Project 1

CPSC 335

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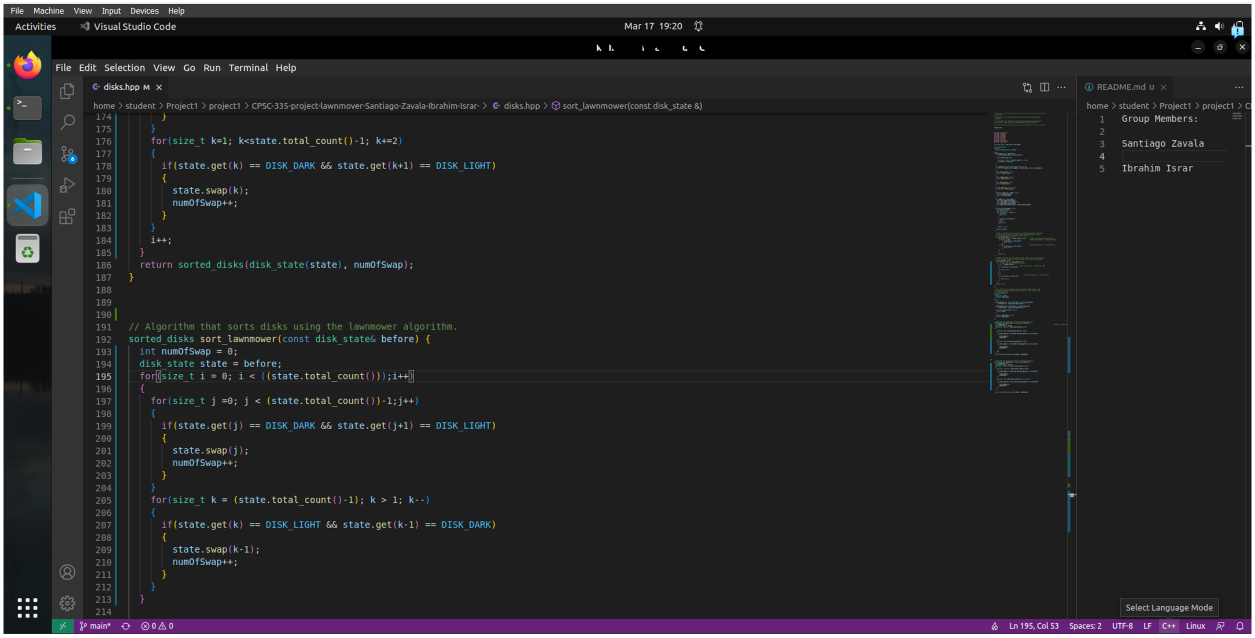
Editor and ReadMe:



```
      }
    }
    for(size_t k=1; k<state.total_count()-1; k+=2)
    {
      if(state.get(k) == DISK_DARK && state.get(k+1) == DISK_LIGHT)
      {
        state.swap(k);
        numOfSwap++;
      }
    }
    i++;
  }
  return sorted_disks(disk_state(state), numOfSwap);
}



// Algorithm that sorts disks using the lawnmower algorithm.
sorted_disks sort_lawnmower(const disk_state& before) {
  int numOfSwap = 0;
  disk_state state = before;
  for(size_t i = 0; i < ((state.total_count()));i++)
  {
    for(size_t j =0; j < (state.total_count())-1;j++)
    {
      if(state.get(j) == DISK_DARK && state.get(j+1) == DISK_LIGHT)
      {
        state.swap(j);
        numOfSwap++;
      }
    }
    for(size_t k = (state.total_count()-1); k > 1; k--)
    {
      if(state.get(k) == DISK_LIGHT && state.get(k-1) == DISK_DARK)
      {
        state.swap(k-1);
        numOfSwap++;
      }
    }
  }

