CS203 DSAA Fall 2022 Quiz2
民间版本

Bonus [20 points]: If you participate in this Quiz in class, your grade will be added 20 points. In other words, if you take part in this Quiz, the Quiz 2 score counted into the final score will be $\min(Quiz\ 2\ original\ score + 20\ points, 100\ points)$.

Note: *This Quiz is very similar to Quiz 2 in 2021 (even exactly the same).*

Problem 1 [20 points] Time Complexity of Heap Building

The time complexity of turn sized-n array A into a binary heap on S via root-fix operator on dynamic array is O(n), where A stores the values in set S.

Problem 2 [20 points] Height of Balanced Binary Search Tree

A balanced binary search tree where n nodes has height O(log n).

Problem 3 [20 points] Huffman Encoding

Given (character, frequency) pairs as following:

H	N	S	O	E	Y	T	D
14	16	8	12	30	18	43	65

(a) Show the detail steps of building its Huffman tree, i.e. draw the Huffman tree building process step by step.

(b) Write down the corresponding scheme of the Huffman tree you obtained in (a), you only need draw a table, which contains two columns, the left is the character, the right is its corresponding Huffman coding.

Problem 4 [10 points] Heap Sorting

Use a table to describe the process of ascending sort of array A using the small root heap. We assume that the array A is already a small root heap.

$$A = \{14, 16, 8, 12, 30, 18, 43, 65, 78, 83, 72, 6, 23\}$$

6	12	8	16	30	14	43	65	78	83	72	18	23
8	12	14	16	30	18	43	65	78	83	72	23	

Problem 5 [30 points] AVL-Tree

Let us define a binary search tree as following:

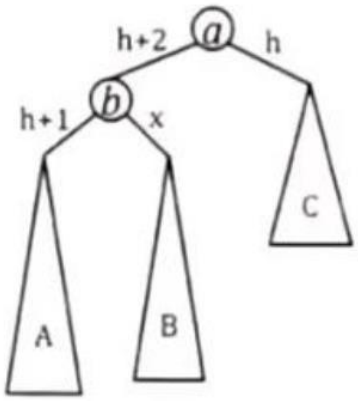

Figure 1. left-left case

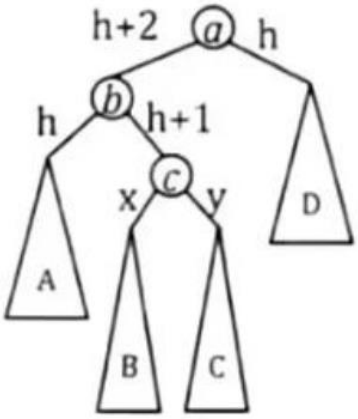

Figure 2. left-right case

(a) Given the imbalance node a in Fig.1, after remedied the imbalance node a,

a→leftchild =_____, a→rightchild =_____

b→leftchild =_____, b→rightchild =_____

(b) Given the imbalance node a in Fig.2, after remedied the imbalance node a,

a→leftchild =_____, a→rightchild =_____

b→leftchild =_____, b→rightchild =_____

c→leftchild =_____, c→rightchild =_____

(c) Draw the corresponding balance ed binary search tree of Figures 1 and 2.

(d) Given the following imbalanced BBST, please draw the balanced BBST after remedy.