

## Tutorial 01: May 16

1. **Big Theta:**

Prove from first principles that

$$\sum_{i=1}^n \frac{1}{(2i)!} \in \Theta(1)$$

2. **Little Omega:**

Prove from first principles that  $n \in \omega\left(2^{\sqrt{\log n}}\right)$ .

3. **Fraction between Big-O and Little-Omega:**

Prove or disprove the following claim. If  $f(n) \in O(h_1(n))$  and  $g(n) \in \omega(h_2(n))$ , then  $\frac{f(n)}{g(n)} \in o\left(\frac{h_1(n)}{h_2(n)}\right)$ , assuming  $f(n), g(n), h_1(n)$  are all positive  $\forall n \geq 0$ . You should prove the statement from first principles or provide a counter example.

4. **Loop Analysis:**

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
```