README.md — ~/project-1-yp-and-aa — Atom

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Project

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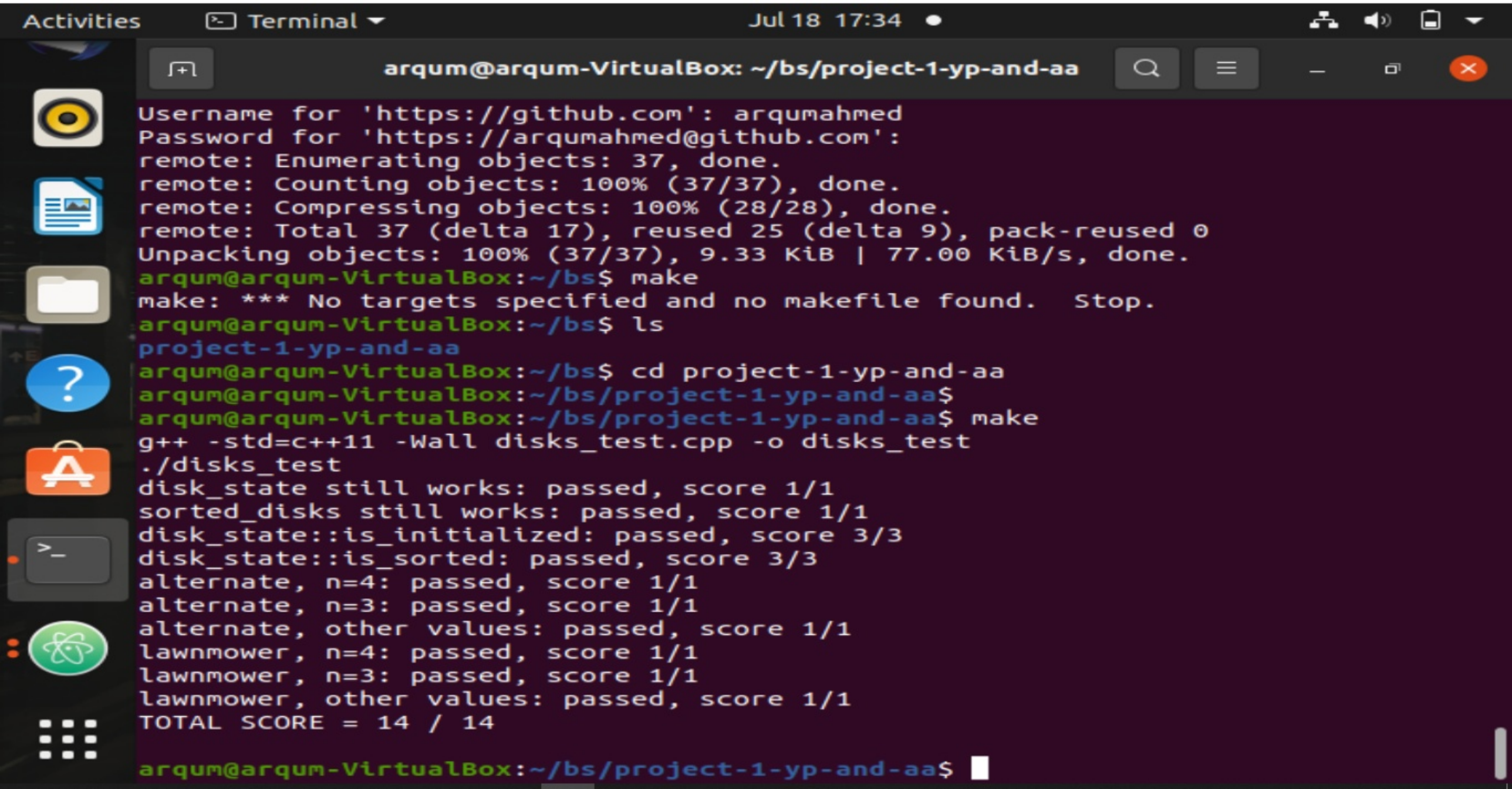
README.md

```
1  # Project-1
2  Implementing algorithms
3
4  Group members:
5
6  Yesh Patel Yesh@csu.fullerton.edu
7
8  Arqum Ahmed ArqumAhmed@csu.fullerton.edu
9
```


