ITP 20001-01 Data Structures, Spring 2023

Final Exam – Part I. Programming.

- You are given **2 problems** (Problems 1 and 2) to complete in **60 minutes**. Total 100 points are given to the two problems.
- The only reference you can access is **https://en.cppreference.com/w/c**
- The starter code is at **https://github.com/hongshin/DataStructures/blob/main/final.zip**
- You make submissions by **6:30 PM**. You can make multiple submissions.

Problem 1 (60 points).

Complete the following two missing functions in `problem1/bintree.cpp`, and then submit `problem1/bintree.cpp` and `problem1/bintree.h` to HDLMS.

(a) `void Tree::print()` prints the status of a binary tree such that the left child is printed right above and the right child right below of a parent node, and the node of the same level is printed at the same column. For example, the tree defined in `main.c` will be printed as follows:

```
                8
        4
    2
        5
1
        6
    3
        7
```

You can add new functions for `Tree::print()` to use.

(b) `bool Tree::isBalanced()` returns true if and only if the tree satisfies the height-balance property. You can add new functions for `bool Tree::isBalanced()` to use.

Problem 2 (40 points).

Complete function `int main ()` in `problem2/heapsort.c` that sorts a list of English words in `words.txt` in ascending shortlex order. In the shortlex order, string s_1 precedes s_2 if the length of $s_1$is shorter than s_2. When $s_1$and s_2 have the same length, the shortlex order is identical to the lexicographical order.

Submit `problem2/heapsort.c` to HDLMS.