

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

(A constituent unit of MAHE, Manipal)

## IV SEMESTER B.TECH. (COMPUTER SCIENCE & ENGINEERING) END SEMESTER EXAMINATIONS, APRIL 2019

SUBJECT: DESIGN & ANALYSIS OF ALGORITHMS [CSE 2202]

## REVISED CREDIT SYSTEM (26/04/2019)

Time: 3 Hours

MAX. MARKS: 50

## **Instructions to Candidates:**

✤ Answer ALL the questions.

✤ Missing data may be suitable assumed.

- **1A.** Explain the fundamental steps in algorithm design and analysis process with a neat diagram.
- **1B.** Write a recursive algorithm for Tower of Hanoi problem. Set up and solve the recurrence relation for the number of disk moves made in this algorithm.
- 1C. Write and explain an algorithm to sort set of items using selection sort and trace the same for the list: M, A, N, G, A, L, U, R, U.
- 2A. Write a procedure for transforming a free tree into a tree rooted at a given vertex of the free tree. Trace the same to transfer the free tree into a tree rooted at vertex 'a' shown in Fig.2A.



Fig. 2A

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**2B.** Briefly explain decrease and conquer technique and its three major variations with suitable example.

- **2C.** You are given a collection of n bolts of different widths and n corresponding nuts. You are allowed to try a nut and bolt together, from which you can determine whether the nut is larger than the bolt, smaller than the bolt, or matches the bolt exactly. However, there is no way to compare two nuts together or two bolts together. The problem is to match each bolt to its nut. Design an algorithm for this problem with average-case efficiency in  $\Theta$  (n log n).
- **3A.** Define an AVL tree and give an example for AVL tree. With neat figure explain four rotation types for AVL trees with three nodes.
- **3B.** Prove that the worst case time efficiency of bottom-up heap construction using key comparison as the basic operation is  $2(n \log_2(n+1))$ . Assume heap to be a full binary tree.
- **3C.** Illustrate collision resolution using double hashing with an example. Also write the hash function for double hashing specifying each of the term.
- 4A. Find the all-pair shortest path using Floyd's algorithm for the graph shown in Fig.
  4A. Show the distance matrices, D<sup>(i)</sup>, in each iteration of the algorithm.



- Fig. 4A
- **4B.** Apply Horspool's algorithm to search for the pattern: *MAHARATH* in the given text:

## MERA\_BHARATH\_MAHAN

Also find the number of character comparisons made.

**4C.** Construct the minimum spanning tree (MST) for the given graph in Fig. 4C, using Prim's Algorithm.



Fig. 4C

**5A.** Consider the following Table 5A with alphabets and their frequencies.

Table 5A

Letter	Ζ	к	М	С	U	D	L	E
Frequency	2	7	24	32	37	42	42	120

Construct a Huffman tree for the same and find out the codewords and number of bits required for encoding each alphabet. Also find the total number of bits required to code the word CUDDLE.

Page 2 of 3

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**5B.** Solve the following assignment problem given in Table 5B, using Branch and Bound Technique.

	Tab	le 5B			
	T1	T2	T3		
P1	6	9	5		
P2	4	8	3		2
P3	5	11	6		3
prob	lem D	) escrit	e anv	two examples of the same	3

**5C.** Explain Briefly class NP problem. Describe any two examples of the same.