# Lab: Multidimensional Lists

This document defines the exercises for the ["Python Advanced" course at @Software University.](https://softuni.bg/trainings/4370/python-advanced-january-2024)

Please submit your solutions (source code) to all the below-described problems in [Judge](https://judge.softuni.org/Contests/1834/Multidimensional-Lists-Lab).

## Sum Matrix Elements

Write a program that **reads a matrix** from the console and prints:

* The **sum** of all **numbers** in the matrix
* The **matrix itself**

On the first line, you will receive the matrix sizes in the format **"{rows}, {columns}".** On the next **rows**, you will get elements for each column separated by a comma and a space **", "**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3, 6  7, 1, 3, 3, 2, 1 1, 3, 9, 8, 5, 6 4, 6, 7, 9, 1, 0 | 76  [[7, 1, 3, 3, 2, 1], [1, 3, 9, 8, 5, 6], [4, 6, 7, 9, 1, 0]] |

## Even Matrix

Write a program that receives a **matrix of numbers** and prints a **new one** only with the even numbers. Use nested comprehension for that problem.

On the first line, you will receive **the rows of the matrix**. On the next **rows**, you will get elements for each column separated with a comma and a space **", "**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 2  1, 2, 3  4, 5, 6 | [[2], [4, 6]] |
| 4  10, 33, 24, 5, 1  67, 34, 11, 110, 3  4, 12, 33, 63, 21  557, 45, 23, 55, 67 | [[10, 24], [34, 110], [4, 12], []] |

## Flattening Matrix

Write a program that receives a **matrix** and prints its flattened version (a list with all the values). For example, the flattened list of the matrix: **[[1, 2], [3, 4]]** will be **[1, 2, 3, 4]**.

On the first line, you will receive the **number of a matrix's rows.** On the next **rows**, you will get the **elements** for **each column** separated with a comma and a space **", "**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 2  1, 2, 3  4, 5, 6 | [1, 2, 3, 4, 5, 6] |
| 3  10, 2, 21, 4  5, 20, 41, 9  6, 2, 4, 99 | [10, 2, 21, 4, 5, 20, 41, 9, 6, 2, 4, 99] |

## Sum Matrix Columns

Write a program that **reads a matrix** from the console and prints the **sum for each column** on separate lines.

On the first line, you will get matrix sizes in the format **"{rows}, {columns}"**. On the next **rows**, you will get **elements** for **each column** separated with a single space.

### Examples

|  |  |  |  |
| --- | --- | --- | --- |
| **Input** | **Output** | **Input** | **Output** |
| 3, 6  7 1 3 3 2 1  1 3 9 8 5 6  4 6 7 9 1 0 | 12  10  19  20  8  7 | 3, 3  1 2 3  4 5 6  7 8 9 | 12  15  18 |

### Hints

* **Read** matrix **sizes**.
* On the next row lines, **read** the **columns**.
* **Traverse** the matrix and **sum** all elements in **each** column.
* Print the **sum** and **continue** with the other columns.

## Primary Diagonal

Write a program that finds the **sum of all numbers in a matrix's primary diagonal** (runs from top left to bottom right). On the **first line**, you will receive an integer **N** – the size of a square matrix. The next N **lines** hold the values for **each column** - N numbers, separated by a single space.



### Examples

|  |  |  |  |
| --- | --- | --- | --- |
| **Input** | **Output** | **Input** | **Output** |
| 3  11 2 4  4 5 6  10 8 -12 | 4 | 3  1 2 3  4 5 6  7 8 9 | 15 |

## Symbol in Matrix

Write a program that reads a number - **N**, representing the **rows** and **columns** of a square **matrix**. On the next **N** lines, you will receive rows of the matrix. Each row consists of ASCII characters. After that, you will receive a symbol. Find the **first occurrence** of that symbol in the matrix and print **its position** in the format: "({row}, {col})". It would help if you started searching from the **top left**.If there is no such symbol, print the message "{symbol} does not occur in the matrix".

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3  ABC  DEF  X!@  ! | (2, 1) |
| 4  asdd  xczc  qwee  qefw  4 | 4 does not occur in the matrix |

## Square with Maximum Sum

Write a program that **reads a matrix** from the console and finds the **2x2 top-left** **submatrix** with the **biggest sum** of its values.

On the first line, you will get matrix sizes in the format **"{rows}, {columns}".** On the next **rows**, you will get **elements** for **each column**, separated with a comma and a space **", "**.

You should print the **found submatrix** and the **sum of its elements,** as shown in the examples.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3, 6  7, 1, 3, 3, 2, 1 1, 3, 9, 8, 5, 6 4, 6, 7, 9, 1, 0 | 9 8  7 9  33 |
| 2, 4  10, 11, 12, 13  14, 15, 16, 17 | 12 13  16 17  58 |

### Hints

* Be aware of **IndexError**
* If you find more than one max square, print the **top-left one**