

Keyword definition:

“Moving through a list repeatedly, swapping elements that are in the wrong order.”

Algorithms

Keyword: Bubble Sort

Questions

Objectives

ADVANCED:
Explain what a bubble sort is and be able to perform a bubble sort on a set of data.

EXPERT:
Understand how the number of comparisons increases in a bubble sort.

When do you need to sort things in your daily activities?

Sort your room?

Sort DVDs, books or computer games so they are in order?

Sort out old clothes that you don't want anymore?

How do you think a computer sorts items?

**Can you 'bubble sort' 10 cards from a deck to get them in the correct order?
Ace is valued at 1 for this task.**





Bubble Sort Algorithm

Objectives

ADVANCED:
Explain what a bubble sort is and be able to perform a bubble sort on a set of data.

EXPERT:
Understand how the number of comparisons increases in a bubble sort.

Take the first element and second element from the list.
Compare them.

- IF element 1 > element 2 THEN
Swap then
- ELSE
Do nothing

Repeat: Move along the list to the next pair

- IF no more elements:
Go to 1
- ELSE:
Go to 2

Until: You have moved through the entire list and not made any changes.



Bubble Sort Example

Element Number
Value

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----|---|---|---|---|----|----|---|
| 13 | 2 | 6 | 8 | 9 | 10 | 12 | 4 |

1) Compare elements 1 and 2

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----|---|---|---|---|----|----|---|
| 13 | 2 | 6 | 8 | 9 | 10 | 12 | 4 |

2) Is element 1 > element 2?

3) **Yes:** so swap them

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|----|---|---|---|----|----|---|
| 2 | 13 | 6 | 8 | 9 | 10 | 12 | 4 |

4) Compare elements 2 and 3

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|----|---|---|---|----|----|---|
| 2 | 13 | 6 | 8 | 9 | 10 | 12 | 4 |

5) Is element 2 > element 3?

6) **Yes:** so swap them

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|----|---|---|----|----|---|
| 2 | 6 | 13 | 8 | 9 | 10 | 12 | 4 |



C O M P U T E R S C I E N C E

Bubble Sort Example



Talk through the next steps that are taken in the bubble sort:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|----|---|---|----|----|---|
| 2 | 6 | 13 | 8 | 9 | 10 | 12 | 4 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|----|---|----|----|---|
| 2 | 6 | 8 | 13 | 9 | 10 | 12 | 4 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|----|---|----|----|---|
| 2 | 6 | 8 | 13 | 9 | 10 | 12 | 4 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|----|---|
| 2 | 6 | 8 | 9 | 13 | 10 | 12 | 4 |



C O M P U T E R S C I E N C E



Bubble Sort Example

Compare elements 5 and 6

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|----|---|
| 2 | 6 | 8 | 9 | 13 | 10 | 12 | 4 |

Is element 5 > element 6?

Yes, so swap them

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|----|---|
| 2 | 6 | 8 | 9 | 10 | 13 | 12 | 4 |

Compare elements 6 and 7

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|----|---|
| 2 | 6 | 8 | 9 | 10 | 13 | 12 | 4 |

Is element 6 > element 7?

Yes, so swap them

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|----|---|
| 2 | 6 | 8 | 9 | 10 | 12 | 13 | 4 |





Bubble Sort Example

Compare elements 7 and 8

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|----|---|
| 2 | 6 | 8 | 9 | 10 | 12 | 13 | 4 |

Is element 7 > element 8?
Yes, so swap them

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|---|----|
| 2 | 6 | 8 | 9 | 10 | 12 | 4 | 13 |

You have come to the end of the list.
A change has been made.
So you start again.

Compare elements 1 and 2
Swap? No

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|---|----|
| 2 | 6 | 8 | 9 | 10 | 12 | 4 | 13 |



C O M P U T E R S C I E N C E



Bubble Sort Example

Compare 2 and 3

Swap? No

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|---|----|
| 2 | 6 | 8 | 9 | 10 | 12 | 4 | 13 |

Compare 3 and 4

Swap? No

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|---|----|
| 2 | 6 | 8 | 9 | 10 | 12 | 4 | 13 |

Compare 4 and 5

Swap? No

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|---|----|
| 2 | 6 | 8 | 9 | 10 | 12 | 4 | 13 |

Compare 5 and 6

Swap? No

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|---|----|
| 2 | 6 | 8 | 9 | 10 | 12 | 4 | 13 |





Bubble Sort Example

Compare 6 and 7

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|----|---|----|
| 2 | 6 | 8 | 9 | 10 | 12 | 4 | 13 |

Swap? Yes

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|---|----|----|
| 2 | 6 | 8 | 9 | 10 | 4 | 12 | 13 |

Compare 7 and 8

Swap? No

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|----|---|----|----|
| 2 | 6 | 8 | 9 | 10 | 4 | 12 | 13 |

You've reached the end.
Have you made any swaps?
Yes, so start again.



C O M P U T E R S C I E N C E

Complexity



CARR MANOR
COMMUNITY SCHOOL

Objectives

ADVANCED:
Explain what a bubble sort is and be able to perform a bubble sort on a set of data.

EXPERT:
Understand how the number of comparisons increases in a bubble sort.

In a list of 10 numbers...

...positioned in the worst case (i.e. all of the elements are in reverse order)

How many comparisons would the sort algorithm need to do?

- 100
- $n*n$ where n is the number of elements
- The average number of swaps is n^2 .

