Let's look at Lab 4, Q2.1.1(c).

```
sum ← 0;
for i = 1 → n do
  for j = 1 → n/i do
    sum ← sum + 1;
  end for
end for
```

This is the same as ...

$$\sum_{i=1}^{n}\sum_{j=1}^{n/i} 1 = \sum_{i=1}^{n} \frac{n}{i} = n\sum_{i=1}^{n} \frac{1}{i}$$

We use this reasoning ...

$$\{\sum_{k=1}^{m} 1 = m\} \text{ is like } \{\sum_{j=1}^{n/i} 1 = \frac{n}{i}\} \ .$$

The following is called a harmonic series and simplifies like so ...

$$\sum_{i=1}^{n} \frac{1}{i} \in O(\ln n)$$

Therefore ...

$$n\sum_{i=1}^{n} \frac{1}{i} \in O(n\ln n)$$

Let's look at Lab 4, Q3.

$$(\lg n)^2 \neq \lg n^2$$

Whereas ...

$$(\lg n)^2 = (\lg n)(\lg n) \in O((\lg n)(\lg n))$$

Notice ...

$$O(\lg n) < O((\lg n)^2) < O(n) < O(n\lg n) < O(n^2)$$

Cheers! – Eddie Ma