Name:

Algorithms and Data Structures
Jacobs University Bremen
Dr. Florian Rabe

Quiz 1
given: 2017-02-23

You have 20 minutes.

## Problem 1.1

Points: 15

In the table below, mark the correct answer in every row.

| $f(n)$ | $g(n)$ | $f(n) \in O(g(n))$ | $g(n) \in O(f(n))$ | both | neither |
|---|---|---|---|---|---|
| $n$ | $n^2$ | | | | |
| $123n \cdot (456 + \log_2 n)$ | $n^2 - 789n$ | | | | |
| $\sqrt{n}$ | $\log_2 n$ | | | | |
| the number of $k \in \mathbb{N}$ such that $k \mid n$ | $\gcd(2n, n^2)$ | | | | |
| time complexity of matrix addition | time complexity of square-and-multiply for $x^n$ | | | | |

Scoring: Let $0 \leq r \leq 5$ be the number of correct answers. Total score is $4r - 5$ (but at least 0).

**If you do not know an answer, you should guess.**

## Problem 1.2

Points: 10

Consider the following algorithm:

```
fun foo(n : ℕ) =
  s := 0
  while n > 0
    for i from 1 to n
      s := s − 2i + 3n
    n := n − 1
  return s + n
```

1. What is the $\Theta$-class of its time complexity in terms of the input $n$?
2. Assume we insert the line $n := 3n$ at the beginning of the function.
   (a) Roughly by what factor does the time complexity increase?
   (b) Does that change the $\Theta$-class of time complexity?