# Exercises: Lists

Problems for exercises and homework for the [“Programming Fundamentals” course @ SoftUni](https://softuni.bg/courses/programming-fundamentals).

You can check your solutions here: <https://judge.softuni.bg/Contests/398/Lists-Exercises>.

## Max Sequence of Equal Elements

Read a **list of integers** and find the **longest sequence of equal elements**. If several exist, print the **leftmost**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3 4 4 **5 5 5** 2 2 | 5 5 5 |
| **7 7** 4 4 5 5 3 3 | 7 7 |
| 1 2 **3 3** | 3 3 |

### Hints

* Scan positions **p** from left to right and keep the **start** and **length** of the current sequence of equal numbers ending at **p**.
* Keep also the currently best (longest) sequence (bestStart + bestLength) and update it after each step.

## \*\* Longest Increasing Subsequence (LIS)

[https://softuni.bg/trainings/1194/algorithms-september-2015](https://softuni.bg/trainings/1194/algorithms-september-2015#lecture-2247)

<https://softuni.bg/forum/9168/list-homework-largest-increasing-subsequence>

Read a **list of integers** and find the **longest increasing subsequence** (LIS). If several such exist, print the **leftmost**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| **1** | 1 |
| 7 **3 5** 8 -1 0 **6 7** | 3 5 6 7 |
| **1 2** 5 **3 5** 2 4 1 | 1 2 3 5 |
| **0** 10 20 30 30 40 **1** 50 **2 3 4 5 6** | 0 1 2 3 4 5 6 |
| 11 12 13 **3** 14 **4** 15 **5 6 7 8** 7 **16** 9 8 | 3 4 5 6 7 8 16 |
| **3** 14 **5** 12 15 **7 8 9 11** 10 1 | 3 5 7 8 9 11 |

### Hints

* Assume we have n numbers in an array nums[0…n-1].
* Let len[p] holds the length of the longest increasing subsequence (LIS) ending at position p.
* In a for loop, we calculate shall len[p] for p = 0 … n-1 as follows:
  + Let left is the leftmost position on the left of p (left < p), such that len[left] is the maximal possible.
  + Then, len[p] = 1 + len[left]. If left does not exist, len[p] = 1.
  + Also save prev[p] = left (we hold if prev[] the previous position, used to obtain the best length for position p).
* Once the values for len[0…n-1] are calculated, restore the LIS starting from position p such that len[p] is maximal and go back and back through p = prev[p].
* The table below illustrates these computations:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| nums[] | **3** | **14** | **5** | **12** | **15** | **7** | **8** | **9** | **11** | **10** | **1** |
| len[] | 1 | 2 | 2 | 3 | 4 | 3 | 4 | 5 | 6 | 6 | 1 |
| prev[] | -1 | 0 | 0 | 2 | 3 | 2 | 5 | 6 | 7 | 7 | -1 |
| LIS | {3} | {3,14} | {3,5} | {3,5,12} | {3,5,12,15} | {3,5,7} | {3,5,7,8} | {3,5,7,8,9} | {3,5,7,8,9,11} | {3,5,7,8,9,10} | {1} |

## \* Array Manipulator

Write a program that **reads an array of integers** from the console and **set of commands** and **executes them over the array**. The commands are as follows:

* **add <index> <element>** – adds element at the specified index (elements right from this position inclusively are shifted to the right).
* **addMany <index> <element 1> <element 2> … <element n>** – adds a set of elements at the specified index.
* **contains <element>** – prints the index of the first occurrence of the specified element (if exists) in the array or **-1** if the element is not found.
* **remove <index>** – removes the element at the specified index.
* **shift <positions>** – **shifts every element** of the array the number of positions **to the** **left** (with rotation).
  + For example, [1, 2, 3, 4, 5] -> shift 2 -> [3, 4, 5, 1, 2]
* **sumPairs** – sums the elements in the array by pairs (first + second, third + fourth, …).
  + For example, [1, 2, 4, 5, 6, 7, 8] -> [3, 9, 13, 8].
* **print** – stop receiving more commands and print the last state of the array.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 1 2 4 5 6 7  add 1 8  contains 1  contains -3  print | 0  -1  [1, 8, 2, 4, 5, 6, 7] |
| 1 2 3 4 5  addMany 5 9 8 7 6 5  contains 15  remove 3  shift 1  print | -1  [2, 3, 5, 9, 8, 7, 6, 5, 1] |
| 2 2 4 2 4  add 1 4  sumPairs  print | [6, 6, 6] |
| 1 2 1 2 1 2 1 2 1 2 1 2  sumPairs  sumPairs  addMany 0 -1 -2 -3  print | [-1, -2, -3, 6, 6, 6] |

## Sum Reversed Numbers

Write a program that reads sequence of numbers, reverses their digits, and prints their sum.

### Examples

|  |  |  |
| --- | --- | --- |
| **Input** | **Output** | **Comments** |
| 123 234 12 | 774 | 321 + 432 + 21 = 774 |
| 12 12 34 84 66 12 | 220 | 21 + 21 + 43+ 48 + 66 + 21 = 220 |
| 120 1200 12000 | 63 | 21 + 21 + 21 = 63 |

## Bomb Numbers

Write a program that **reads sequence of numbers** and **special bomb number** with a certain **power**. Your task is to **detonate every occurrence of the special bomb number** and according to its power **his neighbors from left and right**. Detonations are performed from left to right and all detonated numbers disappear. Finally print the **sum of the remaining elements** in the sequence.

### Examples

|  |  |  |
| --- | --- | --- |
| **Input** | **Output** | **Comments** |
| 1 2 2 4 2 2 2 9  4 2 | 12 | Special number is **4** with power 2. After detontaion we left with the sequence [1, 2, 9] with sum 12. |
| 1 4 4 2 8 9 1  9 3 | 5 | Special number is **9** with power 3. After detontaion we left with the sequence [1, 4] with sum 5. Since the 9 has only 1 neighbour from the right we remove just it (one number instead of 3). |
| 1 7 7 1 2 3  7 1 | 6 | Detonations are performed from left to right. We could not detonate the second occurance of 7 because its already destroyed by the first occurance. The numbers [1, 2, 3] survive. Their sum is 6. |
| 1 1 2 1 1 1 2 1 1 1  2 1 | 4 | The red and yellow numbers disappear in two sequential detonations. The result is the sequence [1, 1, 1, 1]. Sum = 4. |