

CS375 Small Assignment 1 Solutions

Due Sep 9th 10PM ET

This assignment mostly exists to get us familiar with some of the notation I'm going to use this semester and will expect everyone to at least have some familiarity with.

1. O, Ω, Θ : These are the symbols that I expect I'll use almost every day, but we will more concretely define them in the coming classes. I'm expecting that everyone has used O in their 231 classes, and if you've taken it recently with me then probably you've used Ω and Θ . Regarding Ω and Θ , for now it suffices to think: $O \sim \leq$, $\Omega \sim \geq$, and $\Theta \sim =$, in an asymptotic sense where multiplicative constants are ignored. Nothing explicit to do for these yet, but we'll probably start with defining these symbols formally on monday.
2. $\sum$: This is sum notation. If you're unfamiliar with it, I recommend checking out appendix A in CLRS (linked on our course page). The wikipedia page (<https://en.wikipedia.org/wiki/Summation>) is also fine. Basically, you should think of the following two things as exactly equivalent:

$$\sum_{i=1}^n f(i)$$

```
total = 0
for i in range(1, n + 1):
    total += f(i)
return total
```

Note that for the sum notation, the final term is included, while Python's range function doesn't include the final term. Here are some examples:

$$\sum_{i=1}^{10} i = 1 + 2 + \dots + 9 + 10 = 55$$

$$\sum_{i=1}^5 11 = 11 + 11 + 11 + 11 + 11 + 11 = 55$$

$$\sum_{i=1}^5 i^2 = 1 + 4 + 9 + 16 + 25 = 55$$

$$\sum_{i=1}^n 1 = 1 + 1 + \dots + 1 (n \text{ times}) = n$$

$$\sum_{i=1}^n i = 1 + 2 + \dots + (n-1) + n = \frac{n(n+1)}{2} \text{ (this is a classic formula you should know)}$$

For some warm-up:

A) evaluate the following sums:

i. $\sum_{i=1}^3 i^3 = 1 + 8 + 27 = 36$

ii. $\sum_{i=1}^{10} 10 - i = 9 + 8 + \dots + 1 + 0 = 46$

iii. $\sum_{i=1}^n 2 = 2 + 2 + \dots + 2 = 2n$

iv. $\sum_{i=1}^n (n - i) = (n - 1) + (n - 2) + \dots + 1 + 0 = \frac{(n-1)n}{2}$

B) write the equivalent code for this double sum:

$$\sum_{i=1}^n \sum_{j=1}^m f(i, j)$$

```
total = 0
for i in range(1, n + 1):
    for j in range(1, m+1):
        total += f(i, j)
return total
```