UNIVERSITY OF ENGINEERING AND MANAGEMENT, KOLKATA

Degree: B. Tech | Stream: CSE

Year:3rd

Even Semester Term - I Examination, February - 2024

Subject Code: HSMC(CS)602

Subject Name: Essential Studies for Professionals - VI

Full Marks: 30 | Duration: 1 Hour

Date: 26.02.2024 | Time:2.30 PM – 3.30 PM

Part - A

Attempt 5 questions

Each question carries 2 marks (2 × 5)

1. Consider the language L = { a^n | n≥0 }∪{ a^nb^n | n≥0 } and the following statements.
   L is deterministic and context-free.
   L is context-free but not deterministic context-free.
   L is not LL(k) for any k.
   Which of the above statements is/are TRUE?

   or

   Which one of the following languages over the alphabet {0,1} is described by the regular expression: (0+1)*0(0+1)*0(0+1)*?

2. If two relations have 7 & 12 rows respectively, then what will be the total number of tuples in Cartesian product?

   or

   Demonstrate why are duplicate tuples not allowed in a relation?

3. Illustrate the ACID properties of a transaction with example.

   or

   Illustrate all the states of a transaction.

4. A priority queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is: 10, 8, 5, 3, 2. Two new elements 1 and 7 are inserted into the heap in that order. What will be level-order traversal of the heap after the insertion of the elements?

   or

   An unordered list contains n distinct elements. What is the number of comparisons to find an element in this list that is neither maximum nor minimum?

5. Let P be a Quicksort Program to sort numbers in ascending order using the first element as pivot. Let t1 and t2 be the number of comparisons made by P for the

inputs {1, 2, 3, 4, 5} and {4, 1, 5, 3, 2}, respectively. What will be the relation between t1 and t2?

or

Which is the recurrence equation for the worst-case time complexity of the Quicksort algorithm for sorting n (≥2) numbers? ~~In the recurrence equations given in the options below, c is a constant.~~

Part - B

Attempt 2 questions

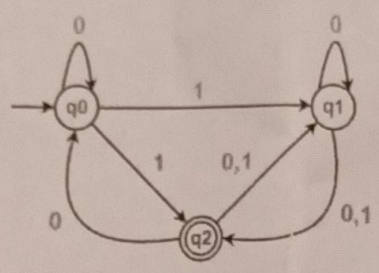
Each question carries 5 marks (5 × 2)

6. Design a FA from given regular expression 10 + (0 + 11)0* 1.

or

Design a DFA from given regular expression : (a+b)*b.

7. Convert this NFA to DFA.



or

Design a Turing Machine for $a^n b^n c^n$

Part - C

Attempt 1 question

Each question carries 10 marks (10 × 1)

8. Discuss the master Theorem for solving recursive algorithm?

or

Solve the recurrence relation: T(n) = 2T(n/2) + cn using recurrence tree method.

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