Activities
Terminal
Jul 18 17:34
arqum@arqum-VirtualBox: ~/bs/project-1-yp-and-aa
Username for 'https://github.com': arqumahmed
Password for 'https://arqumahmed@github.com':
remote: Enumerating objects: 37, done.
remote: Counting objects: 100% (37/37), done.
remote: Compressing objects: 100% (28/28), done.
remote: Total 37 (delta 17), reused 25 (delta 9), pack-reused 0
Unpacking objects: 100% (37/37), 9.33 KiB | 77.00 KiB/s, done.
arqum@arqum-VirtualBox:~/bs$ make
make: *** No targets specified and no makefile found. Stop.
arqum@arqum-VirtualBox:~/bs$ ls
project-1-yp-and-aa
arqum@arqum-VirtualBox:~/bs$ cd project-1-yp-and-aa
arqum@arqum-VirtualBox:~/bs/project-1-yp-and-aa$
arqum@arqum-VirtualBox:~/bs/project-1-yp-and-aa$ 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
arqum@arqum-VirtualBox:~/bs/project-1-yp-and-aa$

Psuedocode and Mathematical Analysis

Lawnmowers algorithm

Input: a positive integer n and a list of 2n disks of alternating colors dark-light, starting with dark

Output: a list of 2n disks, the first n disks are dark, the next n disks are light, and a integer m representing the swaps to move the dark ones before the light ones

```
m=0                                                    // 1
for i = 1 to n+1/2 do                                  // ((n+1/2)-1+1) = n+1/2
    for J = 1 to 2n-2 do                               // (2n-2-1+1) = 2n-2
        if ( L[J+1] == dark && L[J] != dark )          // 4 + max(6,0) = 10
            temp = L[J]                                // 1
            L[J] = L[J+1]                              // 2   6
            L[J+1] = temp                              // 2
            m++                                        // 1
    for K = 2n-2 down to 1 do                          // ((1-2n-2)/-1 + 1) = 2n+2
        if ( L[K-1] == light && L[K] != light )        // 4+max(6,0) = 10
            temp = L[K-1]                              // 2
            L[K-1] = L[K]                              // 2   6
            L[K] = temp                                // 1
            m++                                        // 1
Return (L, m)
```

$$C = 1 + \left(\frac{n+1}{2}\right) \cdot \left((2n-2)\cdot 10) + ((2n+2)\cdot 10)\right)$$

$$= 1 + \left(\frac{n+1}{2}\right) \cdot 20n - 20 + 20n + 20$$

$$= 1 + \left(\frac{n+1}{2}\right) \cdot 40n$$

$$= 20n^2 + 20n + 1$$

Mathematical analysis

Proof : $2n^2+2n+1 \in n^2$

$\lim_{n\to\infty} = \frac{2n^2+2n+1}{n^2}$, $\lim_{n\to\infty} = \frac{(2n^2)'+(2n)'+(1)'}{(n^2)'}$, $\lim_{n\to\infty} = \frac{4n+2}{2n}$

$\lim_{n\to\infty} = \frac{(4n)'+(2)'}{(2n)'}$, $\lim_{n\to\infty} \frac{4}{2} = 2 \geq 0$ and defined

Alternate Algorithm

Input: a positive integer n and a list of 2n disks of alternating colors dark-light, starting with dark

Output: a list of 2n disks, the first n disks are dark, the next n disks are light, and a integer m representing the swaps to move the dark ones before the light ones

```
m = 0                                   // 1
alternate = true                        // 1
for i = 1 to n-1                        // (n-1-1+1) = n-1
    if (alternate == true)              // 1 + max(10n+1, 6n-4) = 10n+1
        for J = 0 to 2n-2 SKIP 2 do     // ((2n-2)/2 + 1) = n
            if ( L[J] == light &&       // 4 + max(6, 0) = 10
                 L[J+1] != light)
                string temp = disk[J]   // 1
                disk[J] = disk[J+1]     // 2
                disk[J+1] = temp        // 2
                m++                     // 1
        alternate = false               // 1
    else
        for J = 1 to 2n-2 SKIP 2 do     // ((2n-2-1)/2 + 1) = (n - 1/2)
            if ( L[J] == light &&       // 4 + max(6, 0) = 10
                 L[J+1] != light)
                string temp = disk[J]   // 1
                disk[J] = disk[J+1]     // 2
                disk[J+1] = temp        // 2
                m++                     // 1
        alternate = true                // 1
Return (L, m)
```

S.C: $2 + (n-1) \cdot (10n + 1)$

$= 2 + 10n^2 + n - 10n - 1$

$= 10n^2 - 9n + 1$

Mathematical Analysis

Proof: $10n^2 - 9n + 1 \in n^2$

$\lim_{n \to \infty} \frac{10n^2 - 9n + 1}{n^2}$, $\lim_{n \to \infty} \frac{(10n^2)' - (9n)' + (1)'}{(n^2)'}$,

$\lim_{n \to \infty} \frac{20n - 9}{2n}$, $\lim_{n \to \infty} \frac{(20n)' - (9)'}{(2n)'}$,

$\lim_{n \to \infty} \frac{20}{2} = 10 \geq 0$ and it is defined

therefore it exists in n^2