Exam. Code : 206701
Subject Code : 4782

M.Sc. Computer Science 1st Semester (Batch 2021-23)
MCS-101 : ADVANCED DATA STRUCTURES

Time Allowed—3 Hours] [Maximum Marks—100

Note :— Attempt ***five*** questions in all, selecting at least ***one*** question from each section. The **fifth** question may be attempted from any section. All questions carry equal marks.

SECTION—A

1. What is Red Black tree ? Write down the insertion algorithm of Red Black tree and insert the following elements : 20, 10, 5, 30, 40, 57, 3, 2, 4, 35, 25, 18, 22, 21. Draw the figures depicting your tree immediately after insertion and label all nodes with their color and identify the rotation type.
   Note :— R-Red Color Node
   B-Black Color Node. 20
2. Answer the following questions :
   (i) Define the properties and drawbacks of binary search tree.
   (ii) Let a Binary Search Tree (BST) contains the numbers 1, 2, 3, 4, 5, 6, 7, 8. When the tree is traversed in post-order and the values in each node printed out, the sequence of values obtained is 2, 1, 4, 3, 7, 8, 6, 5. If the tree is traversed in pre-order, then return the sequence obtained from the above information. 20

SECTION—B

3. Define Heap with their types. If the elements 40, 17, 20, 30, 12, 25, 16, 8, 10, 31 are inserted one by one in the given order into a Max Heap. What will be the resultant Max Heap and return the number of exchanges ? 20
4. What do you understand by priority queues and why priority queues are important ? Write pseudo code for the procedures Heap_Minimum, Heap_Extract_Min, Heap_Decrease_Key and Min_Heap_Insert that implement a min_priority queue with min heap. 20

SECTION—C

5. (a) Suppose we have two binomial Heaps H1 and H2. H1 comprises of three Binomial trees of degree 0, 1 and 2. Similarly, H2 comprises of three Binomial Trees of degree 0, 1 and 4, respectively. Perform the union operation on the given heaps to form a new Heap H. 10
   (b) Draw the state diagram for the Pattern P=abaab. Given the Text T = aabbbabaabab, check whether the given pattern exists in the text or not using String Matching with finite automata. Also, explain the algorithm in detail, specifying its time complexity. 10
6. Explain BFS and DFS algorithms with the help of an example. 20

SECTION—D

7. What is external sorting ? Explain any one external sorting algorithm in detail. 20
8. (a) What is External Hashing ? Explain in detail. 10
   (b) How is random file organized on hard disk ? Explain. 10