

Exercise Sheet 1 for Algorithm Engineering, SS 14

Hand In: *Until Monday, 28.04.2014, 10:00 am, email to wild@cs... or in lecture
(Sorry for the tight deadline; in the future you will have a full week per sheet.).*

Organisational Stuff

- Please hand in your solutions as teams of 2 to 3 students.
- In total, you need at least 40% of the reachable points to be allowed to take the oral exam (the sum over all sheets, not on every single sheet).
- Please make sure you have enrolled for this course in the OLAT online system.

The link is on our course website

<http://wwwagak.cs.uni-kl.de/Vorlesung/ae14.html>.

Problem 1

2 + 3 points

We consider searching in the external memory model, i. e., our machine has internal memory of size M and an unbounded external memory, where transfers from and to the external memory happen in blocks of size B . We assume that the first N cells of external memory contain the numbers $1, \dots, N$ in ascending order and the first cell of internal memory contains the number S that shall be searched in the array.¹

- a) Determine the number of comparisons and the number of I/O operations (I/Os) needed for searching S with
 - (i) linear search and
 - (ii) binary searchfor $M = 20$, $B = 10$, $N = 100$ and $S = 11$.
- b) Give the Θ -class of the average number of comparisons and I/Os depending on M , B and N when searching S with
 - (i) linear search and
 - (ii) binary search.

¹Searching for the *number* S which we already get as input in a list of *numbers* just to find it again may seem useless. In practice, of course, the list in external memory not only contains the keys $1, \dots, N$, but a complete record of data that belongs to the *keys* $1, \dots, N$. (Imagine a database table with a primary key column and additional data columns.) The (pointers to the) records are omitted in this exercise to keep things simple.