Programs in \( C^{++} \) for matrix computations in min plus algebra

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Abstract. The main purpose of this paper is to propose six programs in \( C^{++} \) for matrix computations and solving recurrent equations systems with entries in min plus algebra.

1 Introduction

Idempotent mathematics is based on replacing the usual arithmetic operations with a new set of basic operations, that is on replacing numerical fields by idempotent semirings. Exotic semirings such as the max plus algebra \( R_{\text{max}} \) and min plus algebra \( R_{\text{min}} \) have been introduced in connection with various fields: graph theory, Markov decision processes, discrete event systems theory, see [1, 5, 7, 6, 3].

In min plus algebra (resp., max plus algebra), the arithmetic addition of the conventional algebra is replaced by the point-wise minimization (resp., maximization), denoted here by the symbol \( \oplus \) and the arithmetic multiplication is replaced by the point-wise addition, represented by the symbol \( \otimes \).

Several results in min plus algebra can be successfully applied to a number of problems in networking, see [2].

The paper is organized as follows. The semiring of matrices with entries in min plus algebra is presented in Section 2. In Section 3 we give six programs in language \( C^{++} \) for matrix computations in min plus algebra.

2 Semirings. Matrices over min plus algebra

We start this section by recalling of some necessary backgrounds on semirings for our purposes (see [1][7][8] and references therein for more details).

Let \( S \) be a nonempty set endowed with two binary operations, addition (denoted with \( \oplus \)) and multiplication (denoted with \( \otimes \)). The algebraic structure \((S, \oplus, \otimes, \varepsilon, e)\) is a semiring, if it fulfills the following conditions:

1. \((S, \oplus, \varepsilon)\) is a commutative monoid with \( \varepsilon \) as the neutral element for \( \oplus \);
2. \((S, \otimes, e)\) is a monoid with \( \varepsilon \) as the identity element for \( \otimes \);
3. \(\otimes\) distributes over \(\oplus\);
4. \(\varepsilon\) is an absorbing element for \(\otimes\), that is \(a \otimes \varepsilon = \varepsilon \otimes a = \varepsilon\), \(\forall a \in S\).

A semiring where addition is idempotent (that is, \(a \oplus a = a\), \(\forall a \in S\)) is called an idempotent semiring. If \(\otimes\) is commutative, we say that \(S\) is a commutative semiring.

Let \((S, \oplus, \otimes, \varepsilon, e)\) be an (idempotent) semiring. For each pair of positive integer \((m, n)\), let \(M_{m \times n}(S)\) be denote the set of \(m \times n\) matrices with entries in \(S\). The operations \(\oplus\)
and $\otimes$ on $S$ induce corresponding operations on $M_{m \times n}(S)$ in the obvious way. Indeed, if $A = (A_{ij}), B = (B_{ij}) \in M_{m \times n}(S)$ then we have:

$$A \oplus B = ((A \oplus B)_{ij}) \quad \text{where} \quad (A \oplus B)_{ij} := A_{ij} \oplus B_{ij}. \quad (2.1)$$

If $A = (A_{ij}) \in M_{m \times n}(S)$ and $B = (B_{jk}) \in M_{n \times p}(S)$ then we have:

$$A \otimes B = ((A \otimes B)_{ik}), \quad i = 1, m, \quad k = 1, p \quad \text{where} \quad (A \otimes B)_{ik} := \bigoplus_{j=1}^{n} A_{ij} \otimes B_{jk}. \quad (2.2)$$

The product of a matrix $A = (A_{ij}) \in M_{m \times n}(S)$ with a scalar $\alpha \in S$ is given by:

$$\alpha \otimes A = ((\alpha \otimes A)_{ij}) \quad \text{where} \quad (\alpha \otimes A)_{ij} := \alpha \otimes A_{ij}. \quad (2.3)$$

The set $M_{n \times n}(S)$ contains two special matrices with entries in $S$, namely the zero matrix $O_{\otimes n}$, which has all its entries equal to $\varepsilon$, and the identity matrix $I_{\otimes n}$, which has the diagonal entries equal to $\varepsilon$ and the other entries equal to $\varepsilon$.

It is easy to check that the following proposition holds.

**Proposition 2.1.** $(M_{n \times n}(S), \oplus, \otimes, O_{\otimes n}, I_{\otimes n})$ is an idempotent semiring, where the operations $\oplus$ and $\otimes$ are given in (2.1) and (2.2). \[ \square \]

We call $(M_{n \times n}(S), \oplus, \otimes, O_{\otimes n}, I_{\otimes n})$ the semiring of $n \times n$ matrices with entries in $S$. In particular, if $S := R_{\min} = (\mathbb{R} \cup \{+\infty\}, \oplus := \min, \otimes := +, \varepsilon := +\infty, e := 0$ is called the semiring of $n \times n$ matrices over $R_{\min}$.

When $S = R_{\min}$, the operations $\oplus$ and $\otimes$ given in (2.1) and (2.2), becomes:

$$\begin{align*}
(A \oplus B)_{ij} := \min\{A_{ij}, B_{ij}\} \quad &\text{and} \quad (A \otimes B)_{ik} := \min_{1 \leq k \leq n}\{A_{ij} + B_{jk}\}. \\
\end{align*} \quad (2.4)$$

The operation $\otimes$ on $M_{m \times n}(R_{\min})$ given in (2.3) becomes:

$$\alpha \otimes A = ((\alpha \otimes A)_{ij}) \quad \text{where} \quad (\alpha \otimes A)_{ij} := \alpha + A_{ij}. \quad (2.5)$$

In conventional algebra we know that for a matrix $A = (A_{ij}) \in M_{n \times n}(\mathbb{R})$, the determinant $\det(A)$ is given by

$$\det(A) = \sum_{\sigma \in P_n} sgn(\sigma) \prod_{i=1}^{n} A_{i\sigma(i)},$$

where $P_n$ is the set of all permutations of the set $\{1, 2, ..., n\}$ and $sgn(\sigma)$ is the signature of the permutation $\sigma$.

In min plus algebra (resp., max plus algebra) the determinant has no direct analogue because of the absence of addition inverses. The concept of permanent of a matrix partially play the role of determinant. It is defined similarly of the determinant but with the $sgn(\sigma)$ simply omitted, see [8].

For $A = (A_{ij}) \in M_{n \times n}(S)$, the **permanent** of $A$, denoted by $\text{perm}(A)$ is defined by

$$\text{perm}(A) = \bigoplus_{\sigma \in P_n} \bigotimes_{i=1}^{n} A_{i\sigma(i)}.$$
Let $P_e^n$ (resp., $P_o^n$) be the set of even (resp., odd) permutations of the set \{1, 2, ..., n\}. The bideterminant of $A = (A_{ij}) \in M_{n \times n}(S)$ is the pair $(\Delta_1(A), \Delta_2(A))$, where

$$\Delta_1(A) = \bigoplus_{\sigma \in P_e^n} \bigotimes_{i=1}^{n} A_{i\sigma(i)} \quad \text{and} \quad \Delta_2(A) = \bigoplus_{\sigma \in P_o^n} \bigotimes_{i=1}^{n} A_{i\sigma(i)}. \quad (2.6)$$

The element $\Delta_1(A)$ (resp., $\Delta_2(A)$) is called plus-determinant (resp., minus-determinant) of $A$ and is denoted with $\Delta_1(A) := \det_+^{(\oplus)}(A)$ (resp., $\Delta_2(A) := \det_-^{(\oplus)}(A)$).

Note that $\text{perm}(A) = \Delta_1(A) \oplus \Delta_2(A)$.

When $S = R_{\min}$, the bideterminant of $A$ given in (2.6), becomes:

$$\Delta_1(A) = \min_{\sigma \in P_e^n} \sum_{i=1}^{n} A_{i\sigma(i)} \quad \text{and} \quad \Delta_2(A) = \min_{\sigma \in P_o^n} \sum_{i=1}^{n} A_{i\sigma(i)}. \quad (2.7)$$

3 Programs in $C^{++}$

In this section we give programs written in the language $C^{++}$ for the basic operations with matrices over $R_{\min}$ and for solving a recurrent linear system, and namely:

1. the sum of two matrices $A, B \in M_{m \times n}(R_{\min})$;
2. the product of two matrices $A \in M_{m \times n}(R_{\min})$ and $B \in M_{n \times p}(R_{\min})$;
3. the product of a a scalar $\alpha \in R_{\min}$ with a matrix $A \in M_{m \times n}(R_{\min})$;
4. the power of a matrix $A \in M_{n \times n}(R_{\min})$;
5. $\Delta_1(A)$ and $\Delta_1(A)$ for $A \in M_{n \times n}(R_{\min})$ when $n = 2$ and $n = 3$;
6. the solving a linear system of the form:

$$X(k+1) = A \otimes X(k), \quad k \geq 0,$$

where $A \in M_{n \times n}(R_{\min})$ and $X(k) \in M(n, 1; R_{\min})$.

**Remark 3.1.** In [4] are given five programs in $C^{++}$ for matrix computations in $R_{\max}$. □

- We first give the Form1 Designer of program.

name space Operations_with_matrices_in_min_plus_algebra

```c
{ partial class Form1
```
protected override void Dispose(bool disposing)
{
    if (disposing && (components != null))
    {
        components.Dispose();
    }
    base.Dispose(disposing);
}

