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# Manipulating Rectangular Arrays

We present below some simple algorithms to manipulate 2-dimensional (rectangular) arrays. The code for this lecture is available [in this archive](https:///princomp.github.io/code/projects/MagicSquare.zip).

## Summing the values row per row

The following code sum the values contained in a 2-dimensional array row per row, and display the result each time before moving on to the next row:

 int[,] numbers =
 {
 { 1, 2, 3, 4 },
 { 5, 6, 7, 8 },
 };

 int acc;
 for (int row = 0; row < numbers.GetLength(0); row++)
 {
 acc = 0;
 for (int col = 0; col < numbers.GetLength(1); col++)
 {
 acc += numbers[row, col];
 }
 Console.WriteLine(
 "Total for row #" + row + " is " + acc + "."
 );
 }

 //

This code can easily be adapted to compute the sums *column per column* if needed.

## Computing Magic Square

A [magic square](https://en.wikipedia.org/wiki/Magic_square) is a square matrix where the sums of the numbers in each row, each column, and both the diagonal and the anti-diagonal are the same.

The following is an example of a magic square:

 int[,] arrayP1 =
 {
 { 4, 9, 2 },
 { 3, 5, 7 },
 { 8, 1, 6 },
 };

as we have, diagonally,

$$4+5+6=15$$

and anti-diagonally,

$$2+5+8=15$$

and on the rows,

$$4+9+2=15$$

$$3+5+7=15$$

$$8+1+6=15$$

and finally on the columns

$$4+3+8=15$$

$$9+5+1=15$$

$$2+7+6=15$$

A method to return true if the 2d-matrix of int passed as an argument is a magic square is as follows:

static class MagicSquare
{
 public static bool isMagic(int[,] arrayP)
 {
 bool magicSoFar = true;
 if (arrayP.GetLength(0) == arrayP.GetLength(1))
 { // The array is a square.
 int magicConstant = 0;
 for (int i = 0; i < arrayP.GetLength(1); i++)
 {
 magicConstant += arrayP[i, i];
 }
 int testedValue = 0;
 for (int i = 0; i < arrayP.GetLength(1); i++)
 {
 testedValue += arrayP[
 i,
 arrayP.GetLength(1) - i - 1
 ];
 }
 if (testedValue == magicConstant)
 { // The diagonal and anti-diagonal have the same sums.
 // We test the rows.
 for (int row = 0; row < arrayP.GetLength(0); row++)
 {
 testedValue = 0;
 for (
 int col = 0;
 col < arrayP.GetLength(1);
 col++
 )
 {
 testedValue += arrayP[row, col];
 }

 if (testedValue != magicConstant)
 {
 magicSoFar = false;
 }
 }
 // We test the columns.
 for (int col = 0; col < arrayP.GetLength(1); col++)
 {
 testedValue = 0;
 for (
 int row = 0;
 row < arrayP.GetLength(0);
 row++
 )
 {
 testedValue += arrayP[row, col];
 }

 if (testedValue != magicConstant)
 {
 magicSoFar = false;
 }
 }
 }
 else
 { // The diagonal and anti-diagonal have different same sums.
 magicSoFar = false;
 }
 }
 else
 { // The array is not a square.
 magicSoFar = false;
 }

 return magicSoFar;
 }
}