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Matrices - Exercises

1. Compare Matrices

Write a program that reads two integer matrices (2D arrays) from the console and compares them element by element.

Each matrix contain a line with a positive integer number **R** – the number of rows in the matrix and **C** – the number of columns – followed by **R** lines containing the **C** numbers, separated by spaces (each line will have an equal amount of numbers).

Print "**equal**" if the matrices match and "**not equal**" if they don't match.

Input	Output
2 3 **1 2 3**	equal

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2 1 3 **2 3** **1 2 3** **2 1 3**	
2 3 **1 2 3** **4 5 6** **2 2** **1 3** **4 5**	not equal
2 3 **1 2 3** **2 1 3** **2 3** **1 2 3** **2 1 4**	not equal

2. Matrix Addition

Given two matrices of the same size, write a program to add them together.

First read 2 integers separated by whitespace (rows and cols of the matrices), next read the matrices.

Print new matrix with the sum of the sum of the same indices from the two matrices.

Input	Output
2 2 **1 2** **3 4** **2 2** **2 2**	3 4 5 6
2 3 **1 2 3** **4 3 1** **1 2 3** **4 2 2**	2 4 6 8 5 3

3. Intersection of Two Matrices

Write a program that reads two char matrices **(A[][] and B[][])** of the same order **M * N** and prints the third matrix **C[][],** which is filled with the intersecting elements of **A and B**, otherwise set the element to **'*'**. On the first two lines, you receive **M** and **N**, then on **2 * M** lines **N** characters – the matrices elements.

The matrix elements may be any ASCII char **except '*'.**

Examples

Input	Output

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3 4 a b c d a b c d a b c d k b c k a b g d a k c d	* b c * a b * d a * c d
5 2 1 2 3 4 5 6 7 8 9 1 0 2 3 1 1 6 7 4 1 1	* 2 3 * * 6 7 * * 1

4. Sum Matrix Elements

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

- The count of **rows**
- The count of **columns**
- The sum of all **matrix's elements**

On the first line, you will get the matrix dimensions in the format "**{rows, columns}**".
On the next lines, you will get the elements for each **row** separated by a comma.

Examples

Input	Output

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3 6 **7 1 3 3 2 1** **1 3 9 8 5 6** **4 6 7 9 1 0**	3 6 76
2 4 **10 11 12 13** **14 15 16 17**	2 4 108

5. Maximum Sum of 2X2 Submatrix

Write a program that **reads a matrix** from the console. Then find the biggest sum of a **2x2 submatrix.** Print the submatrix and its sum.

On the first line, you will get the matrix dimensions in the format "**{rows, columns}**". On the next lines, you will get the elements for each **row** separated by a comma.

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

6. Print Diagonals of Square Matrix

Write a program that **reads a matrix** from the console. Then print the diagonals. The matrix will always be square. On the first line, you read a single integer **N** the matrix size. Then on each line N elements. The first diagonal should always start with the element at the **first row and col**. The second diagonal should start with the element at the **last row and first col**.

Input	Output
3 **1 2 3** **1 2 3** **1 2 3**	1 2 3 1 2 3
4 **1 2 3 2**	1 1 1 1 2 2 2 2

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1 1 2 4 **1 2 1 4** **2 2 3 1**	

7. Matrix Diagonal Sum

Write a program to find the sum of both diagonals in a square matrix.

Input	Output
3 3 **1 2 3** **4 5 6** **7 8 9**	30
2 2 **10 11** **14 15**	50

8. Fill the Matrix

Write two **methods** that **fill** a **size N x N matrix** in **two** different **patterns.** Both patterns are described below:

Pattern A

1	**5**	**9**	**13**
2	**6**	**10**	**14**
3	**7**	**11**	**15**
4	**8**	**12**	**16**

Pattern B

1	8	9	16
2	7	10	15
3	6	11	14
4	5	12	13

Input	Output
3 A	1 4 7 2 5 8 3 6 9
4 B	1 8 9 16 2 7 10 15 3 6 11 14 4 5 12 13

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9. Row Sum and Column Sum

Given a matrix, calculate the sum of each row and each column.

Input	Output
3 2 **1 2** **3 4** **5 6**	Row Sums: 3, 7, 11 Column Sums: 9, 12
3 3 **1 2 3** **4 5 6** **7 8 9**	Row Sums: 6, 15, 24 Column Sums: 12, 15, 18

10. Zero Matrix

If an element in a matrix is 0, set its entire row and column to 0.

Input	Output
3 3 **1 2 3** **4 0 6** **7 8 9**	1 0 3 0 0 0 7 0 9
4 4 **1 2 3 0** **4 5 6 7** **0 8 9 1**	0 0 0 0 0 5 6 0 0 0 0 0

11. Matrix Boundary Sum

Write a program that calculates the sum of the boundary elements of a matrix.

