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CPSC 335-02
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CPSC 335 Project 1

Alternate Algorithm

CODE FOR ALTERNATE ALGORITHM

```
int algorithm = 0;                                          1
for (size_t i = 0; i < before.light_count(); i++)
        for (size_t n = i; n < before.total_count() - 1; n++)
                if (before.get(n) > before.get(n + 1))
                        const_cast <disk_state&> (before).swap(n);
                        algorithm++;
                endif
        endfor
endfor
return sorted_disks(before, algorithm);
```

PSEUDO-CODE FOR ALTERNATE ALGORITHM

```
int algo = 0                                                1
for i = 0 to n
        for n = i to 2n-1
                if (n > n+1)                                2 + (max(3,2))
                        Swap                                3
                        algo = algorithm + 1                2
                endif
        endfor
endfor
return sorted_disks(before, algo);
```

STEP COUNT AND BIG (O) PROOF FOR ALTERNATE ALGORITHM

Step Count:

$$\sum_{i=0}^{n} \sum_{n=i}^{2n-1} 5$$

$$\sum_{i=0}^{n} 5(2n-1)+1$$

$$\sum_{i=0}^{n} 10n-4$$

$$10\sum_{i=0}^{n} n - \sum_{i=0}^{n} 4$$

$$= 10 \cdot \frac{n(n+1)}{2} - 4n$$

$$= \frac{10n^2 + 10n}{2} - 4n$$

$$= 5n^2 + 5n - 4n$$

$$= \boxed{5n^2 + n}$$

Big O Proof:

Show that $f(n) = 5n^2+n \; \varepsilon \; O(n^2)$

Find $C > 0$ and $n_0 >= 0$ S.T. $5n^2+n <= (C)n^2 \;\; \forall \; n >= n_0$

$C = 5 + 1 = 6, n = 1$

$5n^2+n <= 6n^2$

$6n^2 - 5n^2 - n >= 0$

$n^2 - n >= 0$

$0 >= 0$

Yes, it belongs to $O(n^2)$.

Lawnmower Algorithm

CODE FOR LAWNMOWER ALGORITHM

```
int algorithm = 0;
    for (size_t i = 0; i < before.light_count(); i++)
    {
      for (size_t j = i; j < before.total_count() - 1; j++)
      {
           if (before.get(j) > before.get(j + 1))
           {
             const_cast <disk_state&> (before).swap(j);
             algorithm++;
           }
     }
     for (size_t j = before.total_count() - 1; j > 0; j--)
     {
       if (before.get(j) < before.get(j - 1))
       {
         const_cast <disk_state&> (before).swap(j - 1);
            algorithm++;
       }
      }
    }
    return sorted_disks(before, algorithm);
}
```

PSEUDO-CODE FOR LAWNMOWER ALGORITHM

Note: n = light_count
2n = total count

```
int algo = 0;                                   1
for int i = 0 to n                              n+1
        for j = i to 2n - 1             tyrui
                if (j > (j+1))                  2 + max(3,2) = 5
                        swap()                          3
                        algo = algo + 1         2
        endfor
        for j = 2n - 1 to 0
                if (j < (j - 1))                2 + max(3,2) = 5
                        swap()                          3
                        algo = algo + 1         2
        endfor

endfor
return sorted_disks()
```

STEP COUNT AND BIG (O) NOTATION FOR LAWNMOWER ALGORITHM

Step Count

int algo

$$\sum_{i=0}^{n}\sum_{j=i}^{2n-1} 5 = \sum_{i=0}^{n} 5(2n-1)$$

$$= \sum_{i=0}^{n} 10n - \sum_{i=0}^{n} 5$$

$$= 10 \cdot \frac{n(n+1)}{2} - 5n$$

$$= \frac{10n^2+10n}{2} - 5n$$

$$= 5n^2 + 5n - 5n$$

$$\boxed{= 5n^2}$$

for i = 0 To n $\quad n+1$

for j = 2n-1 To 0 $\quad \left(\frac{0-2n-1}{-1} + 1\right)$

5

$$n+1 \cdot [\; 5(2n+1+1)]$$

$$(n+1)(10n+10)$$

$$10n^2 + 10n + 10n + 10$$

$$\boxed{10n^2+20n+10}$$

$$5n^2 + 10n^2 + 20n + 10$$

$$= 15n^2 + 20n + 10$$

Big O = $O(n^2)$

Big O Proof:

Show that f(n) = $15n^2+20n+10$ ε $O(n^2)$

Find C > 0 and n_0 >= 0 S.T. $15n^2+20n+10 <= (C)n^2$ ∀ n >= n_0

C = 15 + 20 + 10 = 45, n_0 = 0

$15n^2+20n+10 <= 45n^2$

$45n^2+15n^2+20n+10 >= 0$

$45n^2+15n^2+20n+10$

n >= 0

Yes, it belongs to $O(n^2)$.

TUFFIX SCREENSHOTS