

Problem Statement – Wave Form Traversal

In the kingdom of **NumMatrix**, the Royal Messenger must deliver letters by walking through the castle halls. The castle is represented as an $N \times M$ **matrix**, where each room has a number.

The messenger follows a **wave-like path**:

- In the **first column**, he moves **top to bottom**.
- In the **second column**, he moves **bottom to top**.
- In the **third column**, again **top to bottom**.
- This continues for all columns.

Your task is to print the **wave form traversal** of the matrix.

Input Format

1. The first line contains two integers N and M – the number of rows and columns.
2. The next $N \times M$ numbers represent the matrix elements.

Output Format

- Print the elements of the matrix in **wave order traversal** (space-separated).

Constraints

- $1 \leq N, M \leq 100$
- $1 \leq \text{arr}[i][j] \leq 10^4$

Example 1

Input

```
3 4
1 2 3 4
5 6 7 8
9 10 11 12
```

Output

1 5 9 10 6 2 3 7 11 12 8 4

Example 2

Input

4 3
1 2 3
4 5 6
7 8 9
10 11 12

Output

1 4 7 10 11 8 5 2 3 6 9 12

Problem Statement – Transpose of a Matrix

In the **Academy of NumMatrix**, students are given a magical board represented as an $N \times M$ **matrix**.

The headmaster wants to flip the matrix along its **main diagonal** so that rows become columns and columns become rows.

This operation is called a **Transpose**.

Your task is to help the headmaster by printing the **transpose of the given matrix**.

Input Format

1. The first line contains two integers N and M – the number of rows and columns.
2. The next $N \times M$ numbers represent the matrix elements.

Output Format

- Print the **transpose matrix** (of size $M \times N$).

Constraints

- $1 \leq N, M \leq 100$
- $1 \leq \text{arr}[i][j] \leq 10^4$

Example 1

Input

```
3 3
1 2 3
4 5 6
7 8 9
```

Output

```
1 4 7
2 5 8
3 6 9
```

Example 2

Input

```
2 3
1 2 3
4 5 6
```

Output

```
1 4
2 5
3 6
```

Problem Statement – Spiral Traversal of a Matrix

In the **Royal Garden of NumMatrix**, the King wants to enjoy the flowers arranged in an $N \times M$ **rectangular layout**.

He instructs his gardener to walk in a **spiral path** starting from the **top-left corner**:

1. Walk **left to right** along the top row.
2. Then walk **top to bottom** along the rightmost column.
3. Then walk **right to left** along the bottom row.
4. Then walk **bottom to top** along the leftmost column.
5. Continue the process inward until every element is visited.

Your task is to print the **spiral order traversal** of the given matrix.

Input Format

1. First line: Two integers N and M (rows and columns).
2. Next $N \times M$ integers: The elements of the matrix.

Output Format

- Print the matrix elements in **spiral order traversal** (space-separated).

Constraints

- $1 \leq N, M \leq 100$
- $1 \leq \text{arr}[i][j] \leq 10^4$

Example 1

Input

```
3 3
1 2 3
4 5 6
7 8 9
```

Output

```
1 2 3 6 9 8 7 4 5
```

Example 2

Input

```
3 4
1 2 3 4
5 6 7 8
9 10 11 12
```

Output

```
1 2 3 4 8 12 11 10 9 5 6 7
```

Problem Statement – Rotate Matrix by 90° Clockwise

In the **Palace of Geometry**, the Queen wants to **rotate her painting frames** (arranged in an $N \times N$ square matrix).

The Queen commands:

- Rotate the matrix **90 degrees clockwise** (in place).

Your job is to help the palace workers perform this rotation.

Input Format

1. First line: Integer N (size of the square matrix).
2. Next $N \times N$ integers: The elements of the matrix.

Output Format

- Print the **rotated matrix** (row by row).

Constraints

- $1 \leq N \leq 100$
- $1 \leq \text{arr}[i][j] \leq 10^4$

Example 1

Input

```
3
1 2 3
4 5 6
7 8 9
```

Output

```
7 4 1
8 5 2
9 6 3
```

Example 2

Input

```
4
1 2 3 4
5 6 7 8
9 10 11 12
```

13 14 15 16

Output

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