Project One Report
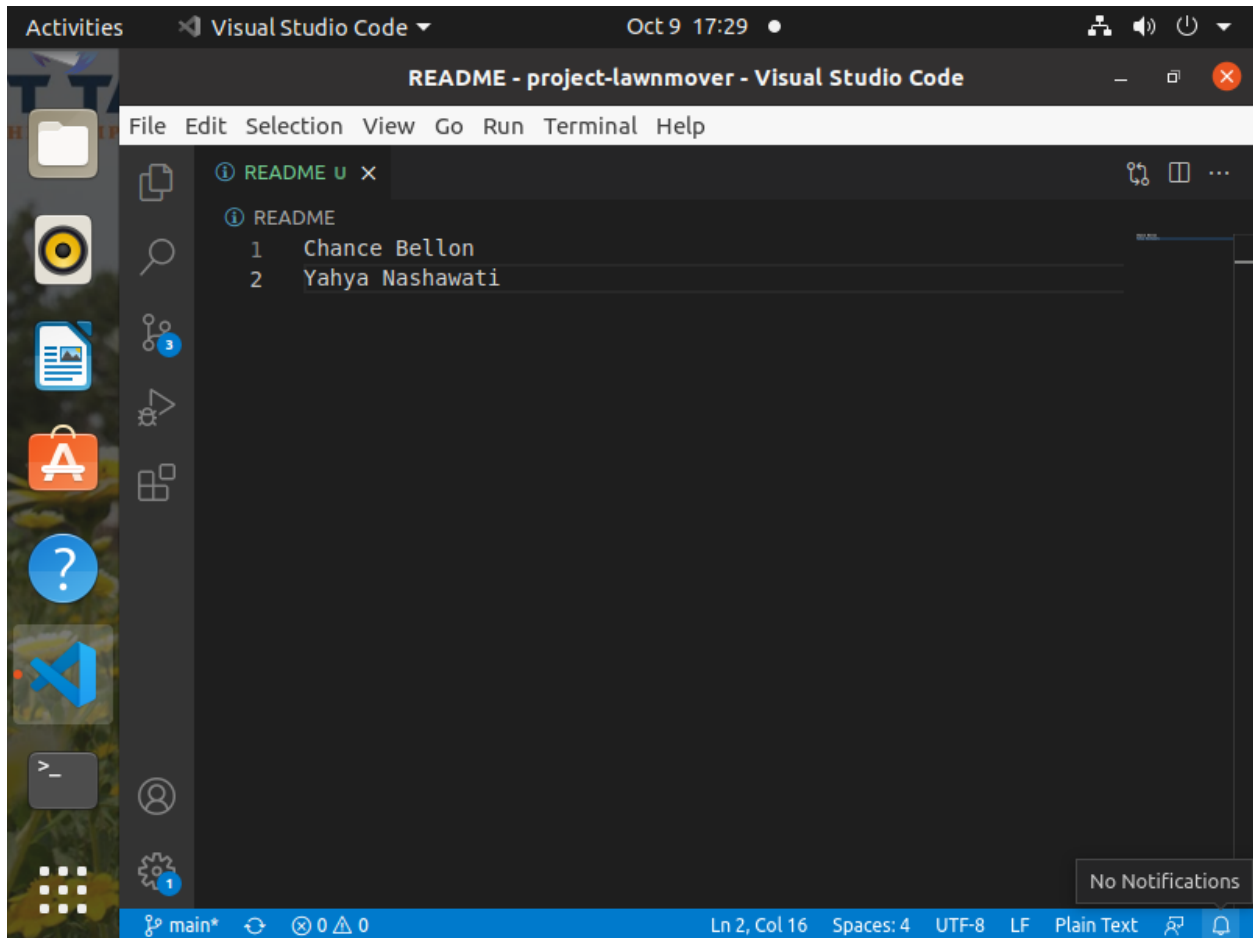
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```
student@tuffix-vm:~/Desktop/Algorithm Engineering Projects/project-lawnmover$ g++ disks_test.cpp
student@tuffix-vm:~/Desktop/Algorithm Engineering Projects/project-lawnmover$ ./a.out
disk_state still works: passed, score 1/1
sorted_disks still 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
```

Project One Report

Pseudocode:

```
Sort_Alternate:
initialize numOfSwap to zero
initialize disk_state state to before

for loop (initialize I to zero; I < count+1; increment I)
  if statement (I modular by two equals to zero)
    for loop (initialize index to zero; compare index to count-1; set index equal to index+2)
      if statement (current disk != next disk)
        if statement (current disk equals dark disk & next disk equals light disk)
          swap disks
          increment numOfSwap
        endif
      endif
    endfor
  endif
  else
    for loop (initialize index to one; index < count-2; set index equal to index+2)
      if statement (current disk != next disk)
        if statement (current disk equals dark disk & next disk equals light disk)
          swap disks
          increment numOfSwap
        endif
      endif
    endfor
  endelse
endfor

return sorted disks


    Sort_Lawnmower:
    initialize numOfSwap to zero
    initialize disk_state state to before

    for loop (initialize I to zero; I < n/2; increment I)
      initialize index to zero
      while (index+1 < n)
        if statement (current disk != next disk)
          if statement (current disk equals dark disk & next disk equals light disk)
            swap disks
            increment numOfSwap
          endif
        endif
        increment index
      endwhile
      while (index > 0)
        if statement (previous disk != current disk)
          if statement (previous disk equals dark disk & current disk equals light disk)
            swap disks
            increment numOfSwap
          endif
        endif
        reduce index
      endwhile
    endfor

    return sorted disks
```

Project One Report

Step Count for Alternate:

$1+1+(n+2)(2+MAX(n+1+MAX(2+MAX(0)), n-2+1+MAX(2+MAX(0)))$

$2+(n+2)(2+MAX(n+1+MAX(2), n-1+MAX(2))$

$2+(n+2)(n+5)$

$= n^2+7n+12$

The time complexity behind the Sort Alternate Algorithm is $O(n^2)$. The Sort Alternate Algorithm is n^2 time complexity because it clearly has 2 nested loops within each other.

Step Count for Lawnmower:

$1+1+((n/2)+1)(1+n-1+1+MAX(2+MAX(0))+n+1+MAX(2+MAX(0)))$

$2+((n/2)+1)(n+1+MAX(2)+n+1+MAX(2)$

$2+((n/2)+1)(2n+6)$

$=n^2+5n+8$

The time complexity behind the Lawnmower Algorithm is $O(n^2)$. Although it gets a little messy with the internal side by side while loops it must be noted that the outer loop had a nested loop inside of it, this means that it is n^2.