```

```
Group Members:

Santiago Zavala

Ibrahim Israr
```

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disks.hpp M
home > student > Project1 > project1 > CPSC-335-project-lawnmover-Santiago-Zavala-Ibrahim-Israr- > disks.hpp > sort_lawnmower(const disk_state &)
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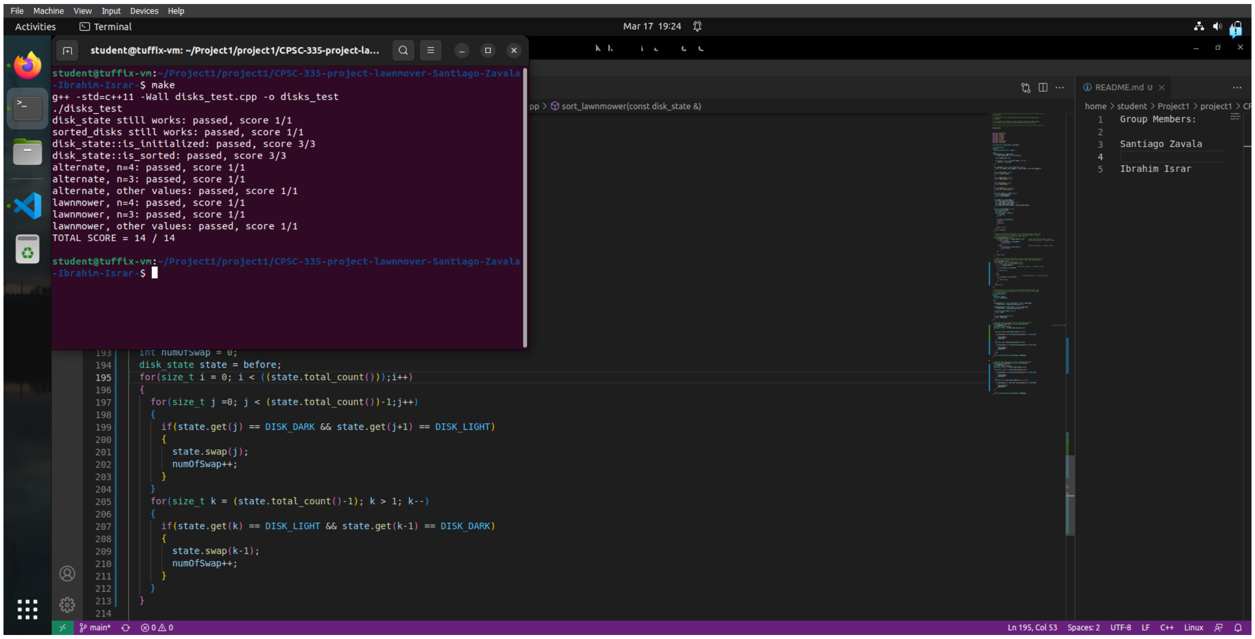
Compiling and Executing:



```
student@tuffix-vm:~/Project1/project1/CPSC-335-project-lawnmover-Santiago-Zavala
-Ibrahim-Israr-$ 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:~/Project1/project1/CPSC-335-project-lawnmover-Santiago-Zavala
-Ibrahim-Israr-$ 
```

