

# Algorithms — Homework 1

## Binary Search

Due: September 8.

- 1) Use Binary Search to search for the numbers 2, 43, and 70 in the sequence

2 5 11 17 19 21 26 33 39 43 51 65 79 88 99.

Show for each iteration which item is selected and which part of the sequence remains.

- 2) Suppose you are given an array  $A$  of  $n$  distinct and sorted numbers that has been circularly shifted  $k$  positions to the right. For example,  $\{35, 42, 5, 15, 27, 29\}$  is a sorted array that has been circularly shifted  $k = 2$  positions, while  $\{27, 29, 35, 42, 5, 15\}$  has been shifted  $k = 4$  positions.
- Suppose you know what  $k$  is. Give an  $\mathcal{O}(1)$  time algorithm to find the largest number in  $A$ .
  - Suppose you do not know what  $k$  is. Give an  $\mathcal{O}(\log n)$  time algorithm to find the largest number in  $A$ .
- 3) You have given two sorted arrays  $A$  and  $B$  of size  $n$ , respectively. Find the median of the two sorted arrays, i. e., of  $A \cup B$ . The overall run time complexity should be  $\mathcal{O}(\log n)$ .