

CPSC 335 - Section 07
Project 1: Lawnmower Problem

Bryan Garcia, PielsManly@csu.fullerton.edu
Bryan Rivas, brivas100@csu.fullerton.edu

Pseudocode

Def Sort_Alternate():

While Disks is not sorted:

```
For i = 0 from i to n, 2 step:          -> ((n - 0 + 1)/2) * 4 = 2(n+1) Tu
    If (Disks[i] == Dark && Disks[i+1] == Light)    -> 3 + (Max(1,0)) = 4 Tu
        Swap Disks[i] and Disks[i+1]              -> 1 Tu
For i = 1 from i to n-1, 2 step:        -> ((n - 1 - 1 + 1)/2) * 4 = 2(n+1) Tu
    If (Disks[i] == Dark && Disks[i+1] == Light)    -> 3 Tu + (Max(1,0)) = 4 Tu
        Swap Disks[i] and Disks[i+1]              -> 1 Tu
```

Total Step Count: $4(n+1)$ Tu

Def Lawnmower():

While Disks is not sorted:

```
For i = 0 from i to n-1:                -> ((n-1 - 0 + 1)/1) * 4 = 4n Tu
    If (Disks[i] == Dark && Disks[i+1] == Light)    -> 3 + (Max(1,0)) = 4Tu
        Swap Disks[i] and Disks[i+1]              -> 1 Tu
For i = n from i to 1, -1 step:          -> ((1 - n + 1)/-1) * 4 = 4(n-2) Tu
    If (Disks[i] == Light && Disks[i-1] == Dark)    -> 3 Tu + (Max(1,0))
        Swap Disks[i] and Disks[i-1]              -> 1 Tu
```

Total Step Count: $4n - 8 + 4n = 8n - 8 = 8(n-1)$ Tu

Time Complexity Explanation:

For our Sort_Alternate() Algorithm, We ended up with a step count of $4(n+1)$ Time Units, with n being our only variable, it would be a Time-Complexity of $O(N)$.

$$4(n + 1) \in O(N)$$

$$c = 8 \quad n_0 = 1$$

$$4n + 4 \leq c * n \quad \forall n \geq n_0$$

$$4(1) + 4 \leq 8 * 1$$

$$4 + 4 \leq 8$$

$$8 \leq 8$$

$$\text{Hence, } 4(n + 1) \in O(N)$$

For our Lawnmower Algorithm, We ended up with a step count of $8(n-1)$ Time Units, Having n again as our only variable, it would also be a Time-Complexity of $O(N)$.

