
You're expected to work on the problems before coming to the lab. Discussion session is not meant to be a lecture. TAs will guide the discussion and correct your solutions if needed. We may not release solutions for all problems. If you're better prepared for discussion, you will learn more. TAs will record names of the students who actively engage in discussion and report them to the instructor. The instructor will factor in participation in final grade.

1. (Basic) We're given a *sorted* array $A[1 \cdots n]$. We want to find the kth smallest element of A. How much time do you need?

2. (Basic) We're given an array $A[1 \cdots n]$, which is not necessarily sorted. We want to find the kth smallest element of A. How much time do you need?

3. (Basic) We're given a *sorted* array $A[1 \cdots n]$ and a target number x. We want to find i such that $A[i] = x$ if such i exists. How much time do you need?

4. (Basic) We're given an array $A[1 \cdots n]$, which is not necessarily sorted, and a target number x. We want to find i such that $A[i] = x$ if such i exists. How much time do you need?

5. (Basic/Intermediate) Show that $T(n) = T(n/5) + O(n)$ implies $T(n) = O(n)$.

6. (Basic) Let $A[1 \cdots 9] = \langle 3, 2, 9, 0, 7, 5, 4, 8, 6 \rangle$. Illustrate the execution of Randomized-Select(A, 1, 9, 4) with Randomized-Partition replaced with Partition; see pg 216. More precisely, list all calls to Randomized-Select(A, p, r, i) with p, r, i specified. Continue to illistrate the execution of Randomized-Select(A, 1, 9, 8). How about Randomized-Select(A, 1, 9, 7)?

7. (Intermediate) Show how quicksort can be made to run in $O(n \log n)$ time in the worst case; assume that all elements are distinct.

8. (Advanced*) Let $X[1 \cdots n]$ and $Y[1 \cdots n]$ be two arrays, each containing n numbers already in sorted order. Give an $O(\log^2 n)$ time algorithm to find the median of all $2n$ elements in arrays X and Y.