

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
```

```
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

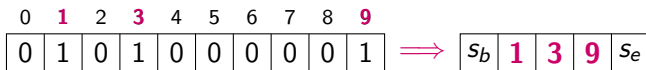
40

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