#region Windows Form Designer generated code
/// <summary>
/// Required method for Designer support-do not modify
/// the contents of this method with the code editor.
/// </summary>
private void InitializeComponent()
{
    System.ComponentModel.ComponentResourceManager resources = new System.ComponentModel.ComponentResourceManager(typeof(Form1));
    this.tabControl1 = new System.Windows.Forms.TabControl();
    this.tabAddition = new System.Windows.Forms.TabPage();
    this.btReset = new System.Windows.Forms.Button();
    this.btComputationSum = new System.Windows.Forms.Button();
    this.btGenerating = new System.Windows.Forms.Button();
    this.label6 = new System.Windows.Forms.Label();
    this.pictureBox1 = new System.Windows.Forms.PictureBox();
    this.panel1 = new System.Windows.Forms.Panel();
    this.pictureBox2 = new System.Windows.Forms.PictureBox();
    this.dataGridResAddition = new System.Windows.Forms.DataGridView();
    this.panel2 = new System.Windows.Forms.Panel();
    this.label4 = new System.Windows.Forms.Label();
    this.label1 = new System.Windows.Forms.Label();
    this.dataGridB = new System.Windows.Forms.DataGridView();
    this.dataGridA = new System.Windows.Forms.DataGridView();
    this.textColumn = new System.Windows.Forms.TextBox();
    this.textLine = new System.Windows.Forms.TextBox();
    this.label3 = new System.Windows.Forms.Label();
    this.label2 = new System.Windows.Forms.Label();
    this.tabMultiplication = new System.Windows.Forms.TabPage();
    this.pictureBox3 = new System.Windows.Forms.PictureBox();
    this.btResetMultiplication = new System.Windows.Forms.Button();
    this.btComputingProduct = new System.Windows.Forms.Button();
}
this.btGenerating2 = new System.Windows.Forms.Button();
this.label5 = new System.Windows.Forms.Label();
this.label13 = new System.Windows.Forms.Label();
this.textcolumnB2 = new System.Windows.Forms.TextBox();
this.textLineB2 = new System.Windows.Forms.TextBox();
this.label11 = new System.Windows.Forms.Label();
this.label12 = new System.Windows.Forms.Label();
this.panel3 = new System.Windows.Forms.Panel();
this.pictureBox4 = new System.Windows.Forms.PictureBox();
this.dataGridProduct = new System.Windows.Forms.DataGridView();
this.panel4 = new System.Windows.Forms.Panel();
this.label7 = new System.Windows.Forms.Label();
this.label8 = new System.Windows.Forms.Label();
this.dataGridB2 = new System.Windows.Forms.DataGridView();
this.dataGridA2 = new System.Windows.Forms.DataGridView();
this.textContentColumnA2 = new System.Windows.Forms.TextBox();
this.textLineA2 = new System.Windows.Forms.TextBox();
this.label9 = new System.Windows.Forms.Label();
this.label10 = new System.Windows.Forms.Label();
this.tabMultiplication_scalar = new System.Windows.Forms.TabPage();
this.pictureBox6 = new System.Windows.Forms.PictureBox();
this.btReset_Product_scalar = new System.Windows.Forms.Button();
this.btProductScalar = new System.Windows.Forms.Button();
this.buttonsGenerating3 = new System.Windows.Forms.Button();
this.textScalar = new System.Windows.Forms.TextBox();
this.label16 = new System.Windows.Forms.Label();
this.panel6 = new System.Windows.Forms.Panel();
this.pictureBox5 = new System.Windows.Forms.PictureBox();
this.dataGridProductScalar = new System.Windows.Forms.DataGridView();
this.panel5 = new System.Windows.Forms.Panel();
this.label17 = new System.Windows.Forms.Label();
this.dataGridA3 = new System.Windows.Forms.DataGridView();
this.textContentA3 = new System.Windows.Forms.TextBox();
this.textLineA3 = new System.Windows.Forms.TextBox();
this.label14 = new System.Windows.Forms.Label();
this.label15 = new System.Windows.Forms.Label();
this.tabLifting_at_power = new System.Windows.Forms.TabPage();
this.pictureBox9 = new System.Windows.Forms.PictureBox();
this.btReset_lifting_at_power = new System.Windows.Forms.Button();
this.btComputPower = new System.Windows.Forms.Button();
this.btGeneratingA4 = new System.Windows.Forms.Button();
this.label29 = new System.Windows.Forms.Label();
this.label21 = new System.Windows.Forms.Label();
this.panel7 = new System.Windows.Forms.Panel();
this.label27 = new System.Windows.Forms.Label();
this.label25 = new System.Windows.Forms.Label();
this.label26 = new System.Windows.Forms.Label();
this.labelPower = new System.Windows.Forms.Label();
this.label24 = new System.Windows.Forms.Label();
this.dataGridMatrix_at_power_n = new System.Windows.Forms.DataGridView();
this.panel8 = new System.Windows.Forms.Panel();
this.dataGridA4 = new System.Windows.Forms.DataGridView();
this.textLabel4 = new System.Windows.Forms.TextBox();
this.tabComputDet = new System.Windows.Forms.TabPage();
this.pictureBox10 = new System.Windows.Forms.PictureBox();
this.bt_Reset_values_det = new System.Windows.Forms.Button();
this.btComputingDeterminant = new System.Windows.Forms.Button();
this.btGeneratingA5 = new System.Windows.Forms.Button();
this.label30 = new System.Windows.Forms.Label();
this.DataBox8 = new System.Windows.Forms.PictureBox();
this.pictureBox7 = new System.Windows.Forms.PictureBox();
this.textLabel4 = new System.Windows.Forms.TextBox();
this.textLabel5 = new System.Windows.Forms.TextBox();
this.tabPage1 = new System.Windows.Forms.TabPage();
this.dataGridA5 = new System.Windows.Forms.DataGridView();
this.textLabel4 = new System.Windows.Forms.TextBox();
this.label22 = new System.Windows.Forms.Label();
this.tabPage1 = new System.Windows.Forms.TabPage();
this.panel12 = new System.Windows.Forms.Panel();
this.label_k = new System.Windows.Forms.Label();
this.dataGridX0 = new System.Windows.Forms.DataGridView();
this.panel9 = new System.Windows.Forms.Panel();
this.label31 = new System.Windows.Forms.Label();
this.label32 = new System.Windows.Forms.Label();
this.label33 = new System.Windows.Forms.Label();
this.label37 = new System.Windows.Forms.Label();
this.dataGridSolutionXk = new System.Windows.Forms.DataGridView();
this.panel11 = new System.Windows.Forms.Panel();
this.label38 = new System.Windows.Forms.Label();
this.dataGridA6 = new System.Windows.Forms.DataGridView();
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```csharp
this.textk = new System.Windows.Forms.TextBox();
this.textlineA6 = new System.Windows.Forms.TextBox();
this.label39 = new System.Windows.Forms.Label();
this.label40 = new System.Windows.Forms.Label();
this.btResetSystem = new System.Windows.Forms.Button();
this.btComputSystem = new System.Windows.Forms.Button();
this.btGeneratingMatrices = new System.Windows.Forms.Button();
this.tabControl1.SuspendLayout();
this.tabAddition.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox1)).BeginInit();
this.panel1.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox2)).BeginInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridRezAddition)).BeginInit();
this.panel2.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridB)).BeginInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridA)).BeginInit();
this.tabMultiplication.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox3)).BeginInit();
this.panel3.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox4)).BeginInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct)).BeginInit();
this.panel4.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridB2)).BeginInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridA2)).BeginInit();
this.tabMultiplication._scalar.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox6)).BeginInit();
this.panel6.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox5)).BeginInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProductScalar)).BeginInit();
this.panel5.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridA3)).BeginInit();
this.tabLifting_.at_.power.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox9)).BeginInit();
this.panel7.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridMatrix_.at_.power_.n)).BeginInit();
this.panel8.SuspendLayout();
```
((System.ComponentModel.ISupportInitialize)(this.dataGridA4)).BeginInit();
this.tabComputDet.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox10)).BeginInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox8)).BeginInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox7)).BeginInit();
this.panel10.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridA5)).BeginInit();
this.tabPage1.SuspendLayout();
this.panel12.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridX0)).BeginInit();
this.panel9.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridSolutionXk)).BeginInit();
this.panel11.SuspendLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridA6)).BeginInit();
this.SuspendLayout();
//
// tabControl1
//
this.tabControl1.Controls.Add(this.tabAddition);
this.tabControl1.Controls.Add(this.tabIMultiplication);
this.tabControl1.Controls.Add(this.tabMultiplication - scalar);
this.tabControl1.Controls.Add(this.tabLifting - at - power);
this.tabControl1.Controls.Add(this.tabComputDet);
this.tabControl1.Controls.Add(this.tabPage1);
this.tabControl1.Location = new System.Drawing.Point(12, 5);
this.tabControl1.Name = "tabControl1";
this.tabControl1.SelectedIndex = 0;
this.tabControl1.Size = new System.Drawing.Size(1000, 696);
this.tabControl1.TabIndex = 0;
//
// tabAddition
//
this.tabAddition.BackColor = System.Drawing.Color.FromArgb(((int)(((byte)(192)), ((int)(((byte)(255)))), ((int)(((byte)(192)))));
this.tabAddition.Controls.Add(this.btReset);
this.tabAddition.Controls.Add(this.btComputingSum);
this.tabAddition.Controls.Add(this.btGenerating);
this.tabAddition.Controls.Add(this.label6);
this.tabAddition.Controls.Add(this.pictureBox1);
this.tabAddition.Controls.Add(this.panel1);
this.tabAddition.Controls.Add(this.panel2);
this.tabAddition.Controls.Add(this.textColumn);
this.tabAddition.Controls.Add(this.textLabel);
this.tabAddition.Controls.Add(this.label3);
this.tabAddition.Controls.Add(this.label2);
this.tabAddition.Location = new System.Drawing.Point(4, 25);
this.tabAddition.Name = "tabAddition";
this.tabAddition.Padding = new System.Windows.Forms.Padding(3);
this.tabAddition.Size = new System.Drawing.Size(992, 667);
this.tabAddition.TabIndex = 0;
this.tabAddition.Text = "Addition";

// btReset
//
this.btReset.BackColor = System.Drawing.Color.Pink;
this.btReset.ForeColor = System.Drawing.Color.Black;
this.btReset.Location = new System.Drawing.Point(546, 296);
this.btReset.Name = "btReset";
this.btReset.Size = new System.Drawing.Size(125, 65);
this.btReset.TabIndex = 38;
this.btReset.Text = "Reset values";
this.btReset.UseVisualStyleBackColor = false;
this.btReset.Click += new System.EventHandler(this.btReset_Click);

// btComputingSum
//
this.btComputingSum.BackColor = System.Drawing.Color.PowderBlue;
this.btComputingSum.ForeColor = System.Drawing.Color.Black;
this.btComputingSum.Location = new System.Drawing.Point(546, 178);
this.btComputingSum.Name = "btComputingSum";
this.btComputingSum.Size = new System.Drawing.Size(125, 65);
this.btComputingSum.TabIndex = 37;
this.btComputingSum.Text = "Computing Matrix";
this.btComputingSum.UseVisualStyleBackColor = false;
this.btComputingSum.Click += new System.EventHandler(this.btComputingSum_Click);

// btGenerating
//
this.btGenerating.BackColor = System.Drawing.Color.PowderBlue;
this.btGenerating.ForeColor = System.Drawing.Color.Black;
this.btGenerating.Location = new System.Drawing.Point(546, 24);
this.btGenerating.Name = "btGenerating";
this.btGenerating.Size = new System.Drawing.Size(125, 65);
this.btGenerating.TabIndex = 36;
this.btGenerating.Text = "Generating";
this.btGenerating.UseVisualStyleBackColor = false;
this.btGenerating.Click += new System.EventHandler(this.btGenerating_Click);
this.btGenerating.TabIndex = 36;
this.btGenerating.Text = "Generating matrix";
this.btGenerating.UseVisualStyleBackColor = false;
this.btGenerating.Click += new System.EventHandler(this.btGenerating_Click);

// label6
//
this.label6.AutoSize = true;
this.label6.Font = new System.Drawing.Font("Microsoft Sans Serif", 9.75F, System.Drawing.FontStyle.Regular, System.Drawing.GraphicsUnit.Point,((byte)(0)));
this.label6.ForeColor = System.Drawing.Color.Red;
this.label6.Location = new System.Drawing.Point(25, 132);
this.label6.Name = "label6";
this.label6.Size = new System.Drawing.Size(39, 16);
this.label6.TabIndex = 35;
this.label6.Text = "Rem:";

// pictureBox1
//
this.pictureBox1.Image = ((System.Drawing.Image)(resources.GetObject("pictureBox1.Image")));
this.pictureBox1.Location = new System.Drawing.Point(74, 128);
this.pictureBox1.Name = "pictureBox1";
this.pictureBox1.Size = new System.Drawing.Size(56, 27);
this.pictureBox1.TabIndex = 34;
this.pictureBox1.TabStop = false;

// panel1
//
this.panel1.Controls.Add(this.pictureBox2);
this.panel1.Controls.Add(this.dataGridResAddition);
this.panel1.Location = new System.Drawing.Point(698, 178);
this.panel1.Name = "panel1";
this.panel1.Size = new System.Drawing.Size(257, 297);
this.panel1.TabIndex = 11;

// pictureBox2
//
this.pictureBox2.BackColor = System.Drawing.Color.Red;
this.pictureBox2.Image = global::Operations_with_matrices.Properties.Resources.a_b;
this.pictureBox2.Location = new System.Drawing.Point(17, 10);
this.pictureBox2.Name = "pictureBox2";
this.pictureBox2.Size = new System.Drawing.Size(115, 33);
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this.pictureBox2.TabIndex = 13;
this.pictureBox2.TabStop = false;

//
// dataGridResAddition
//
this.dataGridResAddition.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridResAddition.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridResAddition.Location = new System.Drawing.Point(17, 49);
this.dataGridResAddition.Name = "dataGridResAddition";
this.dataGridResAddition.Size = new System.Drawing.Size(223, 227);
this.dataGridResAddition.TabIndex = 8;

// panel2
//
this.panel2.Controls.Add(this.label4);
this.panel2.Controls.Add(this.label1);
this.panel2.Controls.Add(this.dataGridB);
this.panel2.Controls.Add(this.dataGridA);
this.panel2.Location = new System.Drawing.Point(16, 178);
this.panel2.Name = "panel2";
this.panel2.Size = new System.Drawing.Size(497, 297);
this.panel2.TabIndex = 8;

// label4
//
this.label4.AutoSize = true;
this.label4.ForeColor = System.Drawing.Color.MidnightBlue;
this.label4.Location = new System.Drawing.Point(266, 16);
this.label4.Name = "label4";
this.label4.Size = new System.Drawing.Size(72, 16);
this.label4.TabIndex = 11;
this.label4.Text = "Matrix B";

// label1
//
this.label1.AutoSize = true;
this.label1.ForeColor = System.Drawing.Color.MidnightBlue;
this.label1.Location = new System.Drawing.Point(27, 16);
this.label1.Name = "label1";
this.label1.Size = new System.Drawing.Size(72, 16);
this.label1.TabIndex = 10;
this.label1.Text = "Matrix A";
// dataGridB
//
this.dataGridB.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridB.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightModeAutoSize;
this.dataGridB.Location = new System.Drawing.Point(257, 49);
this.dataGridB.Name = "dataGridB";
this.dataGridB.Size = new System.Drawing.Size(223, 227);
this.dataGridB.TabIndex = 6;
//
// dataGridA
//
this.dataGridA.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridA.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightModeAutoSize;
this.dataGridA.Location = new System.Drawing.Point(12, 49);
this.dataGridA.Name = "dataGridA";
this.dataGridA.Size = new System.Drawing.Size(223, 227);
this.dataGridA.TabIndex = 0;
//
// textColumn
//
this.textColumn.Location = new System.Drawing.Point(253, 70);
this.textColumn.Name = "textColumn";
this.textColumn.Size = new System.Drawing.Size(41, 22);
this.textColumn.TabIndex = 7;
//
// textLine
//
this.textLine.Location = new System.Drawing.Point(253, 21);
this.textLine.Name = "textLine";
this.textLine.Size = new System.Drawing.Size(41, 22);
this.textLine.TabIndex = 6;
//
// label3
//
this.label3.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label3.AutoSize = true;
this.label3.Location = new System.Drawing.Point(25, 73);
this.label3.Name = "label3";
Programs in C++ for matrix computations in min plus algebra

this.label3.Size = new System.Drawing.Size(196, 16);
this.label3.TabIndex = 5;
this.label3.Text = "Introduce number of columns!";
/
// label2
//
this.label2.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top 
| System.Windows.Forms.AnchorStyles.Bottom) 
| System.Windows.Forms.AnchorStyles.Left)));
this.label2.AutoSize = true;
this.label2.Location = new System.Drawing.Point(22, 24);
this.label2.Name = "label2";
this.label2.Size = new System.Drawing.Size(166, 16);
this.label2.TabIndex = 4;
this.label2.Text = "Introduce number of lines!";
/
// tabMultiplication
//
this.tabMultiplication.BackColor = System.Drawing.Color.FromArgb(((int)(((byte)(192)))), 
((int)(((byte)(255)))), ((int)(((byte)(192)))));
this.tabMultiplication.Controls.Add(this.pictureBox3);
this.tabMultiplication.Controls.Add(this.btResetMultiplication);
this.tabMultiplication.Controls.Add(this.btComputingProduct);
this.tabMultiplication.Controls.Add(this.btGenerating2);
this.tabMultiplication.Controls.Add(this.label5);
this.tabMultiplication.Controls.Add(this.label13);
this.tabMultiplication.Controls.Add(this.textcolumnB2);
this.tabMultiplication.Controls.Add(this.textLineB2);
this.tabMultiplication.Controls.Add(this.label11);
this.tabMultiplication.Controls.Add(this.label12);
this.tabMultiplication.Controls.Add(this.panel3);
this.tabMultiplication.Controls.Add(this.panel4);
this.tabMultiplication.Controls.Add(this.textColumnA2);
this.tabMultiplication.Controls.Add(this.textLineA2);
this.tabMultiplication.Controls.Add(this.label9);
this.tabMultiplication.Controls.Add(this.label10);
this.tabMultiplication.Location = new System.Drawing.Point(4, 25);
this.tabMultiplication.Name = "tabMultiplication";
this.tabMultiplication.Padding = new System.Windows.Forms.Padding(3);
this.tabMultiplication.Size = new System.Drawing.Size(992, 667);
this.tabMultiplication.TabIndex = 1;
this.tabMultiplication.Text = "Multiplication";
//
// pictureBox3
//
// this.pictureBox3.Image = (resources.GetObject("pictureBox3.Image"));
// this.pictureBox3.Location = new System.Drawing.Point(70, 220);
// this.pictureBox3.Name = "pictureBox3";
// this.pictureBox3.Size = new System.Drawing.Size(56, 27);
// this.pictureBox3.TabIndex = 40;
// this.pictureBox3.TabStop = false;
//
// // btResetMultiplication
//
// this.btResetMultiplication.BackColor = System.Drawing.Color.Pink;
// this.btResetMultiplication.ForeColor = System.Drawing.Color.Black;
// this.btResetMultiplication.Location = new System.Drawing.Point(548, 356);
// this.btResetMultiplication.Name = "btResetMultiplication";
// this.btResetMultiplication.Size = new System.Drawing.Size(125, 65);
// this.btResetMultiplication.TabIndex = 39;
// this.btResetMultiplication.Text = "Reset values";
// this.btResetMultiplication.UseVisualStyleBackColor = false;
// this.btResetMultiplication.Click += new System.EventHandler(this.btResetMultiplication_Click);
//
// // btComputingProduct
//
// this.btComputingProduct.BackColor = System.Drawing.Color.PowderBlue;
// this.btCalculareProdus.ForeColor = System.Drawing.SystemColors.ControlText;
// this.btComputingProduct.Location = new System.Drawing.Point(548, 253);
// this.btComputingProduct.Name = "btComputingProduct";
// this.btComputingProduct.Size = new System.Drawing.Size(125, 65);
// this.btComputingProduct.TabIndex = 38;
// this.btComputingProduct.Text = "Computing Matrix";
// this.btComputingProduct.UseVisualStyleBackColor = false;
// this.btComputingProduct.Click += new System.EventHandler(this.btComputingProduct_Click);
//
// // btGenerating2
//
// this.btGenerating2.BackColor = System.Drawing.Color.PowderBlue;
// this.btGenerating2.ForeColor = System.Drawing.Color.Black;
// this.btGenerating2.Location = new System.Drawing.Point(548, 145);
// this.btGenerating2.Name = "btGenerating2";
// this.btGenerating2.Size = new System.Drawing.Size(125, 65);
this.btGenerating2.TabIndex = 37;
this.btGenerating2.Text = "Generating matrix";
this.btGenerating2.UseVisualStyleBackColor = false;
this.btGenerating2.Click += new System.EventHandler(this.btGenerating2_Click);

// label5

this.label5.AutoSize = true;
this.label5.ForeColor = System.Drawing.Color.Red;
this.label5.Location = new System.Drawing.Point(25, 224);
this.label5.Name = "label5";
this.label5.Size = new System.Drawing.Size(39, 16);
this.label5.TabIndex = 35;
this.label5.Text = "Rem:";

// label13

this.label13.AutoSize = true;
this.label13.ForeColor = System.Drawing.Color.Red;
this.label13.Location = new System.Drawing.Point(14, 103);
this.label13.Name = "label13";
this.label13.Size = new System.Drawing.Size(808, 16);
this.label13.TabIndex = 28;
this.label13.Text = "Rem: Matrix A can by multiply with matrix B, only if number of columns of " + "matrix A is equal with number of lines of matrix B!";

// textcolumnB2

this.textcolumnB2.Location = new System.Drawing.Point(344, 191);
this.textcolumnB2.Name = "textcolumnB2";
this.textcolumnB2.Size = new System.Drawing.Size(41, 22);
this.textcolumnB2.TabIndex = 27;

// textLineB2

this.textLineB2.Enabled = false;
this.textLineB2.Location = new System.Drawing.Point(344, 145);
this.textLineB2.Name = "textLineB2";
this.textLineB2.Size = new System.Drawing.Size(41, 22);
this.textLineB2.TabIndex = 26;
this.label11.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label11.AutoSize = true;
this.label11.Location = new System.Drawing.Point(22, 194);
this.label11.Name = "label11";
this.label11.Size = new System.Drawing.Size(303, 16);
this.label11.TabIndex = 25;
this.label11.Text = "Introduce number of columns of matrix B !";

// label12
//
his.label12.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label12.AutoSize = true;
this.label12.Location = new System.Drawing.Point(22, 148);
this.label12.Name = "label12";
this.label12.Size = new System.Drawing.Size(273, 16);
this.label12.TabIndex = 24;
this.label12.Text = "Introduce number of lines of matrix B !";

// panel3
//
this.panel3.Controls.Add(this.pictureBox4);
this.panel3.Controls.Add(this.dataGridProduct);
this.panel3.Location = new System.Drawing.Point(698, 253);
this.panel3.Name = "panel3";
this.panel3.Size = new System.Drawing.Size(257, 297);
this.panel3.TabIndex = 21;

// pictureBox4
//
this.pictureBox4.Image = global::Operations_with_matrices.Properties.Resources.AB;
this.pictureBox4.Location = new System.Drawing.Point(17, 14);
this.pictureBox4.Name = "pictureBox4";
this.pictureBox4.Size = new System.Drawing.Size(126, 29);
this.pictureBox4.TabIndex = 9;
this.pictureBox4.TabStop = false;

// dataGridProduct
//
this.dataGridProduct.BackgroundColor = System.Drawing.Color.WhiteSmoke;
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```csharp
this.dataGridProduct.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridProduct.Location = new System.Drawing.Point(17, 49);
this.dataGridProduct.Name = "dataGridProduct";
this.dataGridProduct.Size = new System.Drawing.Size(223, 227);
this.dataGridProduct.TabIndex = 8;

// panel4
//
this.panel4.Controls.Add(this.label7);
this.panel4.Controls.Add(this.label8);
this.panel4.Controls.Add(this.dataGridB2);
this.panel4.Controls.Add(this.dataGridA2);
this.panel4.Location = new System.Drawing.Point(16, 253);
this.panel4.Name = "panel4";
this.panel4.Size = new System.Drawing.Size(497, 297);
this.panel4.TabIndex = 18;

// label7
//
this.label7.AutoSize = true;
this.label7.ForeColor = System.Drawing.Color.MidnightBlue;
this.label7.Location = new System.Drawing.Point(266, 16);
this.label7.Name = "label7";
this.label7.Size = new System.Drawing.Size(72, 16);
this.label7.TabIndex = 11;
this.label7.Text = "Matrix B";

// label8
//
this.label8.AutoSize = true;
this.label8.ForeColor = System.Drawing.Color.MidnightBlue;
this.label8.Location = new System.Drawing.Point(27, 16);
this.label8.Name = "label8";
this.label8.Size = new System.Drawing.Size(72, 16);
this.label8.TabIndex = 10;
this.label8.Text = "Matrix A";

// dataGridB2
//
this.dataGridB2.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridB2.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridB2.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
```
this.dataGridB2.Location = new System.Drawing.Point(257, 49);
this.dataGridB2.Name = "dataGridB2";
this.dataGridB2.Size = new System.Drawing.Size(223, 227);
this.dataGridB2.TabIndex = 6;
//
// dataGridA2
//
this.dataGridA2.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridA2.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridA2.Location = new System.Drawing.Point(12, 49);
this.dataGridA2.Name = "dataGridA2";
this.dataGridA2.Size = new System.Drawing.Size(223, 227);
this.dataGridA2.TabIndex = 0;
//
// textColumnA2
//
this.textColumnA2.Location = new System.Drawing.Point(344, 63);
this.textColumnA2.Name = "textColumnA2";
this.textColumnA2.Size = new System.Drawing.Size(41, 22);
this.textColumnA2.TabIndex = 17;
this.textColumnA2.Leave += new System.EventHandler(this.textColumnA2_Leave);
//
// textLineA2
//
this.textLineA2.Location = new System.Drawing.Point(344, 17);
this.textLineA2.Name = "textLineA2";
this.textLineA2.Size = new System.Drawing.Size(41, 22);
this.textLineA2.TabIndex = 16;
//
// label9
//
this.label9.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label9.AutoSize = true;
this.label9.ForeColor = System.Drawing.Color.Black;
this.label9.Location = new System.Drawing.Point(22, 66);
this.label9.Name = "label9";
this.label9.Size = new System.Drawing.Size(303, 16);
this.label9.TabIndex = 15;
this.label9.Text = "Introduce number of columns of matrix A!";
//
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// label10

