Atal Bihari Vajpayee Indian Institute of Information Technology & Management

Minor Examination

Sub: Design and Analysis of Algorithms **Course Code: CS203**

Time: 2 Hours **Date: 27/Sept/2023** **Max. Marks: 30**

Note: Attempt all questions and answer them appropriately.

No doubts will be cleared during examination.

1. Let f (n) and g (n) be asymptotically nonnegative functions. Using the basic definition of , Θ-notation, prove that max (f (n), g (n) = Θ (f (n) + g (n)). [2]

2. Is the array with values {23, 17, 14, 6, 13, 10, 1, 5, 7, 12} a max heap? [2]

3. Show that the worst-case running time of MAX-HEAPIFY on a heap of size n is Ω (log n). (Hint: For a heap with n nodes, give node values that cause MAXHEAPIFY to be called recursively at every node on a simple path from the root down to a leaf.) [4]

4. Illustrate the operation of MAX-HEAP-INSERT (A, 10) on the heap
   A = {15, 13, 9, 5, 12, 8, 7, 4, 0, 6, 2, 1} [4]

5. Write pseudocode for the procedures HEAP-MINIMUM, HEAP-EXTRACT-MIN, HEAP-DECREASE-KEY, and MIN-HEAP-INSERT that implement a min-priority queue with a min-heap. [4]

6. Give an adjacency-list representation for a complete binary tree on 7 vertices. Give an equivalent adjacency-matrix representation. Assume that vertices are numbered from 1 to 7 as in a binary heap. [4]

7. Suppose that we represent the graph G = (V, E) as an adjacency matrix. Give a simple implementation of Prim's algorithm for this case that runs in O (V^2) time. [5]

8. Construct the minimum spanning tree (MST) for the given graph using Kruskal's Algorithm. And write the complexity. [5]