

DATA STRUCTURES & ALGORITHMS

Chapter 2: Sorting algorithms

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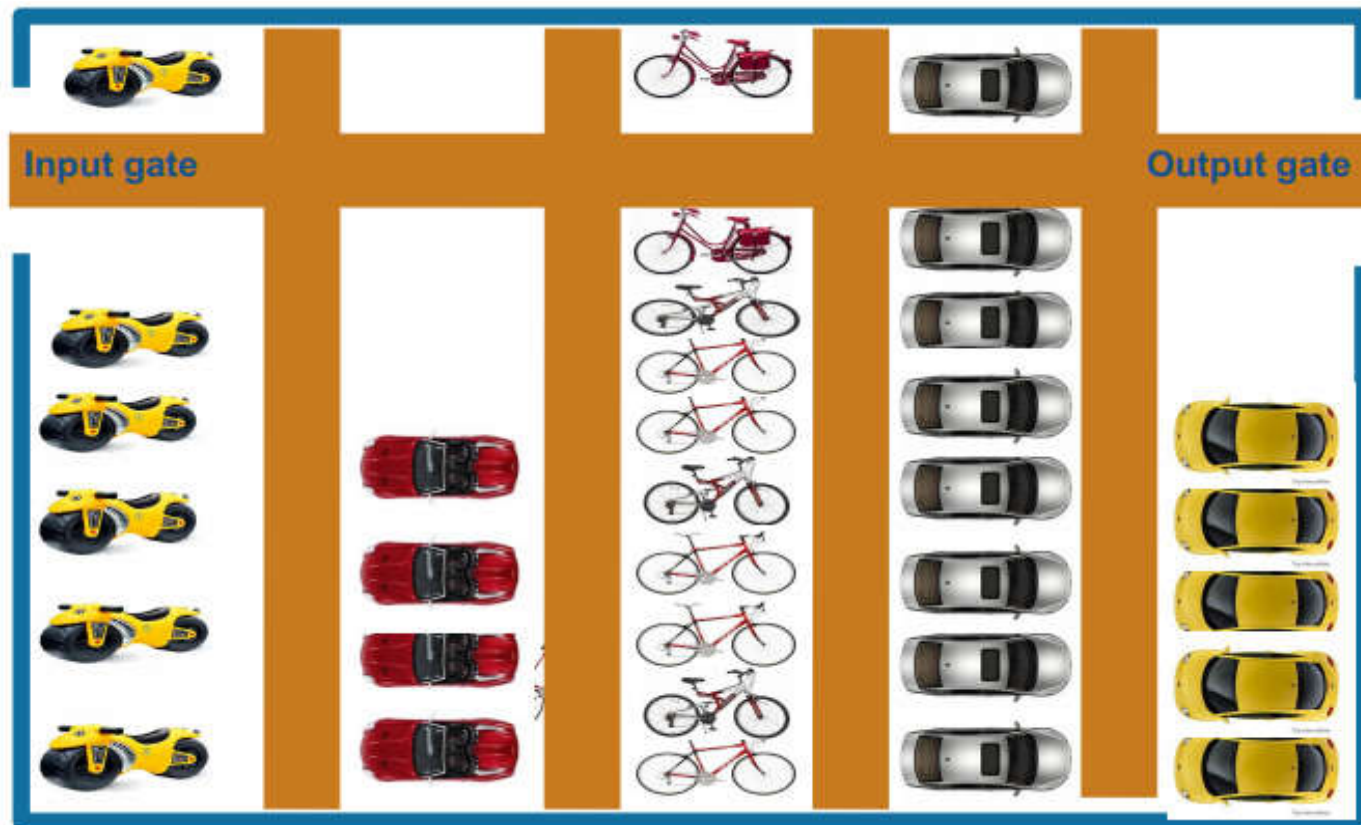
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Nội dung

- I.** Introduction
- II.** Selection sort
- III.** Insertion sort
- IV.** Bubble sort
- V.** Quick sort

