Selection Sort

SCSJ2013 Data Structures & Algorithms

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Selection Sort

Selection Sort Strategy

- Choose the largest/smallest item in the array and place the item in its correct place
- Choose the next larges/next smallest item in the array and place the item in its correct place.
- Repeat the process until all items are sorted.

Selection Sort

- Selection Sort does not depend on the initial arrangement of the data
- Only appropriate for small n - O(n^2) algorithm

Selection Sort Implementation

```
void selectionSort(DataType Data[], int n)
{
  for (int last = n-1; last >= 1; --last)
  {// select largest item in theArray

     int largestIndex = 0;

     // largest item is assumed start at index 0

     for (int p=1;p <= last; ++p)

     {   if (Data[p] > Data[largestIndex])

              largestIndex = p;

     }  // end for


   // swap largest item Data[largestIndex] with
   // Data[last]
    swap(Data[largestIndex],Data[last]);
  } // end for
}  // end selectionSort
```

last : index of the last item in the subarray of items yet to be sorted.

largestIndex : index of the largest item found

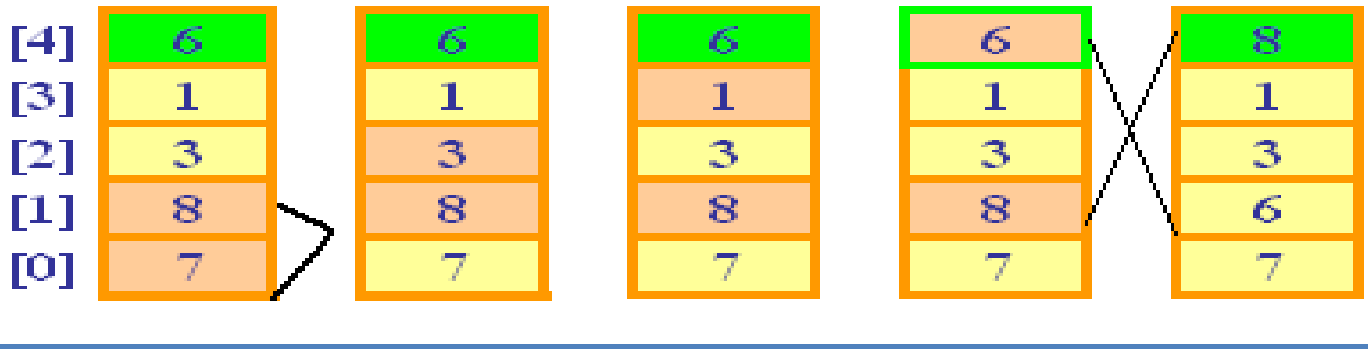
swap: change largest value with item at last index of the subarray.

swap() function

Swap function interchange value x and y. In this example both x and y need to be pass by reference

```
void swap(DataType& x, DataType& y)
{    DataType temp = x;
     x = y;
     y = temp;
}   // end swap
```

Selection Sort Implementation: [7 8 3 1 6]

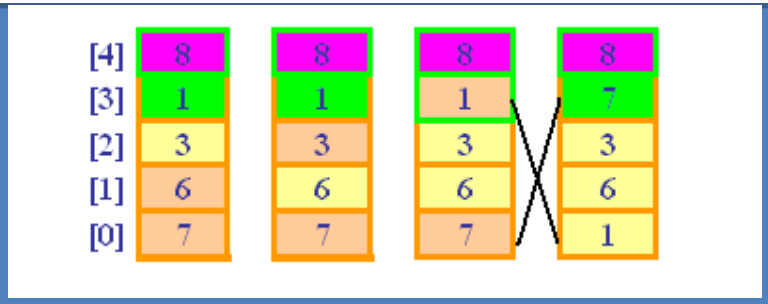


Pass 1, last = 4
largestIndex = 0, 1, 1, 1
p = 1, 2, 3, 4

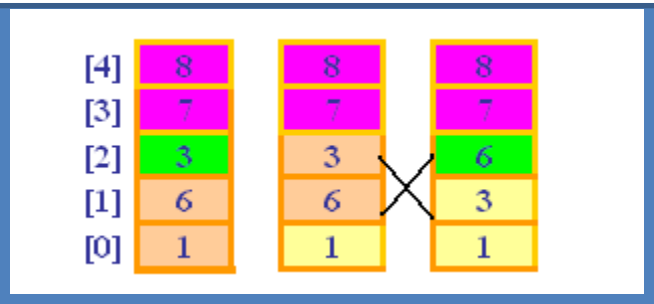
Starting from index 1 to index 4, the largest value in the array will be searched. In pass 1, the largest value is 8 and was found at index 1. Therefore value at index 1 (8) will be swap with value at index last(4).

There are 4 comparisons in this pass.

