

Tutorial 2 for COMP 526 – Efficient Algorithmics, Fall 2023

Problem 1 (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 , $n^2 \lg n$.

Problem 2 (Loop-invariant method and analysis)

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
```

- 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.
- Try to establish the time complexity of this procedure.

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