CSC-321 Design and Analysis of Algorithms
Section 401
Fall 2019-20

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Practice Problems for the Final Exam

1. Let $A[1..n]$ be an array of distinct numbers, and assume that the number of elements $n \geq 2$ is a power of 2 (that is, $2, 4, 8, 16, ...$).

   (a) Give a divide-and-conquer algorithm that finds the second largest element in A (the element in A with exactly $n-2$ elements smaller than it) by performing no more than $3n/2 - 2$ comparisons. Analyze the number of comparisons performed by your algorithm by giving a recurrence relation and solving it. (**Hint.** Divide the array in two halves, find the largest and the second largest elements in each half, and then ...)

   (b) Give an iterative algorithm that finds the second largest element in A by performing no more than $3n/2 - 2$ comparisons.

   (c) Pinocchio claims that it is impossible to come up with an algorithm that finds the second largest number in A by performing fewer than $3n/2 - 2$ comparison in the worst case. Is Pinocchio right? If you agree with Pinocchio, justify your answer. If you disagree, describe an algorithm that finds the second largest element in A by making fewer than $3n/2 - 2$ comparisons in the worst case.

2. Exercise 3.7 on pages 96-97.

3. Exercise 4.18 on page 124 of the textbook.

4. Exercise 5.24 on page 152 of the textbook.

5. Exercise 6.11 on page 177 of the textbook.