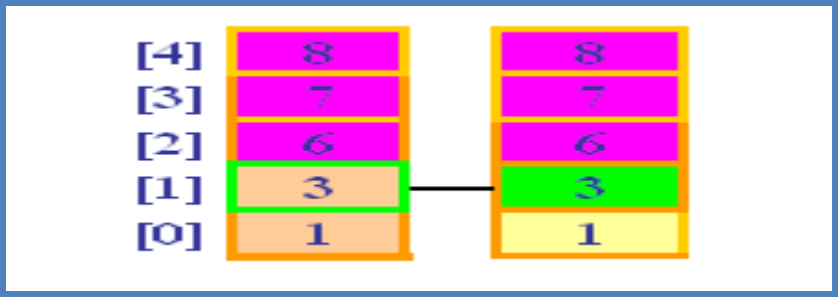
Selection Sort Implementation: [7 8 3 1 6]



Pass 2
last = 3
largestIndex = 0, 0, 0
p = 1, 2, 3

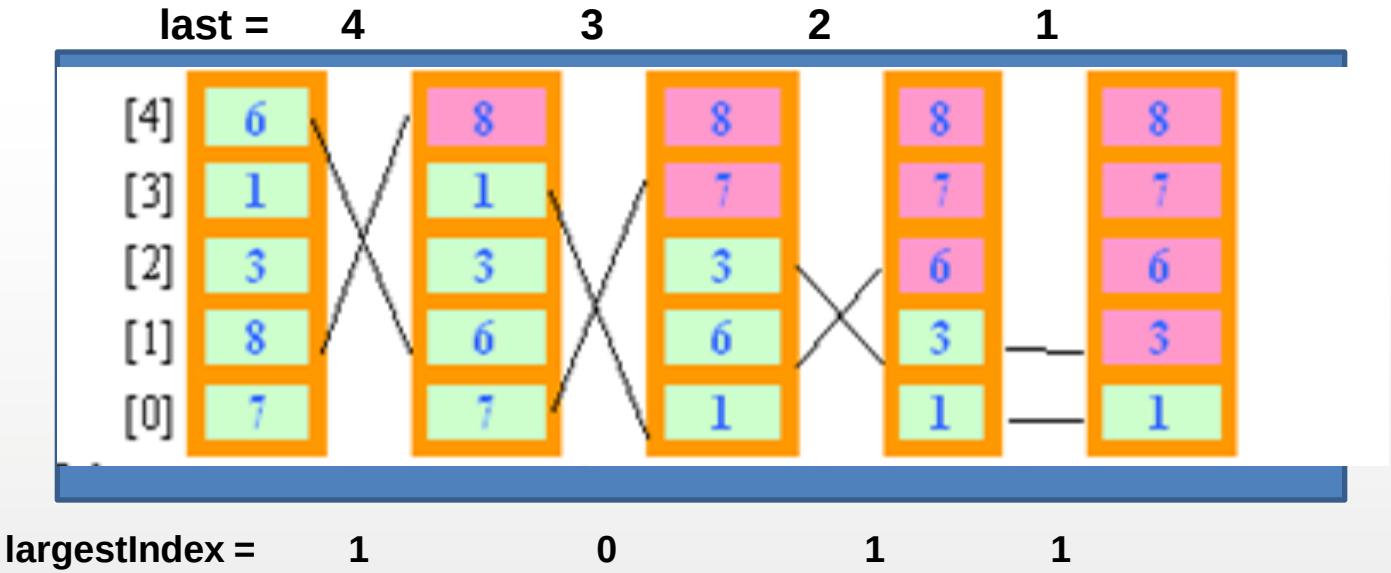


Pass 3
last = 2
largestIndex = 0, 1
p = 1, 2



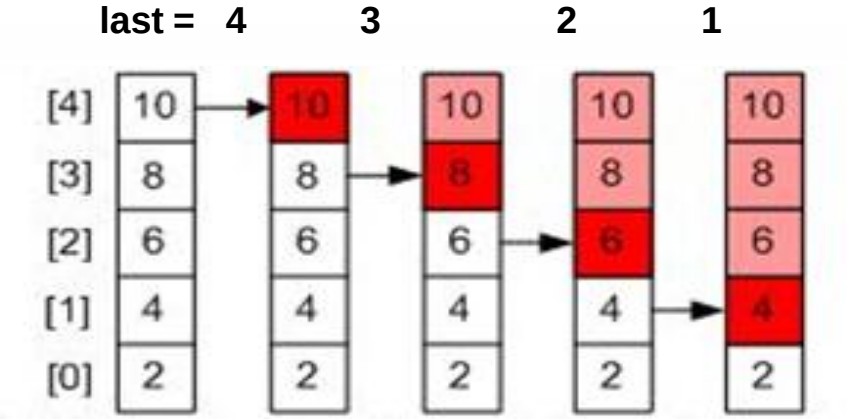
Pass 4
last = 1
largestIndex = 0, 1
p = 1

Selection Sort Implementation: [7 8 3 1 6]



Step by step changes in the list that show the swapping process during selection sort implementation on array [7 8 3 1 6]

Selection Sort Implementation for Best Case [2 4 6 8 10]



largestIndex = 4 3 2 1

Step by step changes in the list that show the swapping process during selection sort implementation on array [2 4 6 8 10]

Selection Sort Analysis

- For an array with size n, the external loop will iterate from *n-1 to 1*.

```
for (int last = n-1; last>=1; --last)
```

- For each iteration, to find the largest number in subarray, the number of comparison inside the internal loop must is equal to the value of last.