//
this.label10.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label10.AutoSize = true;
this.label10.Location = new System.Drawing.Point(22, 17);
this.label10.Name = "label10";
this.label10.Size = new System.Drawing.Size(273, 16);
this.label10.TabIndex = 14;
this.label10.Text = "Introduce number of lines of matrix A";

//
// tabMultiplication_scalar
this.tabMultiplication_scalar.BackColor = System.Drawing.Color.FromArgb(((int)(((byte)(192)))),((int)(((byte)(255)))), ((int)(((byte)(192))));
this.tabMultiplication_scalar.Controls.Add(this.pictureBox6);
this.tabMultiplication_scalar.Controls.Add(this.btReset_Product_Scalar);
this.tabMultiplication_scalar.Controls.Add(this.btProductScalar);
this.tabMultiplication_scalar.Controls.Add(this.butonsGenerating3);
this.tabMultiplication_scalar.Controls.Add(this.label28);
this.tabMultiplication_scalar.Controls.Add(this.textScalar);
this.tabMultiplication_scalar.Controls.Add(this.label16);
this.tabMultiplication_scalar.Controls.Add(this.panel6);
this.tabMultiplication_scalar.Controls.Add(this.panel5);
this.tabMultiplication_scalar.Controls.Add(this.textcolumnA3);
this.tabMultiplication_scalar.Controls.Add(this.textLineA3);
this.tabMultiplication_scalar.Controls.Add(this.label14);
this.tabMultiplication_scalar.Controls.Add(this.label15);
this.tabMultiplication_scalar.Location = new System.Drawing.Point(4, 25);
this.tabMultiplication_scalar.Name = "tabMultiplication_scalar";
this.tabMultiplication_scalar.Padding = new System.Windows.Forms.Padding(3);
this.tabMultiplication_scalar.Size = new System.Drawing.Size(992, 667);
this.tabMultiplication_scalar.TabIndex = 2;
this.tabMultiplication_scalar.Text = "Multiplication with a scalar";

//
// pictureBox6
//
this.pictureBox6.Image = ((System.Drawing.Image)(resources.GetObject("pictureBox6.Image")));
this.pictureBox6.Location = new System.Drawing.Point(56, 162);
this.pictureBox6.Name = "pictureBox6";
this.pictureBox6.Size = new System.Drawing.Size(56, 27);
this.pictureBox6.TabIndex = 43;
this.pictureBox6.TabStop = false;

// btReset_Product_Scalar

this.btReset_Product_Scalar.BackColor = System.Drawing.Color.Pink;
this.btReset_Product_Scalar.ForeColor = System.Drawing.Color.Black;
this.btReset_Product_Scalar.Location = new System.Drawing.Point(316, 421);
this.btReset_Product_Scalar.Name = "btReset_Product_Scalar";
this.btReset_Product_Scalar.Size = new System.Drawing.Size(125, 65);
this.btReset_Product_Scalar.TabIndex = 42;
this.btReset_Product_Scalar.Text = "Reset values";
this.btReset_Product_Scalar.UseVisualStyleBackColor = false;
this.btReset_Product_Scalar.Click += new System.EventHandler(this.btReset_Product_Scalar_Click);

// btProductScalar

this.btProductScalar.BackColor = System.Drawing.Color.PowderBlue;
this.btProductScalar.ForeColor = System.Drawing.SystemColors.ControlText;
this.btProductScalar.Location = new System.Drawing.Point(316, 318);
this.btProductScalar.Name = "btProductScalar";
this.btProductScalar.Size = new System.Drawing.Size(125, 65);
this.btProductScalar.TabIndex = 41;
this.btProductScalar.Text = "Computing Matrix";
this.btProductScalar.UseVisualStyleBackColor = false;
this.btProductScalar.Click += new System.EventHandler(this.btProductScalar_Click);

// butonsGenerating3

this.butonsGenerating3.BackColor = System.Drawing.Color.PowderBlue;
this.butonsGenerating3.ForeColor = System.Drawing.SystemColors.ControlText;
this.butonsGenerating3.Location = new System.Drawing.Point(316, 210);
this.butonsGenerating3.Name = "butonsGenerating3";
this.butonsGenerating3.Size = new System.Drawing.Size(125, 65);
this.butonsGenerating3.TabIndex = 40;
this.butonsGenerating3.Text = "Generating of matrix";
this.butonsGenerating3.UseVisualStyleBackColor = false;
this.butonsGenerating3.Click += new System.EventHandler(this.butonsGenerating3_Click);

// label28

this.label28.AutoSize = true;
this.label28.ForeColor = System.Drawing.Color.Red;
this.label28.Location = new System.Drawing.Point(12, 169);
this.label28.Name = "label28";
this.label28.Size = new System.Drawing.Size(39, 16);
this.label28.TabIndex = 35;
this.label28.Text = "Rem:"

//
// textScalar
//
this.textScalar.Location = new System.Drawing.Point(143, 121);
this.textScalar.Name = "textScalar";
this.textScalar.Size = new System.Drawing.Size(41, 22);
this.textScalar.TabIndex = 19;

//
// label16
//
this.label16.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label16.AutoSize = true;
this.label16.Location = new System.Drawing.Point(12, 127);
this.label16.Name = "label16";
this.label16.Size = new System.Drawing.Size(125, 16);
this.label16.TabIndex = 18;
this.label16.Text = "Introduce the scalar !";

//
// panel6
//
this.panel6.Controls.Add(this.pictureBox5);
this.panel6.Controls.Add(this.dataGridProductScalar);
this.panel6.Location = new System.Drawing.Point(498, 20 1);
this.panel6.Name = "panel6";
this.panel6.Size = new System.Drawing.Size(257, 297);
this.panel6.TabIndex = 17;

//
// pictureBox5
//
this.pictureBox5.BackColor = System.Drawing.Color.Red;
this.pictureBox5.Image = global::Operations_with_matrices.Properties.Resources.scalar;
this.pictureBox5.Location = new System.Drawing.Point(1 7, 10);
this.pictureBox5.Name = "pictureBox5";
this.pictureBox5.Size = new System.Drawing.Size(147, 31);
this.pictureBox5.TabIndex = 13;
this.pictureBox5.TabStop = false;

///
/// dataGridViewProductScalar
///
this.dataGridViewProductScalar.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridViewProductScalar.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridViewProductScalar.Location = new System.Drawing.Point(17, 49);
this.dataGridViewProductScalar.Name = "dataGridViewProductScalar";
this.dataGridViewProductScalar.Size = new System.Drawing.Size(223, 227);
this.dataGridViewProductScalar.TabIndex = 8;

///
/// panel5
///
this.panel5.Controls.Add(this.label17);
this.panel5.Controls.Add(this.dataGridA3);
this.panel5.Location = new System.Drawing.Point(13, 210);
this.panel5.Name = "panel5";
this.panel5.Size = new System.Drawing.Size(269, 297);
this.panel5.TabIndex = 15;

///
/// label17
///
this.label17.AutoSize = true;
this.label17.ForeColor = System.Drawing.Color.MidnightBlue;
this.label17.Location = new System.Drawing.Point(27, 16);
this.label17.Name = "label17";
this.label17.Size = new System.Drawing.Size(72, 16);
this.label17.TabIndex = 10;
this.label17.Text = "Matrix A";

///
/// dataGridViewA3
///
this.dataGridA3.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridA3.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridA3.Location = new System.Drawing.Point(12, 49);
this.dataGridA3.Name = "dataGridViewA3";
this.dataGridA3.Size = new System.Drawing.Size(223, 227);
this.dataGridA3.TabIndex = 0;

///
/// textcolumnA3
///
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this.textcolumnA3.Location = new System.Drawing.Point(318, 68);
this.textcolumnA3.Name = "textcolumnA3"
this.textcolumnA3.Size = new System.Drawing.Size(41, 22);
this.textcolumnA3.TabIndex = 13;

//
// textLineA3
//
this.textLineA3.Location = new System.Drawing.Point(318, 19);
this.textLineA3.Name = "textLineA3"
this.textLineA3.Size = new System.Drawing.Size(41, 22);
this.textLineA3.TabIndex = 12;

//
// label14
//
this.label14.Anchor = ((System.Windows.Forms.AnchorStyles)((((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label14.AutoSize = true;
this.label14.Location = new System.Drawing.Point(12, 71);
this.label14.Name = "label14"
this.label14.Size = new System.Drawing.Size(300, 16);
this.label14.TabIndex = 11;
this.label14.Text = "Introduce number of columns of matrix A!";

//
// label15
//
this.label15.Anchor = ((System.Windows.Forms.AnchorStyles)((((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label15.AutoSize = true;
this.label15.Location = new System.Drawing.Point(12, 22);
this.label15.Name = "label15"
this.label15.Size = new System.Drawing.Size(273, 16);
this.label15.TabIndex = 10;
this.label15.Text = "Introduce number of lines of matrix A !";

//
// tabLifting_at_power
//
this.tabLifting_at_power.BackColor = System.Drawing.Color.FromArgb(((int)(((byte)(192)))), ((int)(((byte)(255)))), ((int)(((byte)(192)))));
this.tabLifting_at_power.Controls.Add(this.pictureBox9);
this.tabLifting_at_power.Controls.Add(this.btReset_lifting_at_power);
this.tabLifting_at_power.Controls.Add(this.btComputPower);
this.tabLifting_at_power.Controls.Add(this.btGeneratingA4);
this.tabLifting_at_power.Controls.Add(this.label29);
this.tabLifting_at_power.Controls.Add(this.label21);
this.tabLifting_at_power.Controls.Add(this.panel7);
this.tabLifting_at_power.Controls.Add(this.panel8);
this.tabLifting_at_power.Controls.Add(this.textPower);
this.tabLifting_at_power.Controls.Add(this.textlineA4);
this.tabLifting_at_power.Controls.Add(this.label18);
this.tabLifting_at_power.Controls.Add(this.label19);
this.tabLifting_at_power.Location = new System.Drawing.Point(4, 25);
this.tabLifting_at_power.Name = "tabLifting_at_power";
this.tabLifting_at_power.Padding = new System.Windows.Forms.Padding(3);
this.tabLifting_at_power.Size = new System.Drawing.Size(992, 667);
this.tabLifting_at_power.TabIndex = 3;
this.tabLifting_at_power.Text = "Lifting at power";

// pictureBox9
// this.pictureBox9.Image = ((System.Drawing.Image)(resources.GetObject("pictureBox9.Image")));
this.pictureBox9.Location = new System.Drawing.Point(59, 155);
this.pictureBox9.Name = "pictureBox9";
this.pictureBox9.Size = new System.Drawing.Size(56, 27);
this.pictureBox9.TabIndex = 46;
this.pictureBox9.TabStop = false;

// btReset_lifting_at_power
// this.btReset_lifting_at_power.BackColor = System.Drawing.Color.Pink;
this.btReset_lifting_at_power.ForeColor = System.Drawing.Color.Black;
this.btReset_lifting_at_power.Location = new System.Drawing.Point(319, 420);
this.btReset_lifting_at_power.Name = "btReset_lifting_at_power";
this.btReset_lifting_at_power.Size = new System.Drawing.Size(125, 65);
this.btReset_lifting_at_power.TabIndex = 45;
this.btReset_lifting_at_power.Text = "Reset values";
this.btReset_lifting_at_power.UseVisualStyleBackColor = false;
this.btReset_lifting_at_power.Click += new System.EventHandler(this.btReset_lifting_at_power_Click);

