

Rocio Salguero

Wednesday, September 14, 2016 7:31 PM

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

Left 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 $\text{disk}[k] > \text{disk}[k+1]$

//swap

Temp = $\text{disk}[k+1]$

Disk[$k+1$] = $\text{disk}[k]$

Disk[k] = Temp

$m++$

$$\left\{ \begin{array}{l} 2n-i \\ \sum_{k=i}^{2n-i} 3 \end{array} \right\} \left\{ \sum_{i=0}^n \left(\sum_{k=i}^{2n-i} 3 \right) \right\}$$

Output m

Running time

$$\sum_{i=0}^n (2n-1-i+1) * 3 \Rightarrow 3 \sum_{i=0}^n 2n-i \Rightarrow 3 \left(\sum_{i=0}^n 2n - \sum_{i=1}^n i \right)$$
$$\Rightarrow 3 \left(2n(n-0+1) - \left[\frac{n(n+1)}{2} \right] \right) \Rightarrow 3 \left(2n^2 + 2n - \frac{n^2}{2} - \frac{n}{2} \right)$$
$$\Rightarrow 3 \left(\frac{3}{2} n^2 + \frac{3}{2} n \right) \Rightarrow \text{Runtime} = \frac{9}{2} n^2 + \frac{9}{2} n$$

$O(n^2)$

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

$$\lim_{n \rightarrow \infty} \frac{\frac{9}{2} n^2 + \frac{9}{2} n}{n^2} \Rightarrow \lim_{n \rightarrow \infty} \frac{9}{2} + \frac{9}{2n} \rightarrow \frac{9}{2}$$

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

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
```

$$\max(l, r) = 1$$

$$\max(l, r) = 1$$

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

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

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

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

$$\text{Running time} = 8n^2 + 10n + 2$$

$$O(n^2)$$

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

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

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

Left-To-Right Algorithms Outputs

C:\WINDOWS\system32\cmd.exe

```
CPSC 335-02 - Programming Assignment #1  
The alternating disks problem: left-to-right algorithm  
Enter an even number of single color disks (light or dark)  
8  
Initial configuration  
ldldldldldldldldld  
After moving darker ones to the left  
dddddddlldlll  
Number of swaps is 36  
Press any key to continue . . .
```

C:\WINDOWS\system32\cmd.exe

```
CPSC 335-02 - Programming Assignment #1
The alternating disks problem: left-to-right algorithm
Enter an even number of single color disks (light or dark)
2
Initial configuration
ldld
After moving darker ones to the left
ddll
Number of swaps is 3
Press any key to continue . . .
```

C:\WINDOWS\system32\cmd.exe

```
CPSC 335-02 - Programming Assignment #1  
The alternating disks problem: left-to-right algorithm  
Enter an even number of single color disks (light or dark)  
10  
Initial configuration  
ldldldldldldldldldld  
After moving darker ones to the left  
dddddddddlllllllll  
Number of swaps is 55  
Press any key to continue . . .
```

C:\WINDOWS\system32\cmd.exe

[illegible]

Lawn Mower Algorithm Outputs

C:\WINDOWS\system32\cmd.exe

```
CPSC 335-02 - Programming Assignment #1
The alternating disks problem: left-to-right algorithm
Enter an even number of single color disks (light or dark)
2
Initial configuration
ldld
After moving darker ones to the left
ddll
Number of swaps is 3
Press any key to continue . . .
```

C:\WINDOWS\system32\cmd.exe

```
CPSC 335-02 - Programming Assignment #1
The alternating disks problem: left-to-right algorithm
Enter an even number of single color disks (light or dark)
6
Initial configuration
ldldldldldld
After moving darker ones to the left
ddddldlllll
Number of swaps is 21
Press any key to continue . . .
```

C:\WINDOWS\system32\cmd.exe

[illegible]

C:\WINDOWS\system32\cmd.exe

```
CPSC 335-02 - Programming Assignment #1
The alternating disks problem: left-to-right algorithm
Enter an even number of single color disks (light or dark)
8
Initial configuration
ldldldldldldldld
After moving darker ones to the left
ddddddldlllllll
Number of swaps is 36
Press any key to continue . . .
```