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student@tuffix-vm: ~/Project1/project1/CPSC-335-project-la...
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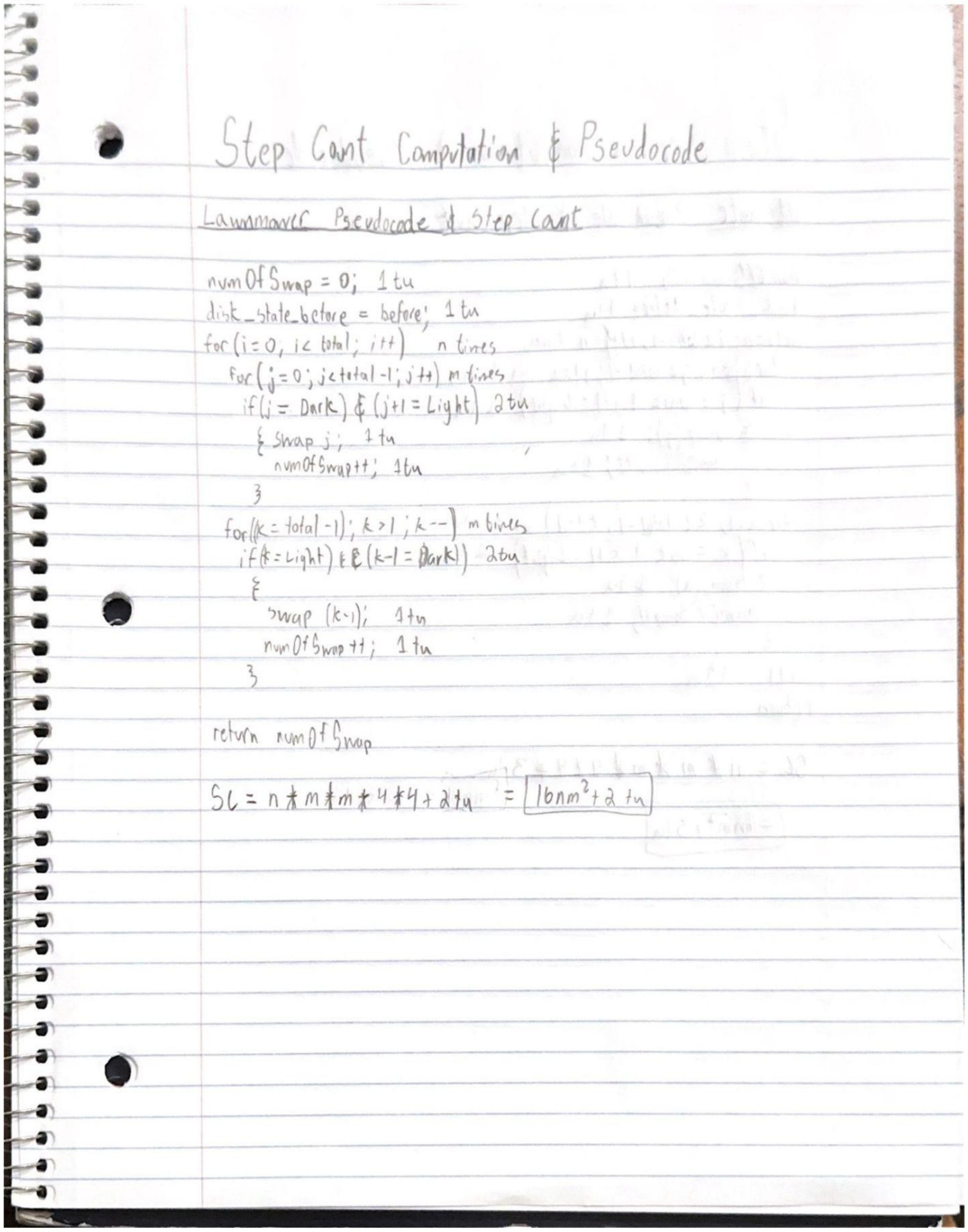
Lawnmower Algorithm Pseudocode and Step Count:



