# CSE 150: Problem Set #4

November 6, 2008

## Problem 1

Write an algorithm kth($k$, $A[0, ..., n-1]$) that finds the $k$th-largest elements of $A$ in $O(n)$ time. Your algorithm should use the partition algorithm we developed for quicksort. Prove your algorithm is correct and that it runs on $O(n)$ time, assuming the partition algorithm always splits its input in half.

## Problem 2

If $A[0, \ldots, n-1]$ is a permutation of $0, ..., n-1$, then we can view $A$ as a function $A : \{0, \ldots, n-1\} \to \{0, \ldots, n-1\}$. Write an algorithm that finds $B[0, \ldots, n-1]$ such that $A \circ B$ is the identity function.

## Problem 3

Suppose you have a two-dimensional matrix $A[0, \ldots, n-1][0, \ldots, m-1]$ such that $A[i][j] \leq A[i][j+1]$ and $A[i][j] \leq A[i+1][j]$ for all $i$ and $j$. Find the fastest algorithm you can to determine whether a given number $x$ occurs in $A$.