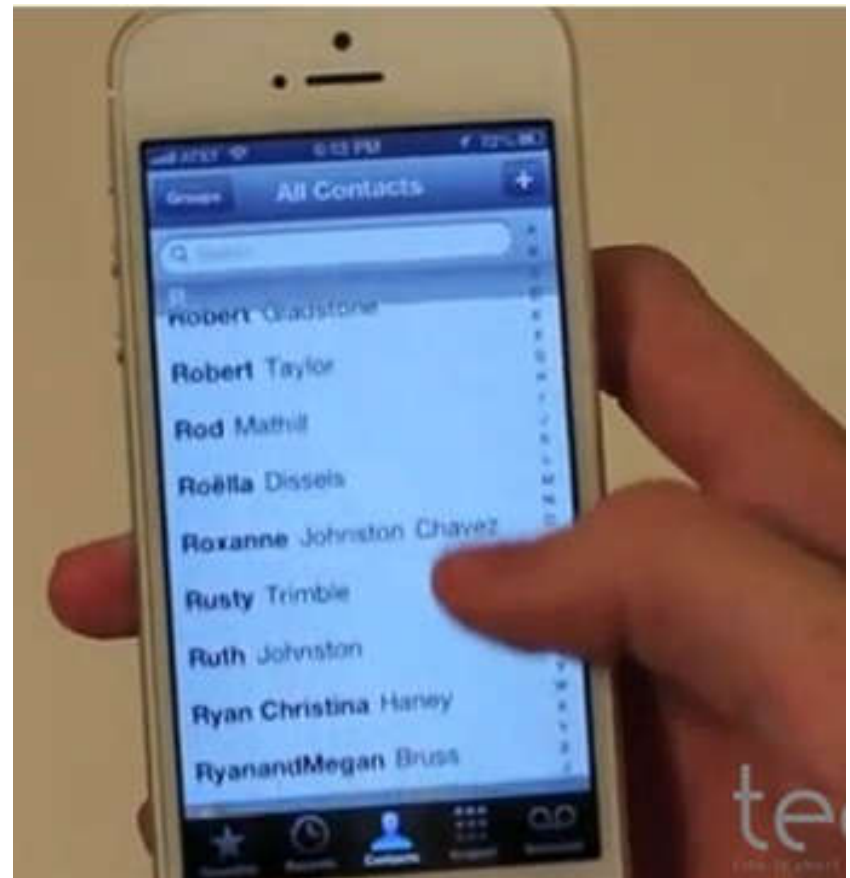
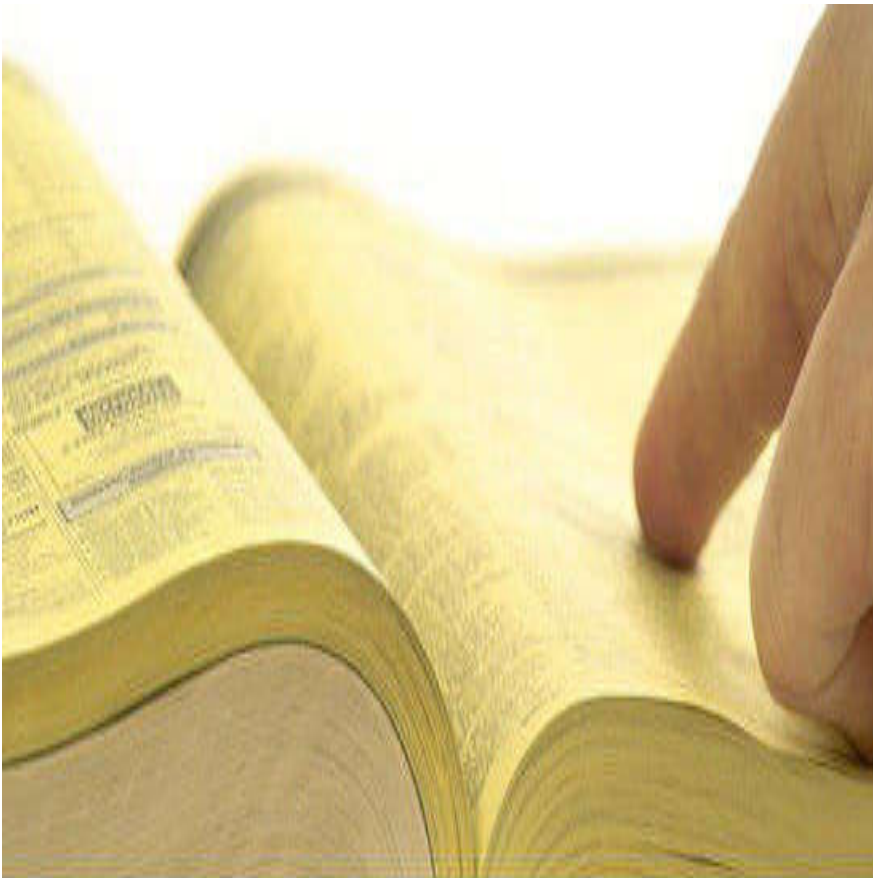
Introduction

❖ I'm looking for my bicycle!



Introduction

❖ Looking for your phone number



I. Introduction

❖ Who will pass this entrance exam?

SỞ GIÁO DỤC VÀ ĐÀO TẠO NAM ĐỊNH
KỶ THI TUYỂN SINH LỚP 10 DANH SÁCH THÍ SINH TRÚNG TUYỂN TRƯỜNG THPT CHUYÊN LÊ HỒNG PHONG
Năm học 2015 - 2016 Vào lớp chuyên: LỊCH SỬ

