

Bubble Sort

Programming and Algorithms

STEM Digital Academy

School of Science & Technology

www.city.ac.uk

Lecture by
Dr Daniil Osudin

```
n = 3
for i in range(1,n+1):
    print("Hello World!")

Hello World!
Hello World!
```

Hello World!



What will we Cover?

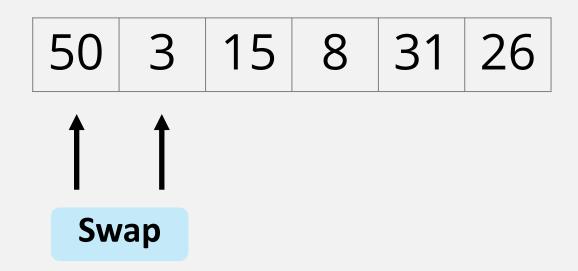
- Bubble sort algorithm
- Understanding the efficiency of the algorithm using big-O notation



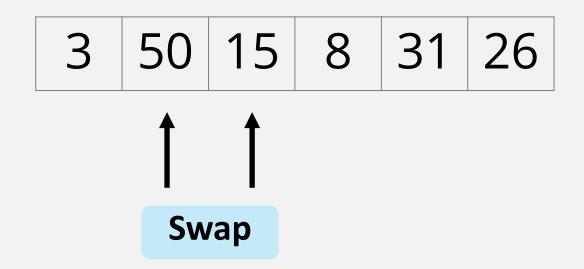
Bubble Sort

- In the first pass, each element in the list is compared with the following element in the list.
- If this element is bigger then the element being compared, then they are swapped.
- If you repeat this process enough times, the data will be sorted in ascending order.

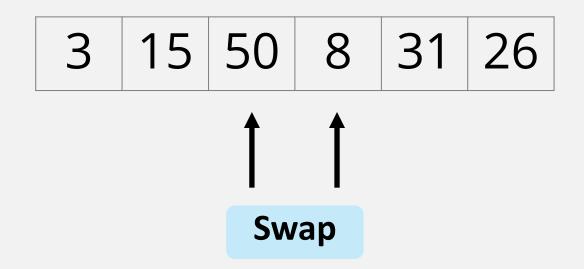




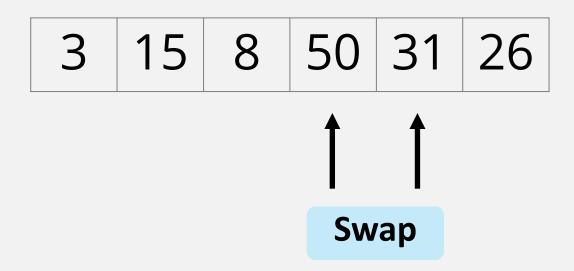




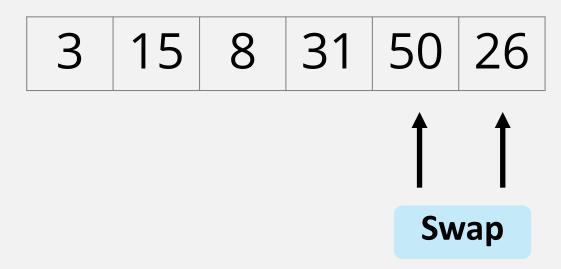




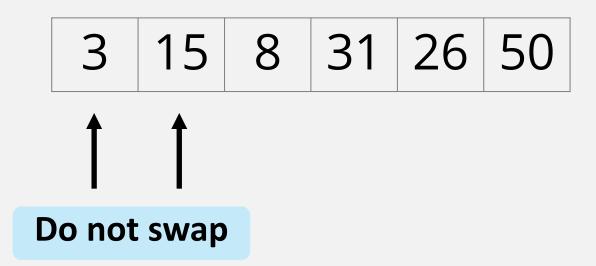




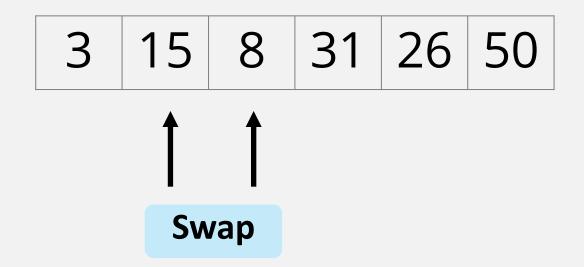




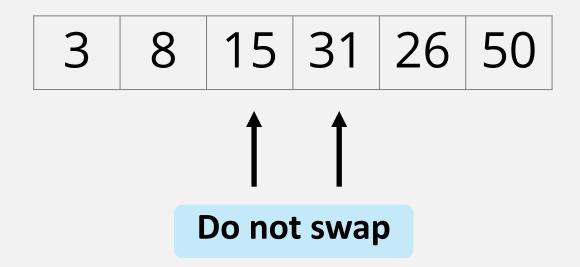




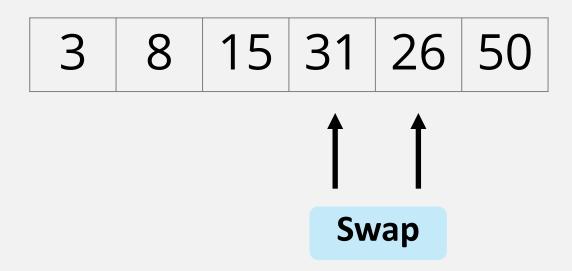














3 8 15 26 31 50



Bubble Sort Algorithm

```
    n = len(list)
    for i in range(n-1)
    for j in range(n-1-i)
    if list[j] > list[j + 1]
    temp = list[j]
    list[j] = list[j + 1]
    list[j] + 1] = temp
```



Bubble Sort Example

```
def bubble sort(list1):
   # this function sorts the list using bubble sort algorithm
   n = len(list1)
   for i in range(n-1):
        for j in range(n-1-i):
            if list1[j] > list1[j+1]:
                temp = list1[j]
                list1[j] = list1[j+1]
                list1[j+1] = temp
input_string = input("Enter your numbers, then press enter: ")
split input = input string.split()
numbers = [int(n) for n in split input]
bubble sort(numbers)
print("sorted list:", numbers)
Enter your numbers, then press enter: 8 3 6 1 9 7 0 2 5 4
sorted list: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```



Analysis

- Makes excessive comparisons.
- Works best on a partially ordered list
- Classical algorithm, good introduction to sorting algorithms.
- Bubble sort uses a nested loop, so in the worst-case scenario, when we have to execute both loops n times, we perform $O(n^2)$ comparisons
- The actual number of operations is $4n(n + 1)/2 = 2n^2 + 2n = O(n^2)$
- The big-O notation for bubble sort is O(n²)



Try It Yourself

Write a program in python environment that takes a string as an input and sorts in alphabetical order using the bubble sort algorithm above

