

# PS Algorithms and Data Structures 2024

## Task sheet 2

### Task 4

The sorting algorithm Insertion-Sort can also be defined recursively. To sort the array  $A[1, \dots, n]$ ,  $A[1, \dots, n - 1]$  is sorted and the element  $A[n]$  is inserted into the rest of the array. Write the appropriate pseudo code.

### Task 5

Given the following algorithm, which expects an array  $A$  as input.

```
1: MAGIC( $A[1, \dots, n]$ )
2:    $\max = -\infty$ 
3:   for  $i = 1$  to  $n - 1$ 
4:     for  $j = i + 1$  to  $n$ 
5:       if  $A[i] + A[j] > \max$ 
6:          $\max = A[i] + A[j]$ 
7:   return  $\max$ 
```

What does this algorithm calculate? Also show that this algorithm has a running time of  $\Theta(n^2)$ .

### Task 6

Let  $g(n)$  and  $f(n)$  be two non-negative functions. Show that  $\max\{f(n), g(n)\} = \Theta(f(n)+g(n))$  applies.