| | | Reg. No. | | | | | | | | | |
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| प्रज्ञानं ब्रह्म क्रिक्ट Manipal INSPIRED BY LIFE | INTERNATIONAL CEN (Manij IV SEMESTER B.S. DEGR SUBJECT: DESIGN AAND AN (BRANCH: C | FRE FOR A cal Universit EE EXAMI NALYSIS OF OMPUTER SCI | APPI y) INA' ALG ENCI | LIE TIC GOR E) | D S DN - ITH | CIE - M. MS | CNC AY (CS | ES 201 245) | 6 | | |
| | 25 | WIA 1, 2010 | | | | | | | | | |

Time: 3 Hours ✓ Answer ANY FIVE full Questions.

- 1A Define the asymptotic notations O, Ω and Θ . Prove that $\frac{1}{2}n(n-1) \in \Theta(n^2)$.
- 1B Apply the bottom-up dynamic programming algorithm to the following instance of the knapsack problem and find the optimal subset. Show each step. Assume Capacity W = 6.

| Item | Weight | Value | | | | |
|------|--------|-------|--|--|--|--|
| 1 | 3 | 25 | | | | |
| 2 | 2 | 20 | | | | |
| 3 | 1 | 15 | | | | |
| 4 | 4 | 40 | | | | |
| 5 | 5 | 50 | | | | |

1C Sort {E, X, A, M, P, L, E} in alphabetic order using Selection Sort method.

(8 + 8 + 4 = 20 marks)

Max. Marks: 100

- 2A With a neat diagram, explain the process of Design and Analysis of Algorithms.
- 2B When do you use Transform and Conquer technique? Explain an algorithm to find the mode of a given set of numbers.
- 2C Explain how hashing can be applied to check whether all elements of a list are distinct. Write the time efficiency of this application.

(10 + 6 + 4 = 20 marks)

- 3A Write the algorithm for constructing a descending heap. Construct a descending heap for the elements (20, 12, 35, 15, 10, 80, 30, 17, 2, 1).
- 3B Explain the general plan of mathematical analysis of recursive algorithms. Analyze the recursive algorithm for computing the nth Fibonacci number.
- 3C Write an algorithm for checking whether a graph is cyclic or not.

(6 + 6 + 8 = 20 marks)

- 4A Design an exhaustive-search algorithm for the Hamiltonian Circuit problem. Analyze the complexity of the algorithm.
- 4B Explain the terms P and NP problems. Give an example for each.
- 4C Write and explain the bubble sort algorithm. Obtain its time complexity.

(5 + 5 + 10 = 20 marks)

- 5A Explain the Johnson Trotter algorithm for generating permutations of n integers. Give an example for a set of 4 integers.
- 5B What are the different ways in which topological sort can be done? Explain with an example for each.
- 5C Design a non-recursive algorithm for the Tower of Hanoi puzzle.

(8 + 8 + 4 = 20 marks)

- 6A What is an AVL tree? Construct the AVL tree for the list of numbers 5, 6, 8, 3, 2, 4 and 7.
- 6B Consider the following algorithm.

Algorithm Fun(A[0..n-1, 0..n-1]) // Input: A matrix A[0..n-1, 0..n-1] of real numbers for $i \leftarrow 0$ to n - 2 do for $j \leftarrow i + 1$ to n - 1 do if A[i, j] != A[j, i] return false return true

- a) What does this algorithm compute?
- b) What is its basic operation?
- c) Is the algorithm optimal? Justify your answer.
- 6C Compute 2101 * 1130 using divide and conquer method.

(8 + 4 + 8 = 20 marks)

- 7A Let A be the adjacency matrix of an undirected graph. Explain what property of the matrix indicates that
 - a) The graph is complete.
 - b) The graph has a self-loop, i.e., an edge connecting a vertex to itself.
 - c) The graph has an isolated vertex, i.e., a vertex with no edges incident on it.

- 7B Explain, in detail, the steps involved in Boyer-Moore algorithm.
- 7C If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$, then prove that $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$

(6+6+8=20 marks)

- 8A Write an algorithm for brute force string matching that returns -1 if search is not successful, otherwise returns its position.
- 8B Apply Dijkstra's algorithm to the following graph with 'a' as the source and find lengths of the paths to all other vertices.



8C What is common between dynamic programming and divide-and-conquer techniques? What is the major difference between them? Explain.

(6 + 10 + 4 = 20 marks)

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