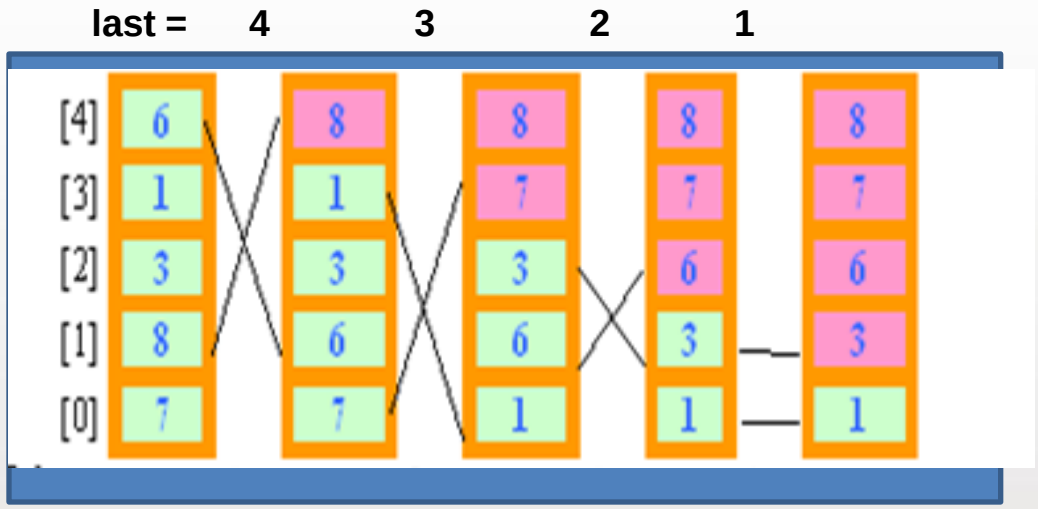
```
for (int p=1;p <=last; ++p)
```

- Therefore the total comparison for Selection Sort in each iteration is *(n-1) + (n-2) + ….. 2 + 1*.
- Generally, the number of comparisons between elements in Selection Sort can be stated as

$$(n-1)+(n-2)+.....+2+1=\frac{n(n-1)}{2}=O(n^2)$$

Selection Sort Analysis

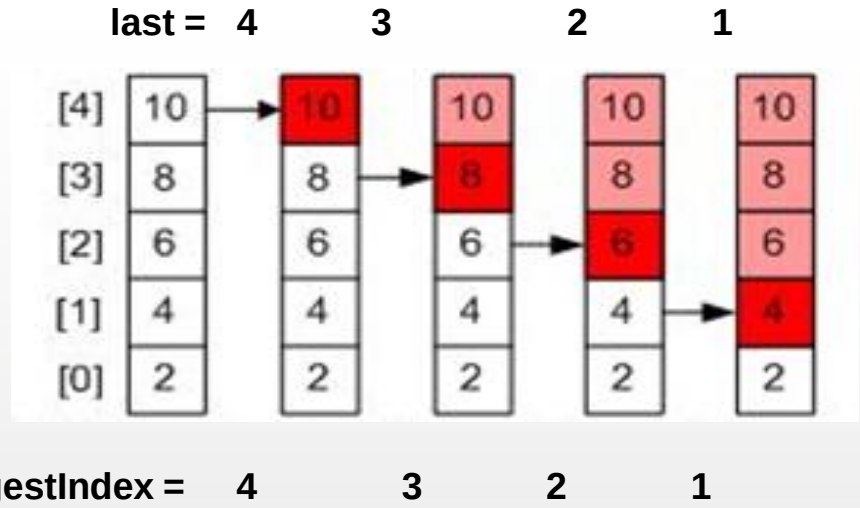
Similar To Bubble Sort, in any cases of Selection Sort (worse case, best case or average case) the number of comparisons between elements is the same.



Number of Comparisons: 4 + 3 + 2 + 1 = 10

For array n= 5 => (n-1) + (n-2) + ….+ 2 + 1 = n(n-1)/2 = $O(n^2)$

Selection Sort Analysis



Number of Comparisons for best case : 4 + 3 + 2 + 1 = 10

For array n= 5 => (n-1) + (n-2)+ …. + 2 + 1 = n(n-1)/2 = $O(n^2)$

Summary

- The efficiency of Selection Sort does not depend on the initial arrangement of the data.
- Time Complexity for Selection Sort is the same for all cases - worse case, best case or average case $O(n^2)$.

Selection	Comparison	Swap
Best Case	$O(n^2)$	$O(n)$
Average Case	$O(n^2)$	$O(n)$
Worst Case	$O(n^2)$	$O(n)$


Thank
You