

## **2. Selection Sort Correctness**

A basic sorting algorithm based on comparison is called selection sort. Its concept is to separate the input list into two sections. A region that is sorted and another that is not. The method continually chooses the initial element of the unsorted region and swaps it with the smallest (or largest depending on the sorting order) element from the unsorted region. Until the entire array is sorted, this process is to be repeated.

### **Pseudo code for Selection Sort:**

```
SelectionSort(Array)
for i from 0 to length(Array) - 1
    minimumIndex = i
    for j from i + 1 to length(Array)
        if Array[j] < Array[minimumIndex]
            minimumIndex = j
    swap Array[i] with Array[minimumIndex]
```

To argue selection sort correctness, below are the points:

#### **1. Initialization:**

The array's items are all present in the right half of the array before the first iteration of the outer loop, while the left half of the array is empty. The requirement that the left part be sorted and the right part be left unsorted is satisfied by this.

#### **2. Maintenance:**

The method chooses the smallest entry from the unsorted list for each iteration of the outer loop. This preserves the feature that the right portion is unsorted and the left section is sorted.

#### **3. Termination:**

When the entire array has been sorted, the process comes to an end. When the outer loop has finished its iterations, this happens. By now, all of the elements in the array have been sorted, meeting the requirements.

The smallest element from the unsorted zone is relocated to the appropriate location in the sorted region at the conclusion of each iteration of the outer loop, which is the selection sort's invariant and the basis for its accuracy. Until the entire array is sorted, these steps are repeated.

In conclusion, selection sort is an appropriate sorting algorithm that effectively arranges an array in either ascending or descending order according to the comparison operator that is applied. Selection sort is less effective than certain other sorting algorithms for large datasets, nevertheless, with a time complexity of  $O(n^2)$ , where  $n$  is the number of elements in the array.