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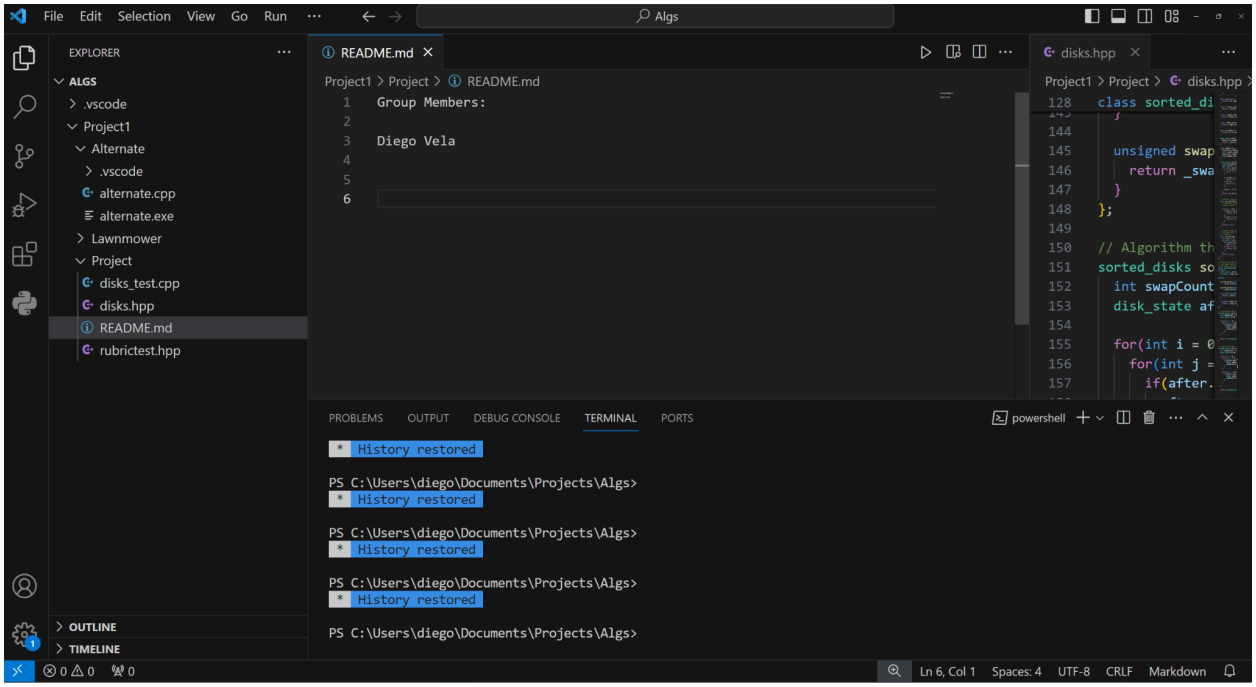
Project 1

