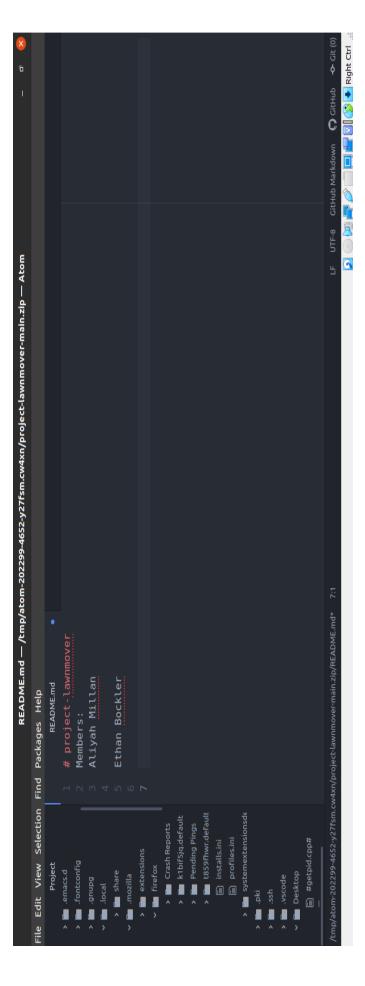
Project 1 CPSC 335

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```
student@tuffix-vm: ~/Desktop/project-lawnmover-main
          student@tuffix-vm:~/Desktop/project-lawnmover-main$ make
g++ -std=c++11 -Wall disks_test.cpp -o disks_test
0
                                                                                                                                                                           Μ↓
           ./disks_test
          ./disks_test
disk_state still works: passed, score 1/1
sorted_disks still works: passed, score 1/1
disk_state::is_initialized: passed, score 3/3
disk_state::is_sorted:
                TEST FAILED:
                line 81 of file disks_test.cpp, message: is_sorted() for n=3
                score 0/3
          alternate, n=4: passed, score 1/1
alternate, n=3: passed, score 1/1
alternate, other values: passed, score 1/1
          lawnmower, n=4:
TEST FAILED:
                line 123 of file disks_test.cpp, message: number of swaps must be 6
                score 0/1
          lawnmower, n=3:
TEST FAILED:
line 130 of file disks_test.cpp, message: number of swaps must be 3
                score 0/1
          lawnmower, other values:
TEST FAILED:
                line 140 of file disks_test.cpp, message: n=10 gives 45 swaps
          score 0/1
TOTAL SCORE = 8 / 14
          make: *** [Makefile:13: run_test] Error 1
           student@tuffix-vm:~/Desktop/project-lawnmover-main$
        > 🛅 Documents
        > 🛅 Music
```

Pseudocode Lawnmower algorithm:

Return sorted disks

Pseudocode Alternate algorithm:

return sorted disks

Pseudocode Lawnmover algorithm step count:

```
Inner loop(if statement):  if(movingRight) \\ For j=0 \ to \ 2n-1 \ do \\ if(disks[j] > disks[j+1]) \ do \\ disks.swap[j] -> 1tu \\ number\_of\_swaps++ -> 1tu \\ else \\ For j=0 \ to \ 2n-1 \ do \\ if(disks[j] > disks[j-1]) \ do \\ if(disks[j] > 1tu \\ disks.swap[j] -> 1tu \\ disks.sw
```

1+ max(2,2) = 3, both loops same Inner loop(with for loop)

$$(2n-1)*3 = 6n-3$$

Outer loop(For i=0 to 2n do)

Sum
$$\{i = 0\}^{2n} 6n - 3 = 2n(6n - 3) = 12n^2 - 6n + 1$$

Proofs:

Prove using <u>definition method</u> that $12n^2$ -6n + 1 belongs to O(n^2):

$$12n^{2} - 6n + 1 = f(n)$$

$$n^{2} = g(n)$$

$$f(n) \ll c * g(n) \text{ for all } n \ll n0$$

$$c = 19$$

$$n0 = 1$$

By definition method, $12n^2$ -6n + 1 belongs to O(n²)

Prove using <u>limit theorem</u> that $12n^2$ - 6n + 1 belongs to $O(n^2)$:

$$limit(12n^2 -6n + 1 / n^2) = limit(24n - 6 / 2n) = limit(24/2) = limit(12) = 12$$

By limit theorem $12n^2$ -6n + 1 belongs to $O(n^2)$

Pseudocode Alternate Algorithm step count:

Outer loop (for i=0 to 2n do):

Sum
$$2n * 2n - 1 = 4n^2 - 2n = O(n^2)$$

Proofs:

~ Prove using <u>definition theorem</u> that $4n^2 - 2n$ belongs to O(n²).

$$f(n) = 4n^2 - 2n$$

 $g(n) = n^2$
 $f(n) <= c * g(n) \text{ for all } n < n0$
 $c = 1$
 $n0 = 1$
 $f(n) <= g(n)$

~ Prove using <u>limit theorem</u> that $4n^2 - 2n$ belongs to O(n²).

$$\lim_{n \to \infty} (4n^2 - 2n)/(n^2) = \lim_{n \to \infty} (4n - 2)/(n) = \lim_{n \to \infty} 4/1 = \lim_{n \to \infty} 4 = 4$$

By limit theorem, $4n^2 - 2n$ belongs to O(n²).