JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
MCA I Semester Examinations, October/November - 2022
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

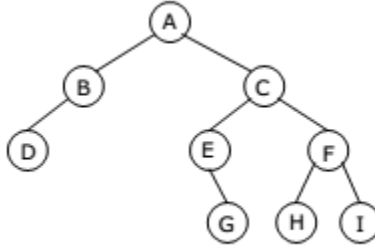Time: 3 Hours   Max.Marks:75

Answer any five questions
All questions carry equal marks
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1.a)   Construct a truth table for each of these compound propositions.
       i) $(P \leftrightarrow q) \oplus (p \leftrightarrow \neg q)$
       ii) $(p \oplus q) \to (p \oplus \neg q)$
   b)   State the converse, contrapositive and inverse of each of these conditional statements.
       i) If it snows tonight, then I will stay at home.
       ii) I go to the beach whenever it is a sunny summer day.   [8+7]

2.a)   What do you mean by a logical equivalence? Give identity, idempotent, commutative, associative, distributive and De Morgan's laws of Boolean algebra.
   b)   Use of rules of inference to show that
       $\forall x\ (P(x) \to (Q(x) \wedge S(x)))$ and $\forall x(P(x) \wedge R(x))$ are true, then $\forall x\ (R(x) \wedge S(x))$
       is true.   [8+7]

3.a)   Let $A = \{a, b, c\}, B = \{x, y\}$ and $C = \{0,1\}$. Find $A \times B \times C$ and $C \times B \times A$.
   b)   Let A, B, and C be sets. Show that $A \cup (B \cap C) = (C \cup B) \cap A$ [7+8]

4.a)   Give examples of different types of correspondences.
   b)   Find a_8 of the sequence $\{a_n\}$, if a_n equals $1 + (-1)^n$.
   c)   Determine whether relation $R = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ is an equivalence relation or not.   [5+5+5]

5.a)   Demonstrate with an example bubble sort algorithm.
   b)   Explain big-omega and big-theta notations with examples.   [8+7]

6.a)   Prove that the sum of first n positive odd integers is n^2 by mathematical induction.
   b)   Give a recursive definition of the set of positive integers that are multiples of 5.   [8+7]

7.a)   Explain the following:
       i) Conditional probability
       ii) Independence of events
   b)   What is the Tower of Hanoi problem? Let H_n denote the number of moves needed to solve the Tower of Hanoi problem with n disks. Give a recurrence relation for the sequence $\{H_n\}$.   [8+7]

8.a) What are complete and planar graphs? Is K_4 a planar graph? If so give non-planar embedding of K_4.

   b) Give the order of vertices visited in pre-order, in-order and post-order traversal of the following tree. [6+9]

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