Dr. Amit Jaiswal

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATIONS- 2022

B.Tech-IV Semester (CS/IT/ECE/Civil/BT/BI)

COURSE CODE: 18B11CI412 MAX. MARKS: 25

COURSE NAME: Design & Analysis of Algorithms

COURSE CREDITS: MAX. TIME: 1 Hour 30 Min

Note: *All questions are compulsory. Marks are indicated against each question in square brackets.*

Q1. i. $T(n) = 2T(n/2) + n \log n$ using master method [5x2]

ii. $T(n) = 2T(n/4) + n^{0.51}$ using master method

iii. $T(n) = 3T(n/4) + n \log n$ using master method

iv. $T(n) = T(n/10) + T(9n/10) + cn$ using recursion tree method

v. Write a snippet/code for the following complexities:

a. Log n

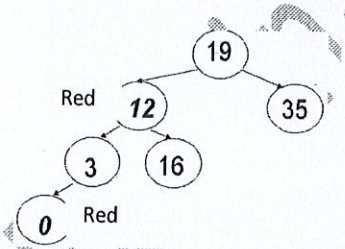
b. n^n

Q2. i. Suppose you want to sort 'n' numbers in O(n log n) time without any extra space then which algorithm can you prefer to complete this task and give proof of its complexity in worst case. [2x2]

ii. Build Min Heap of the following array elements {9, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10}. Depicts the tree structure after each insertion.

Q3. i. Mention all the properties of Red-Black Tree and prove that the worst case complexity for all operations is O(log n). [3x2]

ii.



Given tree is a RBT, Red is written on some nodes which are Red and all others are Black, now Insert a new node '38' and then delete node 19 from the RBT with desired cases.

iii. Consider a scenario in which you delete a node from a Red-Black Tree (RBT) then a "doubly black" may pushed in the tree then how this problem can be solved by mentioning all the possible cases with pictorial example.

Q4. i. What is the Node structure required for BST, AVL, Red-Black, and Skip-list? [5x1]

ii. You have been given some statements then how would you call it an algorithm.

iii. Mention at least three applications of a Stack, Queue, Linked List, Trees.

iv. Mention at least two stable and instable sorting algorithms with their worst case complexities.

v. How many maximum nodes at level 'L' and at height 'H' (Total nodes) in a binary tree with formula.