**Homework: Multidimensional Arrays**

**Problem 1. Fill the matrix**

* Write a program that fills and prints a matrix of size (n, n) as shown below:

*Example for n=4:*

| **a)** | **b)** | **c)** | **d)\*** |
| --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | 1 | 5 | 9 | 13 | | 2 | 6 | 10 | 14 | | 3 | 7 | 11 | 15 | | 4 | 8 | 12 | 16 | | |  |  |  |  | | --- | --- | --- | --- | | 1 | 8 | 9 | 16 | | 2 | 7 | 10 | 15 | | 3 | 6 | 11 | 14 | | 4 | 5 | 12 | 13 | | |  |  |  |  | | --- | --- | --- | --- | | 7 | 11 | 14 | 16 | | 4 | 8 | 12 | 15 | | 2 | 5 | 9 | 13 | | 1 | 3 | 6 | 10 | | |  |  |  |  | | --- | --- | --- | --- | | 1 | 12 | 11 | 10 | | 2 | 13 | 16 | 9 | | 3 | 14 | 15 | 8 | | 4 | 5 | 6 | 7 | |

**Problem 2. Maximal sum**

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

**Problem 3. Sequence n matrix**

* We are given a matrix of strings of size N x M. Sequences in the matrix we define as sets of several neighbour elements located on the same line, column or diagonal.
* Write a program that finds the longest sequence of equal strings in the matrix.

*Example:*

| **matrix** | **result** |  | **matrix** | **result** |
| --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | **ha** | fifi | ho | hi | | fo | **ha** | hi | xx | | xxx | ho | **ha** | xx | | ha, ha, ha |  | |  |  |  | | --- | --- | --- | | s | qq | **s** | | pp | pp | **s** | | pp | qq | **s** | | s, s, s |

**Problem 4. Binary search**

* Write a program, that reads from the console an array of N integers and an integer K, sorts the array and using the method Array.BinSearch() finds the largest number in the array which is ≤ K.

**Problem 5. Sort by string length**

* You are given an array of strings. Write a method that sorts the array by the length of its elements (the number of characters composing them).

**Problem 6.\* Matrix class**

* Write a class Matrix, to hold a matrix of integers. Overload the operators for adding, subtracting and multiplying of matrices, indexer for accessing the matrix content and ToString().

**Problem 7.\* Largest area in matrix**

* Write a program that finds the largest area of equal neighbour elements in a rectangular matrix and prints its size.

*Example:*

| **matrix** | **result** |
| --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | 1 | **3** | 2 | 2 | 2 | 4 | | **3** | **3** | **3** | 2 | 4 | 4 | | 4 | **3** | 1 | 2 | **3** | **3** | | 4 | **3** | 1 | **3** | **3** | 1 | | 4 | **3** | **3** | **3** | 1 | 1 | | 13 |

*Hint: you can use the algorithm*[*Depth-first search*](http://en.wikipedia.org/wiki/Depth-first_search)*or*[*Breadth-first search*](http://en.wikipedia.org/wiki/Breadth-first_search)*.*