

## CPSC 5031 Algorithms

### HW #4 (20 pts)

#### 1) Exercises 5.3 #1 (5 points)

Design a divide-and-conquer algorithm for computing the number of levels in a binary tree. (In particular, the algorithm must return 0 and 1 for the empty and single-node trees, respectively). What is the time efficiency class of your algorithm (explain why)?

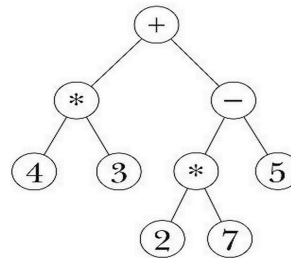
#### 2) Exercises 5.3 #6 (5 points)

Write one of the classic traversal algorithms (preorder, inorder, and postorder) for binary trees. Assuming that your algorithm is recursive, find the number of recursive calls made and give the efficiency class (explain why or show work).

#### 3) Section 5.3 – BST traversal (3 point)

Traverse the following binary tree.

- in preorder.
- in inorder.
- in postorder.



#### 4) Section 6.4 – Heap construction (3 point)

Explain the difference between bottom-up and top-down heap construction. Explain how you get  $O(n)$  for bottom-up construction and  $O(n \log n)$  for top-down heap insertion of a heap of size  $n$ , where  $n$  is the number nodes.

#### 5) Section 6.4 – Heapsort (4 points)

Sort the following list by heapsort. Use the array representation of heaps and show all steps (i.e. show both stage 1 and 2; see figure 6.14 in the Levitin book).

12, 15, 19, 10, 8, 16, 5

#### Note(s):

- Use C++ or Java for those problems that require algorithm design.
- All problems may be found in the Levitin textbook.

#### Submission:

- Deadline: Monday, 5/1/2023, 11:59pm
- Submit your solutions as a single PDF on Canvas under HW #4