# **Question Paper**

Exam Date & Time: 11-May-2018 (09:30 AM - 12:30 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

#### INTERNATIONAL CENTRE FOR APPLIED SCIENCES END SEMESTER THEORY EXAMINATION - APRIL 2018 III SEMESTER B. S. (ENGG) Date: 11.05.2018 Time: 9.30 A. M. TO 12.30 P.M. DESIGN AND ANALYSIS OF ALGORITHMS [CS 234]

Marks: 100

Duration: 180 mins.

## Answer 5 out of 8 questions.

## Missing data, if any, may be suitably assumed.

- 1)
- Explain with diagram, the various asymptotic notations with  ${}^{\rm (6)}$  suitable example.
- <sup>B)</sup> Write an algorithm to find the GCD of two numbers using <sup>(6)</sup> Euclid's method and explain the working of the algorithm to find GCD of 1066 and 904.
- C) Explain recursive solution to the Tower of Hanoi puzzle. Draw <sup>(8)</sup> the call of recursive tree. Derive the recurrence relation to the number of moves made in Tower of Hanoi.
- <sup>2)</sup> Apply quicksort to sort the list E, X, A, M, P, L, E in <sup>(6)</sup> alphabetical order and do the analysis in best and worst cases. Consider A=1, B=2... Z=26.
  - <sup>B)</sup> Compute 2101 \* 1130 by applying divide and conquer <sup>(6)</sup> algorithm for large integer multiplication.
  - Construct AVL tree for the list 5,6,8,3,2,4,7 step-by-step.
    Mention balance factor and type of rotation at each stage if there is any rotation required.
- <sup>3)</sup> Write and explain Horspool's String matching algorithm. Give <sup>(8)</sup> its time complexity in best and worst case. Simulate the
  - algorithm on following Text and Pattern JIM\_SAW\_ME\_IN\_A\_BARBERSHOP : as Text BARBER : as Pattern

Apply topological sorting to the graph shown in Fig Q3B. using source removal and DFS method. Show all the steps in the source removal method and the path traversed, stack contents, popping off order, and topologically sorted order in the DFS method.



<sup>C)</sup> Explain distribution counting method to sort for the following <sup>(6)</sup> array.

10	4.4	10	10	10	10
13	11	12	13	12	12

<sup>4)</sup> Explain the properties of Heap with example. Explain heap sort for  $^{(8)}_{A}$  the elements

<sup>4</sup> H[1:n] = {2,9,7,6,5,8 } . Show heap construction me thod as well as max deletion duringHeap sort.

Apply Prim's algorithm to the graph shown in Q4B. Show (12) step-by-step solution to get the minimal spanning tree.
 Consider a as the starting vertex



Fig Q4B.

- <sup>5)</sup> Explain the dynamic programming algorithm to compute the <sup>(8)</sup> binomial of coefficient. Hence compute 6C3 using the same algorithm.
  - <sup>B)</sup> Explain the terms: P and NP Problems with examples. <sup>(6)</sup>
  - <sup>C)</sup> Explain and Analysis and design process with neat <sup>(6)</sup>

diagram.

- <sup>6)</sup> Write an algorithm for **computing the mode** using transform and conquer technique and give its complexity.
  - <sup>B)</sup> Write an algorithm for **checking element uniqueness in** <sup>(5)</sup> **an array** using transform and conquer technique. Analyze the time complexity of the entire algorithm.

<sup>C)</sup> Explain two versions of hashing for the following list of words. <sup>(10)</sup> A, FOOL, AND, HIS, MONEY, ARE, SOON, PARTED h(K) = sum of K's letters' positions in the alphabet MOD 13 Define transitive closure of a directed graph. Write an <sup>(8)</sup>

 A) algorithm to compute the transitive closure of a graph using Warshall's algorithm. Hence find the transitive closure of the graph shown in Fig. Q7A.



Fig. Q7A.

- <sup>B)</sup> Explain brute-force string match with an example. Give its <sup>(6)</sup> time efficiency.
- <sup>C)</sup> Explain greedy approach of solving a knapsack problem.
  <sup>(6)</sup> Explain Bottom-up approach to solve the following knapsack problem and find the optimal subset.

ITEM	WEIGHT	VALUE
1	2	12
2	1	10
3	3	20
4	2	15

8) Write a note on Cook's theorem

(6)

(5)

A) B)

7)

What do you mean by variable length encoding ? Using (10) Huffman tree find encoding codeword for CAB and DAD. Decode 011110011 from hufman tree.

	symbol	А	В	С	D	_	
	frequency	0.35	0.1	0.2	0.2	0.15	
C)	Differentiate between DFS and BFS.						(4)

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