# Practice Problem Set 5

1. Write a C program that finds the maximum element of the input 2D array.

Examples

|  |  |
| --- | --- |
| Input | Output |
| 4 5 1 2 3 4 5  4 5 6 7 8  5 6 7 8 9  1 2 4 5 7 | Max Element: 9 |

1. Write a C program that finds the row-wise maximum element of the input 2D array.

Examples

|  |  |
| --- | --- |
| Input | Output |
| 4 5 1 2 3 4 5  4 5 6 7 8  5 6 7 8 9  1 2 4 5 7 | Max element of row 0: 5  Max element of row 1: 8  Max element of row 2: 9  Max element of row 3: 5 |

1. Write a C program that finds the column-wise maximum element of the input 2D array.

Examples

|  |  |
| --- | --- |
| Input | Output |
| 4 5 1 2 3 4 5  4 5 6 7 8  5 6 7 8 9  1 2 4 5 7 | Max element of column 0: 5  Max element of column 1: 6  Max element of column 2: 8  Max element of column 3: 9 |

1. Write a C program that asks the user to enter m (number of rows) and n (number of columns) and creates a new array with the first m rows and n columns of the input array.  
   Examples

|  |  |
| --- | --- |
| Input | Output |
| 4 5 1 2 3 4 5  4 5 6 7 8  5 6 7 8 9  1 2 4 5 7  3 3 | 3 3  1 2 3  4 5 5  5 6 7 |

1. Write a C program that calculates the sparsity and density of a matrix.

Hints: A sparse matrix is a matrix where most of the elements are zero and a dense matrix is a matrix where most of the elements are non-zero.

Sparsity = number of zero elements / total elements

Density = number of non-zero elements / total elements

Examples

|  |  |
| --- | --- |
| Input | Output |
| 5 5 0 0 0 0 1  0 1 1 0 0  1 0 0 0 0  0 0 0 0 0  0 1 0 1 0 | Sparsity = 0.76  Density = 0.24 |

1. Write a C program that checks if the input matrix is an identity matrix or not.

Examples

|  |  |
| --- | --- |
| Input | Output |
| 3 3  1 0 0  0 1 0  0 0 1 | Yes |

|  |  |
| --- | --- |
| Input | Output |
| 3 3  1 0 1  0 1 0  1 0 1 | No |

1. Write a C program that stacks the 2 input arrays horizontally and prints the output array.

Hints: The number of rows of the input arrays must be equal to horizontally stack them.  
Examples

|  |  |
| --- | --- |
| Input | Output |
| 4 5 1 2 3 4 5  4 5 6 7 8  5 6 7 8 9  1 2 4 5 7  4 3  1 2 3  5 6 7  1 3 6  2 4 7 | 4 8  1 2 3 4 5 1 2 3  4 5 6 7 8 5 6 7  5 6 7 8 9 1 3 6 1 2 4 5 7 2 4 7 |

Examples

|  |  |
| --- | --- |
| Input | Output |
| 4 5 1 2 3 4 5  4 5 6 7 8  5 6 7 8 9  1 2 4 5 7  3 4  1 2 3  5 6 7  1 3 6  2 4 7 | Not possible to horizontally stack the two arrays |

1. Write a C program that flips a binary matrix horizontally, then inverts it, and returns the resulting matrix.  
   Hints: To flip a matrix horizontally means that each row of the matrix is reversed.    
   For example, flipping [1, 1, 0] horizontally results in [0, 1, 1].   
   To invert a matrix means that each 0 is replaced by 1, and each 1 is replaced by 0.   
   For example, inverting [0, 1, 1] results in [1, 0, 0]  
   Examples

|  |  |
| --- | --- |
| Input | Output |
| 3 4  1 0 0 1  0 0 0 1  1 1 0 0 | After flipping:  1 0 0 1  1 0 0 0  0 0 1 1  After inverting:  0 1 1 0  0 1 1 1  1 1 0 0 |

1. Write a C program that prints all the diagonals left to right of the input array.

Hints:

1 2 3 4

5 1 2 3

9 5 1 2

1 2 3 4

Examples

|  |  |
| --- | --- |
| Input | Output |
| 4 4  1 2 3 4  5 1 2 3  9 5 1 2  1 2 3 4 | 1  9 2  5 5 3  1 1 1 4  2 2 2  3 3  4 |

1. Write a C program that asks the user to enter r and c and reshapes the input matrix to a rxc matrix if possible.  
   Hints: Create a 1d array with mxn elements and populate the 1d array with the elements of input 2d array.  
   Then populate the rxc matrix from the 1d array.  
   Examples

|  |  |
| --- | --- |
| Input | Output |
| 4 4  1 2 3 4  5 1 2 3  9 5 1 2  2 6 | 2 6  1 2 3 4 5 1  2 3 9 5 1 2 |

|  |  |
| --- | --- |
| Input | Output |
| 4 4  1 2 3 4  5 1 2 3  9 5 1 2  2 3 | Not possible |