Refo Yudhanto

CS350

HW 3

1.

```
int min, max;
array a;
check if array only have 1 data
if length==1{
        max = a[0];
        min = a[0];}
Initialize min and max
if a[0] > a[1] {
        max = a[0];
        min = a[1];}
else {
        max = a[1];
        min = a[0];}
start loop starting from 2
for (int i = 2; i <= a.length - 2;) {
        if (a[i] > a[i + 1]) {
                min = Math.min(min, a[i + 1]);
                max = Math.max(max, a[i]);
        } else {
                min = Math.min(min, a[i]);
                max = Math.max(max, a[i + 1]);
        }
        i = i + 2;}
        Continuation for odd number length
if a.length % 2 == 1 {
        min = Math.min(min, a[a.length - 1]);
        max = Math.max(max, a[a.length - 1]);}
```

2. Let i = 5 and n = 15. S takes O (i * n) time, which means (5 * 15) in this case. While T takes O (n log n) time, which mean (16 * log 16) = (16 * 4) in this case. Hence, the algorithm S performs better than the algorithm T when the value of i is less than the value of log n. On the other hand, Let i = 12 and n = 16. S takes O (i * n) time to compute the result, which is equal to (12 * 16) in this case. T takes O (n log n) time, which is equal to (16 * log 16) = (16 * 4) in this case. Hence, the algorithm T performs better than the algorithm S when the value of i is greater than the value of log n.

3. When k=3, number of median & groups is n/3. Worst case scenario would be n-n/3 = 2n/3
Tw(n)<= θ(n)+Tw(n/3)+Tw(2n/3)
When k=7, number of median &groups is n/7. Worst case scenario would be n-2n/8 = 5n/7
Tw(n)<= θ(n)+Tw(n/7)+Tw(5n/7)

4. Since we knew quickselect’s worst case is $O(n^2)$, then the worst case of ilselect is $O(n^2)$.
While the average case, $Tavg(n)$ can be formulized as:
$Tavg(n)= \theta(n)+1/n*\Sigma(O(1)*1/n+O(r-1)*((r-1)/n)+O(n-r)*(n-r)/n)$
Which then simplified
$Tavg(n)=\theta(n)+2/n*\Sigma(1<=r<=n)O(r-1)*((r-1)/n)$
Then we can simplify and get $Tavg(n)=\theta n$

5. Since the operation compares number, so the comparison of N will be
$(N-1)+(N-2)+....+1=N(N-1)/2$