Stt	SBD	Họ và tên	Ngày sinh	Nơi sinh	Điểm sơ tuyển	Điểm thi				Điểm xét đồ	Ghi chú
						Văn	Toán	Ngoại ngữ	Chuyên		
1	111533	Trần Phương Anh	22/07/2000	Tỉnh Nam Định	14	6.75	6.00	9.50	7.75	37.75	
2	111576	Đinh Thu Huyền	29/11/2000	Tỉnh Nam Định	17	6.00	6.25	7.50	8.50	36.75	
3	111564	Hoàng Thị Hiền	29/12/2000	Tỉnh Nam Định	12	6.75	7.00	7.50	7.75	36.75	
4	111605	Nguyễn Thị Nhung	17/10/2000	Tỉnh Nam Định	18	6.50	6.50	7.50	7.50	35.50	
5	111586	Trần Thuý Linh	04/11/2000	Tỉnh Nam Định	12	5.50	6.50	8.75	7.25	35.25	
6	111636	Trần Thuý Trang	29/04/2000	Tỉnh Nam Định	17	6.25	5.75	6.75	8.00	34.75	
7	111631	Phùng Thị Thanh Trà	13/08/2000	Tỉnh Nam Định	18	5.00	6.00	5.75	8.75	34.25	
8	111579	Phùng Thu Hương	15/02/2000	Tỉnh Nam Định	17	5.00	6.00	5.75	8.75	34.25	
9	111596	Lương Thị Thuý Nga	15/08/2000	Tỉnh Nam Định	12	6.25	6.75	8.25	6.50	34.25	
10	111609	Trần Thị Hoài Phượng	10/02/2000	Tỉnh Nam Định	17	5.50	6.25	5.25	8.50	34.00	
11	111628	Phạm Thị Thu	06/10/2000	Tỉnh Nam Định	16	5.75	6.50	6.75	7.25	33.50	
12	111593	Trần Thảo My	24/12/2000	Tỉnh Nam Định	12	5.75	6.25	8.00	6.75	33.50	
13	111603	Nguyễn Hồng Nhung	22/01/2000	Tỉnh Nam Định	16	5.75	6.00	4.00	8.75	33.25	
14	111537	Bùi Tuấn Anh	07/07/2000	Tỉnh Nam Định	11	5.25	6.50	6.50	7.50	33.25	
15	111552	Nguyễn Ngọc Diệp	30/03/2000	Tỉnh Nam Định	17	6.25	6.25	6.25	7.25	33.25	
16	111577	Trần Ngọc Hưng	27/10/2000	Tỉnh Nam Định	18	4.50	6.25	5.75	8.25	33.00	
17	111527	Nguyễn Lan Anh	25/10/2000	Tỉnh Nam Định	12	5.25	6.00	6.25	7.75	33.00	
18	111627	Đỗ Thị Thu	17/12/2000	Tỉnh Nam Định	18	6.75	6.00	5.75	7.00	32.50	



Sorting algorithms

❖ Definition

- Sorting means arranging the elements of an array so that they are placed in some relevant order which may be either ascending or descending

❖ Two kinds of algorithms

- Internal sorting: for data stored in memory
- External sorting: for data stored in files

