

## Exercise sheet 8

In this exercise sheet you will compare the following two procedures, given a sequence of  $n$  integer numbers:

(A) = Sort the  $n$  numbers

(B) = Insert the  $n$  numbers into an initially empty hash table

**Exercise 1** (5 points)

How many operations does (A) need in the worst case? How many operations does (B) need in the worst case? How many block operations does (A) need in the worst case? How many block operations does (B) need in the worst case? For your considerations use Quicksort for (A) (as described in the last lecture) and universal hashing (as described in lecture 5) for (B). It is sufficient to give  $\Theta(\dots)$ . Please state your opinion on which of the two procedures you think is faster in practice and under which circumstances.

**Exercise 2** (5 points)

Write a program that generates a set of  $n$  random whole numbers (range  $1 \dots n$ ) and measures the runtime for both (A) and (B) with  $n$  as input. Repeat the measurement three times for each procedure and take the mean.

**Exercise 3** (5 points)

Calculate the averaged runtime from exercise 2 for  $n = 2^{17}, 2^{18}, 2^{19}, 2^{20}, \dots$ . Increase  $n$  as long as your computer can deal with the size and the computation time is still bearable. Generate a plot with the value of  $n$  on the x-axis (logarithmic scale) and a curve for the runtime of (A) as well as curve for the runtime of (B) (different color).

**Exercise 4** (5 points)

Discuss your plot from exercise 3. In particular: How does it fit your assumptions from exercise 1 and the explanations from the last lecture? The discussion does not have to be long, just focus on the valid arguments.