

## Tutorial 1: May 25

1. Prove from first principles that  $\log(n!) \in \Theta(n \log n)$ .
2. Prove from first principles that  $n \in \omega\left(2^{\sqrt{\log n}}\right)$ .
3. Prove or disprove the following claim. If  $h_1(n) \in O(f(n))$  and  $h_2(n) \in O(g(n))$ , then  $\frac{h_1(n)}{h_2(n)} \in O\left(\frac{f(n)}{g(n)}\right)$ . You should prove the statement from first principles or provide a counter example.
4. Provide a tight  $\Theta$  bound on the following pseudocode as a function of  $n$ :

```
k ← 1
for i ← 1 to n do
  j ← 0
  while j ≤ n do
    j ← j + k
  end while
  k ← 2k
end for
```