Step Count Computation & Pseudocode

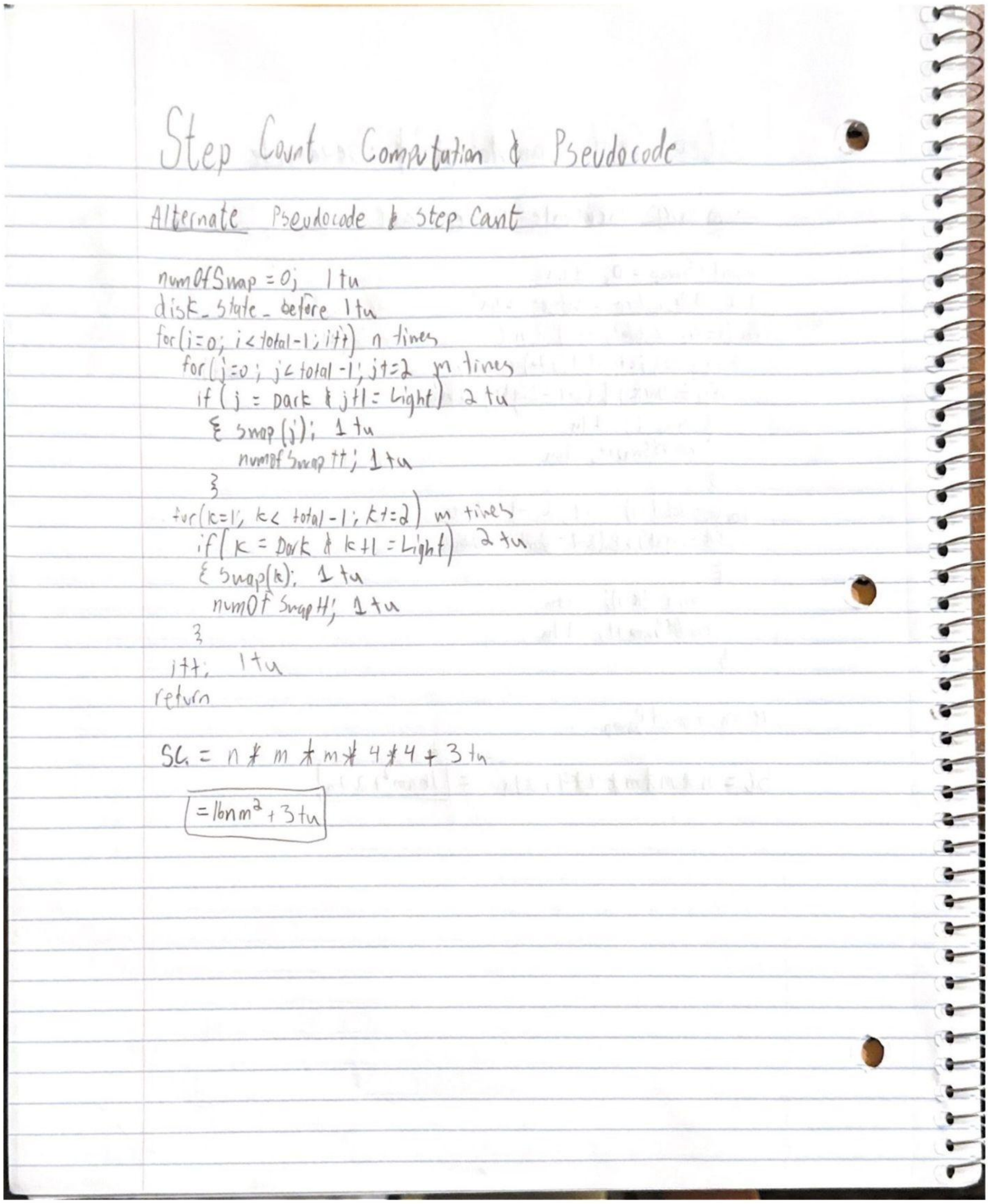
Lawnmower Pseudocode & Step Count

```
numOfSwap = 0;  1 tu
disk_state_before = before;  1 tu
for (i = 0, i < total; i++)     n times
   for (j = 0; j < total - 1; j++)  m times
     if (j = Dark) & (j+1 = Light)  2 tu
       { Swap j;   1 tu
         numOfSwap++;  1 tu
       }
   for ((k = total - 1); k > 1; k--)  m times
     if (k = Light) && (k-1 = Dark))  2 tu
     {
       swap (k-1);   1 tu
       numOfSwap ++;  1 tu
     }

return numOfSwap
```

$SC = n * m * m * 4 * 4 + 2 tu \quad = \boxed{16nm^2 + 2 \text{ tu}}$

Alternate Algorithm Pseudocode and Step Count:



Step Count Computation & Pseudocode

Alternate Pseudocode & Step Cant

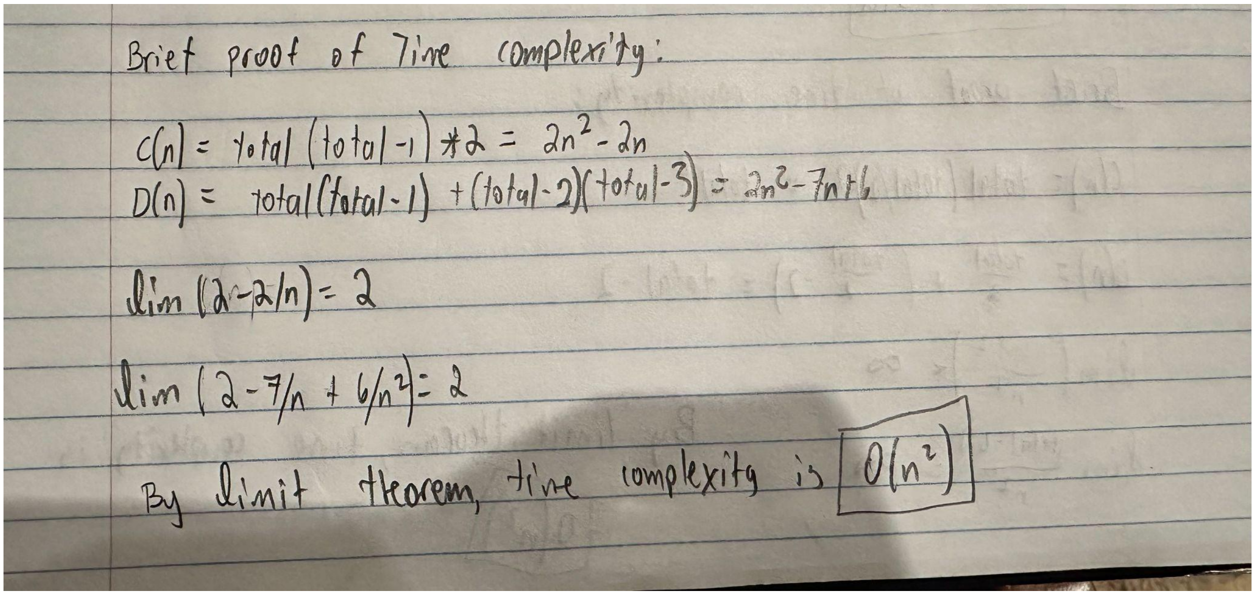
```
numOfSwap = 0;   1 tu
disk_state_before 1 tu
for(i=0; i<total-1; i++) n times
   for(j=0; j<total-1; j+=2  m times
     if (j = Dark & j+1 = Light)  2 tu
       { swap(j); 1 tu
          numOfSwap ++; 1 tu
       }
  for(k=1; k< total-1; k+=2) m times
     if(k = Dark & k+1 = Light)  2 tu
     { Swap(k); 1 tu
       numOf Swap++; 1 tu
     }
  i++; 1 tu
return
```

