Problem Set #3

Quiz, 5 questions

1
point

1.

Suppose you implement the functionality of a priority queue using a *sorted* array (e.g., from biggest to smallest). What is the worst-case running time of Insert and Extract-Min, respectively? (Assume that you have a large enough array to accommodate the Insertions that you face.)

- $\Theta(n)$ and $\Theta(1)$
- $\Theta(n)$ and $\Theta(n)$
- $\Theta(\log n)$ and $\Theta(1)$
- $\Theta(1)$ and $\Theta(n)$

1
point

2.

Suppose you implement the functionality of a priority queue using an *unsorted* array. What is the worst-case running time of Insert and Extract-Min, respectively? (Assume that you have a large enough array to accommodate the Insertions that you face.)

- $\Theta(1)$ and $\Theta(n)$
- $\Theta(n)$ and $\Theta(1)$
- $\Theta(n)$ and $\Theta(n)$
- $\Theta(1)$ and $\Theta(\log n)$

1 point

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3.

You are given a heap with n elements that supports Insert and Extract-Min. Which of the following tasks can you achieve in $O(\log n)$ time?

- Find the largest element stored in the heap.
- None of these.
- Find the median of the elements stored in the heap.
- Find the fifth-smallest element stored in the heap.

1 point

4.

You are given a binary tree (via a pointer to its root) with n nodes. As in lecture, let size(x) denote the number of nodes in the subtree rooted at the node x. How much time is necessary and sufficient to compute size(x) for every node x of the tree?

- $\Theta(n)$
- $\Theta(n \log n)$
- $\Theta(height)$
- $\Theta(n^2)$

1 point

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5.

Suppose we relax the third invariant of red-black trees to the property that there are no *three* reds in a row. That is, if a node and its parent are both red, then both of its children must be black. Call these *relaxed* red-black trees. Which of the following statements is *not* true?

- There is a relaxed red-black tree that is not also a red-black tree.
- The height of every relaxed red-black tree with n nodes is $O(\log n)$.
- Every red-black tree is also a relaxed red-black tree.
- Every binary search tree can be turned into a relaxed red-black tree (via some coloring of the nodes as black or red).