Nội dung

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- V. Quick sort

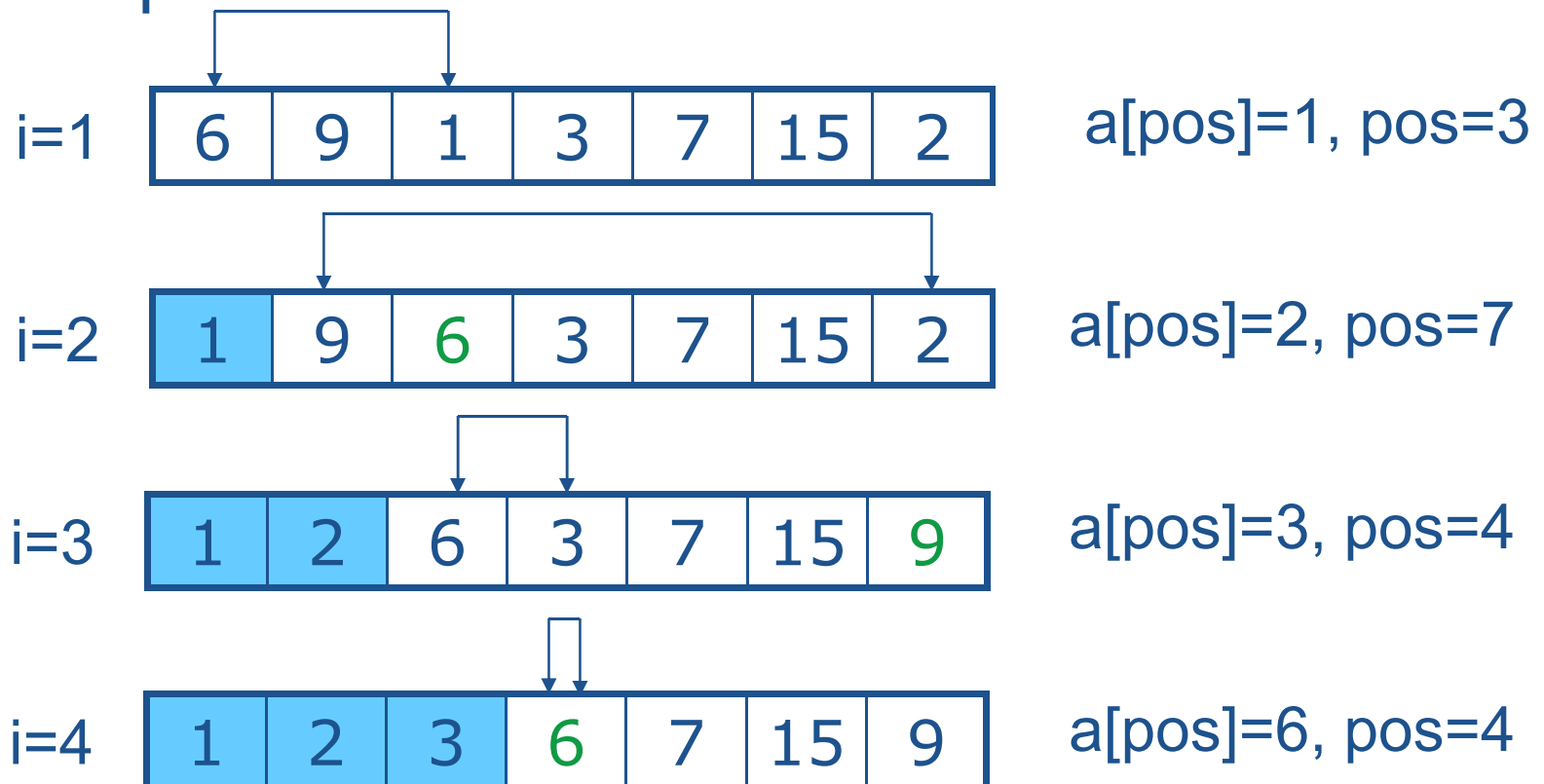
I. Selection sort

❖ Ideas

- First find the smallest value in the array and place it in the first position.
- Then, find the second smallest value in the array and place it in the second position.
- Repeat this procedure until the entire array is sorted

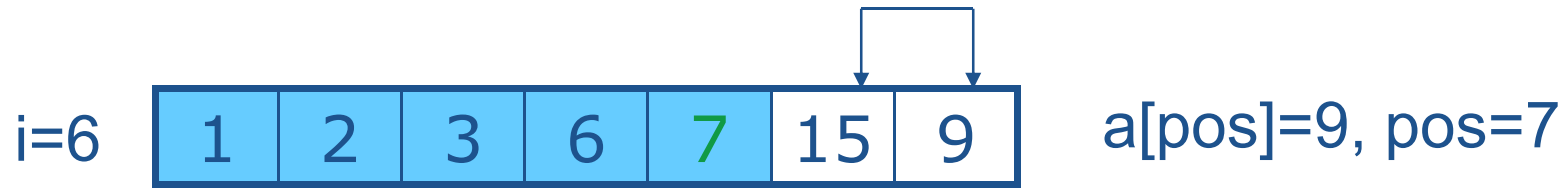
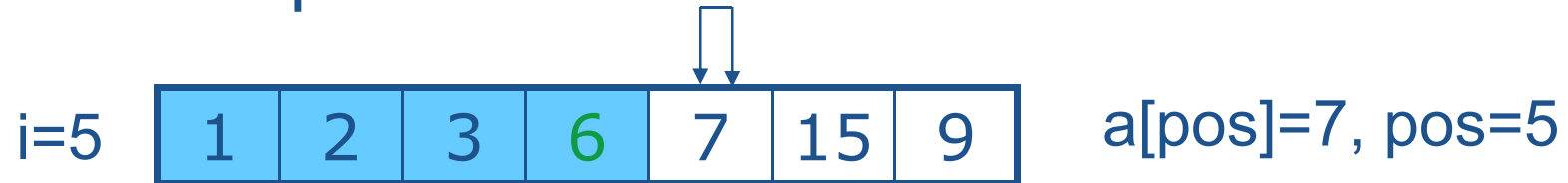
I. Selection sort

❖ Example



I. Selection sort

❖ Example



I. Selection sort

❖ How to implement the algorithm?

- Step 1: Find the position of the minimum element in the segment from $a[x]$ to $a[y]$ (FindMin)
- Step 2: Using function FindMin to develop the algorithm.

