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Project 1

Pseudocode for the alternate algorithm and Big-O Efficiency

Alternate algorithm

def sorted_alternate(const disk_state& before):

```
    create new disk_state that are identical to before     1
    numOfSwap = 0                                          1
    for i = 1 to n do                                      (n -1) + 1 = n
        if ( i % 2 != 0)                                   2
            then
            for j = 0  to 2n - 1 step 2 do                 n+1/2
                if (disk at j == light && disk at j+1 == dark)   3
                    swap                                         1
                    numOfSwap++                          1


        else
            for k =1 to 2n - 2 step 2 do                   ((2n-2)- 1)/2 +1 = n-1/2
                if (disk at k == light && disk at k+1 == dark        3
                    swap                                 1
                    numOfSwap++                          1

    return sorted disk                                   1
```

SC = 1 + 1 + (n) (2 + max(SC then block, SC else block) + 1
    SC then block = (n+1/2)(3+max(2,0)= 5(n+1/2)
    SC else block =((n-1/2) (3+max(2,0) = 5(n-1/2)
  = 2 + (n) (2 + max (5(n+1/2), 5(n-1/2)) + 1
  = 3+2n+ 5n^2+1/2n
  = 3+5/2n+5n^2
  O(n^2)

Proof that the step count belong to O(n^2) limits

5n^2 +5/2n +3 ∊ O(n^2)
lim n to inf (5n^2+5/2n +3)/(n^2)
= lim n to inf (5n^2/n^2) + lim n to inf (5/2n/n^2) + lim n to inf (3/n^2)
= lim n to inf (5) + lim n to inf (5/2n) + lim n to inf (3/n^2)
= 5 >= 0 and a constant therefore 5n^2 +5/2n +3 ∊ O(n^2)

Lawnmower Algortihm

```
def sorted_lawnmower(const disk_state& before):

        create new disk_state that are identical to before     1
        numOfSwap = 0                                          1
        for i = 1 to n                                    n - 1+1 = n
                for j = 0 to 2n - 2                       2n-2 -0+1 = 2n-1
                        if (disk at j == light && disk at j+1 == dark)    3
                                swap                                      1
                                numOfSwap++                    1
                for k = 2n - 1 to 1                       1-(2n-1)+1 = 2n + 3
                        if (disk at j == dark && disk at j+1 == light)    3
                                swap                                      1
                                numOfSwap++                    1
        return sorted disk
```

SC = 1 + 1 + outer for loop(SC first for loop + SC second for loop) + 1
  = 1+1+n [(2n-1)(3+max(2,0)) + (2n+3)(3+max(2,0)] +1
  = 3 + n [(2n-1)(5) + (2n+3)(5)]
  = 3 + n(10n-5+10n+15)
  = 3 +n(10n+10)
  = 3 + 10n^2 +10n
    O(n^2)

Proof that the step count belong to O(n^2) limits

10n^2+10n + 3 ∈ O(n^2)

