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## CS 374 LAB 11: BINARY SEARCH

Date: February 23, 2018.

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**Problem 1.** [Category: Design]

1. Suppose  $A[1..n]$  is an array of  $n$  distinct integers, sorted so that  $A[1] < A[2] < \dots < A[n]$ . Each integer  $A[i]$  could be positive, negative, or zero. Describe a fast algorithm that either computes an index  $i$  such that  $A[i] = i$  or correctly reports that no such index exists..
2. Now suppose  $A[1..n]$  is a sorted array of  $n$  distinct **positive** integers. Describe an even faster algorithm that either computes an index  $i$  such that  $A[i] = i$  or correctly reports that no such index exists. *Hint: This is really easy.*

**Problem 2.** [Category: Design] Suppose we are given an array  $A[1..n]$  such that  $A[1] \geq A[2]$  and  $A[n-1] \leq A[n]$ . We say that an element  $A[x]$  is a **local minimum** if both  $A[x-1] \geq A[x]$  and  $A[x] \leq A[x+1]$ . Describe and analyze a fast algorithm that returns the index of one local minimum.

**Problem 3.** [Category: Design]

1. Suppose you are given two sorted arrays  $A[1..n]$  and  $B[1..n]$  containing distinct integers. Describe a fast algorithm to find the median (meaning the  $n$ th smallest element) of the union  $A \cup B$ .
2. Now suppose you are given two sorted arrays  $A[1..m]$  and  $B[1..n]$  and an integer  $k$ . Describe a fast algorithm to find the  $k$ th smallest element in the union  $A \cup B$ .