DATA STRUCTURES

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OUTLINE

- Sorting algorithms
  - Quadratic Sorting Algorithms
    - Selection sort
    - Bubble sort

SORTING ALGORITHMS

- **Definition:**
  - Given a sequence of n values

    A=(a1,..., an)

  - Compute a permutation

    A'=(a'1,..., a'n)

  - Such that a'1<= a'2<=....<= a'n

CLASSES OF SORTING ALGORITHMS

Class	Complexity	Algorithms
Quadratic	$O(n^2)$	Bubble sort Insertion sort Selection sort
Logarithmic	$O(n \log_2 n)$	Quick Sort Heap Sort Merge Sort
Linear	O(n)	Counting Sort

QUADRATIC SORTING ALGORITHMS

SELECTION SORT

- Selection sort is one of the easiest approaches to sorting.
- It is inspired from the way in which we sort things out in day to day life.
- It is an in-place sorting algorithm because it uses no auxiliary data structures while sorting.

SELECTION SORT PSEUDOCODE

Step 1 – Set MIN to location 0

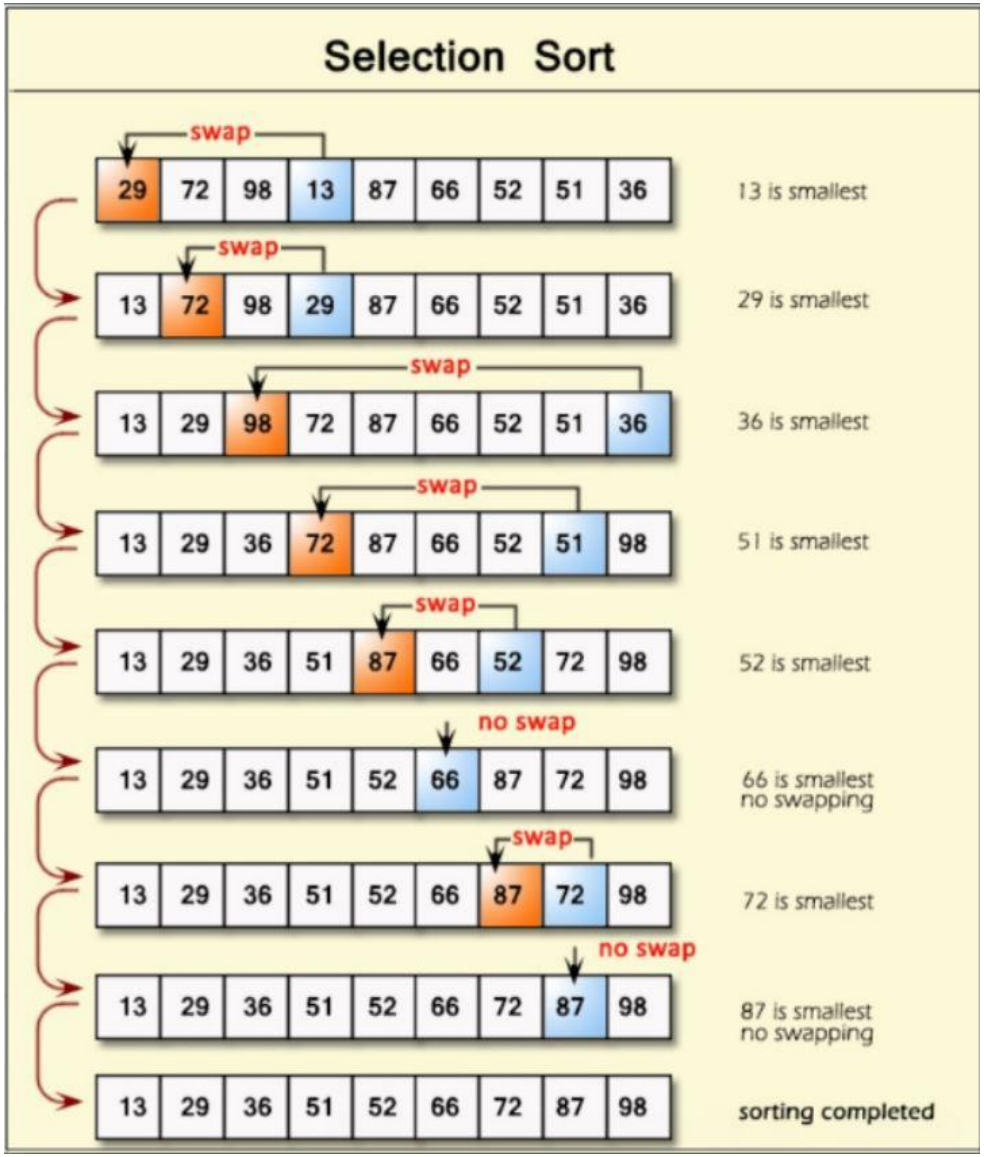
Step 2 – Search the minimum element in the list

