Algorithms and Data Structures
Jacobs University Bremen
Dr. Florian Rabe

Homework 11
given: 2017-05-02

Homework 11

You have to submit your solutions as announced in the lecture.
Unless mentioned otherwise, all problems are due 2017-05-11, 11:00.
There will be no deadline extensions unless mentioned otherwise in the lecture.

Problem 11.1 *Tail Recursion*

Points: 6

Give a tail-recursive definition of the function $map[A](x : List[A], f : A \to B) : List[B]$ of lists.
The following partial solution may help:

fun $map[A](x : List[A],\ f : A \to B)\ =$
  $mapAux(x, f,\ \ \ \ \ \ \ \ )$

fun $mapAux[A](x : List[A],\ f : A \to B,\ result : List[B])\ =$

Problem 11.2 *Backtracking*

Points: 8

Write a program that finds a solution to the n-queens problems (on an $n \times n$ board) using the general backtracking algorithm.

Problem 11.3 *Divide and Conquer*

Points: 8

Implement Karatsuba's divide-and-conquer algorithm for the multiplication of two polynomials of degree $2^n - 1$ as described in the notes.

Problem 11.4 *Master Theorem*

Points: 6

Use the master theorem to derive the Θ-class of the time complexity of

1. mergesort
2. binary search
3. Karatsuba multiplication of polynomials

Show your work.