// btComputPower
// this.btComputPower.BackColor = System.Drawing.Color.PowderBlue;
this.btComputPower.ForeColor = System.Drawing.SystemColors.ControlText;
this.btComputPower.Location = new System.Drawing.Point(319, 317);
this.btComputPower.Name = "btComputPower";
this.btComputPower.Size = new System.Drawing.Size(125, 65);
this.btComputPower.TabIndex = 44;
this.btComputPower.Text = "Comput Matrix";
this.btComputPower.UseVisualStyleBackColor = false;
this.btComputPower.Click += new System.EventHandler(this.btComputPower_Click);

// btGeneratingA4

this.btGeneratingA4.BackColor = System.Drawing.Color.PowderBlue;
this.btGeneratingA4.ForeColor = System.Drawing.SystemColors.ControlText;
this.btGeneratingA4.Location = new System.Drawing.Point(319, 209);
this.btGeneratingA4.Name = "btGeneratingA4";
this.btGeneratingA4.Size = new System.Drawing.Size(125, 65);
this.btGeneratingA4.TabIndex = 43;
this.btGeneratingA4.Text = "Generating matrix";
this.btGeneratingA4.UseVisualStyleBackColor = false;
this.btGeneratingA4.Click += new System.EventHandler(this.btGeneratingA4_Click);

// label29

this.label29.AutoSize = true;
this.label29.ForeColor = System.Drawing.Color.Red;
this.label29.Location = new System.Drawing.Point(19, 160);
this.label29.Name = "label29";
this.label29.Size = new System.Drawing.Size(39, 16);
this.label29.TabIndex = 33;
this.label29.Text = "Rem:";

// label21

this.label21.AutoSize = true;
this.label21.ForeColor = System.Drawing.Color.Red;
this.label21.Location = new System.Drawing.Point(21, 127);
this.label21.Name = "label21";
this.label21.Size = new System.Drawing.Size(314, 16);
this.label21.TabIndex = 23;
this.label21.Text = "Rem: Can be lifting at power only quadratic matrices";

// panel7

this.panel7.Controls.Add(this.label27);
this.panel7.Controls.Add(this.label25);
this.panel7.Controls.Add(this.label26);
this.panel7.Controls.Add(this.labelPower);
this.panel7.Controls.Add(this.label24);
this.panel7.Controls.Add(this.dataGridMatrix); // at power n
this.panel7.Location = new System.Drawing.Point(501, 200);
this.panel7.Name = "panel7";
this.panel7.Size = new System.Drawing.Size(257, 297);
this.panel7.TabIndex = 22;

// label27
//
this.label27.AutoSize = true;
this.label27.ForeColor = System.Drawing.Color.Navy;
this.label27.Location = new System.Drawing.Point(34, 25);
this.label27.Name = "label27";
this.label27.Size = new System.Drawing.Size(60, 16);
this.label27.TabIndex = 18;
this.label27.Text = "Matrix";

// label25
//
this.label25.AutoSize = true;
this.label25.Font = new System.Drawing.Font("Microsoft Sans Serif", 8.25F, System.Drawing.FontStyle.Regular, System.Drawing.GraphicsUnit.Point, ((byte)(0)));
this.label25.ForeColor = System.Drawing.Color.Navy;
this.label25.Location = new System.Drawing.Point(128, 13);
this.label25.Name = "label25";
this.label25.Size = new System.Drawing.Size(10, 13);
this.label25.TabIndex = 17;
this.label25.Text = ")";

