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IT

D.S Assignement

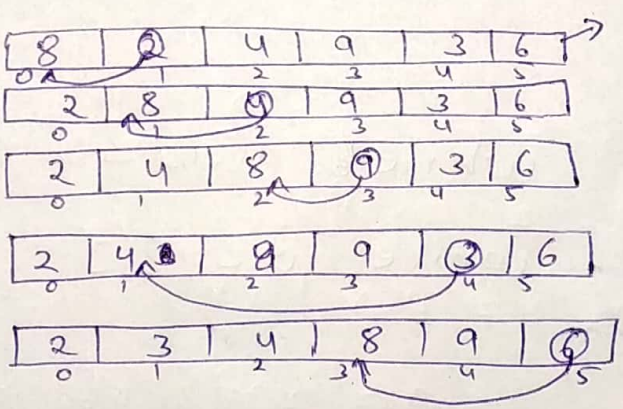
Q1. Analysis on time complexity of insertion sort algorithm.

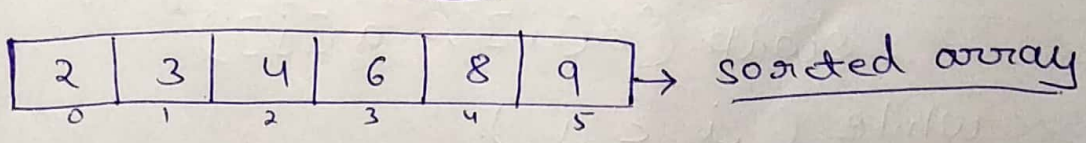
Let a is an array with n elements

1. read a
2. repeat step 3 to 8 for i = 1 to n-1
3. temp = a[i]
4. j = i - 1
5. repeat step 6 to 7 while temp < a[j] and j >= 0
6. a[j+1] = a[j]
7. j = j - 1 // end of 5 loop
8. a[j+1] = temp // end of 2 loop
9. exit

operation followed by insertion sort:

let a = [8, 2, 4, 9, 3, 6].





time complexity = O(n). (best case)

= $O(n^2)$ (worst case)

Time complexity can be reduced by (1) & (2)

(1) Binary search :- By using a sorted array & using binary search cand reduced the complexity to O(ns.

(2) By using linked list : the complexity of insertion become worst and complexity reduced to O(1).

Q2. Quicksort algorithm

```
quick_sort (a[], l h)
if (l < h)
  j = partition (a, l, h)
  quick_sort (a, l, j-1)
  quick_sort (a, j+1, h)
// end of if.
partition (a, l h)
t = a[l]
i = l
j = h+1
do
  do i++ , while a[i] < t and i <= h
  do j-- , while t < a[j]
if (i < j)
    swap (a[i], a[j])
while (i < j).
a[l] = a[j]
a[j] = t
return j
exit
```

the complexity of best case of quick sort is T(n) = O(nlogn).

And the complexity of worst case of quicksort is $T(n) = O(n^2)$.

Bubble Sort Algorithm

```
start
for (i=0 to n)
 for ( j=0 to n-1)
  if ( a[j] > a[j+1])
     temp = a[j]
     a[j] = a[j+1]
     a[j+1] = temp
  end:
```

The complexity of best case of bubble sort is $T(n) = O(n^2)$.
and worst case $T(n) = O(n^2)$.

Complexity comparsion of Quicksort, bubblesort, merge sort and insertion sort :-

Quick sort: $T(n) = O(n \log n)$ (best case) & $O(n^2)$ (worst case).

Bubble sort: $T(n) = O(n^2)$. (best & worst case).

mergesort: $T(n) = O(n \log n)$ (best case).

Insertion sort: $T(n) = O(n^2)$ (worst) & $O(n)$ (best case)