Algorithms and Data Structures
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Quiz 1
given: 2017-02-23

You have 20 minutes.

Problem 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 $0 \le r \le 5$ 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.

Solution:

$f(n) \in O(g(n))$	$g(n) \in O(f(n))$	both	neither
X			
X			
	X		
X			
	X		

Problem 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 Θ-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 Θ-class of time complexity?

Solution:

1. $\Theta(n^2)$

2. (a) 9 (because it's the square of 3)

   (b) No (because it's just a constant factor)