weights as follows: $5\frac{2}{3}$

Data Item:	A	B	C	D	E	F	G	H	I
Weights:	22	5	11	19	2	11	25	5	30

How to construct the tree T using Huffman's algorithm?

4. a) What is a language? $1\frac{2}{3}$

b) Discuss about properties of algebraic system with example. 5

c) Consider the set Q of rational numbers and let * be the operation on Q defined by 5
a*b= a + b - ab

i) Find 3*4, 2* (-5)

ii) Is (Q, *) a semi group? Is it commutative?

iii) Find the identity element for *.

Section – B

1. a) Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology without using a truth table. 3

b) Show that $(p \rightarrow r) \wedge (q \rightarrow r)$ and $(p \vee q) \rightarrow r$ are logically equivalent. 3

c) Express the statement " Every student in this class has studied Data Structure using predicates and quantifiers $1\frac{2}{3}$

d) What is the rule of inference? Show that the hypothesis "It is not sunny this afternoon and 4
it is colder than yesterday, "We will go swimming only if it is sunny," "If we do not go swimming, then we will take a canoe trip," and "If we take a canoe trip, the we will be home by sunset". Lead to the conclusion "we will be home by sunset".

2. a) Define transitive relation. Consider the set A= {1, 2, 3, 4} determine the relations are 3
transitive or not.
R1= {(1, 1), (1, 2), (2, 3), (1, 3), (4, 4)}
R2={(1, 3), (2, 1)}

b) Discuss about composition of relations. $4\frac{2}{3}$

c) What do you mean by one – to- one and onto functions? 4

3. a) Let R be the relation represented by the matrix
$M_r = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$. Find the matrix representation of R^{-1} and R^2 . 4

b) If $R \subseteq A \times B$ and $S \subseteq B \times C$ be two relations then show that $(SoR)^{-1} = R^{-1} o\, S^{-1}$. 3

c) Prove that inverse relation of an equivalence relation is again an equivalence relation 3

d) What do you mean by partial ordering? $1\frac{2}{3}$

4. a) Describe shortest path algorithm for weighted graph. 5

b) What do you mean by isomorphism? Show that graphs G=(V, E) and H=(V, E) displayed 4
in fig © and fig (d) are isomorphic

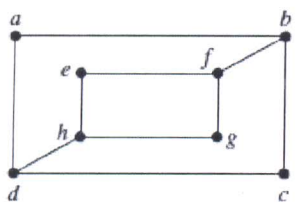


Fig: (c) Graph G

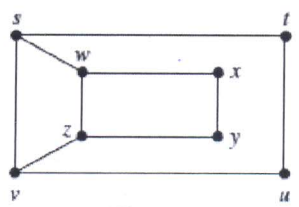


Fig: (d): Graph H

c) Find the in-degree and out-degree of each vertex in the graph G with directed edges $2\frac{2}{3}$
shown in fig: (e)