Rocio Salguero

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CPSC 335 Project 1: Empirical Analysis
Due 09/19/06

The Alternating Disk Problem:
Input: An even positive integer n and a list of 2n disks of alternating color light-dark disks starting with light
Output: A list of 2n disks sorted with dark on left and light disks on right, and m represents the number of swaps

Lest to right algorithm Pseudocode:

```
Int k = 0 , m = 0
For i = 0 to n step 1
        For k = i to 2n-i  step 1
                //if disk on the left is light and the disk on the right is dark , switch
                If disk[k] > disk [k+1]
                        //swap
                        Temp = disk[k + 1]
                        Disk[k+1] = disk [k]
                        Disk[k] = temp
                        m++
Output m
```

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

Running time

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

$$\Rightarrow 3\left(2n(n-0+1) - \left[\frac{n(n+1)}{2}\right]\right) \Rightarrow 3\left(2n^2+2n-\frac{n^2}{2}-\frac{n}{2}\right)$$

$$\Rightarrow 3\left(\frac{3}{2}n^2+\frac{3}{2}n\right) \Rightarrow \text{Runtime} = \frac{9}{2}n^2+\frac{9}{2}n$$

$O(n^2)$

$\frac{9}{2}n^2+\frac{9}{2}n \in O(n^2)$

$$\lim_{n\to\infty} \frac{\frac{9n^2}{2}+\frac{9}{2}n}{n^2} \Rightarrow \lim_{n\to\infty} \frac{9}{2}+\frac{9}{2n} \quad D$$

$\lim_{n\to\infty} \frac{9}{2}+\frac{9}{2n} = \frac{9}{2} > 0$ and a constant

Lawn Mower Algorithm Pseudocode:

```
int index
For j = 0 to n step 1
        //start from left or right depending on the index
        If j % 2 == 0
                Index = 0
        Else
                Index = 2n-1
        For k = 0 to 2n-1 step 1
                If j % 2 == 0
                        Index++
                Else
                        Index--
                If disk[k] > disk [k+1]
                        //swap
                        Temp = disk[k+1]
                        Disk[k+1] = disk[k]
                        Disk[k] = temp
                        m++
        End for
End for
```

$\max(1,1) = 1$

$\sum_{i=0}^{n} \left(1 + 1 + \sum_{k=0}^{2n-1} 4 \right)$

$\sum_{k=0}^{2n-1} 4$

$\sum_{j=0}^{n} \left(1 + 1 + 4(2n - 1 + 0 + 1) \right) \Rightarrow \sum_{j=0}^{n} \left(1 + 1 + 8n \right) \Rightarrow \sum_{j=0}^{n} 2 + \sum_{j=0}^{n} 8n$

$\Rightarrow 2(n - 0 + 1) + 8n(n - 0 + 1) \Rightarrow 2n + 2 + 8n^2 + 8n \Rightarrow 8n^2 + 10n + 2$

Running time: $8n^2 + 10n + 2$

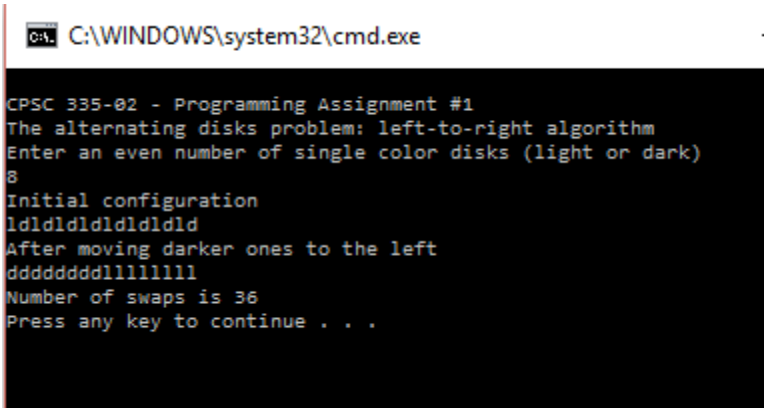
$O(n^2)$

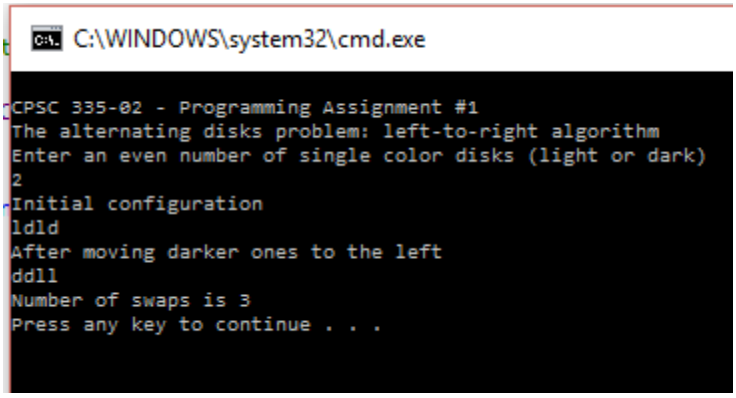
$8n^2 + 10n + 2 \in O(n^2)$

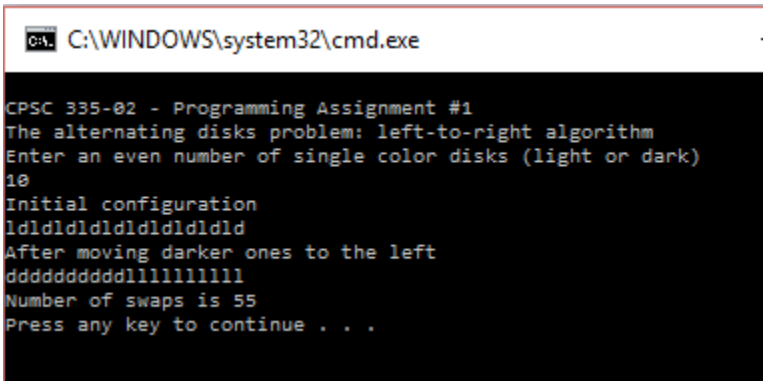
$\lim_{n \to \infty} \frac{8n^2 + 10n + 2}{n^2} > 0$ and constant

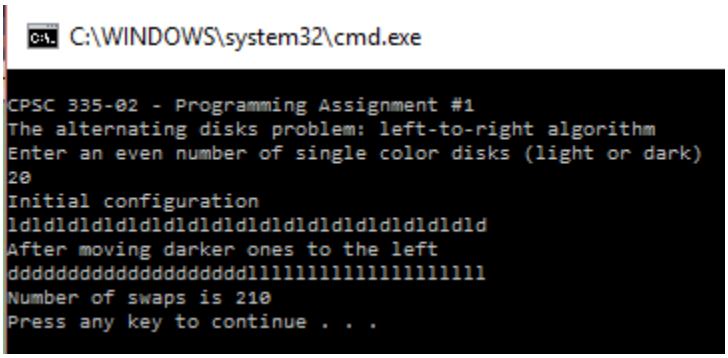
$\lim_{n \to \infty} 8 + \frac{10}{n} + \frac{2}{n^2} = 8 > 0$ and Constant

Left-To-Right Algorithms Outputs









Lawn Mower Algorithm Outputs