Министерство науки и высшего образования Российской Федерации

Пензенский государственный университет

Кафедра «Вычислительная техника»

**ОТЧЕТ**

по лабораторной работе №5

по курсу «Разработка кроссплатформенных приложений»

на тему «Многопоточность в Java»

**Выполнили студенты группы 21ввв1:**

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### Цель работы:

### научиться создавать многопоточные приложения c использованием стандартных средств языка Java.

### Лабораторное задание:

Модифицировать приложение из предыдущей лабораторной работы, реализовав вычисление определенного интеграла в нескольких дополнительных потоках (число потоков определяется номером варианта), снимая нагрузку с основного потока и предотвращая "подвисание" графического интерфейса. Варианты с номерами до 5 включительно реализуют многопоточность путем наследования от класса Thread, остальные реализуют интерфейс Runnable.

**Листинг:**

package my.numberaddition;

import javax.swing.table.DefaultTableModel;

import java.lang.Math;

import java.util.ArrayList;

import javax.swing.JOptionPane;

import javax.swing.JFileChooser;

import java.io.\*;

import java.util.logging.Level;

import java.util.logging.Logger;

import java.util.Scanner;

/\*\*

\*

\* @author student

\*/

public class UI extends javax.swing.JFrame {

/\*\*

\* Creates new form UI

\*/

public UI() {

initComponents();

}

/\*\*

\* This method is called from within the constructor to initialize the form.

\* WARNING: Do NOT modify this code. The content of this method is always

\* regenerated by the Form Editor.

\*/

@SuppressWarnings("unchecked")

// <editor-fold defaultstate="collapsed" desc="Generated Code">

private void initComponents() {

jPanel1 = new javax.swing.JPanel();

jTextField1 = new javax.swing.JTextField();

jTextField2 = new javax.swing.JTextField();

jTextField3 = new javax.swing.JTextField();

jScrollPane1 = new javax.swing.JScrollPane();

jTable1 = new javax.swing.JTable();

jButton1 = new javax.swing.JButton();

jButton2 = new javax.swing.JButton();

jButton3 = new javax.swing.JButton();

jLabel1 = new javax.swing.JLabel();

jLabel2 = new javax.swing.JLabel();

jLabel3 = new javax.swing.JLabel();

jButton4 = new javax.swing.JButton();

jButton5 = new javax.swing.JButton();

jLabel4 = new javax.swing.JLabel();

jButton6 = new javax.swing.JButton();

jButton7 = new javax.swing.JButton();

jButton8 = new javax.swing.JButton();

jButton9 = new javax.swing.JButton();

jLabel5 = new javax.swing.JLabel();

jLabel6 = new javax.swing.JLabel();

setDefaultCloseOperation(javax.swing.WindowConstants.EXIT\_ON\_CLOSE);

jPanel1.setBorder(javax.swing.BorderFactory.createTitledBorder(javax.swing.BorderFactory.createLineBorder(new java.awt.Color(0, 0, 0)), "Name", javax.swing.border.TitledBorder.DEFAULT\_JUSTIFICATION, javax.swing.border.TitledBorder.DEFAULT\_POSITION, new java.awt.Font("Vladimir Script", 1, 14))); // NOI18N

jTextField1.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jTextField1ActionPerformed(evt);

}

});

jTextField2.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jTextField2ActionPerformed(evt);

}

});

jTable1.setModel(new javax.swing.table.DefaultTableModel(

new Object [][] {

},

new String [] {

"Нижняя граница ", "Верхняя граница ", "Шаг интегрирования ", "Результат"

}

) {

boolean[] canEdit = new boolean [] {

true, true, true, false

};

public boolean isCellEditable(int rowIndex, int columnIndex) {

return canEdit [columnIndex];

}

});

jScrollPane1.setViewportView(jTable1);

jButton1.setText("Добавить");

jButton1.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton1ActionPerformed(evt);

}

});

jButton2.setText("Удалить");

jButton2.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton2ActionPerformed(evt);

}

});

jButton3.setText("Вычислить");

jButton3.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton3ActionPerformed(evt);

}

});

jLabel1.setText("Нижняя граница");

jLabel2.setText("Верхняя граница");

jLabel3.setText("Шаг");

jButton4.setText("Загрузить");

jButton4.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton4ActionPerformed(evt);

}

});

jButton5.setText("Очистить");

jButton5.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton5ActionPerformed(evt);

}

});

jLabel4.setText("Загрузка/Очистка из массива");

jButton6.setText("Сохранить");

jButton6.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton6ActionPerformed(evt);