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Input	Output
3 3 **1 2 3** **4 5 6** **7 8 9**	28 // 1 + 2 + 4 + 6 + 9 + 8 + 7 + 4
4 4 **1 2 3 0** **4 5 6 7** **0 8 9 1**	35

12. Rotate Matrix 90 Degrees

Rotate the given matrix 90 degrees to the right (or clockwise).

Input	Output
3 3 **1 2 3** **4 5 6** **7 8 9**	7 4 1 8 5 2 9 6 3
4 4 **0 1 2 3** **4 5 6 7** **8 9 10 11** **12 13 14 15**	12 8 4 0 13 9 5 1 14 10 6 2 15 11 7 3

13. Excel Column Name to Number

In Excel, columns are represented by letters, starting from A for the 1st column, B for the 2nd, and so on. After Z, the columns are represented by two letters, like AA, AB, etc. Write a program that converts an Excel column name to its corresponding column number.

Input	Output

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AB	28
A	1
C	3
CZ	104
MM	351

14. Chessboard Checker

Given a chessboard representation where empty squares are 0 and queens are 1, determine if either two queens threaten each other.

Input	Output
4 4 **0 1 0 0** **0 0 0 1** **1 0 0 0** **0 0 1 0**	No
4 4 **0 1 0 0** **0 0 0 1** **1 0 0 0** **0 1 0 0**	Yes
4 4 **0 1 0 0** **0 0 0 0** **1 0 0 0** **0 0 0 0**	No
3 3 **0 1 0** **0 0 1** **0 0 0**	Yes

15. Excel Sum Formula

Imagine an Excel sheet where each cell contains a number. Write a program that calculates the **sum of a given range**.

Input	Output
3 3 **1 2 3**	21

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4 5 6 **7 8 9** **A1:C2**	
4 4 **0 1 0 0** **0 0 0 1** **1 0 0 0** **0 1 0 0** **A1:B4**	3
4 4 **0 1 0 0** **0 0 0 0** **1 0 0 0** **0 0 0 0** **A1:C4**	2

16. Matrix Border Flip

Given a matrix, flip its border elements in a clockwise direction.

Input	Output
3 3 **1 2 3** **4 5 6** **7 8 9**	4 1 2 7 5 3 8 9 6
4 4 **0 1 0 0** **0 1 0 1** **1 0 0 0** **0 1 0 0**	0 0 1 0 1 0 0 0 0 0 0 1 1 0 0 0

17. Magic Square Checker

Determine if a matrix is a magic square **(a matrix in which the sums of every row, every column, and both main diagonals are the same).**

Input	Output
3 3 **1 2 3** **4 5 6** **7 8 9**	False
4 4	True

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1 0 0 0 **0 0 0 1** **0 1 0 0** **0 0 1 0**	
3 3 **8 1 6** **3 5 7** **4 9 2**	True

18. Spiral Matrix Traversal

Print the elements of a matrix in spiral order.

Input	Output
3 3 **1 2 3** **4 5 6** **7 8 9**	1 2 3 6 9 8 7 4 5
4 4 **1 2 3 4** **5 6 7 8** **9 10 11 12** **13 14 15 16**	True 1 2 3 4 8 12 16 15 14 13 9 5 6 7 11 10
2 2 **1 2** **3 4**	1 2 4 3

19. Checkerboard Pattern

Given an n x n size, generate a matrix with a checkerboard pattern using 0s (for white squares) and 1s (for black squares).

Input	Output
3	0 1 0 1 0 1 0 1 0
4	0 1 0 1 1 0 1 0 0 1 0 1 1 0 1 0

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20. Maximal Sum

Write a program that reads a rectangular integer matrix of size **N x M** and finds the square **3 x 3** with **a maximal sum of its elements**.

- On the first line, you will receive the rows **N** and columns **M**.
- On the next **N lines,** you will receive **each row with its elements**.

Print the **elements** of the 3 x 3 square as a matrix, along with their **sum**. See the format of the output below.

Input	Output
4 5 **1 5 5 2 4** **2 1 4 14 3** **3 7 11 2 8** **4 8 12 16 4**	Sum = 75 1 4 14 7 11 2 8 12 16
5 6 **1 0 4 3 1 1** **1 3 1 3 0 4** **6 4 1 2 5 6** **2 2 1 5 4 1** **3 3 3 6 0 5**	Sum = 34 2 5 6 5 4 1 6 0 5

21. Snowflakes*

Generate every state of a given matrix, where **"*"** represents a **snowflake**, falling on the ground. "0" is empty space and the "#" is a barrier, which cannot move.
Print every state until all flakes cannot fall anymore.

Input	Output
3 3 * 0 * 0 0 0 0 0 0	0 0 0 * 0 * 0 0 0 === 0 0 0

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	0 0 0 * 0 *
4 4 * 0 * * 0 0 # 0 # 0 # 0 # 0 # #	0 0 * 0 * 0 # * # 0 # 0 # 0 # # ==== 0 0 * 0 * 0 # 0 # 0 # * # 0 # #