

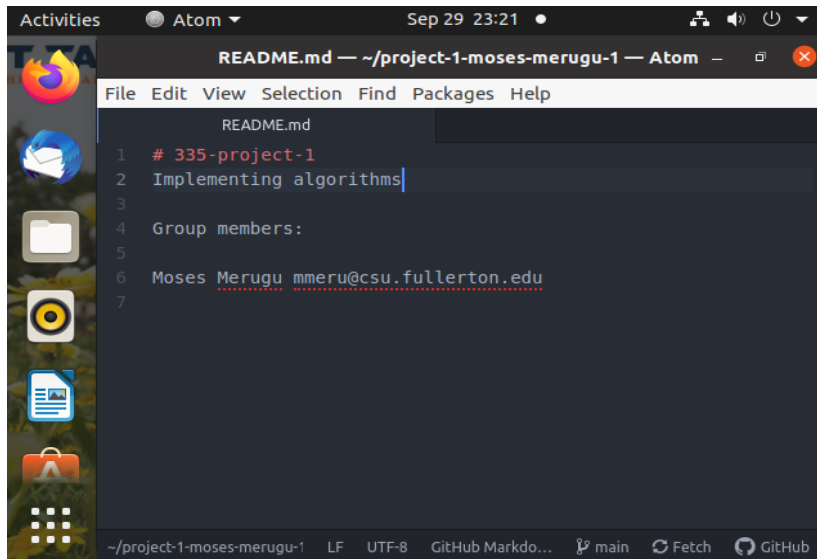
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10/1/2021

CPSC 353-01

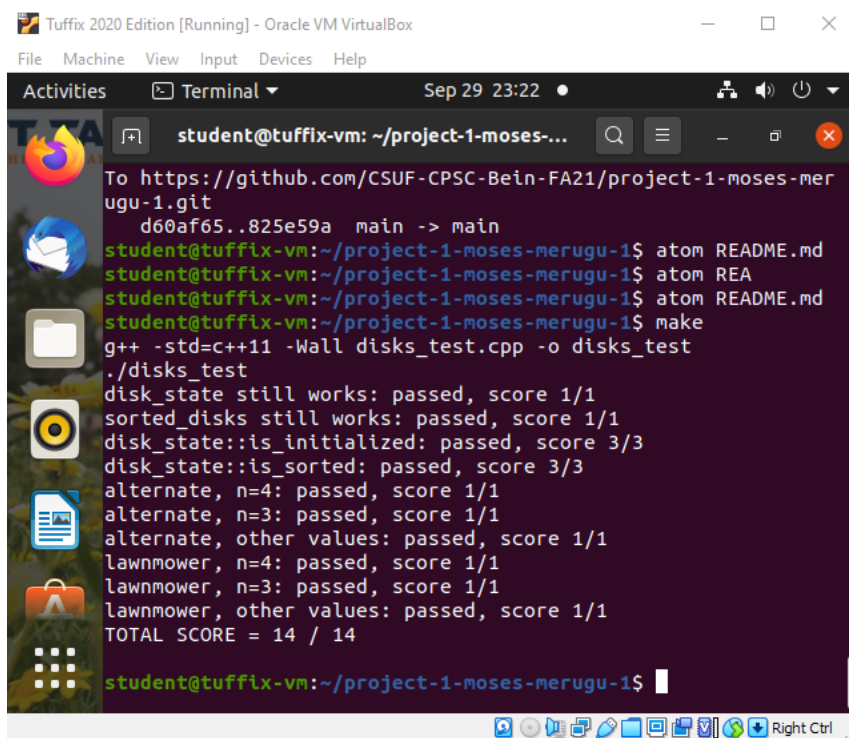
Project 1 Report



The screenshot shows the Atom text editor interface. The title bar indicates the file is 'README.md' located in '~/.project-1-moses-merugu-1'. The menu bar includes File, Edit, View, Selection, Find, Packages, and Help. The editor content shows a README file with the following text:

```
1 # 335-project-1
2 Implementing algorithms
3
4 Group members:
5
6 Moses Merugu mmeru@csu.fullerton.edu
7
```

The status bar at the bottom shows the file path, line and column numbers (LF, UTF-8), the file encoding (GitHub Markdo...), and the current branch (main).



