

5. Homework

Due **2/26/09** before class

This homework is for extra credit only and not mandatory. Any points earned here will be added to previous homework scores in order to help meet the 60% threshold.

1. **Deterministic select (6 points)**

Consider two variations of the deterministic selection algorithm:

- a) Divide into groups of 7.
- b) Divide into groups of 3.

Show that the runtime proof of $O(n)$ works fine in case a). In case b) show where you run into problems when trying to prove a runtime of $O(n)$.

Do you think it will work for 9, 11, 13, ...?

2. **Median computation (6 points)**

Suppose arrays A and B are **both sorted** and contain n elements each. Give a randomized divide-and-conquer algorithm to find the median of $A \cup B$ in expected $O(\log n)$ time.

(Describe it either in words or as pseudo-code; whatever you prefer). Argue **shortly** why the runtime is $O(\log n)$.

3. **Red-black trees (0 points – just for practice)**

Find a sequence of numbers which, when incrementally inserted into a red-black tree, causes the following sequence of rotations:

right, right, right, left.

You may start with an initially non-empty tree, and you may insert numbers that do not cause any rotations. But there should not be any additional rotations performed.

Draw the sequence of trees that you obtain after each insertion. For each such tree indicate the node that violates the red-black tree condition, indicate the nodes that participate in the rotation, the type of the rotation, and the subtrees that correspond to each other before and after the rotation.

Hint: Use a red-black tree demo from the web.