$$8(n - 1) \in O(N)$$

$$c = 8 \quad n_0 = 2$$

$$8(n - 1) \leq c * n \quad \forall n \geq n_0$$

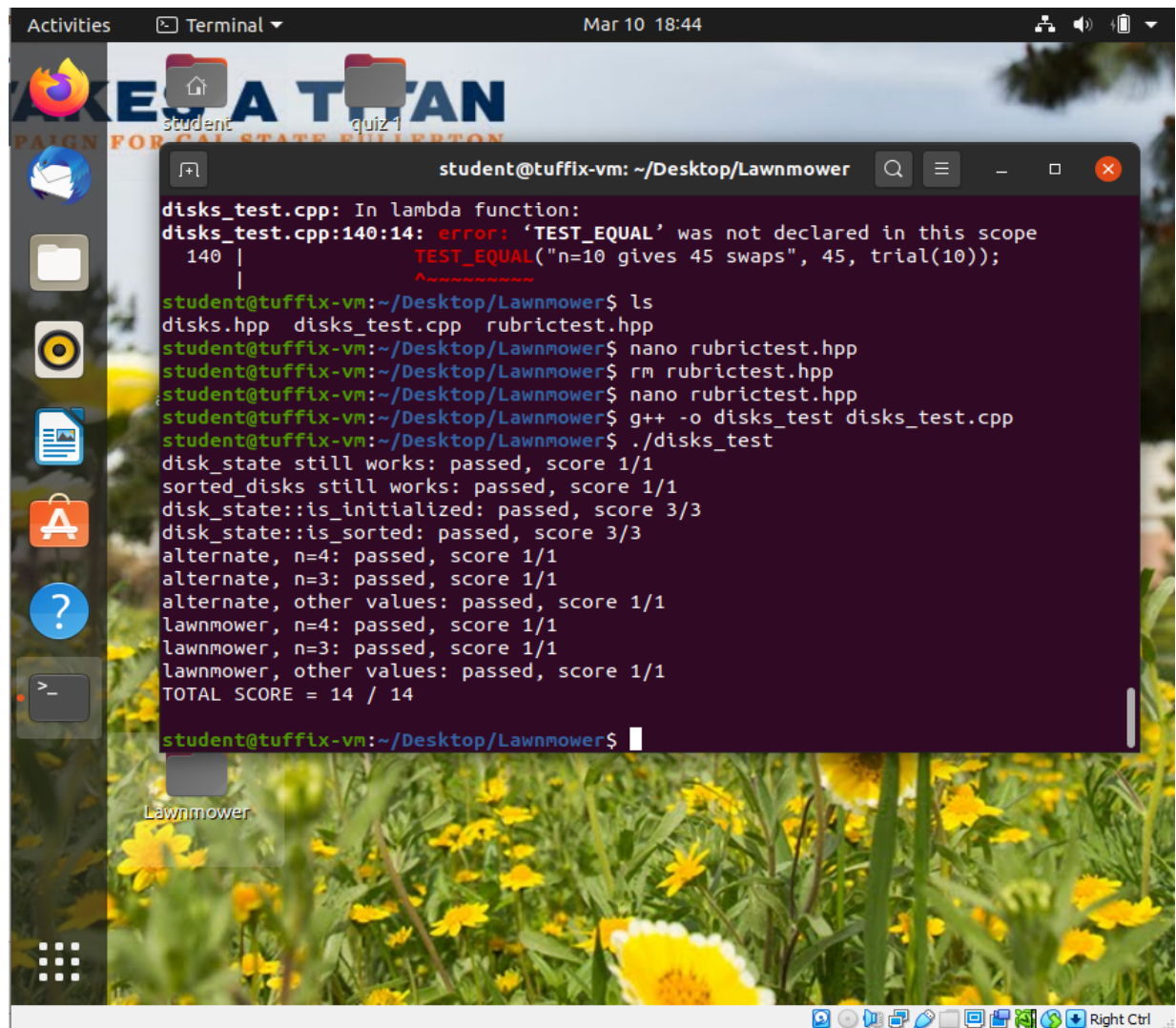
$$8n - 8 \leq 8 * 2$$

$$8(2) - 8 \leq 16$$

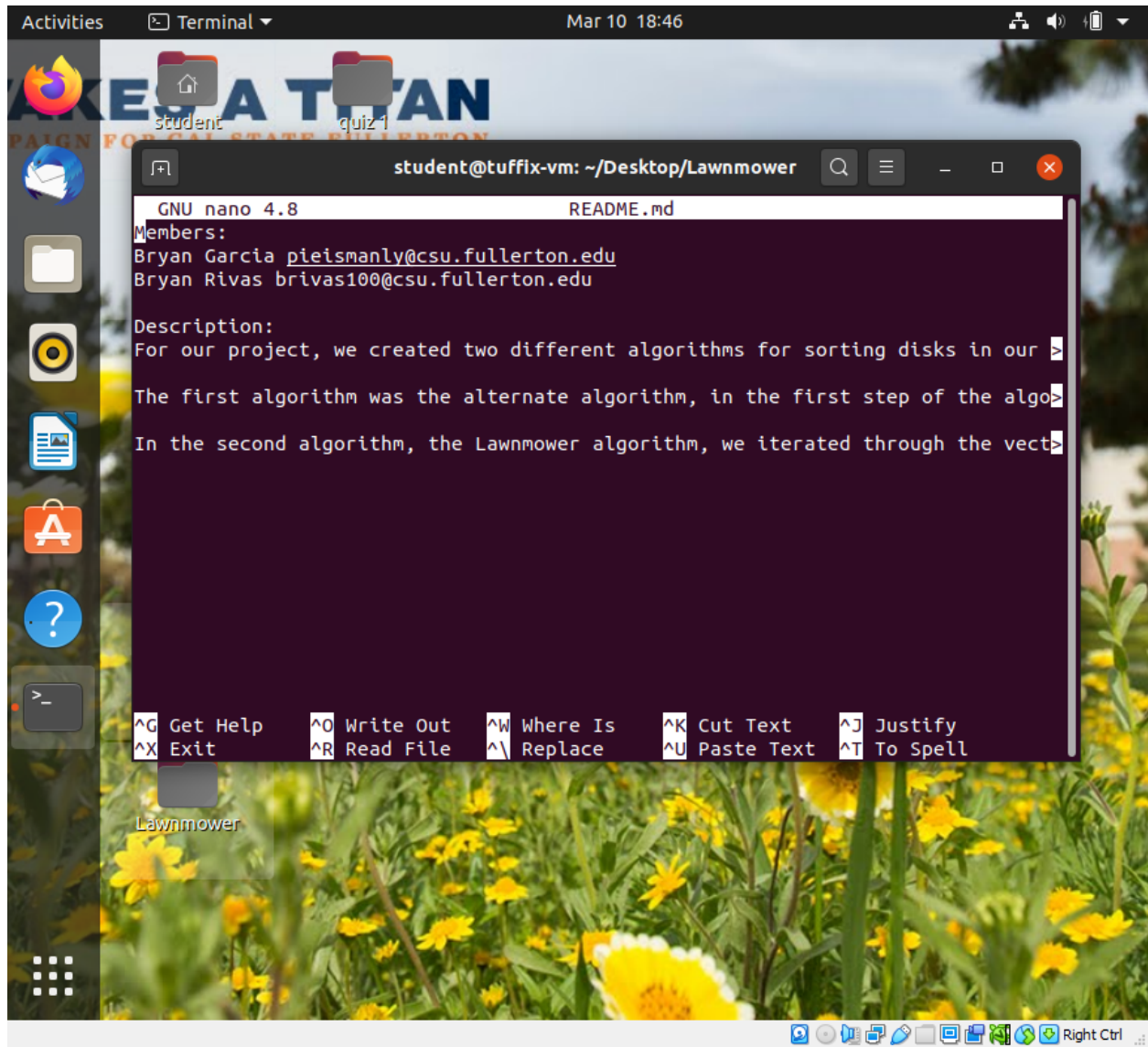
$$8 \leq 16$$

$$\text{Hence, } 8(n - 1) \in O(N)$$

Screenshots



```
student@tuffix-vm: ~/Desktop/Lawnmower
disks_test.cpp: In lambda function:
disks_test.cpp:140:14: error: 'TEST_EQUAL' was not declared in this scope
  140 |         TEST_EQUAL("n=10 gives 45 swaps", 45, trial(10));
      |         ^
student@tuffix-vm:~/Desktop/Lawnmower$ ls
disks.hpp disks_test.cpp rubric_test.hpp
student@tuffix-vm:~/Desktop/Lawnmower$ nano rubric_test.hpp
student@tuffix-vm:~/Desktop/Lawnmower$ rm rubric_test.hpp
student@tuffix-vm:~/Desktop/Lawnmower$ nano rubric_test.hpp
student@tuffix-vm:~/Desktop/Lawnmower$ g++ -o disks_test disks_test.cpp
student@tuffix-vm:~/Desktop/Lawnmower$ ./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: passed, score 3/3
alternate, n=4: passed, score 1/1
alternate, n=3: passed, score 1/1
alternate, other values: passed, score 1/1
lawnmower, n=4: passed, score 1/1
lawnmower, n=3: passed, score 1/1
lawnmower, other values: passed, score 1/1
TOTAL SCORE = 14 / 14
student@tuffix-vm:~/Desktop/Lawnmower$
```



```
student@tuffix-vm: ~/Desktop/Lawnmower
GNU nano 4.8 README.md
Members:
Bryan Garcia pieismanly@csu.fullerton.edu
Bryan Rivas brivas100@csu.fullerton.edu

Description:
For our project, we created two different algorithms for sorting disks in our
The first algorithm was the alternate algorithm, in the first step of the algo
In the second algorithm, the Lawnmower algorithm, we iterated through the vect
```

^G Get Help	^O Write Out	^W Where Is	^K Cut Text	^J Justify
^X Exit	^R Read File	^_ Replace	^U Paste Text	^T To Spell

Lawnmower