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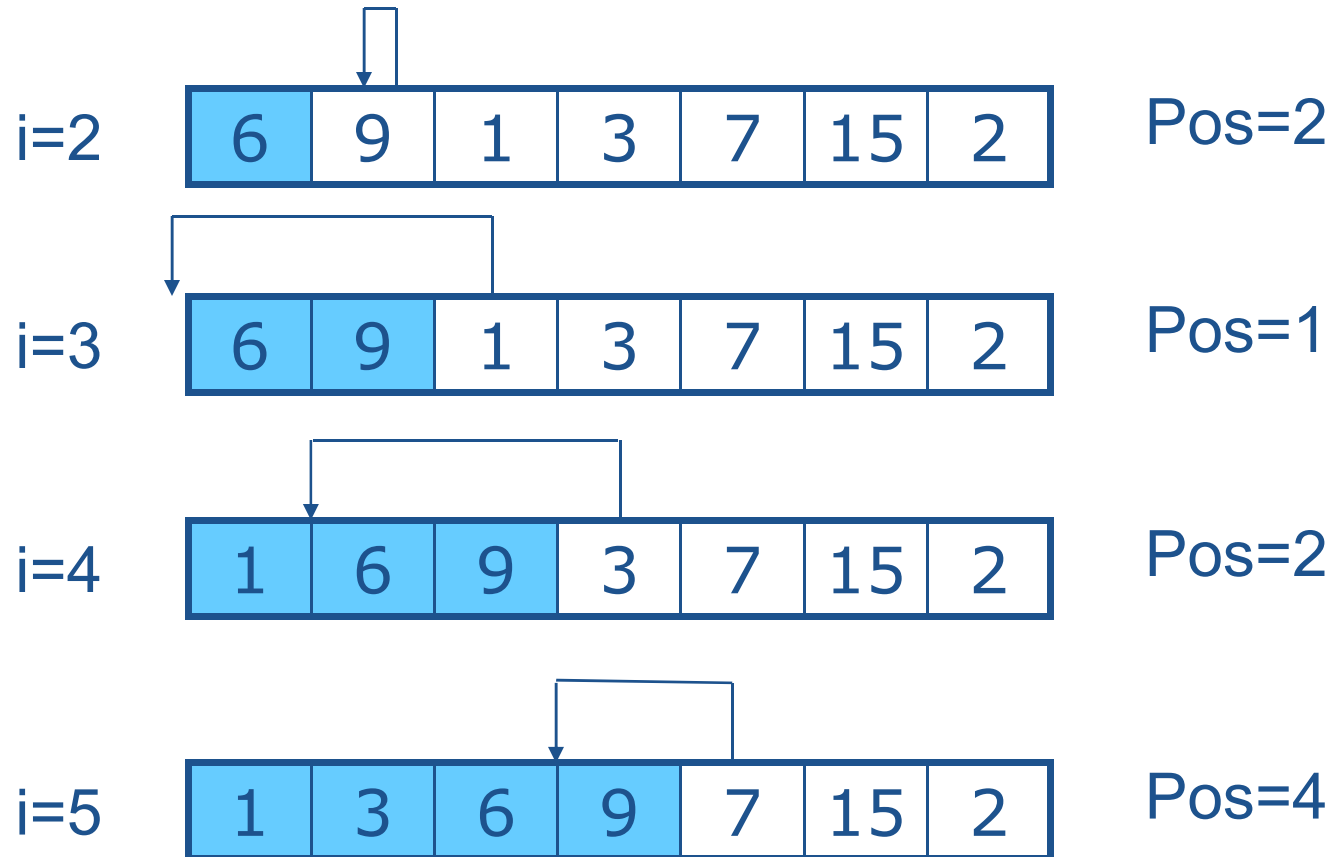
II. Insertion sort

❖ Ideas

- It inserts each item into its proper place in the final list
- Algorithm
 - Consider $a[1]$ is a sorted list
 - Insert $a[2]$ into the list $\{a[1]\}$ to build a sorted list of the two items
 - Continue the process until all items are inserted to the sorted list

