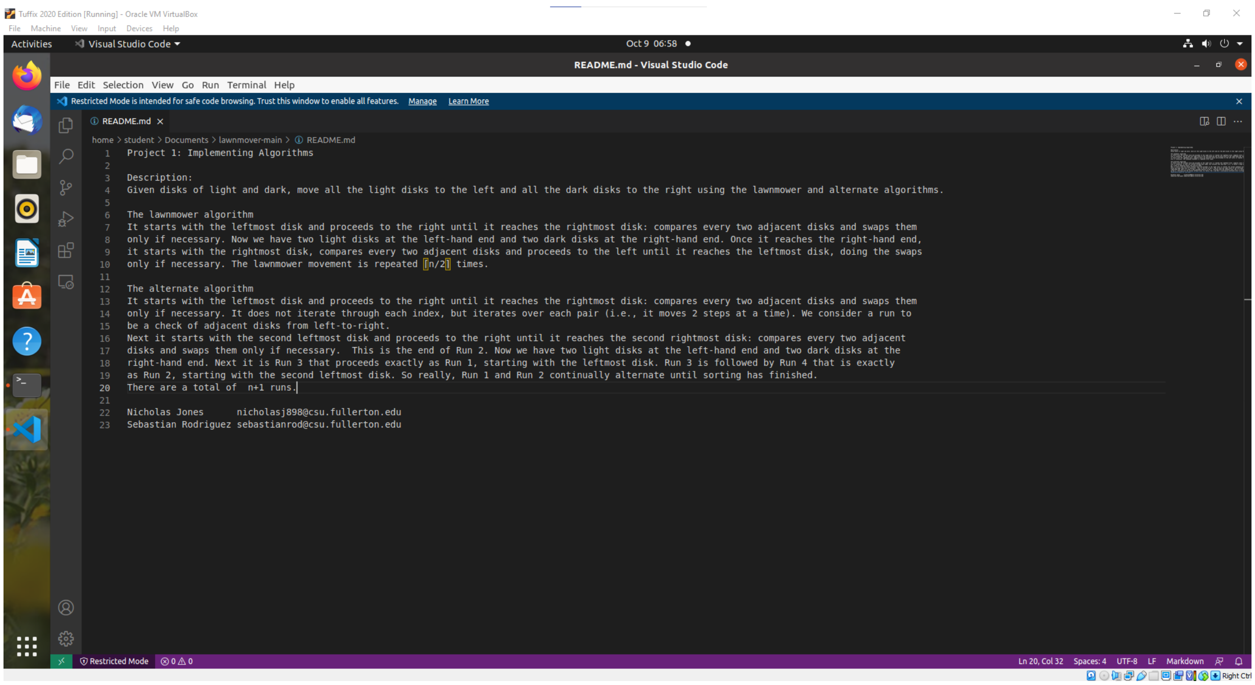
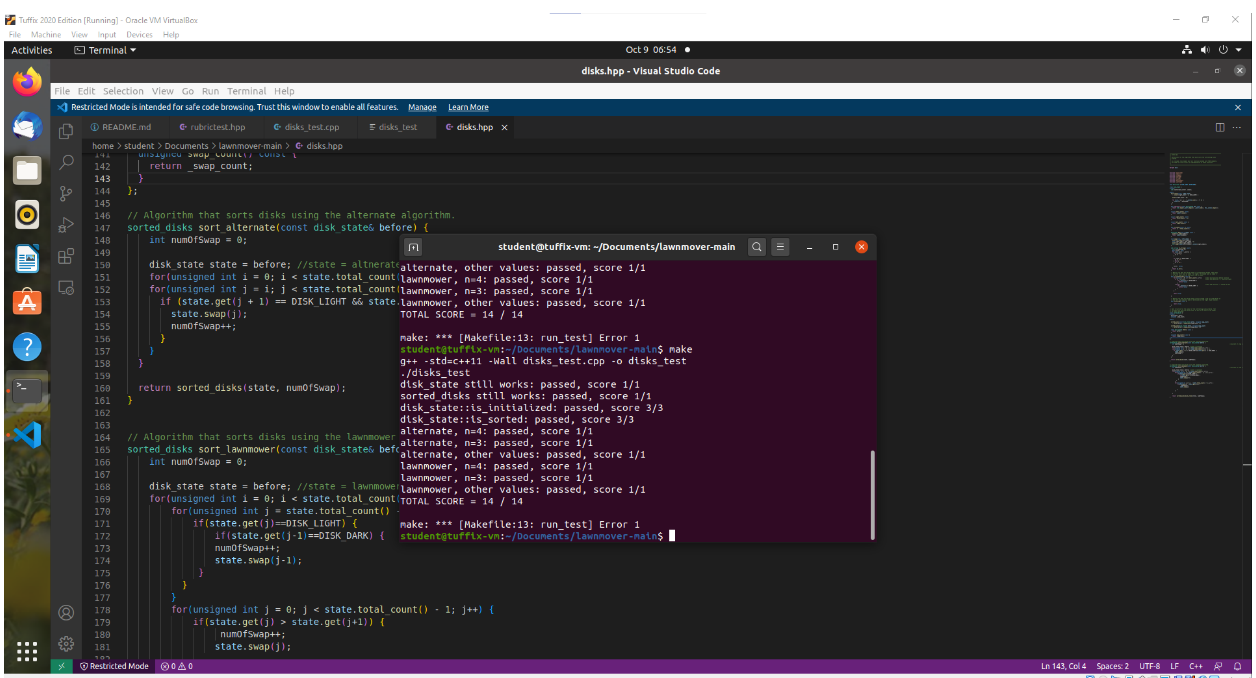
Project 1: Implementing Algorithms