// label26
//
this.label26.AutoSize = true;
this.label26.Font = new System.Drawing.Font("Microsoft Sans Serif", 8.25F, System.Drawing.FontStyle.Regular, System.Drawing.GraphicsUnit.Point, ((byte)(0)));
this.label26.ForeColor = System.Drawing.Color.Navy;
this.label26.Location = new System.Drawing.Point(107, 13);
this.label26.Name = "label26";
this.label26.Size = new System.Drawing.Size(10, 13);
this.label26.TabIndex = 16;
this.label26.Text = "(";
//
// labelPower
//
this.labelPower.AutoSize = true;
this.labelPower.Font = new System.Drawing.Font("Microsoft Sans Serif", 8.25F, System.Drawing.FontStyle.Regular, System.Drawing.GraphicsUnit.Point, ((byte)(0)));
this.labelPower.ForeColor = System.Drawing.Color.Navy;
this.labelPower.Location = new System.Drawing.Point(114, 13);
this.labelPower.Name = "labelPower";
this.labelPower.Size = new System.Drawing.Size(13, 13);
this.labelPower.TabIndex = 15;
this.labelPower.Text = "1";
//
// label24
//
this.label24.AutoSize = true;
this.label24.ForeColor = System.Drawing.Color.Navy;
this.label24.Location = new System.Drawing.Point(100, 25);
this.label24.Name = "label24";
this.label24.Size = new System.Drawing.Size(17, 16);
this.label24.TabIndex = 14;
this.label24.Text = "A";
//
// dataGridMatrix—at—power—n
//
this.dataGridMatrix—at—power—n.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridMatrix—at—power—n.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridMatrix—at—power—n.Location = new System.Drawing.Point(17, 49);
this.dataGridMatrix—at—power—n.Name = "dataGridMatrix—at—power—n";
this.dataGridMatrix—at—power—n.Size = new System.Drawing.Size(223, 227);
this.dataGridMatrix—at—power—n.TabIndex = 8;
//
// panel8
//
this.panel8.Controls.Add(this.label20);
this.panel8.Controls.Add(this.dataGridA4);
this.panel8.Location = new System.Drawing.Point(16, 209);
this.panel8.Name = "panel8";
this.panel8.Size = new System.Drawing.Size(269, 297);
this.panel8.TabIndex = 20;
//
// label20
///
this.label20.AutoSize = true;
this.label20.ForeColor = System.Drawing.Color.MidnightBlue;
this.label20.Location = new System.Drawing.Point(27, 16);
this.label20.Name = ”label20”;
this.label20.Size = new System.Drawing.Size(72, 16);
this.label20.TabIndex = 10;
this.label20.Text = ”Matrix A”;
///
/// dataGridA4
///
this.dataGridA4.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridA4.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridA4.Location = new System.Drawing.Point(12, 49);
this.dataGridA4.Name = ”dataGridA4”;
this.dataGridA4.Size = new System.Drawing.Size(223, 227);
this.dataGridA4.TabIndex = 0;
///
/// textPower
///
this.textPower.Location = new System.Drawing.Point(311, 76);
this.textPower.Name = ”textPower”;
this.textPower.Size = new System.Drawing.Size(41, 22);
this.textPower.TabIndex = 18;
///
/// textlineA4
///
this.textlineA4.Location = new System.Drawing.Point(382, 24);
this.textlineA4.Name = ”textlineA4”;
this.textlineA4.Size = new System.Drawing.Size(41, 22);
this.textlineA4.TabIndex = 17;
///
/// label18
///
this.label18.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label18.AutoSize = true;
this.label18.Location = new System.Drawing.Point(19, 76);
this.label18.Name = ”label18”;
this.label18.Size = new System.Drawing.Size(286, 16);
this.label18.TabIndex = 16;
this.label18.Text = "Introduce power of lifting for matrix A!";
    //
    // label19
    //
    this.label19.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
    this.label19.AutoSize = true;
    this.label19.Location = new System.Drawing.Point(19, 27);
    this.label19.Name = "label19";
    this.label19.Size = new System.Drawing.Size(357, 16);
    this.label19.TabIndex = 15;
    this.label19.Text = "Introduce number of lines and columns for matrix A!";
    //
    // tabComputDet
    //
    this.tabComputDet.BackColor = System.Drawing.Color.FromArgb(((int)(((byte)(192)))), ((int)(((byte)(255)))), ((int)(((byte)(192)))));
    this.tabComputDet.Controls.Add(this.pictureBox10);
    this.tabComputDet.Controls.Add(this.btReset_values_det);
    this.tabComputDet.Controls.Add(this.btGeneratingA5);
    this.tabComputDet.Controls.Add(this.label30);
    this.tabComputDet.Controls.Add(this.pictureBox8);
    this.tabComputDet.Controls.Add(this.pictureBox7);
    this.tabComputDet.Controls.Add(this.textDet_minus);
    this.tabComputDet.Controls.Add(this.textDet_plus);
    this.tabComputDet.Controls.Add(this.panel10);
    this.tabComputDet.Controls.Add(this.textlineA5);
    this.tabComputDet.Controls.Add(this.label22);
    this.tabComputDet.Location = new System.Drawing.Point(4, 25);
    this.tabComputDet.Name = "tabComputDet";
    this.tabComputDet.Padding = new System.Windows.Forms.Padding(3);
    this.tabComputDet.Size = new System.Drawing.Size(992, 667);
    this.tabComputDet.TabIndex = 4;
    this.tabComputDet.Text = "Computing of determinant";
    //
    // pictureBox10
    //
    this.pictureBox10.Image = ((System.Drawing.Image)(resources.GetObject("pictureBox10.Image")));
    this.pictureBox10.Location = new System.Drawing.Point(53, 82);
    this.pictureBox10.Name = "pictureBox10";
this.pictureBox10.Size = new System.Drawing.Size(56, 27);
this.pictureBox10.TabIndex = 49;
this.pictureBox10.TabStop = false;
//
// bt
−
Reset
−
values
−
det
//
this.bt_Reset_values_det.BackColor = System.Drawing.Color.Pink;
this.bt_Reset_values_det.ForeColor = System.Drawing.Color.Black;
this.bt_Reset_values_det.Location = new System.Drawing.Point(328, 369);
this.bt_Reset_values_det.Name = "bt_Reset_values_det";
this.bt_Reset_values_det.Size = new System.Drawing.Size(125, 65);
this.bt_Reset_values_det.TabIndex = 48;
this.bt_Reset_values_det.Text = "Reset values";
this.bt_Reset_values_det.UseVisualStyleBackColor = false;
bt_Reset_values_det.Click += new System.EventHandler(this.
// btComputingDeterminant
//
this.btComputingDeterminant.BackColor = System.Drawing.Color.PowderBlue;
this.btComputingDeterminant.ForeColor = System.Drawing.SystemColors.ControlText;
this.btComputingDeterminant.Location = new System.Drawing.Point(328, 266);
this.btComputingDeterminant.Name = "btComputingDeterminant";
this.btComputingDeterminant.Size = new System.Drawing.Size(125, 65);
this.btComputingDeterminant.TabIndex = 47;
this.btComputingDeterminant.Text = "Computing determinant";
this.btComputingDeterminant.UseVisualStyleBackColor = false;
btComputingDeterminant_Click = new System.EventHandler(this.
// btGeneratingA5
//
this.btGeneratingA5.BackColor = System.Drawing.Color.PowderBlue;
this.btGeneratingA5.ForeColor = System.Drawing.SystemColors.ControlText;
this.btGeneratingA5.Location = new System.Drawing.Point(328, 158);
this.btGeneratingA5.Name = "btGeneratingA5";
this.btGeneratingA5.Size = new System.Drawing.Size(125, 65);
this.btGeneratingA5.TabIndex = 46;
this.btGeneratingA5.Text = "Generating matrix";
this.btGeneratingA5.UseVisualStyleBackColor = false;
btGeneratingA5_Click = new System.EventHandler(this.
// label30
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```csharp
//
this.label30.AutoSize = true;
this.label30.ForeColor = System.Drawing.Color.Red;
this.label30.Location = new System.Drawing.Point(8, 88);
this.label30.Name = "label30";
this.label30.Size = new System.Drawing.Size(39, 16);
this.label30.TabIndex = 35;
this.label30.Text = "Rem:";
//
// pictureBox8
//
this.pictureBox8.BackColor = System.Drawing.Color.White;
this.pictureBox8.Image = ((System.Drawing.Image)(resources.GetObject("pictureBox8.Image")));
this.pictureBox8.Location = new System.Drawing.Point(547, 271);
this.pictureBox8.Name = "pictureBox8";
this.pictureBox8.Size = new System.Drawing.Size(83, 31);
this.pictureBox8.TabIndex = 28;
this.pictureBox8.TabStop = false;
//
// pictureBox7
//
this.pictureBox7.BackColor = System.Drawing.Color.White;
this.pictureBox7.Image = ((System.Drawing.Image)(resources.GetObject("pictureBox7.Image")));
this.pictureBox7.Location = new System.Drawing.Point(547, 197);
this.pictureBox7.Name = "pictureBox7";
this.pictureBox7.Size = new System.Drawing.Size(83, 33);
this.pictureBox7.TabIndex = 27;
this.pictureBox7.TabStop = false;
//
// textDet_minus
//
this.textDet_minus.Location = new System.Drawing.Point(636, 275);
this.textDet_minus.Name = "textDet_minus";
this.textDet_minus.Size = new System.Drawing.Size(71, 22);
this.textDet_minus.TextAlign = System.Windows.Forms.HorizontalAlignment.Right;
//
// textDet_plus
//
this.textDet_plus.Location = new System.Drawing.Point(636, 202);
this.textDet_plus.Name = "textDet_plus";
```
this.textDet._plus.Size = new System.Drawing.Size(71, 22);
this.textDet._plus.TabIndex = 25;
this.textDet._plus.TextAlign = System.Windows.Forms.HorizontalAlignment.Right;
//
// panel10
//
this.panel10.Controls.Add(this.label23);
this.panel10.Controls.Add(this.dataGridA5);
this.panel10.Location = new System.Drawing.Point(25, 158);
this.panel10.Name = "panel10";
this.panel10.Size = new System.Drawing.Size(269, 297);
this.panel10.TabIndex = 23;
//
// label23
//
this.label23.AutoSize = true;
this.label23.ForeColor = System.Drawing.Color.MidnightBlue;
this.label23.Location = new System.Drawing.Point(27, 16);
this.label23.Name = "label23";
this.label23.Size = new System.Drawing.Size(72, 16);
this.label23.TabIndex = 10;
this.label23.Text = "Matrix A";
//
// dataGridA5
//
this.dataGridA5.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridA5.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridA5.Location = new System.Drawing.Point(12, 49);
this.dataGridA5.Name = "dataGridA5";
this.dataGridA5.Size = new System.Drawing.Size(223, 227);
this.dataGridA5.TabIndex = 0;
//
// textlineA5
//
this.textlineA5.Location = new System.Drawing.Point(371, 27);
this.textlineA5.Name = "textlineA5";
this.textlineA5.Size = new System.Drawing.Size(41, 22);
this.textlineA5.TabIndex = 21;
//
// label22
//
this.label22.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Left | System.Windows.Forms.AnchorStyles.Top) | System.Windows.Forms.AnchorStyles.Right)));
//
// dataGridA6
//
this.dataGridA6.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridA6.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridA6.Location = new System.Drawing.Point(12, 49);
this.dataGridA6.Name = "dataGridA6";
this.dataGridA6.Size = new System.Drawing.Size(223, 227);
this.dataGridA6.TabIndex = 0;
//
// textlineA6
//
this.textlineA6.Location = new System.Drawing.Point(371, 27);
this.textlineA6.Name = "textlineA6";
this.textlineA6.Size = new System.Drawing.Size(41, 22);
this.textlineA6.TabIndex = 21;
//
// label23
//
this.label23.Text = "Matrix B";
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Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom} | System.Windows.Forms.AnchorStyles.Left));
        this.label22.AutoSize = true;
        this.label22.Location = new System.Drawing.Point(8, 30);
        this.label22.Name = "label22";
        this.label22.Size = new System.Drawing.SizeF(357, 16);
        this.label22.TabIndex = 20;
        this.label22.Text = "Introduce number of lines and columns of matrix A !";
        //
        // tabPage1
        //
        tabPage1.BackColor = System.Drawing.Color.FromArgb(((int)(((byte)(192)))), ((int)(((byte)(255)))), ((int)(((byte)(192)))));
        tabPage1.Controls.Add(this.btResetSystem);
        tabPage1.Controls.Add(this.btComputSystem);
        tabPage1.Controls.Add(this.btGeneratingMatrices);
        tabPage1.Controls.Add(this.panel12);
        tabPage1.Controls.Add(this.panel9);
        tabPage1.Controls.Add(this.panel11);
        tabPage1.Controls.Add(this.textk);
        tabPage1.Controls.Add(this.textlineA6);
        tabPage1.Controls.Add(this.label39);
        tabPage1.Controls.Add(this.label40);
        tabPage1.Location = new System.Drawing.Point(4, 25);
        tabPage1.Name = "tabPage1";
        tabPage1.Padding = new System.Windows.Forms.Padding(3);
        tabPage1.Size = new System.Drawing.Size(992, 667);
        tabPage1.TabIndex = 5;
        tabPage1.Text = "Solving of system";
        //
        // panel12
        //
        panel12.Controls.Add(this.label41);
        panel12.Controls.Add(this.dataGridX0);
        panel12.Location = new System.Drawing.Point(293, 103);
        panel12.Name = "panel12";
        panel12.Size = new System.Drawing.Size(126, 282);
        panel12.TabIndex = 64;
        //
        // label41
        //
        this.label41.AutoSize = true;
        this.label41.ForeColor = System.Drawing.Color.MidnightBlue;
this.label41.Location = new System.Drawing.Point(27, 16);
this.label41.Name = "label41";
this.label41.Size = new System.Drawing.Size(84, 16);
this.label41.TabIndex = 10;
this.label41.Text = "Matrix x(0)";
//
// dataGridX0
//
this.dataGridX0.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridX0.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridX0.Location = new System.Drawing.Point(30, 49);
this.dataGridX0.Name = "dataGridX0";
this.dataGridX0.Size = new System.Drawing.Size(67, 227);
this.dataGridX0.TabIndex = 0;
//
// panel9
//
this.panel9.Controls.Add(this.label_k);
this.panel9.Controls.Add(this.label32);
this.panel9.Controls.Add(this.label33);
this.panel9.Controls.Add(this.label37);
this.panel9.Controls.Add(this.dataGridSolutionXk);
this.panel9.Location = new System.Drawing.Point(630, 103);
this.panel9.Name = "panel9";
this.panel9.Size = new System.Drawing.Size(257, 282);
this.panel9.TabIndex = 62;
//
// label_k
//
this.label_k.ForeColor = System.Drawing.Color.Navy;
this.label_k.Location = new System.Drawing.Point(112, 25);
this.label_k.Name = "label_k";
this.label_k.Size = new System.Drawing.Size(19, 18);
this.label_k.TabIndex = 20;
this.label_k.Text = "k";
//
// label32
//
this.label32.AutoSize = true;
this.label32.Font = new System.Drawing.Font("Microsoft Sans Serif", 9.75F, System.Drawing.FontStyle.Regular, System.Drawing.GraphicsUnit.Point, ((byte)(0)));
this.label32.ForeColor = System.Drawing.Color.Navy;
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this.label32.Location = new System.Drawing.Point(129, 25);
this.label32.Name = "label32";
this.label32.Size = new System.Drawing.Size(12, 16);
this.label32.TabIndex = 19;
this.label32.Text = ")";

// label33

this.label33.AutoSize = true;
this.label33.ForeColor = System.Drawing.Color.Navy;
this.label33.Location = new System.Drawing.Point(34, 25);
this.label33.Name = "label33";
this.label33.Size = new System.Drawing.Size(60, 16);
this.label33.TabIndex = 18;
this.label33.Text = "Matrix";

// label37

this.label37.AutoSize = true;
this.label37.ForeColor = System.Drawing.Color.Navy;
this.label37.Location = new System.Drawing.Point(100, 25);
this.label37.Name = "label37";
this.label37.Size = new System.Drawing.Size(18, 16);
this.label37.TabIndex = 14;
this.label37.Text = "x(";

// dataGridSolutionXk

this.dataGridSolutionXk.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridSolutionXk.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridSolutionXk.Location = new System.Drawing.Point(54, 49);
this.dataGridSolutionXk.Name = "dataGridSolutionXk";
this.dataGridSolutionXk.Size = new System.Drawing.Size(77, 227);
this.dataGridSolutionXk.TabIndex = 8;

// panel11

this.panel11.Controls.Add(this.label38);
this.panel11.Controls.Add(this.dataGridA6);
this.panel11.Location = new System.Drawing.Point(18, 103);
this.panel11.Name = "panel11";
this.panel11.Size = new System.Drawing.Size(269, 282);
this.panel11.TabIndex = 60;

//
// label38
//
this.label38.AutoSize = true;
this.label38.ForeColor = System.Drawing.Color.MidnightBlue;
this.label38.Location = new System.Drawing.Point(27, 16);
this.label38.Name = "label38"
this.label38.Size = new System.Drawing.Size(72, 16);
this.label38.TabIndex = 10;
this.label38.Text = "Matrix A";

//
// dataGridA6
//
this.dataGridA6.BackgroundColor = System.Drawing.Color.WhiteSmoke;
this.dataGridA6.ColumnHeadersHeightSizeMode = System.Windows.Forms.DataGridViewColumnHeadersHeightSizeMode.AutoSize;
this.dataGridA6.Location = new System.Drawing.Point(23, 49);
this.dataGridA6.Name = "dataGridA6";
this.dataGridA6.Size = new System.Drawing.Size(223, 227);
this.dataGridA6.TabIndex = 0;

//
// textk
//
this.textk.Location = new System.Drawing.Point(176, 66);
this.textk.Name = "textk"
this.textk.Size = new System.Drawing.Size(41, 22);
this.textk.TabIndex = 58;

//
// textlineA6
//
this.textlineA6.Location = new System.Drawing.Point(378, 26);
this.textlineA6.Name = "textlineA6"
this.textlineA6.Size = new System.Drawing.Size(41, 22);
this.textlineA6.TabIndex = 57;

//
// label39
//
this.label39.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label39.AutoSize = true;
this.label39.Location = new System.Drawing.Point(15, 66);
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this.label39.Name = "label39";
this.label39.Size = new System.Drawing.Size(155, 16);
this.label39.TabIndex = 56;
this.label39.Text = "Introduce value of k!";

//
// label40
//
this.label40.Anchor = ((System.Windows.Forms.AnchorStyles)(((System.Windows.Forms.AnchorStyles.Top | System.Windows.Forms.AnchorStyles.Bottom) | System.Windows.Forms.AnchorStyles.Left)));
this.label40.AutoSize = true;
this.label40.Location = new System.Drawing.Point(15, 29);
this.label40.Name = "label40";
this.label40.Size = new System.Drawing.Size(357, 16);
this.label40.TabIndex = 55;
this.label40.Text = "Introduce number of lines and columns of matrix A!";

//
// btResetSystem
//
this.btResetSystem.BackColor = System.Drawing.Color.Pink;
this.btResetSystem.ForeColor = System.Drawing.Color.Black;
this.btResetSystem.Location = new System.Drawing.Point(461, 314);
this.btResetSystem.Name = "btResetSystem";
this.btResetSystem.Size = new System.Drawing.Size(125, 65);
this.btResetSystem.TabIndex = 67;
this.btResetSystem.Text = "Reset values";
this.btResetSystem.UseVisualStyleBackColor = false;
this.btResetSystem.Click += new System.EventHandler(this.btResetSystem_Click);

//
// btComputSystem
//
this.btComputSystem.BackColor = System.Drawing.Color.PowderBlue;
this.btComputSystem.ForeColor = System.Drawing.SystemColors.ControlText;
this.btComputSystem.Location = new System.Drawing.Point(461, 211);
this.btComputSystem.Name = "btComputSystem";
this.btComputSystem.Size = new System.Drawing.Size(125, 65);
this.btComputSystem.TabIndex = 66;
this.btComputSystem.Text = "Computing matrix x(k)";
this.btComputSystem.UseVisualStyleBackColor = false;
this.btComputSystem.Click += new System.EventHandler(this.btComputSystem_Click);

//
// btGeneratingMatrices
//
this.btGeneratingMatrices.BackColor = System.Drawing.Color.PowderBlue;
this.btGeneratingMatrices.ForeColor = System.Drawing.SystemColors.ControlText;
this.btGeneratingMatrices.Location = new System.Drawing.Point(461, 103);
this.btGeneratingMatrices.Name = "btGeneratingMatrices";
this.btGeneratingMatrices.Size = new System.Drawing.Size(125, 65);
this.btGeneratingMatrices.TabIndex = 65;
this.btGeneratingMatrices.Text = "Generating matrix";
this.btGeneratingMatrices.UseVisualStyleBackColor = false;
this.btGeneratingMatrices.Click += new System.EventHandler(this.
btGeneratingMatrices_Click);

//
// Form1
//
this.AutoScaleDimensions = new System.Drawing.SizeF(8F, 16F);
this.AutoScaleMode = System.Windows.Forms.AutoScaleMode.Font;
this.BackColor = System.Drawing.Color.FromArgb(((int)(((byte)(192)))), ((int)(((byte)(255)))), ((int)(((byte)(192)))));
this.ClientSize = new System.Drawing.Size(1024, 742);
this.Controls.Add(this.tabControl1);
this.Font = new System.Drawing.Font("Microsoft Sans Serif", 9.75F, System.Drawing.FontStyle.Regular, System.Drawing.GraphicsUnit.Point, ((byte)(0)));
this.Margin = new System.Windows.Forms.Padding(4);
this.Name = "Form1";
this.Text = "Operations with matrices in min-plus algebra";
this.tabControl1.ResumeLayout(false);
this.tabAddition.ResumeLayout(false);
this.tabAddition.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox1)).EndInit();
this.panel1.ResumeLayout(false);
((System.ComponentModel.ISupportInitialize)(this.pictureBox2)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridResAddition)).EndInit();
this.panel2.ResumeLayout(false);
this.panel2.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridB)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridA)).EndInit();
this.tabMultiplication.ResumeLayout(false);
this.tabMultiplication.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox3)).EndInit();
this.panel3.ResumeLayout(false);
((System.ComponentModel.ISupportInitialize)(this.pictureBox4)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct)).EndInit();
this.panel4.ResumeLayout(false);
((System.ComponentModel.ISupportInitialize)(this.pictureBox5)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox6)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct1)).EndInit();
this.tabSolving.ResumeLayout(false);
this.tabSolving.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox7)).EndInit();
this.panel5.ResumeLayout(false);
((System.ComponentModel.ISupportInitialize)(this.pictureBox8)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct2)).EndInit();
this.panel6.ResumeLayout(false);
this.panel6.PerformLayout();
this.tabControl2.ResumeLayout(false);
this.tabControl2.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox9)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox10)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct3)).EndInit();
this.panel7.ResumeLayout(false);
this.panel7.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox11)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox12)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct4)).EndInit();
this.panel8.ResumeLayout(false);
this.panel8.PerformLayout();
this.tabControl3.ResumeLayout(false);
this.tabControl3.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox13)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox14)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct5)).EndInit();
this.panel9.ResumeLayout(false);
this.panel9.PerformLayout();
this.tabControl4.ResumeLayout(false);
this.tabControl4.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox15)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox16)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct6)).EndInit();
this.panel10.ResumeLayout(false);
this.panel10.PerformLayout();
this.tabControl5.ResumeLayout(false);
this.tabControl5.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox17)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox18)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct7)).EndInit();
this.panel11.ResumeLayout(false);
this.panel11.PerformLayout();
this.tabControl6.ResumeLayout(false);
this.tabControl6.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox19)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox20)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct8)).EndInit();
this.panel12.ResumeLayout(false);
this.panel12.PerformLayout();
this.tabControl7.ResumeLayout(false);
this.tabControl7.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox21)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox22)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct9)).EndInit();
this.panel13.ResumeLayout(false);
this.panel13.PerformLayout();
this.tabControl8.ResumeLayout(false);
this.tabControl8.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox23)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox24)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct10)).EndInit();
this.panel14.ResumeLayout(false);
this.panel14.PerformLayout();
this.tabControl9.ResumeLayout(false);
this.tabControl9.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox25)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox26)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct11)).EndInit();
this.panel15.ResumeLayout(false);
this.panel15.PerformLayout();
this.tabControl10.ResumeLayout(false);
this.tabControl10.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox27)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox28)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProduct12)).EndInit();
this.panel16.ResumeLayout(false);
this.panel16.PerformLayout();
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```csharp
this.panel4.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridB2)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridA2)).EndInit();
this.tabMultiplication_scalar.ResumeLayout(false);
this.tabMultiplication_scalar.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox6)).EndInit();
this.panel6.PerformLayout(false);
((System.ComponentModel.ISupportInitialize)(this.pictureBox5)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.dataGridProductScalar)).EndInit();
this.panel5.PerformLayout(false);
this.panel5.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridA3)).EndInit();
this.tabLifting_at_power.ResumeLayout(false);
this.tabLifting_at_power.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox9)).EndInit();
this.panel7.PerformLayout(false);
this.panel7.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridMatrix_at_power_n)).EndInit();
this.panel8.ResumeLayout(false);
this.panel8.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridA4)).EndInit();
this.tabComputDet.ResumeLayout(false);
this.tabComputDet.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.pictureBox10)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox8)).EndInit();
((System.ComponentModel.ISupportInitialize)(this.pictureBox7)).EndInit();
this.panel10.ResumeLayout(false);
this.panel10.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridA5)).EndInit();
this.tabPage1.ResumeLayout(false);
this.tabPage1.PerformLayout();
this.panel12.ResumeLayout(false);
this.panel12.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridX0)).EndInit();
this.panel9.ResumeLayout(false);
this.panel9.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridSolutieXk)).EndInit();
this.panel11.ResumeLayout(false);
this.panel11.PerformLayout();
((System.ComponentModel.ISupportInitialize)(this.dataGridA6)).EndInit();
this.ResumeLayout(false);
```
#endregion
private System.Windows.Forms.TabControl tabControl1;
private System.Windows.Forms.TabPage tabAddition;
private System.Windows.Forms.TabPage tabMultiplication;
private System.Windows.Forms.TabPage tabMultiplication_scalar;
private System.Windows.Forms.Panel panel2;
private System.Windows.Forms.DataGridView dataGridB;
private System.Windows.Forms.DataGridView dataGridA;
private System.Windows.Forms.TextBox textColumn;
private System.Windows.Forms.TextBox textLine;
private System.Windows.Forms.Label label3;
private System.Windows.Forms.Label label2;
private System.Windows.Forms.Label label4;
private System.Windows.Forms.Label label1;
private System.Windows.Forms.Panel panel1;
private System.Windows.Forms.DataGridView dataGridResAddition;
private System.Windows.Forms.PictureBox pictureBox2;
private System.Windows.Forms.TextBox textcolumnB2;
private System.Windows.Forms.TextBox textLineB2;
private System.Windows.Forms.Label label11;
private System.Windows.Forms.Label label12;
private System.Windows.Forms.Panel panel3;
private System.Windows.Forms.DataGridView dataGridProduct;
private System.Windows.Forms.Panel panel4;
private System.Windows.Forms.DataGridView dataGridB2;
private System.Windows.Forms.DataGridView dataGridA2;
private System.Windows.Forms.TextBox textcolumnA2;
private System.Windows.Forms.TextBox textLineA2;
private System.Windows.Forms.Label label14;
private System.Windows.Forms.Label label15;
private System.Windows.Forms.PictureBox pictureBox4;
private System.Windows.Forms.Panel panel5;
private System.Windows.Forms.DataGridView dataGridA3;
private System.Windows.Forms.TextBox textcolumnA3;
private System.Windows.Forms.TextBox textLineA3;
private System.Windows.Forms.Label label14;
private System.Windows.Forms.Label label15;
private System.Windows.Forms.TextBox textScalar;
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private System.Windows.Forms.Label label16;
private System.Windows.Forms.Panel panel6;
private System.Windows.Forms.PictureBox pictureBox5;
private System.Windows.Forms.DataGridView dataGridViewProductScalar;
private System.Windows.Forms.TabControl tabLiftingAtPower;
private System.Windows.Forms.Panel panel7;
private System.Windows.Forms.DataGridView dataGridViewMatrixAtPowerN;
private System.Windows.Forms.Panel panel8;
private System.Windows.Forms.DataGridView dataGridViewA4;
private System.Windows.Forms.TextBox textPower;
private System.Windows.Forms.TextBox textlineA4;
private System.Windows.Forms.Label label18;
private System.Windows.Forms.Label label19;
private System.Windows.Forms.TabPage tabComputDet;
private System.Windows.Forms.TextBox textlineA5;
private System.Windows.Forms.Label label22;
private System.Windows.Forms.Label label25;
private System.Windows.Forms.Label label26;
private System.Windows.Forms.Label labelPower;
private System.Windows.Forms.Label label24;
private System.Windows.Forms.Panel panel10;
private System.Windows.Forms.Label label23;
private System.Windows.Forms.DataGridView dataGridViewA5;
private System.Windows.Forms.PictureBox pictureBox8;
private System.Windows.Forms.PictureBox pictureBox7;
private System.Windows.Forms.TextBox textDetMinus;
private System.Windows.Forms.TextBox textDetPlus;
private System.Windows.Forms.Label label27;
private System.Windows.Forms.Label label6;
private System.Windows.Forms.PictureBox pictureBox1;
private System.Windows.Forms.Label label5;
private System.Windows.Forms.Label label28;
private System.Windows.Forms.Label label29;
private System.Windows.Forms.Label label30;
private System.Windows.Forms.Button btGenerating;
private System.Windows.Forms.Button btReset;
private System.Windows.Forms.Button btComputSum;
private System.Windows.Forms.Button btComputProduct;
private System.Windows.Forms.Button btGenerating2;
private System.Windows.Forms.Button btResetMultiplication;
private System.Windows.Forms.Button btResetProductScalar;
The principal program is constituted from the following lines.

