Topic-07-selection-sort

Wednesday, June 26, 2024 2:46 PM

SELECTION SORT!

① Intro: Fairly intuitive iterative process!

- iteration 0: Find (index of) smallest elt in $A[0,\ldots,n-1]$
  Swap w/ $A[0]$.
  $A[0]$ now correct
- iteration 1: Find (index of) smallest elt in $A[1,\ldots,n-1]$
  Swap w/ $A[1]$
  $A[0,1]$ now correct

⋮

- iteration $n-2$: Find (index of) smallest elt in $A[n-2,n-1]$
  Swap w/ $A[n-2]$
  $A[0,\ldots,n-2]$ now correct

Now the list is sorted!

② Example

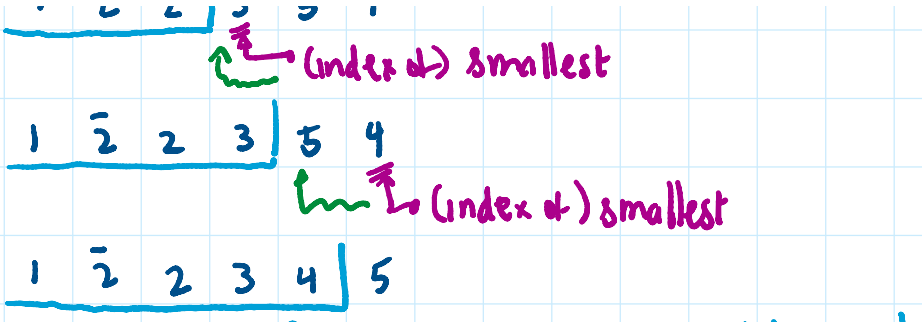
$\bar{2}$ is a 2 but think it as diff. from 2.

2 5 $\bar{2}$ 3 1 4
↑ (index of) smallest

1 | 5 $\bar{2}$ 3 2 4
✓ ↑ (index of) smallest

1 $\bar{2}$ | 5 3 2 4
✓ ↑ (index of) smallest

1 $\bar{2}$ 2 | 3 5 4
↑ (index of) smallest



since first 5 correct, all correct! Done!

③ Pseudocode:

```
\\ PRE: A is a list of length n.
for i = 0 to n-2                          n − 1 times
    minindex = i                          c1
    for j = i+1 to n-1                    n − 1 − (i + 1) + 1 = n − i − 1 times.
        if A[j] < A[minindex]             } c2
            minindex = j                  }
        end
    end
    swap A[i] with A[minindex]            c3
end
\\ POST: A is sorted.
```

finds and places 0th, 1st, etc elt.

swap! EVEN IF i == minindex

starting at A[i] looks for (index of) smallest elt in A[i,...,n-1]

Time Complexity is the same, always!

It's

$$T(n) = \sum_{i=0}^{n-2} \left[c_1 + \left[\sum_{j=i+1}^{n-1} c_2 \right] + c_3 \right]$$

= try this! See latex notes for details!

$= \Theta(n^2)$ ← Same as Bubble!

This is best-case, worst-case, avg-case!

④ Some Details!

(A) Auxiliary Space: List has length n (don't count)

For any n we have

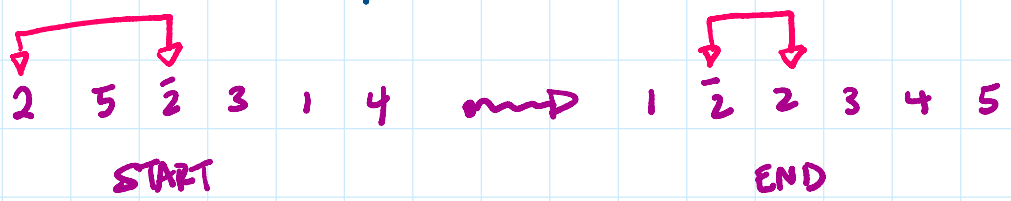
- 2 loop indices
- minindex
- poss. a swap variable

& aux space is $\Theta(1)$

(B) In-Place: yes blc it swaps within the list!

(C) Stable?

Look at our example!



The rel. positions of $2, \bar{2}$ switched!

NOT STABLE!