}

});

jButton7.setText("Сохранить");

jButton7.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton7ActionPerformed(evt);

}

});

jButton8.setText("Считать");

jButton8.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton8ActionPerformed(evt);

}

});

jButton9.setText("Считать");

jButton9.addActionListener(new java.awt.event.ActionListener() {

public void actionPerformed(java.awt.event.ActionEvent evt) {

jButton9ActionPerformed(evt);

}

});

jLabel5.setText("TXT");

jLabel6.setText("BIN");

javax.swing.GroupLayout jPanel1Layout = new javax.swing.GroupLayout(jPanel1);

jPanel1.setLayout(jPanel1Layout);

jPanel1Layout.setHorizontalGroup(

jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(206, 206, 206)

.addComponent(jLabel1)

.addGap(18, 18, 18)

.addComponent(jLabel2)

.addGap(57, 57, 57)

.addComponent(jLabel3)

.addGap(0, 0, Short.MAX\_VALUE))

.addGroup(jPanel1Layout.createSequentialGroup()

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(244, 244, 244)

.addComponent(jButton4)

.addGap(136, 136, 136)

.addComponent(jButton5))

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(326, 326, 326)

.addComponent(jLabel4)))

.addContainerGap(javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE))

.addGroup(jPanel1Layout.createSequentialGroup()

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(46, 46, 46)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.TRAILING, false)

.addComponent(jButton3)

.addComponent(jButton1, javax.swing.GroupLayout.Alignment.LEADING, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)

.addComponent(jButton2, javax.swing.GroupLayout.Alignment.LEADING, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE))

.addGap(48, 48, 48)

.addComponent(jScrollPane1, javax.swing.GroupLayout.PREFERRED\_SIZE, 452, javax.swing.GroupLayout.PREFERRED\_SIZE))

.addGroup(jPanel1Layout.createSequentialGroup()

.addContainerGap(javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)

.addComponent(jTextField1, javax.swing.GroupLayout.PREFERRED\_SIZE, 40, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addGap(70, 70, 70)

.addComponent(jTextField2, javax.swing.GroupLayout.PREFERRED\_SIZE, 42, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addGap(70, 70, 70)

.addComponent(jTextField3, javax.swing.GroupLayout.PREFERRED\_SIZE, 47, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addGap(180, 180, 180)))

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(18, 18, 18)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.TRAILING)

.addComponent(jButton6, javax.swing.GroupLayout.PREFERRED\_SIZE, 75, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addComponent(jButton9))

.addGap(29, 29, Short.MAX\_VALUE)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING, false)

.addComponent(jButton7, javax.swing.GroupLayout.PREFERRED\_SIZE, 1, Short.MAX\_VALUE)

.addComponent(jButton8, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)))

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(45, 45, 45)

.addComponent(jLabel5)

.addPreferredGap(javax.swing.LayoutStyle.ComponentPlacement.RELATED, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)

.addComponent(jLabel6)

.addGap(28, 28, 28))))

);

jPanel1Layout.setVerticalGroup(

jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addGroup(jPanel1Layout.createSequentialGroup()

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(130, 130, 130)

.addComponent(jButton1)

.addGap(18, 18, 18)

.addComponent(jButton2)

.addGap(18, 18, 18)

.addComponent(jButton3))

.addGroup(javax.swing.GroupLayout.Alignment.TRAILING, jPanel1Layout.createSequentialGroup()

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.BASELINE)

.addComponent(jLabel1)

.addComponent(jLabel2)

.addComponent(jLabel3))

.addGap(11, 11, 11)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.BASELINE)

.addComponent(jTextField2, javax.swing.GroupLayout.PREFERRED\_SIZE, 32, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addComponent(jTextField1, javax.swing.GroupLayout.PREFERRED\_SIZE, 32, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addComponent(jTextField3))

.addGap(24, 24, 24)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(2, 2, 2)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.BASELINE)

.addComponent(jLabel5)

.addComponent(jLabel6))

.addGap(18, 18, 18)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.BASELINE)

.addComponent(jButton6)

.addComponent(jButton7))

.addGap(18, 18, 18)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.BASELINE)

.addComponent(jButton8)

.addComponent(jButton9)))

.addComponent(jScrollPane1, javax.swing.GroupLayout.PREFERRED\_SIZE, 243, javax.swing.GroupLayout.PREFERRED\_SIZE))))

.addGap(13, 13, 13)

.addComponent(jLabel4)