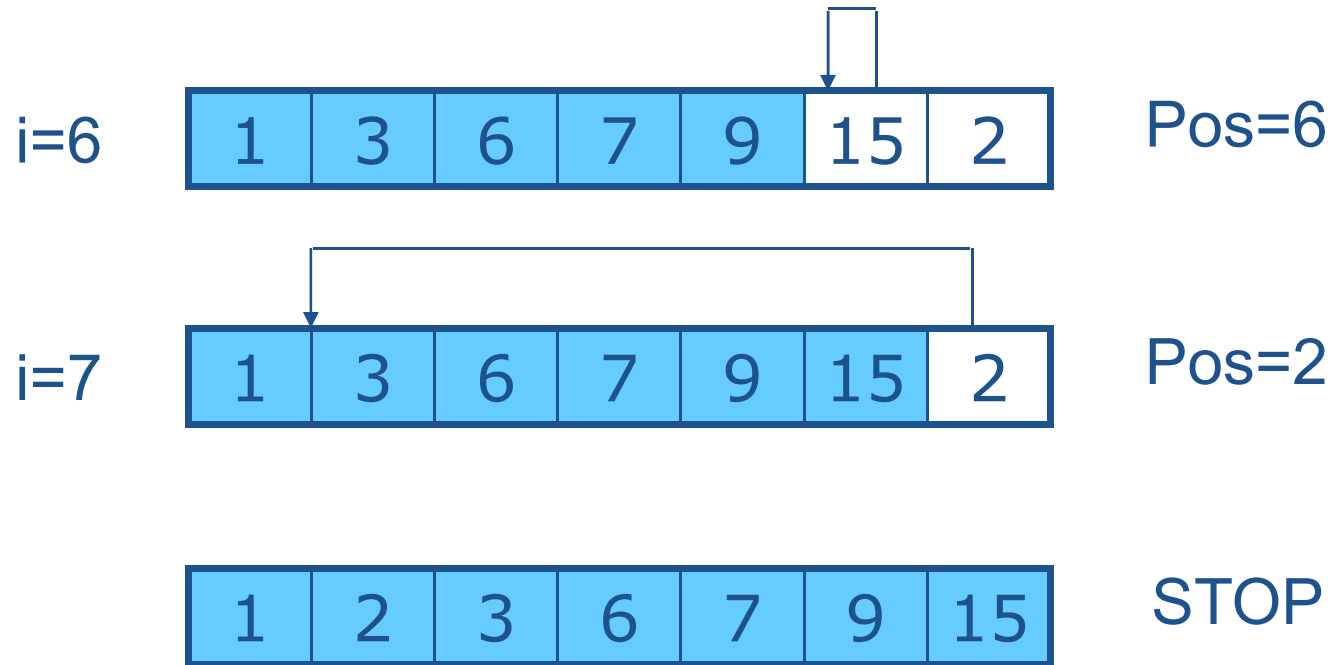
II. Insertion sort

❖ Example



II. Insertion sort

❖ Example



II. Insertion sort

❖ **How to implement the algorithm?**

- Step 1: Find the position to insert (from left to right, or right to left), and move elements by one position
- Step 2: Develop the algorithm.

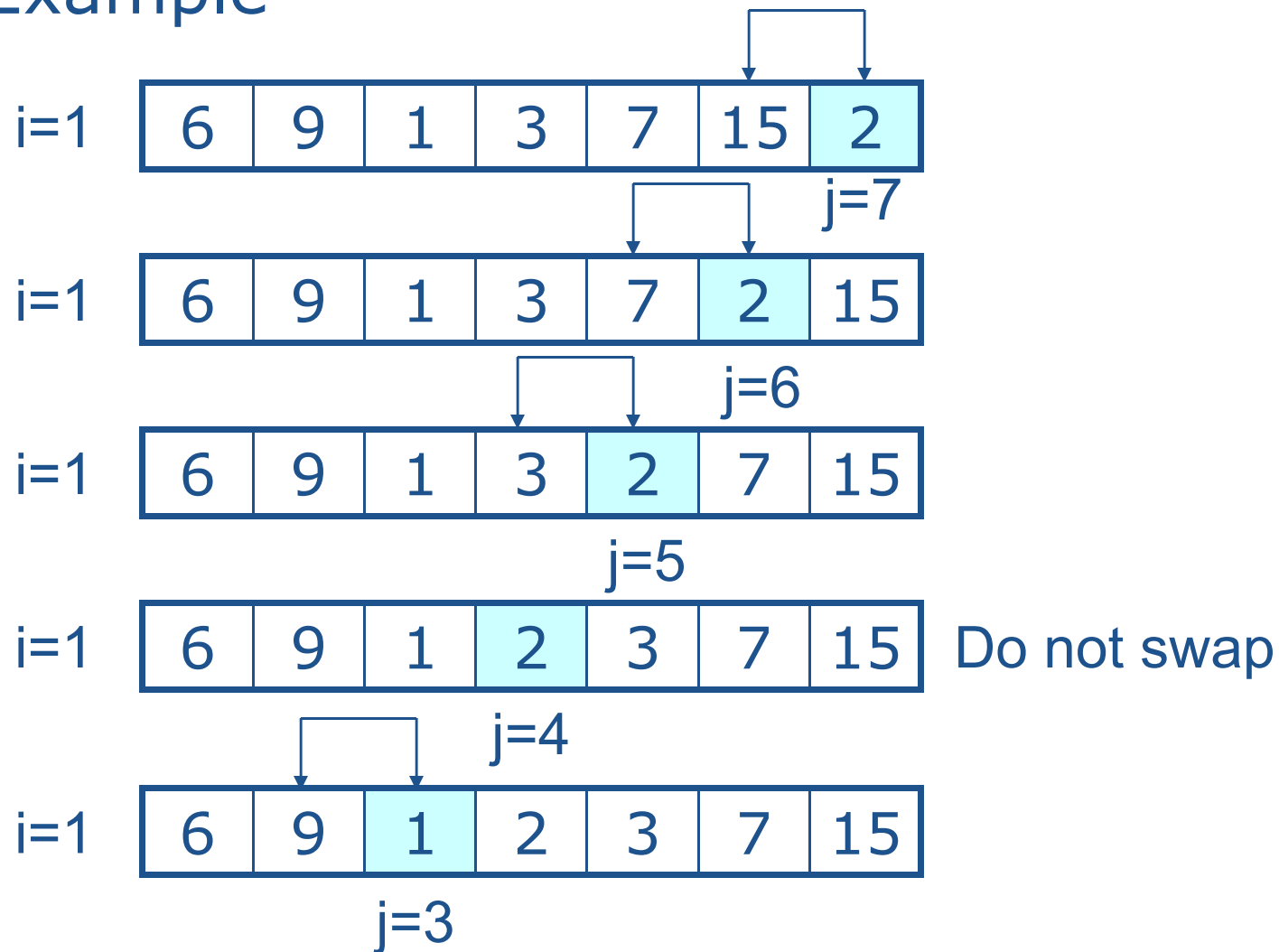
III. Bubble sort

❖ Ideas

- Repeatedly moving the smallest/largest element to the lowest/highest index position of the array segment
- Compare two adjacent elements. If they are not in the right order, interchange (swap) them