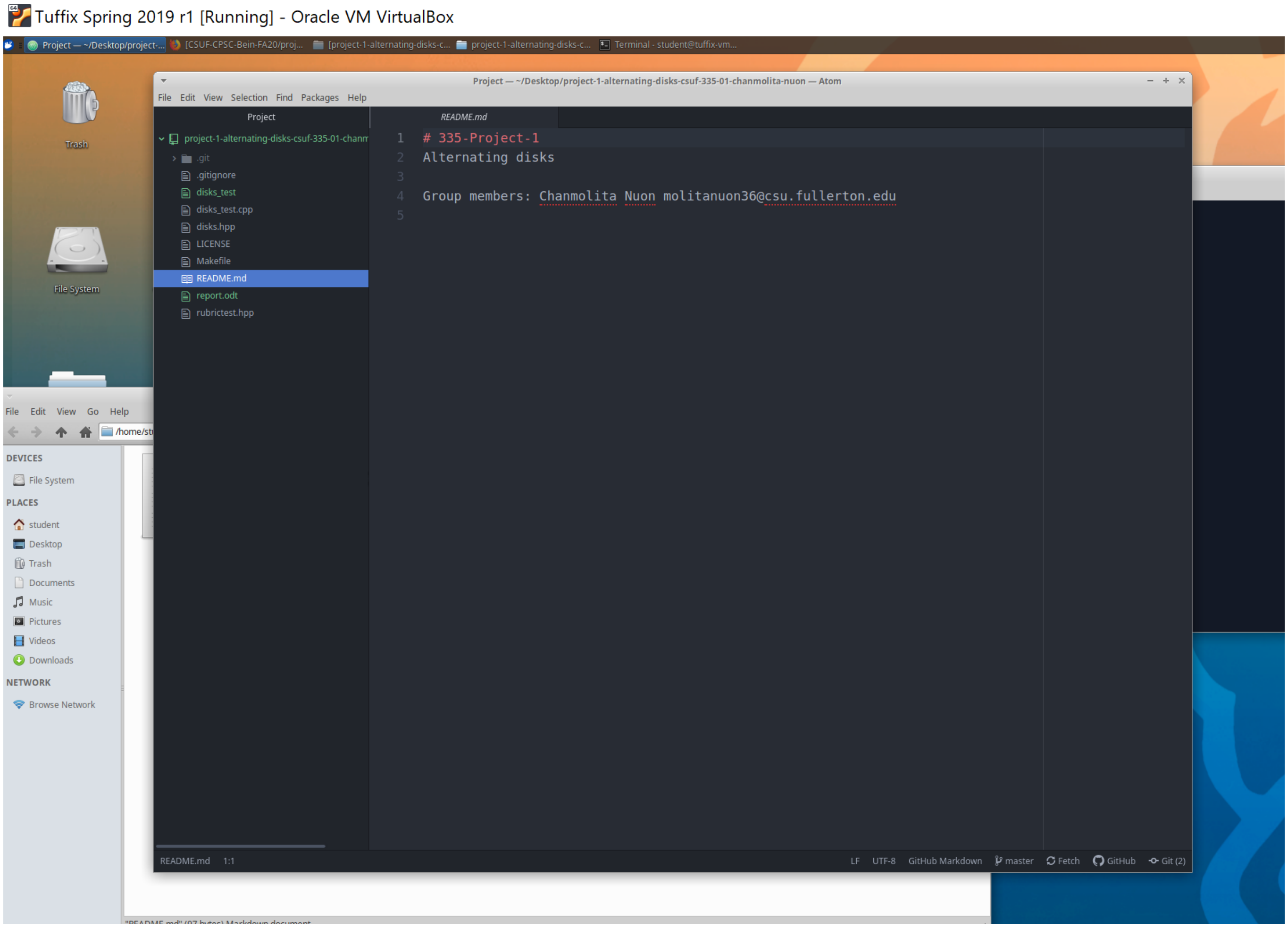
lim n to inf (10n^2+10n +3)/(n^2)

