2025-08-12

# 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,

and anti-diagonally,

and on the rows,

and finally on the columns

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;  
 }  
}