Paper Id: 214303 **RollNo:** | | | | | | | | | | | | | |

MCA
(SEM-III) THEORY EXAMINATION 2019-20
DESIGN & ANALYSIS OF ALGORITHMS

Time: 3 Hours ***Total Marks: 70***

Note: **1.** Attempt all Sections. 1f require any missing data; then choose suitably.

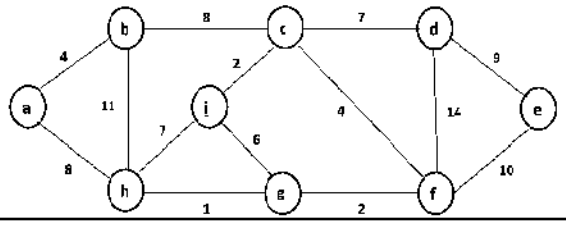
SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a.	Define the concept of an algorithm.
b.	State recursion and its different types?
c.	Define Knapsack problem statement.
d.	What is Heap? Give example of Max-Heap.
e.	When we use dynamic programming approach? Define.
f.	What is Non-Comparison sort? Define with example.
g.	Describe divide and conquer paradigm.

SECTION B

2. Attempt any *three* of tbe following: **7 x 3 = 21**

a.	Show that the worst case running time of HEAPlFY on a heap of size n is O(n logn).
b.	Explain the red-black tree properties. Find the maximum height of a red-black tree with 1,000,000 values?
c.	Find the time complexity of recurrence relation $T(n) = 2T(\sqrt{n}) + 1$
d.	Apply Kruskal's algorithm to find minimum spanning tree. 
e.	Explain Boyer-Moore algorithm for stiing matching for text: "a b c a a b c c a a b b a b c a" pattern abc. Compute worst time complexity of this algorithm.

SECTION C

3. Attempt any *one* part of tbe foiiowing: **7 x 1 = 7**

(a)	Show that the running time of Quick-Sort is Θ(n2) when the array A is sorted in non-increasing order.
(b)	Using master method solve the following recurrence $T(n) = 4T(n/2) + n^2\log n$

4. Attempt any *one* part of tbe foiiowing: **7 x 1 = 7**

(a)	Show that results of inserting the following items in an initially empty B-tiee of order 5. 25,31,38,76,05,60,38,08,30,15,35,17,23,53,27,43,65,48
(b)	What do you understand by Binomial Heap? How to merge two binomial heaps?

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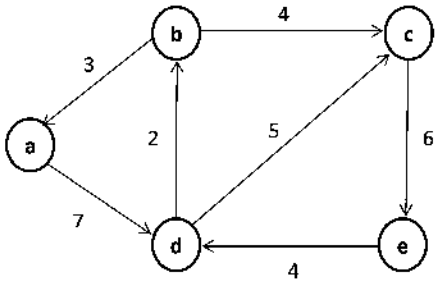
5. Attempt any *one* part of tbe foiiowing: 7 x 1 = 7

(a)	Explain Dynamic Programming. Apply it on Matrix Chain Multiplication problem.
(b)	Discuss Travelling salesman Problem and various approaches to solve the problem with complexity analysis of each.

6. Attempt any *one* part of tbe foiiowing: 7 x 1 = 7

(a)	Write and explain Bellman-Ford algorithm with the help of suitable example.
(b)	Solve the following instance of the single source shortest path problem with vertex 'a' as the source. 

7. Attempt any *one* part of tbe foiiowing: 7 x 1 = 7

(a)	Discuss the relationship between the class P, NP, NP-Complete and NP-hard problems with suitable example of each class.
(b)	Write short notes on any two of the following:- i. Knuth-Morris-Pratt algorithm for pattern matching. ii. Approximation of a NP-complete problem. iii. Backtracking. iv. Randomized sorting algorithm.

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