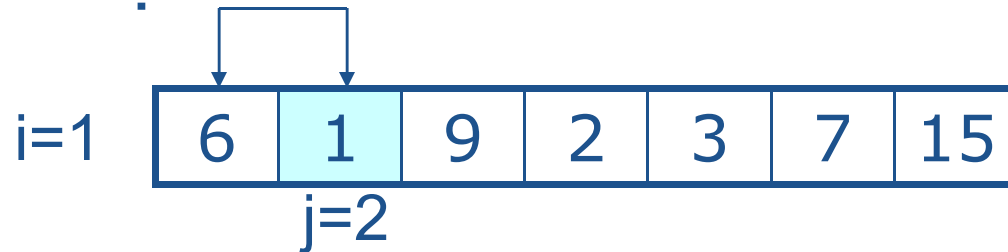
III. Bubble sort

❖ Example



III. Bubble sort

❖ Ví dụ



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STOP

III. Bubble sort

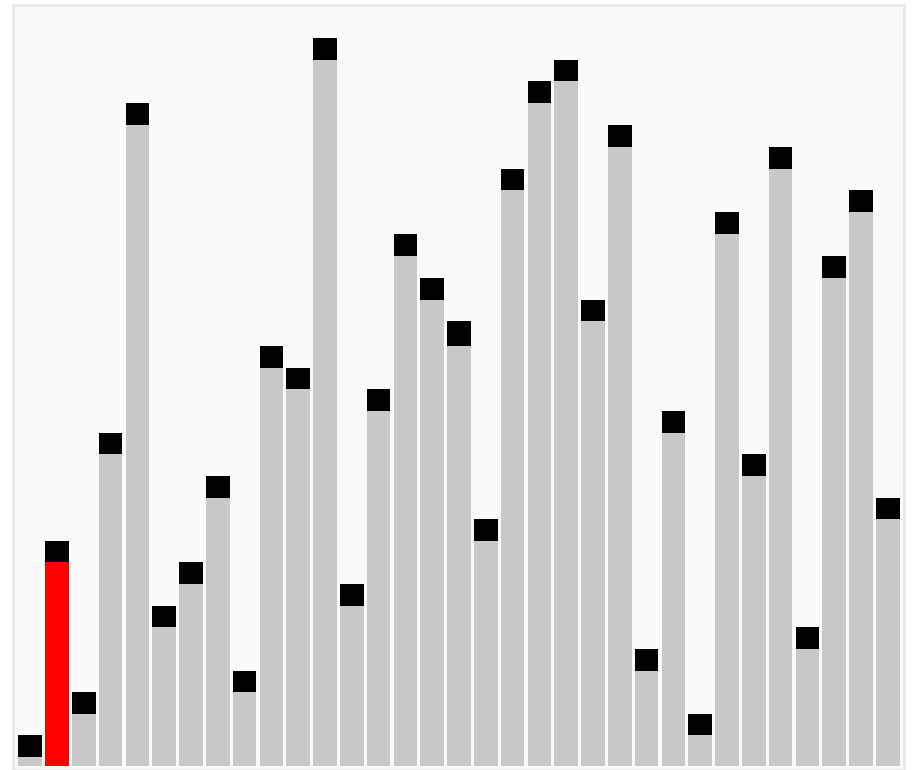
❖ Example

6 5 3 1 8 7 2 4

III. Bubble sort

❖ Shaker sort (Cocktail sort)

- Moving the smallest element to the lowest index position of the array segment
- Moving the largest element to the highest index position of the array segment



IV.Quick sort

❖ Ideas

- Divide and conquer strategy
- Given $x=a[k]$ is an item in the list.
- Partition the list into two parts



- Continue partitioning the sub-lists.
- STOP when all sub-lists are sorted.

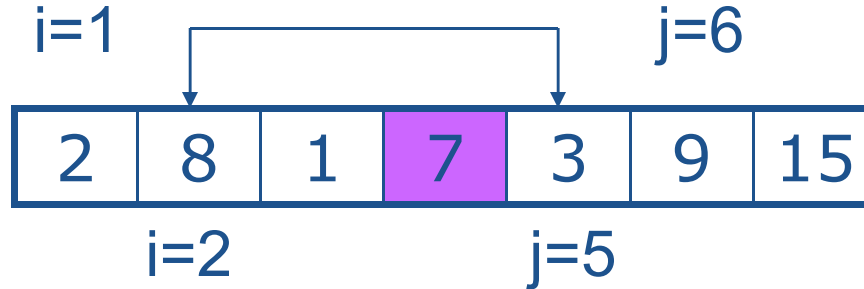
IV.Quick sort

❖ Example

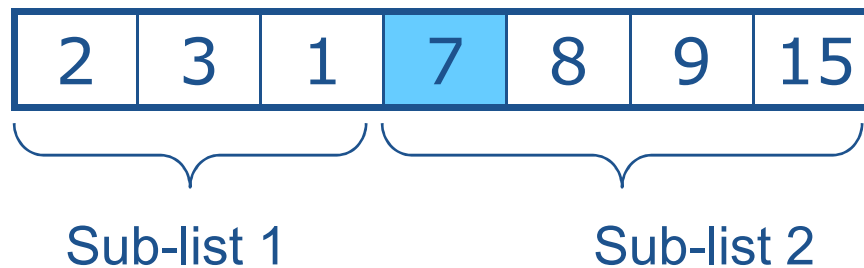
Partition
the array



HV(a[1], a[6])



