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Tutorial 2 for COMP 526 – Applied Algorithmics, Spring 2021

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
```

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.