CSC 411. Spring 2023

Homework #6

Due: Apr 6, 2023 (Thursday) 11:59 pm

1. Textbook #6.1-2 (a) (b) (20 Points)

2. Let $A = \{a_1, \ldots, a_n\}$ and $B = \{b_1, \ldots, b_m\}$ be two sets of numbers. Consider the problem of finding their intersection, i.e., the set C of all the numbers that are in both A and B.

a. Design a brute-force algorithm for solving this problem and determine its efficiency class.

b. Design a presorting-based algorithm for solving this problem and determine its efficiency class.

2. Textbook #6.3-4 (c) (10 Points)

4. For each of the following lists, construct an AVL tree by inserting their elements successively, starting with the empty tree.

a. 1, 2, 3, 4, 5, 6

b. 6, 5, 4, 3, 2, 1

c. 3, 6, 5, 1, 2, 4

3. Textbook #6.3-7 (a) (10 Points)

7. a. Construct a 2-3 tree for the list C, O, M, P, U, T, I, N, G. Use the alphabetical order of the letters and insert them successively starting with the empty tree.

4. Textbook #6.4-1 (a) (b) (c) (30 Points)

1. a. Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by the bottom-up algorithm.

b. Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by successive key insertions (top-down algorithm).

c. Is it always true that the bottom-up and top-down algorithms yield the same heap for the same input?

5. Textbook #6.4-7 (c) (10 Points)

7. Sort the following lists by heapsort by using the array representation of heaps.

a. 1, 2, 3, 4, 5 (in increasing order)

b. 5, 4, 3, 2, 1 (in increasing order)

c. S, O, R, T, I, N, G (in alphabetical order)

6. Textbook #6.5-4 (a) (b) (20 Points)

4. a. Apply Horner's rule to evaluate the polynomial

$$p(x) = 3x^4 - x^3 + 2x + 5 \quad \text{at } x = -2.$$

b. Use the results of the above application of Horner's rule to find the quotient and remainder of the division of $p(x)$ by $x + 2$.