Pseudocode: Left and Right Algorithm

```
Begin print_disks()
        For i=0 to 2*n
                If disks[i] = 1
                        Print "d"  (1)
                Else if disks[i] = 0
                        Print "l"  (1)
End print_disks()
```

1 + max(1,0) = 1 + 1 = 2

1 + max(1,2) = 1 + 2 = 3

$\sum_{i=0}^{2n} 3 = \left(\frac{2n-0+1}{1}\right)3$

$(2n+1)3 =$

$6n + 3$

```
Start main()
8 {  (4) ← Initialize n, k, i, q
     (2) ← Initialize m=0, temp=0
     (1) ← Initialize array disks
     (1) ← Read in a number, n

     (1) ← Set disks array of n = to new array of n*2

        For i=0 to n
                disks[2 * i] = 1 ⟶ (1)   } 2
                disks[2 * i + 1] = 0 → (1)

     (1) ← Print_disks()

        For k = 0 to n
                For q = 0 to 2*n
1 + max(0,7)            If disks[q] = 1 ⟶ (1)
1 + 7 = 8               Else
                3 + max(4,0)  If (q != 0) and (disks[q − 1] = 1)
                  3 + 4 = 7       temp = disks[q] ⟶ (1)
                                  disks[q] = disks[q − 1] → (1)
                                  disks[q − 1] = temp; → (1)
                                  m++ ⟶ (1)

     (1) ← print_disks()
     (1) ← print number of swap, m
     (1) ← delete array disks
}
```

$\sum_{k=0}^{n} \sum_{q=0}^{2n} 8 \Rightarrow \sum_{q=0}^{2n} 8 = (2n-0+1)8$

$(2n+1)8 = 16n + 8$

$\sum_{k=0}^{n} 16n + 8 = \sum_{k=0}^{n} 16n + \sum_{k=0}^{n} 8$

$\sum_{k=0}^{n} 16n = 16 \sum_{k=0}^{n} n = \frac{16n(n+1)}{2}$

$\sum_{k=0}^{n} 8 = (n-0+1)8 = 8n + 8$

$8 \not{16}\left(\frac{n(n+1)}{\not{2}}\right) + 8n + 8 = 8n^2 + 8n + 8n + 8$

$8n^2 + 8n + 8n + 8 =$

$8n^2 + 16n + 8$

$= \underline{8} + \underline{1} + (\underline{2n+2}) + \underline{1} + (\underline{6n+3}) + (\underline{8n^2+16n+8}) + (\underline{1}) + (\underline{6n+3}) + \underline{1} + \underline{1} =$

$= 8n^2 + 30n + 29$

$= 8n^2 + 30n + 29 \in O(n^2)$ $\lim_{n\to\infty} \frac{8n^2+30n+29}{n^2} = \lim_{n\to\infty} \frac{8n^2}{n^2} = 8 \geq 0.$

Pseudocode: Lawnmower Algorithm

```
Begin print_disks()
        For i=0 to 2*n
                If disks[i] = 1
                        Print "d" (1)
                Else if disks[i] = 0
                        Print "l" (1)
End print_disks()
```

1 + max(1,2) = 1 + 2 = 3 ; 1 + max(0,1) = 1 + 1 = 2

$\sum_{i=0}^{2n} 3 = (2n-0+1)3 = 6n+3$

```
Start main ()
{
    (4) ← Initialize n, l, k, j
    (2) ← Initialize m=0, temp=0
    (1) ← Initialize array disks
    (1) ← Read a number, n

    (1) ← Set disks array of n = to new array of n*2
        For i=0 to n
                disks[2 * i] = 1 → (1)
                disks[2 * i + 1] = 0 → (1)
    } 2

    (1) ← Print_disks() (6n+3)

        For k=0 to n/2+1
                For j=0 to n*2-1
                        If (disks[j] = 1) and (disks[j] != disks[j+1])
                                temp = disks[j]; → (1)
                                disks[j] = disks[j+1] → (1)
                                disks[j+1] = temp → (1)
                                m++ → (1)
                } 4
        } 3 + max(4,0) = 3 + 4 = 7

        for q = n*2-1 to n-3
                if (disks[q] = 1)
                else if (disks[q] != 1) and (disks[q] != disks[q-1])
                        temp = disks[q] → (1)
                        disks[q] = disks[q - 1] → (1)
                        disks[q – 1] = temp → (1)
                        m++ → (1)
                } 4
        } 1 + max(0,7) = 1 + 7 = 8 ; 3 + max(4,0) = 3 + 4 = 7

    (1) ← print_disks() (6n+3)
    (1) ← print number of swap, m
    (1) ← delete array disks
}
```

$\sum_{k=0}^{\frac{n}{2}+1} \sum_{j=0}^{2n-1} 7 \Rightarrow (2n-1-0+1)7 = 14n$

$\sum_{k=0}^{\frac{n}{2}+1} 14n = \left(\frac{n}{2}+1-0+1\right)(14n)$

$\left(\frac{n}{2}+\frac{4}{2}\right)(14n) = \left(\frac{n+4}{2}\right)(14n)$

$7n^2 + 28n$

$\sum_{k=0}^{\frac{n}{2}+1} \sum_{k=2n-1}^{n-3} 8 \Rightarrow ((n-3)-(2n-1)+1)8$

$(n-3-2n+1+1)8 = (-n-1)8 = -8n-8$

$\sum_{k=0}^{\frac{n}{2}+1} -8n-8 \Rightarrow \left(\frac{n}{2}+1-0+1\right)(-8n-8)$

$\left(\frac{n+4}{2}\right)(-8n-8) = \left(\frac{n+4}{2}\right)(-2)(4n+4) = (-)(n+4)(4n+4)$