Step 3 – Swap with value at location MIN

Step 4 – Increment MIN to point to next element

Step 5 – Repeat until list is sorted

SELECTION SORT



SELECTION SORT

```
public static void selectionSort(int[] arr){
      for (int i = 0; i < arr.length - 1; i++)
      {
          // Search for smallest element
         int index = i;
         for (int j = i + 1; j < arr.length; j++){
            if (arr[j] < arr[index]){
               index = j;//searching for lowest index
            }
         }
          // Swap smallest element with arr[i]
         int smallestNumber = arr[index];
         arr[index] = arr[i];
         arr[i] = smallestNumber;
      }
   }
```

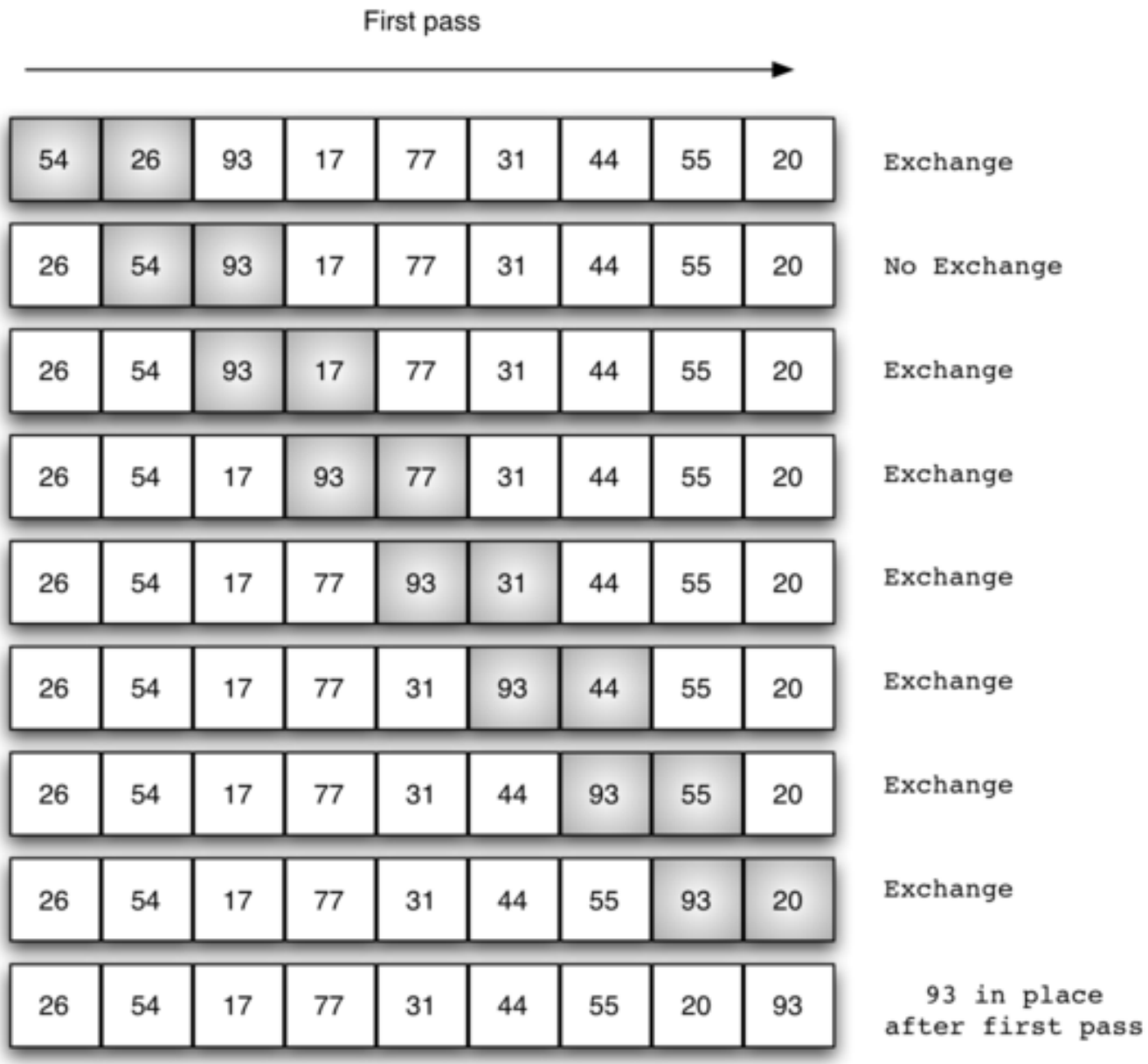
ASSIGNMENT

- Count the number of comparisons in Selection sort algorithm.
- Prove that selection sort worst case, average case and best case are in $O(n^2)$.

BUBBLE SORT

- Bubble sort repeatedly swaps adjacent elements if they are not ordered.
- Bubble sort performance is poor in the real world.

BUBBLE SORT



BUBBLE SORT

```
static void bubbleSort(int[] arr) {
        int n = arr.length;
        int temp = 0;
         for(int i=0; i < n; i++){
                for(int j=1; j < (n-i); j++){
                        if(arr[j-1] > arr[j]){
                                //swap elements
                                temp = arr[j-1];
                                arr[j-1] = arr[j];
                                arr[j] = temp;
                        }

                }
        }

}
```

ASSIGNMENT

- Count the number of comparisons in Bubble sort algorithm.
- What is the order of the best, worst, and average cases of bubble sort.
- Think of a way to optimize bubble sort algorithm.

THANK YOU