using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Text;
using System.Windows.Forms;
namespace Operations_with_matrices
{
    public partial class Form1 : Form
    {
        public Form1()
        {
            InitializeComponent();
        }
        public int[,] A5 = new int[50, 50];
        private void initMatrixA()
        {
            // Create an unbound DataGridView by declaring a column count.
            int column = 0;
            column = Convert.ToInt16(textColumn.Text);
            dataGridViewA.ColumnCount = column;
            dataGridViewA.AllowUserToOrderColumns = false;
            dataGridViewA.AllowUserToAddRows = false;
            dataGridViewA.Enabled = true;
            dataGridViewA.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
            dataGridViewA.ColumnHeaderBorderStyle = DataGridViewHeaderBorderStyle.Raised;
            dataGridViewA.CellBorderStyle = DataGridViewCellBorderStyle.Single;
            dataGridViewA.GridColor = Color.DodgerBlue;
            dataGridViewA.ColumnHeadersVisible = false;
            dataGridViewA.RowHeadersVisible = false;
            dataGridViewA.BackgroundColor = Color.WhiteSmoke;
            dataGridViewA.BorderStyle = BorderStyle.None;
            dataGridViewA.AllowUserToResizeColumns = true;
            DataGridViewCellStyle style = new DataGridViewCellStyle();
            style.Format = "N0";
            dataGridViewA.DefaultCellStyle = style;
            dataGridViewA.DefaultCellStyle = Font(12.75F);
            // Set the column header style.
            DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
            columnHeaderStyle.BackColor = Color.AntiqueWhite;
            columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
            dataGridViewA.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
            dataGridViewA.DefaultCellStyle = style;
            // Set the column header style.
            DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
            columnHeaderStyle.BackColor = Color.AntiqueWhite;
            columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
            dataGridViewA.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
            dataGridViewA.DefaultCellStyle = style;
            DataGridViewCell CellR = new DataGridViewTextBoxCell();
        }
    }
}
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;

DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textLine.Text);
dataGridA.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridA.Columns[i].Name = "C" + (i + 1);
    dataGridA.Columns[i].CellTemplate = CellR;
    dataGridA.Columns[i].Width = 30;
    dataGridA.Columns[i].DefaultCellStyle = style;
}

private void initMatrixB()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
    column = Convert.ToInt16(textColumn.Text);
dataGridB.ColumnCount = column;
dataGridB.AllowUserToOrderColumns = false;
dataGridB.AllowUserToAddRows = false;
dataGridB.Enabled = true;
dataGridB.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridB.ColumnHeaderBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridB.CellBorderStyle = DataGridViewCellBorderStyle.Single;
dataGridB.GridColor = Color.DodgerBlue;
dataGridB.ColumnHeaderVisible = false;
dataGridB.RowHeadersVisible = false;
dataGridB.BackgroundColor = Color.WhiteSmoke;
dataGridB.BorderStyle = BorderStyle.None;
dataGridB.AllowUserToResizeColumns = true;
    // dataGridB.DefaultCellStyle = Font(12.75F);
    // Set the column header style.
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
    columnHeaderStyle.BackColor = Color.AntiqueWhite;
    columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridB.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
    DataGridViewCell CellR = new DataGridViewTextBoxCell();
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CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textLine.Text);
dataGridB.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridViewB.Columns[i].Name = "C" + (i + 1);
    dataGridViewB.Columns[i].CellTemplate = CellR;
dataGridB.Columns[i].Width = 30;
}

private void initMatrixA2()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
column = Convert.ToInt16(textColumnA2.Text);
dataGridA2.ColumnCount = column;
dataGridA2.AllowUserToOrderColumns = false;
dataGridA2.AllowUserToAddRows = false;
dataGridA2.Enabled = true;
dataGridA2.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridA2.ColumnHeaderBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridA2.DefaultCellStyle = new DataGridViewCellStyle();
    columnHeaderStyle.BackColor = Color.AntiqueWhite;
    columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridResAddition.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
dataGridA2.DefaultCellStyle.Alignment = DataGridViewContentAlignment.MiddleRight;
DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textLineA2.Text);
dataGridA2.RowCount = line;
for (int i = 0; i < column; i++)
{
    //dataGridA2.Columns[i].Name = "C" + (i + 1);
dataGridA2.Columns[i].Name = "C" + (i + 1);
dataGridA2.Columns[i].CellTemplate = CellR;
dataGridA2.Columns[i].Width = 30;
}
private void initMatrixB2()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
column = Convert.ToInt16(textColumnB2.Text);
dataGridB2.ColumnCount = column;
dataGridB2.AllowUserToOrderColumns = false;
dataGridB2.AllowUserToAddRows = false;
dataGridB2.Enabled = true;
dataGridB2.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridB2.ColumnHeaderBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridB2.ColumnHeaderStyle = DataGridViewCellStyle.Right;
DataGridViewCell CellR = new DataGridViewTextBoxCell();
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
}
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textLineB2.Text);
dataGridB2.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridB2.Columns[i].Name = "C" + (i + 1);
dataGridB2.Columns[i].CellTemplate = CellR;
dataGridB2.Columns[i].Width = 30;
}
private void initMatrixA3()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
column = Convert.ToInt16(textcolumnA3.Text);
dataGridA3.ColumnCount = column;
dataGridA3.AllowUserToOrderColumns = false;
dataGridA3.AllowUserToAddRows = false;
dataGridA3.Enabled = true;
dataGridA3.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridA3.ColumnHeadersBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridA3.CellBorderStyle = DataGridViewCellBorderStyle.Single;
dataGridA3.GridColor = Color.DodgerBlue;
dataGridA3.RowHeadersVisible = false;
dataGridA3.RowHeadersVisible = false;
dataGridA3.BackgroundColor = Color.WhiteSmoke;
dataGridA3.BorderStyle = BorderStyle.None;
dataGridA3.AllowUserToResizeColumns = true;
    // dataGridViewA3.DefaultCellStyle = Font(12.75F);
    // Set the column header style.
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
columnHeaderStyle.BackColor = Color.AntiqueWhite;
columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridA3.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
DataGridViewCell CellR = new DataGridViewTextBoxCell();
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
    line = Convert.ToInt16(textLineA3.Text);
dataGridA3.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridA3.Columns[i].Name = "C" + (i + 1);
dataGridA3.Columns[i].CellTemplate = CellR;
dataGridA3.Columns[i].Width = 30;
}
}
private void initMatrixA4()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
column = Convert.ToInt16(textlineA4.Text);
dataGridA4.ColumnCount = column;
dataGridA4.AllowUserToOrderColumns = false;
dataGridA4.AllowUserToAddRows = false;
dataGridA4.Enabled = true;
dataGridA4.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.
    DisplayedCellsExceptHeaders;
dataGridA4.ColumnHeaderBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridA4.CellBorderStyle = DataGridViewCellBorderStyle.Single;
dataGridA4.GridColor = Color.DodgerBlue;
dataGridA4.ColumnHeaderVisible = false;
dataGridA4.RowHeadersVisible = false;
dataGridA4.BackgroundColor = Color.WhiteSmoke;
dataGridA4.BorderStyle = BorderStyle.None;
dataGridA4.AllowUserToResizeColumns = true;
    // dataGridA4.DefaultCellStyle = Font(12.75F);
    // Set the column header style.
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
columnHeaderStyle.BackColor = Color.AntiqueWhite;
columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridA4.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
DataGridViewCell CellR = new DataGridViewTextBoxCell();
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textlineA4.Text);
dataGridA4.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridA4.Columns[i].Name = ”C” + (i + 1);
dataGridA4.Columns[i].CellTemplate = CellR;
dataGridA4.Columns[i].Width = 30;
}
}

private void initMatrixA5()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
column = Convert.ToInt16(textlineA5.Text);
dataGridA5.ColumnCount = column;
dataGridA5.AllowUserToOrderColumns = false;
dataGridA5.AllowUserToAddRows = false;
dataGridA5.Enabled = true;
dataGridA5.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridA5.ColumnHeaderBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridA5.CellBorderStyle = DataGridViewCellBorderStyle.Single;
dataGridA5.GridColor = Color.DodgerBlue;
dataGridA5.RowHeadersVisible = false;
dataGridA5.RowHeadersVisible = false;
dataGridA5.BackgroundColor = Color.WhiteSmoke;
dataGridA5.BorderStyle = BorderStyle.None;
dataGridA5.AllowUserToResizeColumns = true;
    // dataGridA5.DefaultCellStyle = Font(12.75F);
    // Set the column header style.
    DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
    columnHeaderStyle.BackColor = Color.AntiqueWhite;
    columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridA5.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
    DataGridViewCell CellR = new DataGridViewTextBoxCell();
    CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
    DataGridViewCell CellL = new DataGridViewTextBoxCell();
    CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
    int line = 0;
    line = Convert.ToInt16(textlineA5.Text);
dataGridA5.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridA5.Columns[i].Name = "C" + (i + 1);
dataGridA5.Columns[i].CellTemplate = CellR;
dataGridA5.Columns[i].Width = 30;
}

private void initMatrixA6()
{
int column = 0;
column = Convert.ToInt16(textlineA6.Text);
dataGridA6.ColumnCount = column;
dataGridA6.AllowUserToOrderColumns = false;
dataGridA6.AllowUserToAddRows = false;
dataGridA6.Enabled = true;
dataGridA6.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridA6.ColumnHeaderBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridA6.ColumnHeaderBorderStyle = DataGridViewCellBorderStyle.Single;
dataGridA6.GridView.BorderStyle = BorderStyle.None;
dataGridA6.GridView.BackgroundColor = Color.WhiteSmoke;
dataGridA6.GridView.BorderStyle = BorderStyle.None;
dataGridA6.GridView.AllowUserToResizeColumns = true;
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
columnHeaderStyle.BackColor = Color.AntiqueWhite;
columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridA6.GridView.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
DataGridViewCell CellR = new DataGridViewTextBoxCell();
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;

int line = 0;
line = Convert.ToInt16(textlineA6.Text);
dataGridA6.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridA6.Columns[i].Name = "C" + (i + 1);
dataGridA6.Columns[i].CellTemplate = CellR;
dataGridA6.Columns[i].Width = 30;
}
}
private void initMatrixX0()
{
    int column = 0;
    column = 1;
    dataGridX0.ColumnCount = column;
    dataGridX0.AllowUserToOrderColumns = false;
    dataGridX0.AllowUserToAddRows = false;
    dataGridX0.Enabled = true;
    dataGridX0.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.
DisplayedCellsExceptHeaders;
    dataGridX0.ColumnHeaderBorderStyle = DataGridviewHeaderBorderStyle.Raised;
    dataGridX0.ColumnHeaderBorderStyle = DataGridviewCellBorderStyle.Single;
    dataGridX0.GridViewColor = Color.DodgerBlue;
    dataGridX0.ColumnHeaderBorderStyle = false;
    dataGridX0.ColumnHeaderBorderStyle = false;
    dataGridX0.ColumnHeaderBorderStyle = Color.WhiteSmoke;
    dataGridX0.ColumnHeaderBorderStyle = BorderStyle.None;
    dataGridX0.AllowUserToResizeColumns = true;
    DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
    columnHeaderStyle.BackColor = Color.AntiqueWhite;
    columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
    dataGridX0.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
    dataGridViewCell CellR = new DataGridViewTextBoxCell();
    CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
    dataGridViewCell CellL = new DataGridViewTextBoxCell();
    CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
    line = 0;
    line = Convert.ToInt16(textlineA6.Text);
    dataGridX0.RowCount = line;
    for (int i = 0; i < column; i++)
    {
        dataGridX0.Columns[i].Name = “C” + (i + 1);
        dataGridX0.Columns[i].CellTemplate = CellR;
        dataGridX0.Columns[i].Width = 30;
    }
}
private void initMatrixAdditionResult()
// Create an unbound DataGridView by declaring a column count.
int column = 0;
column = Convert.ToInt16(textcolumn.Text);
dataGridResAddition.ColumnCount = column;
dataGridResAddition.AllowUserToOrderColumns = false;
dataGridResAddition.AllowUserToAddRows = false;
dataGridResAddition.Enabled = true;
dataGridResAddition.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridResAddition.ColumnHeaderBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridResAddition.CellBorderStyle = DataGridViewCellBorderStyle.Single;
dataGridResAddition.GridColumnColor = Color.DodgerBlue;
dataGridResAddition.ColumnHeaderVisible = false;
dataGridResAddition.RowHeadersVisible = false;
dataGridResAddition.BackgroundColor = Color.WhiteSmoke;
dataGridResAddition.BorderStyle = BorderStyle.None;
dataGridResAddition.AllowUserToResizeColumns = true;
// dataGridResAddition.DefaultCellStyle = Font(12.75F);
// Set the column header style.
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
columnHeaderStyle.BackColor = Color.AntiqueWhite;
columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridResAddition.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
DataGridViewCell CellR = new DataGridViewTextBoxCell();
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textLine.Text);
dataGridResAddition.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridResAddition.Columns[i].Name = "C" + (i + 1);
dataGridResAddition.Columns[i].CellTemplate = CellR;
dataGridResAddition.Columns[i].Width = 30;
}
private void initMatrixProduct()
{
    // Create an unbound DataGridView by declaring a column count.
}
int column = 0;
column = Convert.ToInt16(textcolumnB2.Text);
dataGridProduct.ColumnCount = column;
dataGridProduct.AllowUserToOrderColumns = false;
dataGridProduct.AllowUserToAddRows = false;
dataGridProduct.Enabled = true;
dataGridProduct.AllowUserToResizeColumns = true;
// dataGridProduct.DefaultCellStyle = Font(12.75F);
// Set the column header style.
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
columnHeaderStyle.BackColor = Color.AntiqueWhite;
columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridProduct.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
DataGridViewCell CellR = new DataGridViewTextBoxCell();
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textLineA2.Text);
dataGridProduct.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridProduct.Columns[i].Name = "C" + (i + 1);
    dataGridProduct.Columns[i].CellTemplate = CellR;
    dataGridProduct.Columns[i].Width = 30;
}
private void initMatrixScalarProduct()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
column = Convert.ToInt16(textColumnA3.Text);
dataGridScalarProduct.ColumnCount = column;
dataGridScalarProduct.AllowUserToOrderColumns = false;
dataGridScalarProduct.AllowUserToAddRows = false;
dataGridScalarProduct.Enabled = true;
dataGridScalarProduct.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridScalarProduct.ColumnHeaderBorderStyle = DataGridViewColumnHeaderBorderStyle.Raised;
dataGridScalarProduct.GridColor = Color.DodgerBlue;
dataGridScalarProduct.ColumnHeaderVisible = false;
dataGridScalarProduct.RowHeadersVisible = false;
dataGridScalarProduct.BackgroundColor = Color.WhiteSmoke;
dataGridScalarProduct.BorderStyle = BorderStyle.None;
dataGridScalarProduct.AllowUserToResizeColumns = true;