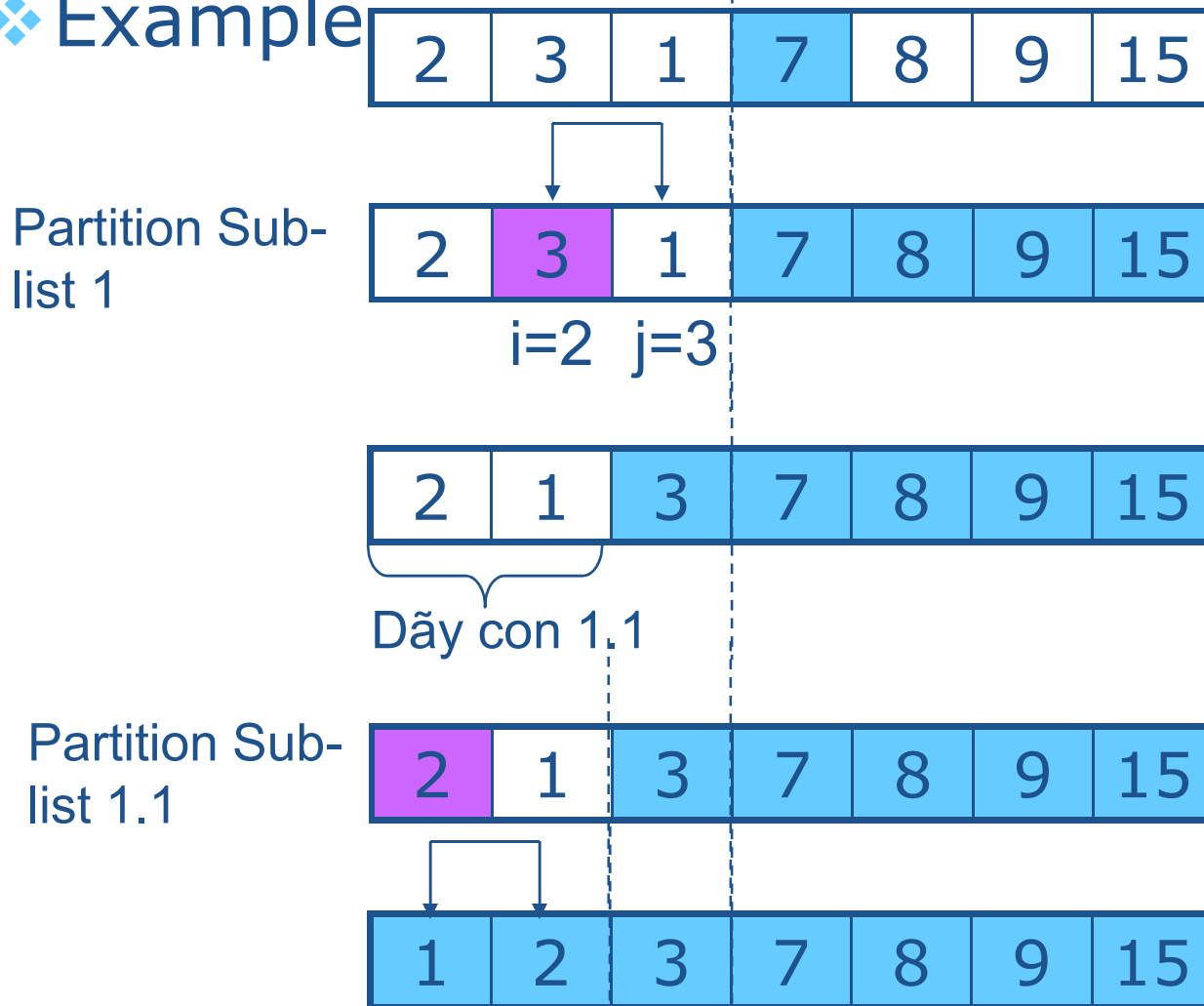
HV(a[2], a[5])



HV(a[2], a[5])

IV.Quick sort

❖ Example



IV.Quick sort

❖ Algorithm (C++)

```
void QuickSort(int a[], int left, int right)
{
    int i, j;
    int x;
    x = a[(left + right)/2];
    i=left; j=right;
    do{
        while(a[i] < x) i++;
        while(a[j] > x) j--;
        if(i <= j)
        {
            HoanVi(a[i], a[j]);
            i++; j--;
        }
    }while(i < j)
    if(left < j) QuickSort(a, left, j);
    if(i < right) QuickSort(a, i, right);
}
```

V. Exercises

- ❖ Sort the following elements using the sorting algorithms

2 23 9 0 5 4 -2 2 4 8

- ❖ Write program to implement the sorting algorithms: Selection sort, bubble sort, insertion sort, and Quick sort.
 - An array of integer numbers
 - An array of students