

Matrix used in linear algebra

/*

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```
#region Usings
using System;
```

```
using System.Text;
using System.Xml.Serialization;
#endregion

namespace Utilities.Math
{
///

/// Matrix used in linear algebra
///
[Serializable()]
public class Matrix
{
#region Constructor
///

/// Constructor
///
/// Width of the matrix /// Height of the matrix public
Matrix(int Width,int Height)
{
    _Width = Width;
    _Height = Height;
    _Values = new double[Width, Height];
}
#endregion

#region Public Properties
///

/// Width of the matrix
///
[XmlElement]
public int Width
{
    get { return _Width; }
    set { _Width = value; _Values = new double[Width, Height]; }
}
}
```

```
///  
  
/// Height of the matrix  
///  
[XmlElement]  
public int Height  
{  
get { return _Height; }  
set { _Height = value; _Values = new double[Width, Height]; }  
}  
///  
  
/// Sets the values of the matrix  
///  
/// X position /// Y position /// the value at a point in the  
matrix  
public double this[int X, int Y]  
{  
get  
{  
if (X < _Width && X >= 0 && Y < _Height && Y >= 0)  
{  
return _Values[X, Y];  
}  
throw new Exception("Index out of bounds");  
}  
  
set  
{  
if (X < _Width && X >= 0 && Y < _Height && Y >= 0)  
{  
_Values[X, Y] = value;  
return;  
}  
throw new Exception("Index out of bounds");  
}  
}
```

```
///  
  
/// Values for the matrix  
///  
[XmlElement]  
public double[,] Values  
{  
    get { return _Values; }  
    set { _Values = value; }  
}  
#endregion  
  
#region Private Variables  
private int _Width = 1;  
private int _Height = 1;  
private double[,] _Values = null;  
#endregion  
  
#region Operators  
public static bool operator ==(Matrix M1, Matrix M2)  
{  
    if (M1.Width != M2.Width || M1.Height != M2.Height)  
        return false;  
    for (int x = 0; x <= M1.Width; ++x) { for (int y = 0; y <= M1.Height; ++y) { if (M1[x, y] != M2[x, y]) return false; } }  
    return true; } public static bool operator !=(Matrix M1, Matrix M2) { return !(M1 == M2); } public static Matrix operator +(Matrix M1, Matrix M2) { if (M1.Width != M2.Width || M1.Height != M2.Height) throw new ArgumentException("Both matrices must be the same dimensions."); Matrix TempMatrix = new Matrix(M1.Width, M1.Height); for (int x = 0; x < M1.Width; ++x) { for (int y = 0; y < M1.Height; ++y) { TempMatrix[x, y] = M1[x, y] + M2[x, y]; } } return TempMatrix; } public static Matrix operator -(Matrix M1, Matrix M2) { if (M1.Width != M2.Width || M1.Height != M2.Height) throw new ArgumentException("Both matrices must be the same dimensions."); Matrix TempMatrix = new Matrix(M1.Width, M1.Height); for (int x = 0; x < M1.Width; ++x) { for (int y = 0; y < M1.Height; ++y) { TempMatrix[x, y] = M1[x, y] - M2[x, y]; } } return TempMatrix; }
```

```

0; y < M1.Height; ++y) { TempMatrix[x, y] = M1[x, y] - M2[x, y]; } } return TempMatrix; } public static Matrix operator -(Matrix M1) { Matrix TempMatrix = new Matrix(M1.Width, M1.Height); for (int x = 0; x < M1.Width; ++x) { for (int y = 0; y < M1.Height; ++y) { TempMatrix[x, y] = -M1[x, y]; } } return TempMatrix; } public static Matrix operator *(Matrix M1, Matrix M2) { if (M1.Width != M2.Width || M1.Height != M2.Height) throw new ArgumentException("Dimensions for the matrices are incorrect."); Matrix TempMatrix = new Matrix(M2.Width, M1.Height); for (int x = 0; x < M2.Width; ++x) { for (int y = 0; y < M1.Height; ++y) { TempMatrix[x,y]=0.0; for (int i = 0; i < M1.Width; ++i) { for (int j = 0; j < M2.Height; ++j) { TempMatrix[x, y] += (M1[i, y] * M2[x, j]); } } } } return TempMatrix; } public static Matrix operator *(Matrix M1,double D) { Matrix TempMatrix = new Matrix(M1.Width, M1.Height); for (int x = 0; x < M1.Width; ++x) { for (int y = 0; y < M1.Height; ++y) { TempMatrix[x, y] = M1[x, y] * D; } } return TempMatrix; } public static Matrix operator *(double D, Matrix M1) { Matrix TempMatrix = new Matrix(M1.Width, M1.Height); for (int x = 0; x < M1.Width; ++x) { for (int y = 0; y < M1.Height; ++y) { TempMatrix[x, y] = M1[x, y] * D; } } return TempMatrix; } public static Matrix operator /(Matrix M1, double D) { return M1 * (1 / D); } public static Matrix operator /(double D, Matrix M1) { return M1 * (1 / D); } #endregion #region Public Overridden Functions
public override bool Equals(object obj) { if (obj is Matrix) { return this == (Matrix)obj; } return false; }
public override int GetHashCode() { double Hash=0; for (int x = 0; x < Width; ++x) { for (int y = 0; y < Height; ++y) { Hash += this[x, y]; } } return (int)Hash; }
public override string ToString() {
    StringBuilder Builder = new StringBuilder(); string Seperator = ""; Builder.Append("{ " + System.Environment.NewLine);
    for (int x = 0; x < Width; ++x) { Builder.Append("{"); for (int y = 0; y < Height; ++y) { Builder.Append(Seperator + this[x, y]); Seperator = ","; } Builder.Append("}" + System.Environment.NewLine); Seperator = ""; }
    Builder.Append("}"); return Builder.ToString(); } #endregion

```

```
#region Public Functions ///
/// Transposes the matrix
///

/// Returns a new transposed matrix
public Matrix Transpose()
{
    Matrix TempValues = new Matrix(Height, Width);
    for (int x = 0; x < Width; ++x) { for (int y = 0; y < Height; ++y) { TempValues[y, x] = _Values[x, y]; } } return TempValues; } ///
/// Gets the determinant of a square matrix
///

/// The determinant of a square matrix
public double Determinant()
{
    if (Width != Height)
        throw new Exception("The determinant can not be calculated for a non square matrix");
    if (Width == 2)
    {
        return (this[0, 0] * this[1, 1]) - (this[0, 1] * this[1, 0]);
    }
    double Answer = 0.0;
    for (int x = 0; x < Width; ++x) { Matrix TempMatrix = new Matrix(Width - 1, Height - 1); int WidthCounter = 0; for (int y = 0; y < Width; ++y) { if (y != x) { for (int z = 1; z < Height; ++z) { TempMatrix[WidthCounter, z - 1] = this[y, z]; } ++WidthCounter; } } if (x % 2 == 0) { Answer += TempMatrix.Determinant(); } else { Answer -= TempMatrix.Determinant(); } } return Answer; } #endregion } }
[/csharp]
```