// Set the column header style.
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
columnHeaderStyle.BackColor = Color.AntiqueWhite;
columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridScalarProduct.ColumnHeaderDefaultCellStyle = columnHeaderStyle;

for (int i = 0; i < column; i++)
{
    dataGridScalarProduct.Columns[i].Name = "C" + (i + 1);
dataGridScalarProduct.Columns[i].CellTemplate = CellR;
dataGridScalarProduct.Columns[i].Width = 30;
}

private void initPowerMatrix()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
column = Convert.ToInt16(textLineA4.Text);
dataGridMatrix_at_power_n.ColumnCount = column;
dataGridMatrix_.at_.power_.n.AllowUserToOrderColumns=false;
dataGridMatrix_.at_.power_.n.AllowUserToAddRows=false;
dataGridMatrix_.at_.power_.n.Enabled =true;
dataGridMatrix_.at_.power_.n.AutoSizeRowsMode=DataGridViewAutoSizeRowsMode.
DisplayedCellsExceptHeaders;
dataGridMatrix_.at_.power_.n.ColumnHeaderBorderStyle = DataGridViewHeader
BorderStyle.Raised;
dataGridMatrix_.at_.power_.n.CellBorderStyle = DataGridViewCellBorderStyle.Single;
dataGridMatrix_.at_.power_.n.ColumnHeadersDefaultCellStyle = columnHeaderStyle;
// dataGridProduct.DefaultCellStyle = Font(12.75F);
// Set the column header style.
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
columnHeaderStyle.BackColor = Color.AntiqueWhite;
columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridMatrix_.at_.power_.n.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
DataGridViewCell CellR = new DataGridViewTextBoxCell();
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textlineA4.Text);
dataGridMatrix_.at_.power_.n.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridMatrix_.at_.power_.n.Columns[i].Name = ”C” + (i +1);
dataGridMatrix_.at_.power_.n.Columns[i].CellTemplate = CellR;
dataGridMatrix_.at_.power_.n.Columns[i].Width = 30;
}
private void initMatrixSolutionSystem()
{
    // Create an unbound DataGridView by declaring a column count.
    int column = 0;
column = 1;
dataGridSolutionXk.ColumnCount = column;
dataGridSolutionXk.AllowUserToOrderColumns = false;
dataGridSolutionXk.AllowUserToAddRows = false;
dataGridSolutionXk.Enabled = true;
dataGridSolutionXk.AutoSizeRowsMode = DataGridViewAutoSizeRowsMode.DisplayedCellsExceptHeaders;
dataGridSolutionXk.ColumnHeadersBorderStyle = DataGridViewHeaderBorderStyle.Raised;
dataGridSolutionXk.CellBorderStyle = DataGridViewCellBorderStyle.Single;
dataGridSolutionXk.ColumnHeaderStyle = Color.DodgerBlue;
dataGridSolutionXk.ColumnHeaderVisible = false;
dataGridSolutionXk.RowHeadersVisible = false;
dataGridSolutionXk.BackgroundColor = Color.WhiteSmoke;
dataGridSolutionXk.ColumnHeaderStyle = BorderStyle.None;
dataGridSolutionXk.AllowUserToResizeColumns = true;
DataGridViewCellStyle columnHeaderStyle = new DataGridViewCellStyle();
columnHeaderStyle.BackColor = Color.AntiqueWhite;
columnHeaderStyle.Alignment = DataGridViewContentAlignment.MiddleCenter;
dataGridSolutionXk.ColumnHeaderDefaultCellStyle = columnHeaderStyle;
DataGridViewCell CellR = new DataGridViewTextBoxCell();
CellR.Style.Alignment = DataGridViewContentAlignment.MiddleRight;
DataGridViewCell CellL = new DataGridViewTextBoxCell();
CellL.Style.Alignment = DataGridViewContentAlignment.MiddleLeft;
int line = 0;
line = Convert.ToInt16(textlineA6.Text);
dataGridSolutionXk.RowCount = line;
for (int i = 0; i < column; i++)
{
    dataGridSolutionXk.Columns[i].Name = "C" + (i + 1);
dataGridSolutionXk.Columns[i].CellTemplate = CellR;
dataGridSolutionXk.Columns[i].Width = 30;
}
private void btGenerating_Click(object sender, EventArgs e)
{
    if (textLine.Text != "" && textColumn.Text != ")
    {
        initMatrixA();
        initMatrixB();
    }
    else
    {

if (textLine.Text == "" && textColumn.Text == ")
    MessageBox.Show("Introduce number of lines and number of columns!");
else if (textLine.Text == "")
    MessageBox.Show("Introduce number of lines!");
else if (textColumn.Text == "")
    MessageBox.Show("Introduce number of columns!");
}
private void btGenerating2_Click(object sender, EventArgs e)
{
    if (textLineA2.Text != "" && textColumnA2.Text != "" && textLineB2.Text != ""
        && textColumnB2.Text != ")
    {
        initMatrixA2();
        initMatrixB2();
    }
    else
    {
        if (textLineA2.Text == "" && textColumnA2.Text == "" && textLineB2.Text
            == "" && textColumnB2.Text == ")
            MessageBox.Show("Introduce number of lines and number of columns!");
        else
        {
            if (textLineA2.Text == "" || textLineB2.Text == ")
                MessageBox.Show("Introduce number of lines for matrix A!");
            else if (textColumnA2.Text == "")
                MessageBox.Show("Introduce number of columns for matrix A!");
            else if (textColumnB2.Text == "")
                MessageBox.Show("Introduce number of columns for matrix B!");
        }
    }
}
private void Generatingbuttons3_Click(object sender, EventArgs e)
{
    if (textLineA3.Text != "")
    {
        initMatrixA3();
    }
    else
        MessageBox.Show("Introduce number of lines and number of columns!");
}
private void GeneratingA4_Click(object sender, EventArgs e)
```csharp
{  
    if (textLineA4.Text != "")  
    {  
        initMatrixA4();  
    }  
    else  
        MessageBox.Show("Introduce number of lines and number of columns!");
}
private void GeneratingA5_Click(object sender, EventArgs e)  
{  
    if (textLineA5.Text != "")  
    {  
        initMatrixA5();  
    }  
    else  
        MessageBox.Show("Introduce number of lines and number of columns!");
}
private void btGeneratingMatrices_Click(object sender, EventArgs e)  
{  
    if (textlineA6.Text != "")  
    {  
        initMatrixA6();  
        initMatrixX0();  
    }  
    else  
        MessageBox.Show("Introduce number of lines and columns!");
}
private void btComputeSumClick(object sender, EventArgs e)  
{  
    initMatrixAdditionResult();  
    int line = 0;  
    int column = 0;  
    column = Convert.ToInt16(textColumn.Text);  
    line = Convert.ToInt16(textLine.Text);  
    int[,] A = new int[line, column];  
    int[,] B = new int[line, column];  
    int[,] ResAddition = new int[line, column];  
    for (int i = 0; i < line; i++)  
    {  
        for (int j = 0; j < column; j++)  
        {  
            MessageBox.Show(dataGridA.Rows[i].Cells[j].Value.ToString()); 
        }
```

if (dataGridA.Rows[i].Cells[j].Value.ToString() == "E")
    A[i, j] = Int32.MaxValue;
else
    A[i, j] = Convert.ToInt16(dataGridA.Rows[i].Cells[j].Value.ToString());
if (dataGridB.Rows[i].Cells[j].Value.ToString() == "E")
    B[i, j] = Int32.MaxValue;
else
    B[i, j] = Convert.ToInt16(dataGridB.Rows[i].Cells[j].Value.ToString());
if (A[i, j] < B[i, j])
    ResAddition[i, j] = A[i, j];
else
    ResAddition[i, j] = B[i, j];
}
}
for (int i = 0; i < line; i++)
{
    for (int j = 0; j < column; j++)
    {
        if (ResAddition[i, j] == Int32.MaxValue)
            dataGridResAddition.Rows[i].Cells[j].Value = "E";
        else
            dataGridResAddition.Rows[i].Cells[j].Value = ResAddition[i, j];
    }
}
private void btComputationProduct_Click(object sender, EventArgs e)
{
    initMatrixProduct();
    int lineA = 0; int lineB = 0;
    int columnA = 0; int columnB = 0;
    columnA = Convert.ToInt16(textColumnA2.Text);
    lineA = Convert.ToInt16(textLineA2.Text);
    columnB = Convert.ToInt16(textColumnB2.Text);
    lineB = Convert.ToInt16(textLineB2.Text);
    int[,] A2 = new int[lineA, columnA];
    int[,] B2 = new int[lineB, columnB];
    int[,] Product = new int[lineA, columnB];
    int[,] Sum = new int[lineA, columnB];
    int k;
    for (int i = 0; i < lineA; i++)
    {
        for (int j = 0; j < columnA; j++)
        {
```csharp
if (dataGridA2.Rows[i].Cells[j].Value.ToString() == "E")
    A2[i, j] = Int32.MaxValue;
else
    A2[i, j] = Convert.ToInt16(dataGridA2.Rows[i].Cells[j].Value.ToString());
}
for (int i = 0; i < lineB; i++)
{
    for (int j = 0; j < columnB; j++)
    {
        if (dataGridB2.Rows[i].Cells[j].Value.ToString() == "E")
            B2[i, j] = Int32.MaxValue;
        else
            B2[i, j] = Convert.ToInt16(dataGridB2.Rows[i].Cells[j].Value.ToString());
    }
}
for (int i = 0; i < lineA; i++)
{
    for (int j = 0; j < columnB; j++)
    {
        Product[i, j] = Int32.MaxValue;
        for (k = 0; k < lineB; k++)
        {
            if (A2[i, k] == Int32.MaxValue || B2[k, j] == Int32.MaxValue)
                Sum[i, j] = Int32.MaxValue;
            else
                Sum[i, j] = A2[i, k] + B2[k, j];
        }
    }
}
for (int i = 0; i < lineA; i++)
{
    for (int j = 0; j < columnB; j++)
    {
        if (Product[i, j] == Int32.MaxValue)
            dataGridProduct.Rows[i].Cells[j].Value = "E";
        else
            dataGridProduct.Rows[i].Cells[j].Value = Product[i, j];
    }
}
```
private void textColumnA2_Leave(object sender, EventArgs e)
{
    textLineB2.Text = textColumnA2.Text;
}
private void btScalarProduct_Click(object sender, EventArgs e)
{
    initMatrixScalarProduct();
    if (textScalar.Text != "")
    {
        int lineA = 0;
        int columnA = 0;
        columnA = Convert.ToInt16(textcolumnA3.Text);
        lineA = Convert.ToInt16(textLineA3.Text);
        int[,] A3 = new int[lineA, columnA];
        int[,] ScalarProduct = new int[lineA, columnA];
        int a;
        a = Convert.ToInt16(textScalar.Text);
        for (int i = 0; i < lineA; i++)
        {
            for (int j = 0; j < columnA; j++)
            {
                if (dataGridA3.Rows[i].Cells[j].Value.ToString() == "E")
                    A3[i, j] = Int32.MaxValue;
                else
                    A3[i, j] = Convert.ToInt16(dataGridA3.Rows[i].Cells[j].Value.ToString());
            }
        }
        for (int i = 0; i < lineA; i++)
        {
            for (int j = 0; j < columnA; j++)
            {
                if (A3[i, j] == Int32.MaxValue)
                    ScalarProduct[i, j] = Int32.MaxValue;
                else
                    ScalarProduct[i, j] = (A3[i, j] + a);
            }
        }
        for (int i = 0; i < lineA; i++)
        {
        }
for (int j = 0; j < columnA; j++)
{
    if (ScalarProduct[i, j] == Int32.MaxValue)
        dataGridScalarProduct.Rows[i].Cells[j].Value = "E";
    else
        dataGridScalarProduct.Rows[i].Cells[j].Value = ScalarProduct[i,j];
}