Lawnmower Algorithm Pseudo Code:

Create local variable to count the swaps	1 tu
Create temp disk state	1 tu
For i from 0 to n/2	n/2 + 1 tu
For j total count - 1	1-n tu
If j is less than total count - 1	2 tu
Increment	1 tu
Swap states	1 tu
Swap j-1 and j	3 tu
For j from 0 to n-1	n-1 tu
If j is greater than j+1	2 tu
Increment	1 tu
Swap states	1 tu
Swap j and j+1	3 tu

Mathematical Analysis

Step Count:

O(n^2)

SC = 1 + 1 + outer for loop(SC first for loop + SC second for loop) + 1

SC = 1 + 1+ ((n/2) + 1) ((1-n)(2 + max(6, 0)) + n(2 + max(5, 0))

= 2 + ((n/2) + 1) (8 - 6n + 5n)

= 2+((n/2) + 1) (8 - 1n)

= 2 + ((8n/2) + 1)(8 - 1n)

$= 2 + (8n/2)-(n^2/2) + 8 - n$

$= 10 + (8n/2)-(n^2/2) + 8 - n$

$= 10 + 3n-(n^2/2)$

$= O((n^2/2) - 3n - 10))$

$= O((n^2/2))$

$= O(n^2)$

Proof:

$8n^2 + 3n + 8 \in O(n^2)$

$\lim_{n \to \infty} (8n^2 + 3n + 8)/(n^2)$

$= \lim_{n \to \infty} (8n^2/n^2) + \lim_{n \to \infty} (8n/n^2) + \lim_{n \to \infty} (3/n^2)$

$= \lim_{n \to \infty} (8) + \lim_{n \to \infty} (8n) + \lim_{n \to \infty} (3/n^2)$

$= 8 >= 0$ and is a constant

$8n^2 + 3n + 8 \in O(n^2)$

Alternate Algorithm Pseudo Code:

Create local variable to count the swaps	1 tu
Create temp disk state	1 tu
For i from 0 total count	n/(2n+1) tu
For j = 1 total count - 1	n tu
If j+1 and j	2 tu
Swap states	1 tu
Increment	1 tu

Mathematical Analysis

Step Count:

O(n^2)

SC = 1 + 1 + (n/2 + 1)n(2 + max(3, 0))

= 2 + (n/2 + 1)(n)(5)

= 2 + (n/2 + 1)(5n)

= 2 + (5n^2)/2 + 5n = (5n^2)/2 + 5n + 2

= O((5n^2)/2 + 5n + 2)

= O((5n^2)/2)

= O(n^2)

Proof:

5n^2 + 5n + 2 ∈ O(n^2)

lim n to inf (5n^2 + 5n + 2)/(n^2)

= lim n to inf (5n^2/n^2) + lim n to inf (5n/n^2) + lim n to inf (2/n^2)

$= \lim n$ to inf (2) + lim n to inf (5n) + lim n to inf (5/n^2)

= 5 >= 0 and is a constant

$5n^2 + 5n + 2 \in O(n^2)$