CPSC335-01 Project 1

1)
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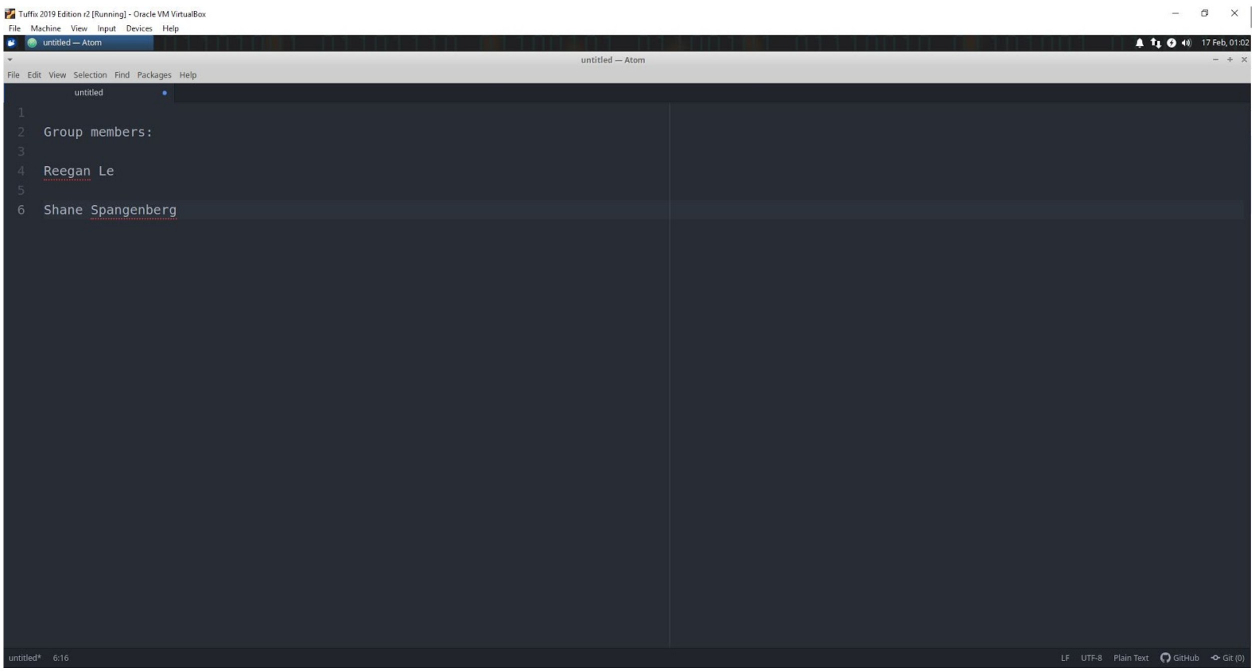
2)



3)

left to right algorithm pseudocode

```
for i=0 to 2n-1 do
    for j=0 to 2n-i-1 do
        if(list[j]=='DARK' && list[j+1]=='LIGHT')
            then swap(list[j])
        end for
    end for
done
```

lawnmower algorithm pseudocode

```
for k=0 to (2n-1)/2 do
    for i=0 to 2n-1 do
        if(list[j]=='DARK' && list[j+1]=='LIGHT')
            then swap(list[i])
        end for
    for i=2n-1 to 0 do
```

```
      if(list[j]=='DARK' && list[j-1]=='LIGHT')
         then swap(list[i-1])
      end for
   end for
done
```

4)

left to right algorithm: Dependent nested loops: O(n²)

```
for i=0 to 2n-1 do ------------------------------------------> n
   for j=0 to 2n-i-1 do ------------------------------------> 2n
      if(list[j]=='DARK' && list[j+1]=='LIGHT') ------> 3t.u ----------> 3times(1,0) = 3t.u
         then swap(list[j]) --------------------------------> 1t.u ----------↑
      end for
   end for
Done -------------------------------------------------------> 1t.u ----------------------
```

$$= \sum_{i=0}^{n} \sum_{j=0}^{2n} 3 = \sum_{i=0}^{n} 3i = 3 \sum_{i=0}^{n} i = 3 * n(n+1)/2 = 3 * (n^2 + n)/2 \Rightarrow 3n^2/2 + 3n/2 + 1$$

$\Rightarrow f(n) = 3n^2/2 + 3n/2 + 1$

$\Rightarrow f(n)\ \varepsilon\ O(n^2)$

- Using Limit theorem:

$\lim_{n\to\infty} (3n^2/2 + 3n/2 + 1) / n^2 \Rightarrow 3n^2/n^2 + 3n/n^2 + 2/n^2 \Rightarrow 3 + 0 + 0 \geq 0$ and a constant.

Thus, $f(n)\ \varepsilon\ O(n^2)$.

lawnmower algorithm: O(n²)

```
for k=0 to (2n-1)/2 do ------------------------------------------> (2n+1)/2  times
   for i=0 to 2n-1 do -------------------------------------------> 2n times
      if(list[j]=='DARK' && list[j+1]=='LIGHT') ----------> 3t.u
         then swap(list[i]) -----------------------------------> 1t.u
      end for
   for i=2n-1 to 0 do ------------------------------------------> 2n times
      if(list[j]=='DARK' && list[j-1]=='LIGHT') -----------> 3t.u
         then swap(list[i-1]) ---------------------------------> 1t.u
      end for
   end for
Done -----------------------------------------------------------> 1t.u
```

1. $((2n+1)/2) \ * \ [2n * (max(2+2,\ 0)) + 2n * (max(2+2, 0))] + 1$
2. $((2n+1)/2) \ * (8n+8n)+1$
3. $((2n+1)/2) \ * (16n)+1$
4. $16n^2 + 8n + 1$

Using Limit Theorem we can prove the lawnmower algorithm is in $O(n^2)$

1. $16n^2 + 8n + 1 \in O(n^2)$?
2. $\lim_{n \to \infty} (16n^2 + 8n + 1)/n^2$
3. $\lim_{n \to \infty} 16n^2/n^2 + 8n/n^2 + 1/n^2$
4. $\lim_{n \to \infty} 16 + 8/n + 1/n^2$
5. $16 + 0 + 0 \ \geq 0$ and a constant
6. Therefore $16n^2 + 8n + 1 \in O(n^2)$