private void btComputPower_Click(object sender, EventArgs e)
{
    initPowerMatrix();
    labelPower.Text = textPower.Text;
    if (textPower.Text != "")
    {
        int lineA = 0;
        int columnA = 0;
        columnA = Convert.ToInt16(textlineA4.Text);
        lineA = Convert.ToInt16(textlineA4.Text);
        int[,] A4 = new int[lineA, columnA];
        int[,] B = new int[lineA, columnA];
        int[,] Power_n = new int[lineA, columnA];
        int[,] sum = new int[lineA, columnA];
        int a;
        a = Convert.ToInt16(textPower.Text);
        for (int i = 0; i < lineA; i++)
        {
            for (int j = 0; j < columnA; j++)
            {
                if (dataGridA4.Rows[i].Cells[j].Value.ToString() == "E")
                    A4[i, j] = Int32.MaxValue;
                else
                    A4[i, j] = Convert.ToInt16(dataGridA4.Rows[i].Cells[j].Value.ToString());
                B[i, j] = A4[i, j];
            }
        }
        for (int p = 2; p <= a; p++)
        {
            for (int i = 0; i < lineA; i++)
            {
                for (int j = 0; j < columnA; j++)
                {
                    // Code continues here...
                }
            }
        }
    }
{
    Power_n[i, j] = Int32.MaxValue;
    for (int k = 0; k < lineA; k++)
    {
        //if (Power_n[i, j] <= (Power[i, k] + A4[k,j]))
        // Power_n[i, j] = Power[i, j];
        //else
        if (A4[i, k] == Int32.MaxValue || B[k, j] == Int32.MaxValue)
            sum[i, j] = Int32.MaxValue;
        else
            sum[i, j] = A4[i, k] + B[k,j];
        if (Power_n[i, j] < sum[i,j])
            Power_n[i, j] = Power_n[i,j];
        else
            Power_n[i, j] = sum[i,j];
        //sum[i, j] = Power_n[i, j];
        //Power_n[i, j] = sum[i,j];
        //Power = new int [i,j];
        //Power[i, j] = Power_n[i, j];
        //dataGridScalarProduct.Rows[i].Cells[j].Value = Power_n[i, j];
    }
    //Power_n = B;
}
for (int i = 0; i < lineA;i++)
{
    for (int j = 0; j < columnA;j++)
    {
        B[i, j] = Power_n[i,j];
        //dataGridMatrix_at_power_n.Rows[i].Cells[j].Value = Power_n[i, j];
    }
    //Power_n = B;
}
for (int i = 0; i < lineA; i++)
{
    for (int j = 0; j < columnA; j++)
    {
        if (Power_n[i, j] == Int32.MaxValue)
            dataGridMatrix_at_power_n.Rows[i].Cells[j].Value = "E";
        else
            dataGridMatrix_at_Power_n.Rows[i].Cells[j].Value = Power_n[i,j];
    }
}
private void ComputingDeterminant()
{
    int lineA = 0; int columnA = 0;
    lineA = Convert.ToInt16(textlineA5.Text);
    columnA = Convert.ToInt16(textlineA5.Text);
    A5 = new int[lineA, lineA];
    for (int i = 0; i < lineA; i++)
    {
        for (int j = 0; j < columnA; j++)
        {
            if (dataGridA5.Rows[i].Cells[j].Value.ToString() == "E")
                A5[i, j] = Int32.MaxValue;
            else
                A5[i, j] = Convert.ToInt16(dataGridA5.Rows[i].Cells[j].Value.ToString());
        }
    }
    int det_plus;
    int det_minus;
    int n = Convert.ToInt16(textlineA5.Text);
    if (n == 1)
    {
        det_plus = A5[0, 0];
        textDet_plus.Text = det_plus.ToString();
        textDet_minus.Text = "";
    }
    else if (n == 2)
    {
        if (A5[0, 0] == Int32.MaxValue || A5[1, 1] == Int32.MaxValue)
            det_plus = Int32.MaxValue;
        else
            det_plus = A5[0, 0] + A5[1, 1];
        if (A5[0, 1] == Int32.MaxValue || A5[1, 0] == Int32.MaxValue)
            det_minus = Int32.MaxValue;
        else
            det_minus = A5[0, 1] + A5[1, 0];
        if (det_plus == Int32.MaxValue)
            textDet_plus.Text = "E";
        else
textDet_plus.Text = det_plus.ToString();
if (det_minus == Int32.MaxValue)
    textDet_minus.Text = "E";
else
    textDet_minus.Text = det_minus.ToString();
}
else if (n == 3)
{
    int a1;
    int a2;
    int a3;
    if (A5[0, 0] == Int32.MaxValue || A5[1, 1] == Int32.MaxValue || A5[2, 2] == Int32.MaxValue)
        a1 = Int32.MaxValue;
    else
        a1 = A5[0, 0] + A5[1, 1] + A5[2, 2];
    if (A5[1, 0] == Int32.MaxValue || A5[2, 1] == Int32.MaxValue || A5[0, 2] == Int32.MaxValue)
        a2 = Int32.MaxValue;
    else
        a2 = A5[1, 0] + A5[2, 1] + A5[0, 2];
    if (A5[2, 0] == Int32.MaxValue || A5[0, 1] == Int32.MaxValue || A5[1, 2] == Int32.MaxValue)
        a3 = Int32.MaxValue;
    else
        a3 = A5[2, 0] + A5[0, 1] + A5[1, 2];
    det_plus = Int32.MaxValue;
    if (a1 < det_plus)
        det_plus = a1;
    if (a2 < det_plus)
        det_plus = a2;
    if (a3 < det_plus)
        det_plus = a3;
    int b1;
    int b2;
    int b3;
    if (A5[0, 2] == Int32.MaxValue || A5[1, 1] == Int32.MaxValue || A5[2, 0] == Int32.MaxValue)
        b1 = Int32.MaxValue;
    else
        b1 = A5[0, 2] + A5[1, 1] + A5[2, 0];
if (A5[1, 2] == Int32.MaxValue || A5[2, 1] == Int32.MaxValue || A5[0, 0] == Int32.MaxValue)
    b2 = Int32.MaxValue;
else
    b2 = A5[1, 2] + A5[2, 1] + A5[0, 0];
if (A5[0, 1] == Int32.MaxValue || A5[1, 0] == Int32.MaxValue || A5[2, 2] == Int32.MaxValue)
    b3 = Int32.MaxValue;
else
    b3 = A5[0, 1] + A5[1, 0] + A5[2, 2];
det_minus = Int32.MaxValue;
if (b1 < det_minus)
    det_minus = b1;
if (b2 < det_minus)
    det_minus = b2;
if (b3 < det_minus)
    det_minus = b3;
if (det_plus == Int32.MaxValue)
    textDet_plus.Text = "E";
else
    textDet_plus.Text = det_plus.ToString();
if (det_minus == Int32.MaxValue)
    textDet_minus.Text = "E";
else
    textDet_minus.Text = det_minus.ToString();
}
private void btComputingDeterminant_Click(object sender, EventArgs e)
{
    ComputingDeterminant();
}

private void btComputSystem_Click(object sender, EventArgs e)
{
    initMatrixSolutionSystem();
    label_k.Text = textk.Text;
    if (textk.Text != "")
    {
        int lineA = 0;
        int columnA = 0;
        int linex0 = 0;
Programs in C++ for matrix computations in min plus algebra

```csharp
columnA = Convert.ToInt16(textlineA6.Text);
lineA = Convert.ToInt16(textlineA6.Text);
linex0 = Convert.ToInt16(textlineA6.Text);

int[,] A6 = new int[lineA, columnA];
int[,] X0 = new int[linex0, 1];
int[,] Xk = new int[lineA, 1];
int[,] B = new int[lineA, columnA];
int[,] Power_n = new int[lineA, columnA];
int[,] sum = new int[lineA, columnA];
int[,] sum2 = new int[lineA, 1];
int k;
k = Convert.ToInt16(textk.Text);

for (int i = 0; i < lineA; i++)
{
    for (int j = 0; j < columnA; j++)
    {
        if (dataGridA6.Rows[i].Cells[j].Value.ToString() == "E")
            A6[i, j] = Int32.MaxValue;
        else
            A6[i, j] = Convert.ToInt16(dataGridA6.Rows[i].Cells[j].Value.ToString());

        B[i, j] = A6[i, j];
    }
}

for (int i = 0; i < linex0; i++)
{
    if (dataGridX0.Rows[i].Cells[0].Value.ToString() == "E")
        X0[i, 0] = Int32.MaxValue;
    else
        X0[i, 0] = Convert.ToInt16(dataGridX0.Rows[i].Cells[0].Value.ToString());
}

if (k == 1)
{
    for (int i = 0; i < lineA; i++)
    {
        for (int j = 0; j < columnA; j++)
        {
            Power_n[i, j] = A6[i, j];
        }
    }
}
else
{
    for (int p = 2; p <= k; p++)
    {
        // Code for matrix computations
    }
}
```

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for (int i = 0; i < lineA; i++)
{
    for (int j = 0; j < columnA; j++)
    {
        Power_n[i, j] = Int32.MaxValue;
        for (int h = 0; h < lineA; h++)
        {
            if (A6[i, h] == Int32.MaxValue || B[h, j] == Int32.MaxValue)
                sum[i, j] = Int32.MaxValue;
            else
                sum[i, j] = A6[i, h] + B[h, j];
            if (Power_n[i, j] < sum[i, j])
                Power_n[i, j] = sum[i, j];
        }
    }
}
for (int i = 0; i < lineA; i++)
{
    for (int j = 0; j < columnA; j++)
    {
        B[i, j] = Power_n[i, j];
    }
}
for (int i = 0; i < lineA; i++)
{
    for (int j = 0; j < 1; j++)
    {
        Xk[i, j] = Int32.MaxValue;
        for (int h = 0; h < lineA; h++)
        {
            if (Power_n[i, h] == Int32.MaxValue || X0[h, j] == Int32.MaxValue)
                sum2[i, j] = Int32.MaxValue;
            else
                sum2[i, j] = Power_n[i, h] + X0[h, j];
            if (Xk[i, j] < sum2[i, j])
                Xk[i, j] = sum2[i, j];
            else
                Xk[i, j] = Xk[i, j];
        }
    }
}
Programs in C++ for matrix computations in min plus algebra

```csharp
Xk[i, j] = sum2[i,j];
}
}
}
for (int i = 0; i < lineA; i++)
{
    if (Xk[i, 0] == Int32.MaxValue)
        dataGridViewSolutionXk.Rows[i].Cells[0].Value = "E";
    else
        dataGridViewSolutionXk.Rows[i].Cells[0].Value = Xk[i,0];
}
}
public void Reset_Values_for_Addition()
{
    textColumn.ResetText();
textLine.ResetText();
dataGridA.Rows.Clear();
dataGridB.Rows.Clear();
dataGridResAddition.Rows.Clear();
}
public void Reset_Values_for_Multiplication()
{
    textColumnA2.ResetText();
textLineA2.ResetText();
textColumnB2.ResetText();
textLineB2.ResetText();
dataGridA2.Rows.Clear();
dataGridB2.Rows.Clear();
dataGridProduct.Rows.Clear();
}
public void Reset_Values_for_Scalar_Multiplication()
{
    textColumnA3.ResetText();
textScalar.ResetText();
textLineA3.ResetText();
dataGridA3.Rows.Clear();
dataGridScalarProduct.Rows.Clear();
}
public void Reset_Values_for_Lifting_at_Power()
{
    textLineA4.ResetText();
}
textPower.ResetText();
dataGridA4.Rows.Clear();
dataGridMatrix—at_Power_n.Rows.Clear();
}
public void Reset_Values_for_Computing_Determinant()
{
    textlineA5.ResetText();
    Det_minus.ResetText();
    Det_plus.ResetText();
    dataGridA5.Rows.Clear();
}
public void Reset_Values_for_Computation_system()
{
    textlineA6.ResetText();
    textk.ResetText();
    label_k.Text = "k";
    dataGridSolutionXk.Rows.Clear();
    dataGridA6.Rows.Clear();
    dataGridX0.Rows.Clear();
}
private void btReset_Click(object sender, EventArgs e)
{
    Reset_Values_for_Addition();
}
private void btResetMultiplication_Click(object sender, EventArgs e)
{
    Reset_Values_for_Multiplication();
}
private void btReset_Scalar_Product_Click(object sender, EventArgs e)
{
    Reset_Values_for_Scalar_Multiplication();
}
private void btReset_lifting_at_power_Click(object sender, EventArgs e)
{
    Reset_Values_for_Lifting_at_Power();
}
private void btReset_values_det_Click(object sender, EventArgs e)
{
    Reset_Values_for_Computing_Determinant();
}
private void btResetSystem_Click(object sender, EventArgs e)
{
Programs in \textit{C++} for matrix computations in min plus algebra

Reset \_\_Values\_\_for\_\_Computation\_\_System();
\}
\}

We illustrate the utilization of the above programs in the solving of the following problems.

**Problem 3.1. Sum of two matrices \(A\) and \(B\) over \(\mathbb{R}_{\text{min}}\).**

| Inputs data | Outputs data |
|-------------|--------------|
| Number of lines | 3 |
| Number of columns | 5 |
| Matrix \(A\) | Matrix \(B\) | Matrix \(A \oplus B\) |
| \begin{bmatrix} 12 & 0 & E & 3 & 5 \\ −1 & 0 & 2 & E & 7 \\ 5 & 3 & 1 & 8 & 0 \end{bmatrix} | \begin{bmatrix} 0 & −3 & 2 & E & E \\ −8 & −1 & 3 & 8 & E \\ E & 1 & −5 & 2 & 7 \end{bmatrix} | \begin{bmatrix} 0 & −3 & 2 & 3 & 5 \\ −8 & −1 & 2 & 8 & 7 \\ 5 & 1 & −5 & 2 & 0 \end{bmatrix} |

**Problem 3.2. Product of two matrices \(A\) and \(B\) over \(\mathbb{R}_{\text{min}}\).**

| Inputs data | Outputs data |
|-------------|--------------|
| Number of lines of \(A\)! | 5 |
| Number of columns of \(A\)! | 3 |
| Number of lines of \(B\)! | 3 |
| Number of columns of \(B\)! | 4 |
| Matrix \(A\) | Matrix \(B\) | Matrix \(A \otimes B\) |
| \begin{bmatrix} 12 & −1 & 5 \\ 0 & 0 & 3 \\ E & 2 & 1 \\ 3 & E & 8 \\ 5 & 7 & 0 \end{bmatrix} | \begin{bmatrix} 1 & 7 & E & 0 \\ 4 & −2 & 1 & E \\ 3 & 7 & E & 0 \end{bmatrix} | \begin{bmatrix} 3 & −3 & 0 & 5 \\ 1 & −2 & 1 & 0 \\ 4 & 0 & 3 & 1 \\ 4 & 10 & E & 3 \\ 3 & 5 & 8 & 0 \end{bmatrix} |

**Problem 3.3. Multiplication with scalar \(a \in \mathbb{R}\) of a matrix \(A\) over \(\mathbb{R}_{\text{min}}\).**

| Inputs data | Outputs data |
|-------------|--------------|
| Number of lines of \(A\)! | 3 |
| Number of columns of \(A\)! | 4 |
| Scalar \(a\)! | −5 |
| Matrix \(A\) | Matrix \(a \otimes A\) |
| \begin{bmatrix} 4 & −7 & 8 & E \\ 5 & E & 0 & 8 \\ 9 & 2 & 3 & 1 \end{bmatrix} | \begin{bmatrix} −1 & −12 & 3 & E \\ 0 & E & −5 & 3 \\ 4 & −3 & −2 & −4 \end{bmatrix} |
Problem 3.4. Compute the matrix $A^n$ for $n \geq 2$, where $A \in M_{7 \times 7}(\mathbb{R}_{min})$

**Inputs data**

Number of lines and columns of $A$! 7

Power of $A$! 2

| Matrix $A$ | Matrix $A^{(2)}$ |
|------------|------------------|
| 0 4 0 5 9 6 0 | 0 4 9 13 7 21 1 |
| E E 7 E E E E | E E E E E E |
| E 5 0 E 6 10 E | 9 5 0 14 6 10 21 |
| E 9 E 0 E 8 E E | 13 9 14 0 22 8 19 |
| 7 E 6 E 0 14 E | 7 11 6 22 0 14 25 |
| E E 10 8 14 0 11 | 21 15 10 8 14 0 11 |
| E E E E E E 11 0 | E E 21 19 25 11 0 |

Similarly, we have

$A^{(3)} = \begin{pmatrix} 0 & 4 & 9 & 13 & 7 & 19 & 32 \\ 4 & 0 & 5 & 9 & 11 & 15 & 26 \\ 9 & 5 & 0 & 14 & 6 & 10 & 21 \\ 13 & 9 & 14 & 0 & 20 & 8 & 19 \\ 7 & 11 & 6 & 20 & 0 & 14 & 25 \\ 19 & 15 & 10 & 8 & 14 & 0 & 11 \\ 32 & 26 & 21 & 19 & 25 & 11 & 0 \end{pmatrix}$, $A^{(4)} = \begin{pmatrix} 0 & 4 & 9 & 13 & 7 & 19 & 30 \\ 4 & 0 & 5 & 9 & 11 & 15 & 26 \\ 9 & 5 & 0 & 14 & 6 & 10 & 21 \\ 13 & 9 & 14 & 0 & 20 & 8 & 19 \\ 7 & 11 & 6 & 20 & 0 & 14 & 25 \\ 19 & 15 & 10 & 8 & 14 & 0 & 11 \\ 30 & 26 & 21 & 19 & 25 & 11 & 0 \end{pmatrix}$

and $A^{(n)} = A^{(4)}$, for all $n \geq 5$.

Problem 3.5. Compute the bideterminant and permanent of $A \in M_{3 \times 3}(\mathbb{R}_{min})$.

**Inputs data**

| Matrix $A$ |  |
|------------|------|
| 8 -6 -1    | det$^+(A) = -2$ |
| 3 5 1      | det$^-(A) = -3$ |
| 9 -4 0      |  |

Then, the bideterminant of $A$ is $(\Delta_1(A), \Delta_2(A)) = (-2, -3)$ and its permanent is $\text{perm}(A) = (-2) \oplus (-3) = \min\{-2, -3\} = -3$.

Problem 3.6. Solve the system $X(k+1) = AX(k)$ ($k \geq 0$) with $A \in M_{6 \times 6}(\mathbb{R}_{min})$.

**Inputs data**

Number of lines and columns of $A$! 6

Value for $k$! 1
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| Matrix $A$ | Matrix $X(0)$ | Matrix $X(1)$ |
|-----------|---------------|---------------|
| 0 10 12 2 14 E | 10 | 7 |
| E 0 E E 5 E | -2 | -2 |
| E 4 0 E E E | 3 | 2 |
| E E E 0 E -3 | 5 | 1 |
| E E E E 0 4 | 9 | 8 |
| 5 E E 6 E 0 | 4 | 4 |

Similarly, $X(2) = (3 - 2 2 1 8 4)^T$ and $X(k) = X(2)$ for all $k \geq 3$.

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