

**Due date**

Wednesday, November 13, 2013

**Program objectives**

The objectives of this assignment are as follows.

An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution (ABET b).

**Value**

This program is worth 15 points. The distribution of points will be as follows.

Criterion	Value
Problem 1	10
Problem 2	2
Problem 3	3

**Delivery Method**

Turn in a hardcopy at the beginning of class.

**Data for problems below.**

$A = \{30, 33, 30, 23, 32, 27, 28, 31\}$

**Problems**

1. Draw max and min heaps from the above data. Pick the elements from right to left. (10 pts)
2. For the max heap in problem 2, how many comparisons were done to fix the heap after removing the maximum item. Count a comparison only if two elements in the tree are compared to each other. (2 pts)
3. Suppose we implement a *decrease-key* operation for a min heap.
  - a. State the asymptotic running time of this operation. Assume you know where the element is located within the heap. (1 pt)
  - b. Assuming you have an element at level 3 of an  $n$ -element min-heap and you invoke the *decrease-key* operation at that element, state the most number of comparisons that would be needed to fix the heap. (1 pt)
  - c. With the same assumptions as part b, state the least number of comparisons that would be needed to fix the heap. (1 pt)