

Analysis Report

IMPLEMENTING ALGORITHMS

Project 1

CPSC 335

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README.md

[illegible]

“make” output

```
student@tuffix-vm:~/335/project-1-alternating-disks-moonsoo-jo$ 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 1/1
disk_state::is_sorted: passed, score 1/1
alternate, n=3: passed, score 1/1
alternate, n=4: passed, score 1/1
alternate, other values: passed, score 1/1
lawnmower, n=3: passed, score 1/1
lawnmower, n=4: passed, score 1/1
lawnmower, other values: passed, score 1/1
TOTAL SCORE = 10 / 10
```

Alternate Disks

Pseudocode:

```
// even = 0 (1)
// for int j = 0; j < n; j++ do <-- provided in guideline (n)
//   for int i = even; i < before.size-1; i+=2 do (n)
//     if left is white and right is black then (2)
//       switch left and right (5)
//     else
//       skip
//   endfor
// if even = 0 then (1)
//   even = 1 (1)
// else
//   even = 0 (1)
// endif
// endfor
// endwhile
```

Algorithm Analysis:

```
// step count = 1 + n * ((n * 7) + 2)
//   = 1 + n * (7n + 2)
//   = 1 + 7n^2 + 2n
//   = 7n^2 + 2n + 1
// time complexity = O(n^2)
```

Proof:

Is $7n^2 + 2n + 1$ in the class of n^2 ?

Proof by definition: find c and n_0 such that $7n^2 + 2n + 1 \leq c * n^2$, $n > n_0$

Let $n_0 = 1$ and $c = 10$

$7n^2 + 2n + 1 \leq 10n^2$, $n > 1$

This is true. Therefore, $7n^2 + 2n + 1$ is in the class of n^2 .

Lawnmower

Pseudocode:

```
// position = 0
// for int j = 0, j < n / 2, j++ do (n/2)
//   for position, position < before.size - 1, position++ do (2n - 1)
//     if left is white and right is black then (2) // "and" counts as an operator
//       switch left and right (5, swap function)
//     else
//       skip
//     endif
//   endfor
// for position, position > 0, position-- do (2n - 1)
//   if left is white and right is black then (2)
//     switch left and right (5)
//   else
//     skip
//   endif
// endfor
// endfor
```

Algorithm Analysis:

```
// step count = 1 + (n/2) * ((2n - 1) * 7 + (2n - 1) * 7)
//   = 1 + (n/2) * (14n - 7 + 14n - 7)
//   = 1 + (n/2) * (28n - 14)
//   = 1 + 14n^2 - 7n
//   = 14n^2 - 7n + 1
// time complexity = O(n^2)
```

Proof:

Is $14n^2 - 7n + 1$ in the class of n^2 ?

Proof by definition: find c and n_0 such that $14n^2 - 7n + 1 \leq c * n^2$, $n > n_0$

Let $n_0 = 1$ and $c = 22$ (sum the absolute value of the coefficients)

$$14n^2 - 7n + 1 \leq 22n^2, n > 1$$

This is true. Therefore, $14n^2 - 7n + 1$ is in the class of n^2 .