The screenshot shows a terminal window titled 'Tuffix 2020 Edition [Running] - Oracle VM VirtualBox'. The terminal prompt is 'student@tuffix-vm: ~/project-1-moses-...'. The user has run the following commands:

```
student@tuffix-vm:~/project-1-moses-merugu-1$ atom README.md
student@tuffix-vm:~/project-1-moses-merugu-1$ atom REA
student@tuffix-vm:~/project-1-moses-merugu-1$ atom README.md
student@tuffix-vm:~/project-1-moses-merugu-1$ 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 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:~/project-1-moses-merugu-1$
```

The terminal output shows the results of the program execution, including the total score of 14 out of 14.

Lawnmower

Pseudocode

Count = 0

Disk_state = before

from i to light_count

if (i % 2 == 0) go left to right

if adjacent disks differ disk_state.get(j) > disk_state.get(j+1)

swap() and increment swap count

else go right to left

if adjacent disks differ disk_state.get(j) > disk_state.get(j+1)

swap() disk state and increment swap count

Return sorted disks state and swap count

Step Count

```
// Algorithm that sorts disks using the lawnmower algorithm.
sorted_disks sort_lawnmower(const disk_state& before) {

    int count = 0; \
    disk_state check = before; \

    for(size_t i = 0; i < check.light_count(); i++) { n / 2
        if(i % 2 == 0) { //incrementing 2
            for(size_t j = 0; j < check.total_count() - 1; j++) { n - 1
                if(check.get(j) > check.get(j + 1)) { 2
                    check.swap(j); 3
                    count++; \
                }
            }
        } else { //not incrementing
            for(size_t j = check.total_count() - 2; j < check.total_count() - 1; j--) { n - 1
                if(check.get(j) > check.get(j + 1)) { 2
                    check.swap(j); 3
                    count++; \
                }
            }
        }
    }

    return sorted_disks(disk_state(check), count);
}
```

$$S_c = 2 + (n) \cdot 6(n-1) \cdot 6(n-1)$$
$$= 36n^3 - 72n^2 + 36n + 2$$

Proof

$$36n^3 - 72n^2 + 36n + 2 \in O(n^3)$$

def $c=146$ and $n_0=1$
 $36n^3 - 72n^2 + 36n + 2 \leq 146n^3 \forall n \geq 1$

lim: $\lim_{n \rightarrow \infty} \frac{36n^3 - 72n^2 + 36n + 2}{n^3} \rightarrow \lim_{n \rightarrow \infty} \frac{216n - 144}{4n}$

$\lim_{n \rightarrow \infty} \frac{108n^2 - 144n + 36}{2n^2} = 54$ $\lim_{n \rightarrow \infty} \frac{216}{4} = 54$

Alternate

Pseudocode

Count = 0

Disk_state = before

from i to light_count

go left to right

if adjacent disks differ disk_state.get(j) > disk_state.get(j+1)

swap() disk state and increment swap count

Return sorted disks state and swap count

Step Count

```
// Algorithm that sorts disks using the alternate algorithm.
sorted_disks sort_alternate(const disk_state& before) {

    int count = 0;
    disk_state check = before;

    for(size_t i = 0; i < check.light_count(); i++) {
        for(size_t j = 0; j < check.total_count() - 1; j++) {
            if(check.get(j) > check.get(j + 1)) {
                check.swap(j);
                count++;
            }
        }
    }

    return sorted_disks(disk_state(check), count);
}
```

$SC = 2 + \left(\frac{n}{2}\right) \times 6(n-1)$
 $= 3n^2 - 3n + 2$

Proof

$$3n^2 - 3n + 2 \in O(n^2)$$

$$\text{def: } C=8 \text{ and } n_0=1$$

$$3n^2 - 3n + 2 \leq 8n^2 \quad \forall n \geq 1$$

$$\text{limits: } \lim_{n \rightarrow \infty} \frac{3n^2 - 3n + 2}{n^2}$$

$$\lim_{n \rightarrow \infty} \frac{6n - 3}{2n}$$

$$\lim_{n \rightarrow \infty} \frac{6}{2} = 3$$