

Tutorial 2 for COMP 526 – Applied Algorithmics, Spring 2021

Problem 1 (Loop-invariant method and amortization)

Consider again the *Mod* function from last time:

```
1  procedure Mod(n, k)
2    // Input: positive integers n, k.
3    // Output: value of n mod k.
4    t := n
5    while t ≥ k
6      t := (t − k)
7    end while
8    return t
```

- a) Apply the *invariant method* to prove the correctness of the function *Mod*(*n*, *k*), which is supposed to compute $n \bmod k$, where *n* and *k* are two positive integer input parameters of the function.
- b) Try to establish the time complexity of this procedure.

Hint: You might find it helpful to revisit the potential function from last week.

Problem 2 (Orders of magnitude)

Order the following functions with respect to their asymptotic order of magnitude (i.e., their Θ -class).

$\lg n$, n , \sqrt{n} , $n^{1.5}$, n^2 , $n \lg n$, $n \lg \lg n$, $n \lg^2 n$, $n \lg(n^2)$, $\frac{2}{n}$, 2^n , $2^{n/2}$, 37 , n^3 , $n^2 \lg n$.