

# Array

Arnaud Malapert, Gilles Menez, Marie Pelleau

Master Informatique, Université Côte d'Azur

# Array

- A collection of items stored at contiguous memory locations
- Data structure to store multiple items of the same type

arr : 

1	2	3
---	---	---

## In Python

```
arr = [1, 2, 3]
```

## In C

```
int [] arr = {1, 2, 3};
```

## In R

```
arr <- c(1, 2, 3)
```

## In Java

```
int [] arr = {1, 2, 3};
```

## Exercise 1: Making Book

### Statement

Given two numbers  $A$  and  $B$ , count the number of occurrences of each digit in the range between  $A$  and  $B$  included

### Representation

0	1	2	3	4	5	6	7	8	9

### Example

Input:

10 15

Output:

Case 1: 0:1 1:7 2:1 3:1 4:1 5:1 6:0 7:0 8:0 9:0

# Exercise 1: Making Book

## Statement

Given two numbers  $A$  and  $B$ , count the number of occurrences of each digit in the range between  $A$  and  $B$  included

## What problems can arise?

- What do we know of  $A$  and  $B$ ?
- Can  $A > B$ ?
- Can  $A = B$ ?
- How great can  $A$  and  $B$  be?
- How great can the number of occurrences be?
  - ⇒ Are integers big enough for the solution?
  - ⇒ What type of array for the solution?

## Exercise 1: Making Book

### Solution 1: Brut force

```
read A and B on the standard input
if A > B then
    exchange their value

initialize the solution array with 0

foreach page between A and B
    foreach digit in page
        increment the corresponding cell

print the result
```

## Exercise 1: Making Book

### Solution 2: Arithmetic

```
read  $A$  and  $B$  on the standard input
if  $A > B$  then exchange their value

 $\text{diff} \leftarrow B - A + 1$ 
initialize the solution array with  $\lfloor \text{diff} / 10 \rfloor$ 

if  $\text{diff} \bmod 10 \neq 0$  then
    deal with the units

 $A \leftarrow \lfloor A / 10 \rfloor$ 
 $B \leftarrow \lfloor B / 10 \rfloor$ 
deal with the tens

print the result
```

## Exercise 1: Making Book

More test cases

Input:

```
10 15
15 104
220 202
912 912
900 999
0
```

Output:

```
Case 1: 0:1 1:7 2:1 3:1 4:1 5:1 6:0 7:0 8:0 9:0
Case 2: 0:14 1:19 2:19 3:19 4:19 5:19 6:19 7:19 8:19 9:19
Case 3: 0:10 1:11 2:22 3:2 4:2 5:2 6:2 7:2 8:2 9:2
Case 4: 0:0 1:1 2:1 3:0 4:0 5:0 6:0 7:0 8:0 9:1
Case 5: 0:20 1:20 2:20 3:20 4:20 5:20 6:20 7:20 8:20 9:120
```

## Exercise 2: It's a Murder

### Statement

Given an array of integers, for each number sum the previous strictly smaller numbers

### Representation

$$\begin{array}{|c|c|c|c|c|} \hline 1 & 5 & 3 & 6 & 4 \\ \hline \end{array}$$
$$\sum \begin{array}{|c|c|c|c|c|} \hline 0 & 1 & 1 & 9 & 4 \\ \hline \end{array} = 15$$

### Example

Input:

1  
5  
1 5 3 6 4

Output:

15



## Exercise 2: It's a Murder

### Statement

Given an array of integers, for each number sum the previous strictly smaller numbers

### What problems can arise?

- What do we know of the data?
  - ⇒ Are integers big enough for the solution?
  - ⇒ What type for the solution?

## Exercise 2: It's a Murder

### Solution: Brut force

```
read the array tab on standard input
```

```
result  $\leftarrow$  0
```

```
foreach value in tab
```

```
    result  $\leftarrow$  result + sum of previous values strictly smaller  
    than value
```

```
print result
```

## Exercise 2: It's a Murder

More test cases

Input:

2

5

1 5 3 6 4

7

1 3 5 2 6 7 4

Output:

15

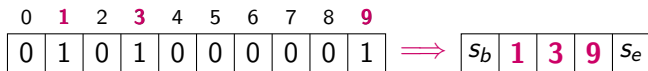
40

## Exercise 3: Longest Connected Subsequence

### Statement

Given a binary sequence and a number  $k > 0$  find how long is the longest connected subsequence which contains at most  $k$  ones

### Representation



### Example

Input:

10 1  
0101000001

Output:

7

## Exercise 3: Longest Connected Subsequence

### Statement

Given a binary sequence and a number  $k > 0$  find how long is the longest connected subsequence which contains at most  $k$  ones

### What problems can arise?

- What do we know of  $k$ ?
- How great can  $k$  be?
- How long can the sequence be?
  - ⇒ Are integers big enough for the solution?
  - ⇒ What type of array for the solution?

## Exercise 3: Longest Connected Subsequence

### Solution

```
read  $T$  on the standard input
```

```
foreach test case
```

```
    read  $n$  and  $k$  on the standard input
```

```
    read the sequence on the standard input
```

```
    create array  $to$  represent the sequence
```

```
     $max \leftarrow 0$ 
```

```
    for  $i$  from 0 to  $n - offset$ 
```

```
        if  $max < array[i + offset] - array[i]$ 
```

```
             $max \leftarrow array[i + offset] - array[i]$ 
```

```
print  $max$ 
```

## Exercise 3: Longest Connected Subsequence

More test cases

Input:

3

3 1

000

4 2

1111

5 3

01110

Output:

3

2

5