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Correctness of Selection Sort:

Algorithm :-

Find the smallest element in the unsorted part of the array and swap it with the first element in that part of the array.

for $i = 0$ to $n - 1$ {

 minimum = i

 for $j = i + 1$ to n {

 if ($arr[j] < arr[minimum]$) {

 minimum = j

 }

 }

 if ($i \neq minimum$) {

 swap (i^{th} element, minimum element)

}

}

Correctness:

The correctness of the Selection Sort Algorithm can be proven by using a loop invariant and demonstrating that it holds true during the execution of the algorithm.

Initialization:-

Invariant

At the start of each iteration of the outer loop, the subarray before the current index i is sorted, and all elements in this subarray are smaller than or equal to any element in the unsorted portion of the array:

```
for  $i = 0$  to  $n - 1$  {  
    minimum =  $i$ 
```

```
}
```

Maintenance:

Before the execution of the inner loop, all the elements before i are sorted. The inner loop identifies the minimum element in the array and swaps the values accordingly.

for $j = i + 1$ to n {

if $(arr[j] < arr[minimum])$ {
 $minimum = j$

}

swap ($arr[i], arr[minimum]$)

The algorithm sorts the element at index i , which belongs at the index $minimum$. The outer loop runs from 0 to $n - 1$, iterating through the array.

Termination:

Once the outer loop completes, the algorithm terminates. The entire array is sorted, and there are no infinite loops or conditions that would prevent the completion.