

Sorting techniques

Algorithms :

An algorithm is a method of representing the step-by-step procedure for solving a problem.

Sorting:

Arranging the elements in a list either in ascending or descending order. Various sorting algorithms are.

- 1) Bubble sort
- 2) Selection sort
- 3) Insertion sort
- 4) Quick sort
- 5) Merge sort
- 6) Heap sort

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Bubble Sort

The bubble sort is an example of exchange sort. In this method, repetitive comparison is performed among elements and essential swapping of element is done. Bubble sort is commonly used in sorting algorithm. It is easy to understand but time consuming i.e. takes more number of comparison to sort a list. In this type, two successive elements are compared and swapping

is done. Thus, step-by-step entire array elements are checked. It is different from the selection sort. Instead of searching the minimum element and then applying swapping, two records are swapped instantly upon noticing that they are not in order.

Algorithm:

Bubble-Sort ($A[], N$)

Step 1: start

Step 2: Take an array of n elements

Step 3: for $i=0, \dots, n-2$

Step 4: for $j=i+1, \dots, n-1$

Step 5: if $arr[j] > arr[j+1]$ then
Interchange $arr[j]$ and $arr[j+1]$
End of if

Step 6: Print the sorted array arr

Step 7: Stop

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Selection Sort

Selection sort (select the smallest and Exchange)

The first item is compared with the remaining $n-1$ items, and whichever of all is lowest, is put in the first position. Then the second item from the list is taken and compared with the remaining $(n-2)$ items, if an item with a value less than that of the second item is found on the $(n-2)$ items, it is swapped (Interchanged) with the second item of the list and so on.

selection sort

comparisons

8 5 7 1 9 3

(n-1) first smallest

1 5 7 8 9 3

(n-2) second smallest

1 3 7 8 9 5

(n-3) third smallest

1 3 5 8 9 7

2

1 3 5 7 9 8

1

1 3 5 7 8 9

0

Insertion Sort

Insertion sort iterates, consuming one input element each repetition, and growing a sorted output list. Each iteration, insertion sort removes one element from the input data, finds the location it belongs within the sorted list, and inserts it there. It repeats until no input elements remain.

Algorithm:

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Step 1: start

Step 2: for $i \leftarrow 1$ to $\text{length}(A)$

Step 3: $j \leftarrow i$

Step 4: while $j > 0$ and $A[j-1] > A[j]$

Step 5: swap $A[j]$ and $A[j-1]$

Step 6: $j \leftarrow j-1$
Step 7: end while
Step 8: end for
Step 9: stop

Quick Sort

Quick sort is a divide and conquer algorithm. Developed by Tony Hoare in 1959.

Quick sort first divides a large array into two smaller sub-arrays: the low elements and the high elements.

Quick sort can then recursively sort the sub-arrays.

Algorithm:

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Step 1: Pick an element, called a pivot, from the array

Step 2: Partitioning:

reorder the array so that all elements with values less than the pivot come before the pivot, while all elements with values greater than the pivot come after it (equal values can go either way). After this partitioning, the pivot is in its final position. This is called the partition operation.

Step 3: Recursively apply the above steps to the sub-array of elements with similar smaller values and separately to the sub-array of elements with greater values.

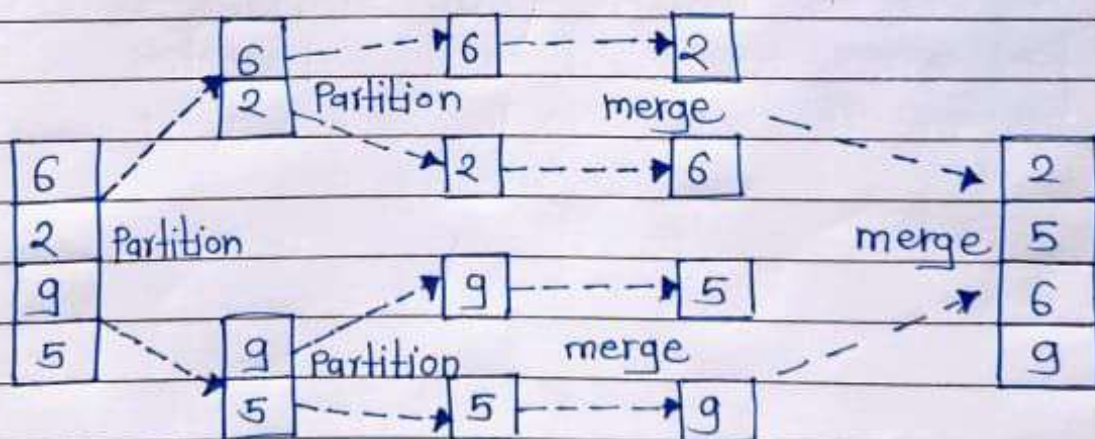
Merge Sort

Merge sort is a sorting technique based on divide and conquer technique. In merge sort the unsorted list is divided into N sublists, each having one element, because a list of one element is considered sorted. Then, it repeatedly merge these sublists, to produce new sorted sublists, and at last one sorted list is produced. Merge sort is quite fast, and has a time complexity of $O(n \log n)$.

Conceptually, merge sort works as follows:

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1. Divide the unsorted list into two sub-lists of about half the size.
2. Divide each of the two sub lists recursively until we have list sizes of length 1, in which case the list itself is returned.
3. Merge the two sub lists back into one sorted list.



The result is : [2, 5, 6, 9]

Heap Sort

Heap sort is a completely binary tree with the property that a parent is always greater than or equal to either of its children (if they exist). First the heap (max or min) is created using binary tree and then heap is sorted using priority queue.

Steps:

Step 1: start with just one element.

Step 2: Insert next elements and make this heap.

Step 3: Repeat step 2, until all elements are included in the heap.

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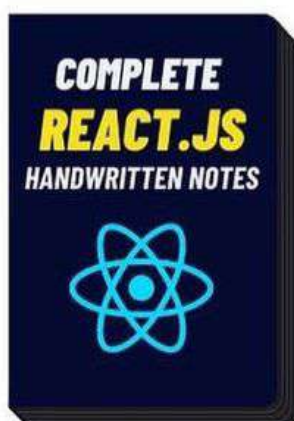
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