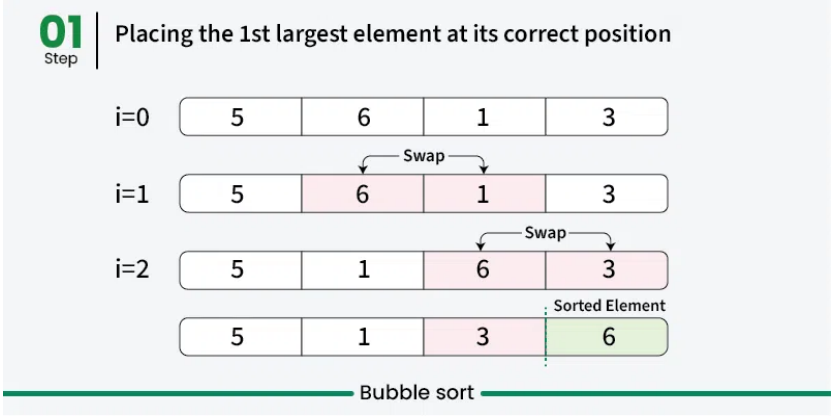
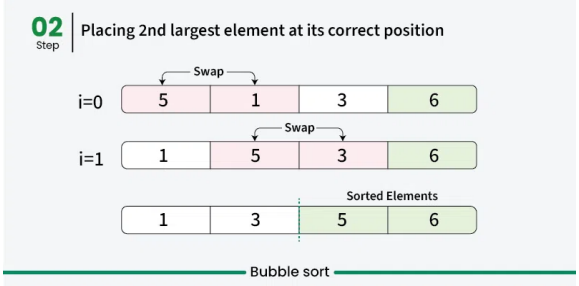
Bubble Sort

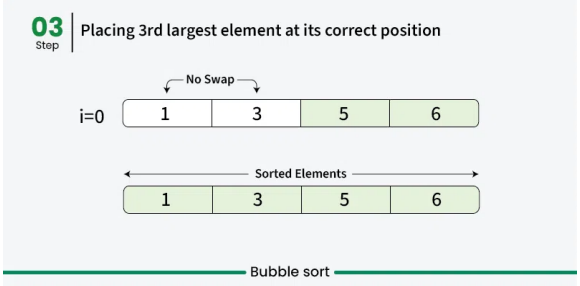
💡 **Bubble sort** is a sorting algorithm that compares two adjacent elements and swaps them until they are in the intended order.

Algorithm steps

1. Starting from the first index, compare the first and the second elements.
2. If the first element is greater than the second element, they are swapped.
3. Now, compare the second and the third elements. Swap them if they are not in order.
4. The above process goes on until the last element.







Pseudocode

```
bubbleSort(array)
  for i <- 1 to sizeOfArray - 1
    for j <- 1 to sizeOfArray - 1 - i
      if leftElement > rightElement
        swap leftElement and rightElement
end bubbleSort
```

Optimized Bubble Sort

→ There are 2 approach to optimize bubble sort.

1. By checking whether the given array is already sorted or not. We can achieve that with boolean value to save whether any swaps were made or not.
2. Even the complexity does not matter, every loop we go through the array, max element comes at the back of an array so we can fix the loop ending descendingly (n, n-1, ... 0)

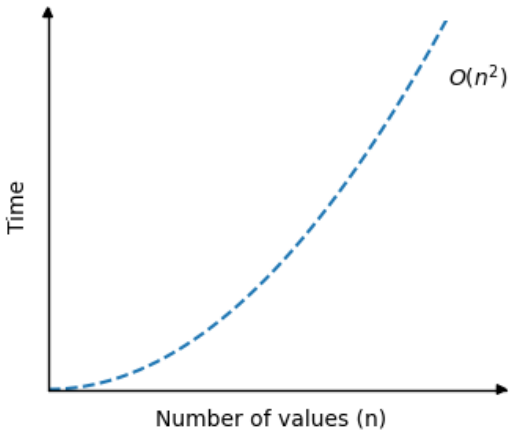
Optimized Pseudocode

```
bubbleSort(array)
  for i <- 1 to sizeOfArray - 1
    swapped <- false
    for j <- 1 to sizeOfArray - 1 - i
      if leftElement > rightElement
        swap leftElement and rightElement
        swapped <- true
    if swapped == false
```

```
        break
    end bubbleSort
```

Analysis

- **Worst Case Complexity:** `O(n2)` If we want to sort in ascending order and the array is in descending order then the worst case occurs.
- **Best Case Complexity:** `O(n)` If the array is already sorted, then there is no need for sorting.
- **Average Case Complexity:** `O(n2)` It occurs when the elements of the array are in jumbled order (neither ascending nor descending).



Advantages of Bubble Sort

- Bubble sort is easy to understand and implement.
- It does not require any additional memory space.
- It is a stable sorting algorithm, meaning that elements with the same key value maintain their relative order in the sorted output.

Disadvantages of Bubble Sort

- Bubble sort has a time complexity of O(n^2) which makes it very slow for large data sets.
- Bubble sort has almost no or limited real world applications. It is mostly used in academics to teach different ways of sorting.

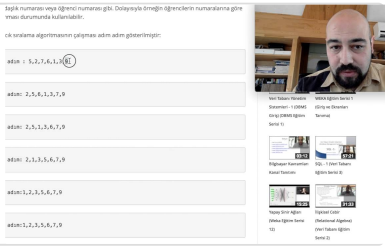
📌 Java implementation can be found under Implementation_Java folder

📚 References

Bubble Sort (Kabarcık / Baloncuk Sıralması) Algoritma Analizi 5

Algoritma analizi açısından kabarcık / baloncuk sırlaması olarak geçen (bubble sort) algoritmanın çalışmasını anlatıp analizini yapıyoruz, en iyi, en kötü ve ortalama durum analizlerine bakıyoruz.

https://www.youtube.com/watch?v=wiNIQ_IT3fk



Bubble Sort (With Code in Python/C++/Java/C)

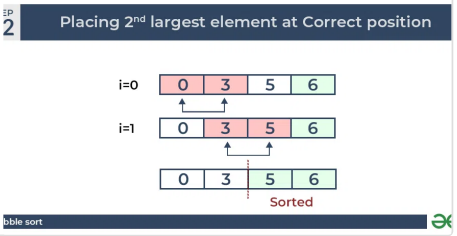
The bubble sort algorithm compares two adjacent elements and swaps them if they are not in the intended order. In this tutorial, we will learn about the working of the bubble sort algorithm along with its implementations in Python, Java and C/C++.

https://www.programiz.com/dsa/bubble-sort

Bubble Sort Algorithm - GeeksforGeeks

A Computer Science portal for geeks. It contains well written, well thought and well explained computer science and programming articles, quizzes and practice/competitive

https://www.geeksforgeeks.org/bubble-sort-algorithm/



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SerhatKumas - Overview

Computer engineering student who loves coding in different fields instead of focusing on a one spesific area. - SerhatKumas

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