$(-)(4n^2+12n+16) = -4n^2-12n-16$

Should be: $(n+4)(-4n-4) = -4n^2-16n-4n-16 = -4n^2-20n-16$

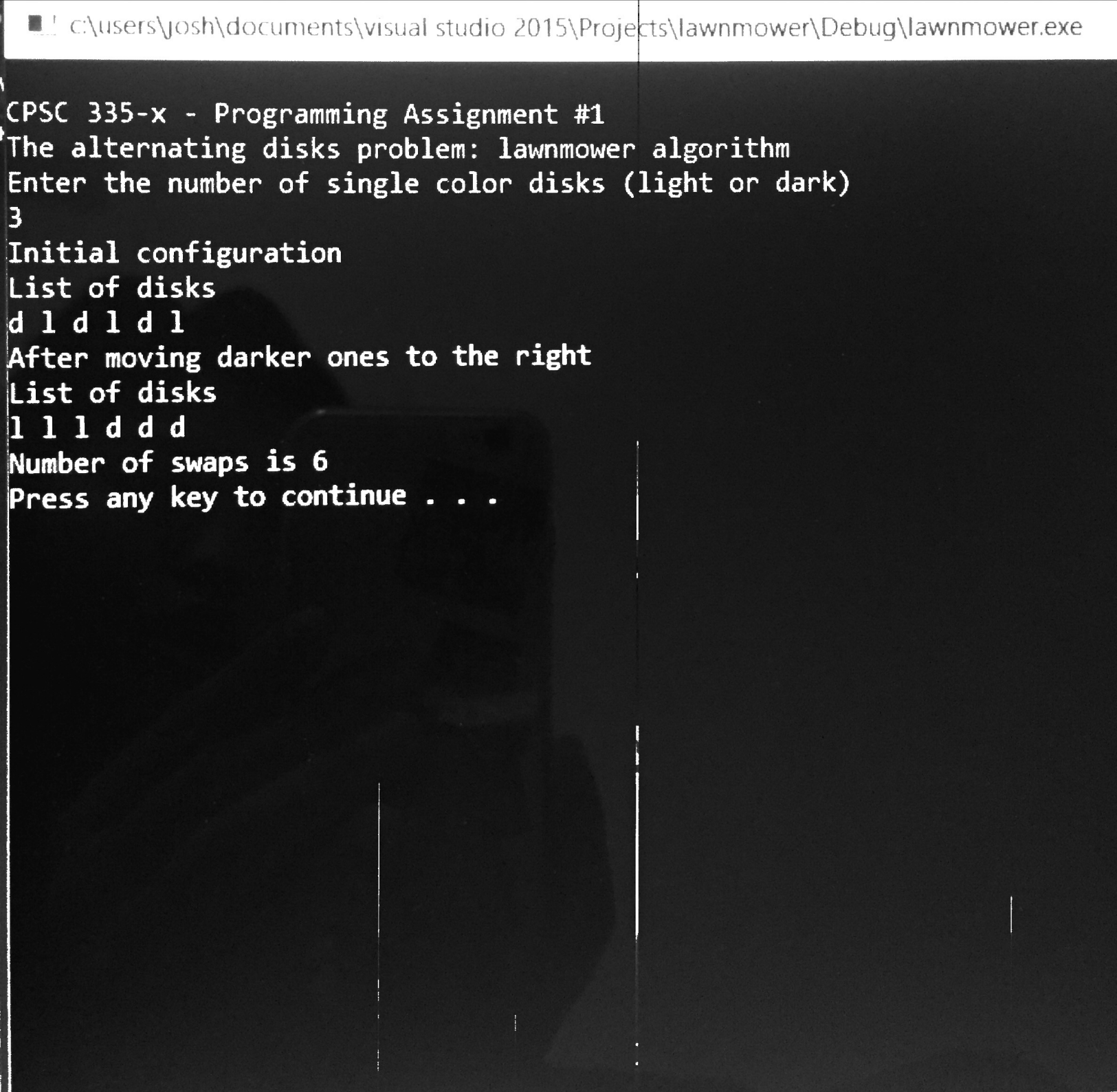
$= \underline{8} + \underline{1} + (\underline{2n}+\underline{2}) + \underline{1} + (\underline{6n}+\underline{3}) + (\underline{7n^2}+28n) + (\underline{-4n^2}-20n-16) + \underline{1} + (\underline{6n}+\underline{3}) + \underline{1} + \underline{1}$

$= 3n^2 + 22n + 5$

$= 3n^2 + 22n + 5 \in O(n^2) = \lim_{n\to\infty} \frac{3n^2+22n+5}{n^2} = \lim_{n\to\infty} \frac{3n^2}{n^2} = 3 \geq 0$

C:\Users\Josh\Documents\Visual Studio 2015\Projects\CPSC335-1\Debug\CPSC335-1.exe

```
CPSC 335-03 - Programming Assignment #1
The alternating disks problem: left-to-right algorithm
Enter the number of single color disks (light or dark)
4
Initial configuration
List of disks
d l d l d l d l
After moving darker ones to the right
List of disks
l l l l d d d d
Number of swaps is 10
Press any key to continue . . .
```


c:\users\josh\documents\visual studio 2015\Projects\lawnmower\Debug\lawnmower.exe
CPSC 335-x - Programming Assignment #1
The alternating disks problem: lawnmower algorithm
Enter the number of single color disks (light or dark)
3
Initial configuration
List of disks
d l d l d l
After moving darker ones to the right
List of disks
l l l d d d
Number of swaps is 6
Press any key to continue . . .