SC = n * m * m * 4 * 4 + 3 tu

$\boxed{= 16nm^2 + 3 \text{ tu}}$

Proof Argument for Lawnmover and Alternate Algorithms:

Lawnmower:



Brief proof of Time complexity:

$C(n) = total\ (total-1) * 2 = 2n^2 - 2n$

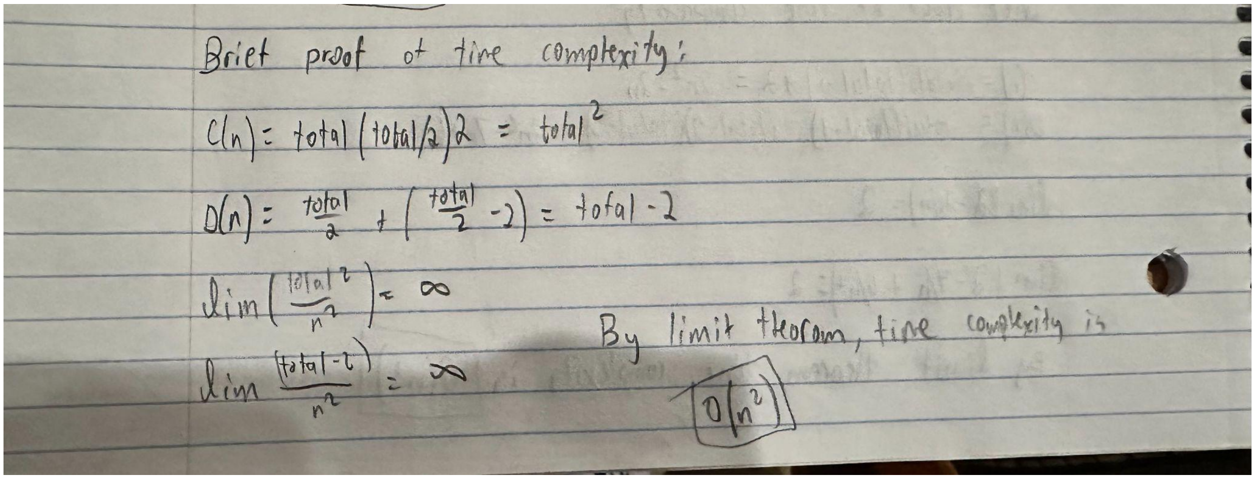
$D(n) = total(total-1) + (total-2)(total-3) = 2n^2 - 7n + 6$

$\lim\ (2 - 2/n) = 2$

$\lim\ (2 - 7/n + 6/n^2) = 2$

By limit theorem, time complexity is $\boxed{O(n^2)}$

Alternate:



Brief proof of time complexity:

$C(n) = total\ (total/2)2 = total^2$

$D(n) = \frac{total}{2} + \left(\frac{total}{2} - 2\right) = total - 2$

$\lim\left(\frac{total^2}{n^2}\right) = \infty$

$\lim \frac{(total-2)}{n^2} = \infty$

By limit theorem, time complexity is

$\boxed{O(n^2)}$