

CSC 142

Sorting

CSC 142 Q 1

The problem

Given $a[0], a[1], \dots, a[n-1]$

reorder entries so that

$$a[0] \leq a[1] \leq \dots \leq a[n-1]$$

→ a very common operation

→ lots of application (search in a database...)

First: Look at a simpler problem

Suppose

$$a[0] \leq a[1] \leq \dots \leq a[i-1]$$

How to add $a[i]$ so that

$$a[0] \leq a[1] \leq \dots \leq a[i]$$

e.g: 1 4 5 8 9 6

add 6 → 1 4 5 6 8 9

CSC 142 Q 2

Insertion algorithm

1. Store $a[i]$ in a temporary variable $temp$
2. Shift all elements $> temp$ to the right by one position
3. Insert $temp$ in the space created

Requirement:

a is sorted up through $a[i-1]$
(if not, does NOT work)

Outcome:

after insertion, a is sorted up through $a[i]$

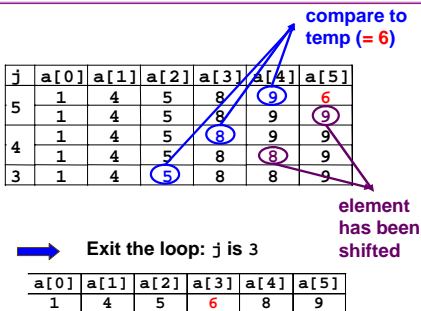
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Insert as a method

```
public void insert(int[] a, int i)
{
    int j, temp;
    temp = a[i];
    for(j=i; j>0 && a[j-1]>temp; j--)
        a[j] = a[j-1];
    a[j] = temp;
}
```

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How does it work?



CSC 142 Q 5

Insertion Sort

→ Use insert

```
public void sort (int[] a)
{
    int i;
    for (i=1; i<a.length; i++)
        insert(a,i);
}
```

Example: sort(a)

i	a[0]	a[1]	a[2]	a[3]	a[4]
initially	10	20	15	5	3
1	10	20	15	5	3
2	10	15	20	5	3
3	5	10	15	20	3
4	3	5	10	15	20

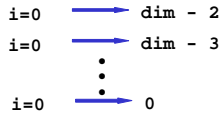
CSC 142 Q 6

Bubble Sort

Idea :

- Compare $a[i]$ and $a[i+1]$
- if $a[i] > a[i+1]$,
exchange $a[i]$ and $a[i+1]$

Loop over :



Example: first pass of bubble sort (i=0 to 3)

i	a[0]	a[1]	a[2]	a[3]	a[4]
initially	10	20	15	5	3
0	10	20	15	5	3
1	10	15	20	5	3
2	10	15	5	20	3
3	10	15	5	3	20

20 drifts to the top (like a bubble in a liquid)

For all of the passes

Pass	a[0]	a[1]	a[2]	a[3]	a[4]
initially	10	20	15	5	3
1	10	15	5	3	20
2	10	5	3	15	20
3	5	3	10	15	20
4	3	5	10	15	20

Efficiency is the key

Bubble Sort is less efficient than Insert Sort

→ Check it out

There are many sorting algorithms :
to find the best algorithm, theory + practice