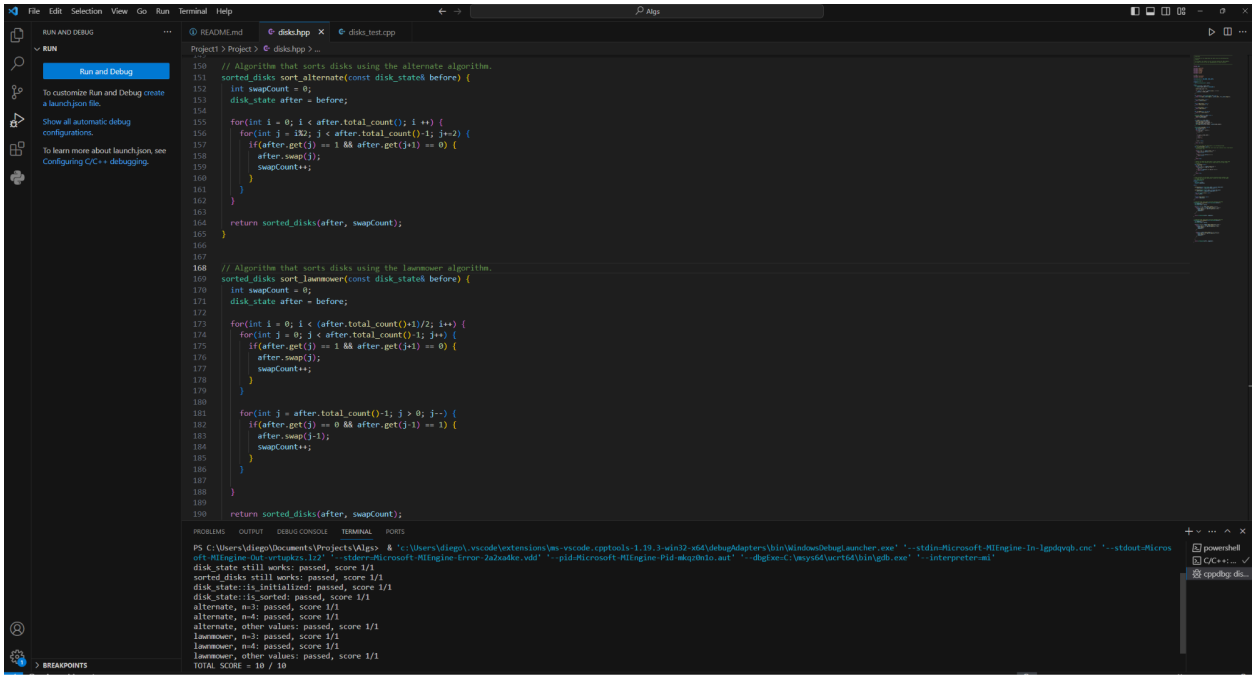
Table of Contents

Preliminary Screenshots

README.md



Execution of Two Algorithms



Assumptions

Swap()

For the mathematical analysis, I am going to let the swap() step count = 1. When passing in index (i), the total count for that swap will be 1. When passing in index (i+1), the total count for that swap will be 2.

```
void swap(size_t left_index)
```

Summation Formula

The summation formula will be represented by the SUMM(x to n) function in which x is the index of summation and n is the upper limit of the summation.

$$\sum_{x=1}^{n}$$

And/Or

The and/or keywords will be representing && and || respectively as a step count of 1

Lawnmower: Pseudocode

```
for i= 0 < (n+1)/2 {
    for j = 0 < n-1 do {
        if j == dark and j+1 == light {
            swap elements at j
        }
    }
    for j = n > 0 do {
        if j == light and j-1 == dark {
            swap elements at j-1
        }
    }
}
```

Lawnmower: Analysis

```
SUMM(i = 0 to (n+1)/2 -1) * (SUMM(j = 0 to n-1 -1)*(4+1) + SUMM(j = n-1 to 0 +1)*(4+2)
(n+1)/2   *  ((n-1)5 + (n-1)6)
(n+1)/2   *  ((5n-5)+(6n-6))
(n+1)/2   *   (11n-11)
(11n^2 - 11n + 11n -11)/2
(11n^2-11)/2 == O(n^2)

Prove Lawnmower Algorithm exists in O(n^2) using limit
for (11n^2-11)/2 >= cn^2 ==> Divide both sides by n^2
(11n^2-11)/2n^2 >= c
As the limit of n goes to infinity, 11n^2/2n^2 approaches 5.5
                                   -11/2n^2 approaches 0
Since 5.5 > 0 we can say (11n^2-11)/2 exists in O(n^2)
```

Alternate: Pseudocode

```
for i=0 < n do {
    for j = i%2 < n do
        if j == 1 and j+1 == dark
            swap elements at j
}
```

Alternate: Analysis

```
(SUMM(i = 1 to n) * (SUMM(j = 1 to n) * (4 + 1)))-n/2
n * n * 5 - n/2
5n^2 - 1/2(n) == O(n^2)

Prove Alternate Algorithm exists in O(n^2) using limit
for (5n^2-n/2) >= cn^2 ==> Divide both sides by n^2
(5n^2-n/2)/2n^2 >= c
As the limit of n goes to infinity, 5n^2/2n^2 approaches 5
                                   -n/4n^2 approaches 0
Since 5 > 0 we can say (5n^2-n/2) exists in O(n^2)
```