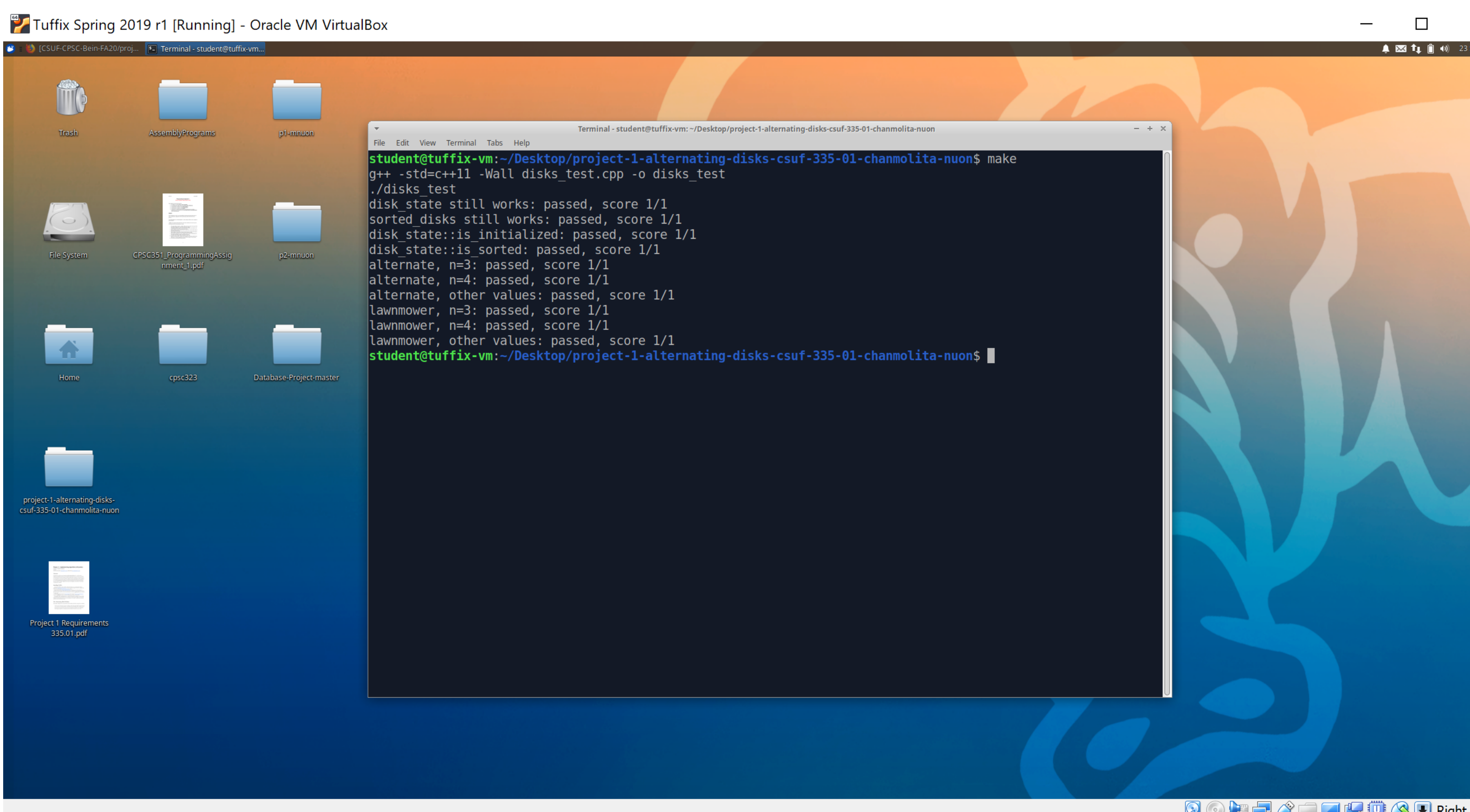
= lim n to inf (10n^2/n^2) + lim n to inf (10n/n^2) + lim n to inf (3/n^2)

= lim n to inf (10) + lim n to inf (10n) + lim n to inf (3/n^2)

= 10 >= 0 and a constant therefore 10n^2 +10n +3 ∈ O(n^2)

Screenshots


Tuffix Spring 2019 r1 [Running] - Oracle VM VirtualBox
Project — ~/Desktop/project-1-alternating-disks-csuf-335-01-chanmolita-nuon — Atom
README.md
335-Project-1
Alternating disks
Group members: Chanmolita Nuon molitanuon36@csu.fullerton.edu
.gitignore
disks_test
disks_test.cpp
disks.hpp
LICENSE
Makefile
README.md
report.odt
rubrictest.hpp


Tuffix Spring 2019 r1 [Running] - Oracle VM VirtualBox
Terminal - student@tuffix-vm: ~/Desktop/project-1-alternating-disks-csuf-335-01-chanmolita-nuon
student@tuffix-vm:~/Desktop/project-1-alternating-disks-csuf-335-01-chanmolita-nuon$ make
g++ -std=c++11 -Wall disks_test.cpp -o 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 1/1
disk_state::is_sorted: passed, score 1/1
alternate, n=3: passed, score 1/1
alternate, n=4: passed, score 1/1
alternate, other values: passed, score 1/1
lawnmower, n=3: passed, score 1/1
lawnmower, n=4: passed, score 1/1
lawnmower, other values: passed, score 1/1
student@tuffix-vm:~/Desktop/project-1-alternating-disks-csuf-335-01-chanmolita-nuon$