.addPreferredGap(javax.swing.LayoutStyle.ComponentPlacement.UNRELATED)

.addGroup(jPanel1Layout.createParallelGroup(javax.swing.GroupLayout.Alignment.BASELINE)

.addComponent(jButton4)

.addComponent(jButton5))

.addContainerGap(43, Short.MAX\_VALUE))

);

javax.swing.GroupLayout layout = new javax.swing.GroupLayout(getContentPane());

getContentPane().setLayout(layout);

layout.setHorizontalGroup(

layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addComponent(jPanel1, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)

);

layout.setVerticalGroup(

layout.createParallelGroup(javax.swing.GroupLayout.Alignment.LEADING)

.addComponent(jPanel1, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)

);

pack();

}// </editor-fold>

public static class RecIntegral implements Serializable{

private

double a, b, h, rez;

RecIntegral(double a, double b, double h, double rez){

this.a = a;

this.b = b;

this.h = h;

this.rez = rez;

}

public void setRez(double rez){

this.rez = rez;

}

public double getA(){

return a;

}

public double getB(){

return b;

}

public double getH(){

return h;

}

public double getRez(){

return rez;

}

}

class RecIntegralException extends Exception{

private int a;

public int getA(){return a;}

public RecIntegralException(String message, int a)

{

super(message);

this.a = a;

}

}

class ThreadCalculateClass extends Thread{

private double a, b, h;

double rez = 0;

public ThreadCalculateClass(double Upper\_bound, double Lower\_bound, double Step)

{

this.b = Upper\_bound;

this.a = Lower\_bound;

this.h = Step;

}

@Override

public void run()

{

for (double i = a; i < b; i=i+h)

{

if(i+h > b)

{

h = b-i;

}

rez += h \* (1/Math.log(i) + 1/Math.log(i+h)) / 2;

}

}

public double GetResult(){return rez;}

}

public ArrayList<RecIntegral> Line = new ArrayList<RecIntegral>();

public double MutliThreadCalculate(double Upper\_bound, double Lower\_bound, double Step, int ThreadCount)

{

double Res = 0;

ThreadCalculateClass[] threads = new ThreadCalculateClass[ThreadCount];

double step = (Upper\_bound - Lower\_bound)/ ThreadCount;

for (int i = 0; i < ThreadCount; i++)

{

double lowerBound = (i \* step) + Lower\_bound;

double upper = Math.min(((i+1) \* step) + Lower\_bound, Upper\_bound);

threads[i] = new ThreadCalculateClass(upper, lowerBound,Step);

threads[i].start();

}

try

{

for (ThreadCalculateClass thread : threads) {

thread.join();

Res += thread.GetResult();

}

} catch(Exception e)

{

JOptionPane.showMessageDialog(null, "Ошибка при вычислении (" + e.getMessage() + ")");

}

return Res;

}

private void jButton2ActionPerformed(java.awt.event.ActionEvent evt) {

DefaultTableModel myTable=(DefaultTableModel)jTable1.getModel();

int selectedRow = jTable1.getSelectedRow();

if(selectedRow!=-1)

{

myTable.removeRow(selectedRow);

Line.remove(selectedRow);

}

}

private void jTextField1ActionPerformed(java.awt.event.ActionEvent evt) {

//myTable.insertRow(0, rowData);

}

private void jButton1ActionPerformed(java.awt.event.ActionEvent evt) {

DefaultTableModel myTable=(DefaultTableModel)jTable1.getModel();

double h = 0, a = 0, b = 0;

try {

a = Double.parseDouble(jTextField1.getText());

b = Double.parseDouble(jTextField2.getText());

h = Double.parseDouble(jTextField3.getText());

if(a>b){throw new RecIntegralException("Значение нижней границы больше верхней границы интеграла!",4);}

if(a<0.000001 || a>1000000){throw new RecIntegralException("Введено значение для поля A < либо > допустимого!",1);}

if(b<0.000001 || b>1000000){throw new RecIntegralException("Введено значение для поля B < либо > допустимого!",2);}

if(h<0.000001 || h>1000000){throw new RecIntegralException("Введено значение для поля H < либо > допустимого!",3);}

myTable.insertRow(0, new Object[]{

jTextField1.getText(),

jTextField2.getText(),

jTextField3.getText(),

});

}catch(RecIntegralException ex)

{

JOptionPane.showMessageDialog(null, ex.getMessage());

}

}

private void jTextField2ActionPerformed(java.awt.event.ActionEvent evt) {

// TODO add your handling code here:

}

private void jButton3ActionPerformed(java.awt.event.ActionEvent evt) {

DefaultTableModel myTable=(DefaultTableModel)jTable1.getModel();

int selectedRow = jTable1.getSelectedRow();

double h = 0, a = 0, b = 0, rez = 0;

if(selectedRow!=-1)

{

a = Double.parseDouble(myTable.getValueAt(selectedRow, 0).toString());

b = Double.parseDouble(myTable.getValueAt(selectedRow, 1).toString());

h = Double.parseDouble(myTable.getValueAt(selectedRow, 2).toString());

}

/\*for (double i = a; i<b; i=i+h)

{

if(i+h>b)

{

h = b-i;

}

x += h \* (1/Math.log(i) + 1/Math.log(i+h)) / 2;

}\*/

//int Tcount = (int)(b - a) / 4;

rez = MutliThreadCalculate(b, a, h,4);

myTable.setValueAt(rez, selectedRow, 3);

RecIntegral lin = new RecIntegral(a,b,h,rez);

Line.add(lin);

}

private void jButton4ActionPerformed(java.awt.event.ActionEvent evt) {

DefaultTableModel myTable = (DefaultTableModel)jTable1.getModel();

for(RecIntegral rec: Line)

{

myTable.addRow(new Object[]{rec.a,rec.b,rec.h,rec.rez});

}

}

private void jButton5ActionPerformed(java.awt.event.ActionEvent evt) {

DefaultTableModel myTable=(DefaultTableModel)jTable1.getModel();

myTable.setRowCount(0);

}

private void jButton6ActionPerformed(java.awt.event.ActionEvent evt) {

JFileChooser fileopen = new JFileChooser();

int ret = fileopen.showDialog(null, "Cохранить файл");

if (ret == JFileChooser.APPROVE\_OPTION) {

File file = fileopen.getSelectedFile();

try {

FileWriter myfile = new FileWriter(file);

for(RecIntegral rec: Line)

{

String a = String.valueOf(rec.a) + " " + String.valueOf(rec.b)+ " " + String.valueOf(rec.h)+ " " + String.valueOf(rec.rez) + "\n";

myfile.write(a);

}

myfile.close();

} catch (IOException ex) {

Logger.getLogger(UI.class.getName()).log(Level.SEVERE, null, ex);

}

}

}

private void jButton9ActionPerformed(java.awt.event.ActionEvent evt) {

DefaultTableModel myTable=(DefaultTableModel)jTable1.getModel();

Line.clear();

myTable.setRowCount(0);

int selectedRow = jTable1.getSelectedRow();

JFileChooser fileopen = new JFileChooser();

int ret = fileopen.showDialog(null, "Открыть файл");

if (ret == JFileChooser.APPROVE\_OPTION) {

File file = fileopen.getSelectedFile();

try {

FileReader myfile = new FileReader(file);

Scanner scan = new Scanner(myfile);

Double a,b,h,rez;

String str;

String[] arr;

while (scan.hasNextLine()) {

str = scan.nextLine();

arr = str.split(" ");

str = arr[0];

a = Double.parseDouble(str);

str = arr[1];

b = Double.parseDouble(str);

str = arr[2];

h = Double.parseDouble(str);

str = arr[3];

rez = Double.parseDouble(str);

Line.add(new RecIntegral(a,b,h,rez));

}

for(RecIntegral rec: Line)

{

myTable.addRow(new Object[]{rec.a,rec.b,rec.h,rec.rez});

}

myfile.close();

} catch (FileNotFoundException ex) {

Logger.getLogger(UI.class.getName()).log(Level.SEVERE, null, ex);

} catch (IOException ex) {

Logger.getLogger(UI.class.getName()).log(Level.SEVERE, null, ex);

}

}

}

private void jButton7ActionPerformed(java.awt.event.ActionEvent evt) {

ObjectOutputStream out = null;

JFileChooser fileopen = new JFileChooser();

int ret = fileopen.showDialog(null, "Cохранить файл");

if (ret == JFileChooser.APPROVE\_OPTION) {

File file = fileopen.getSelectedFile();

try{

out = new ObjectOutputStream(new BufferedOutputStream(new FileOutputStream(file)));

out.writeObject(Line);

out.close();

}catch(IOException ex)

{

ex.printStackTrace();

}

}

/\*JFileChooser fileopen = new JFileChooser();

int ret = fileopen.showDialog(null, "Cохранить файл");

if (ret == JFileChooser.APPROVE\_OPTION) {

File file = fileopen.getSelectedFile();

try{

FileOutputStream outputStream = new FileOutputStream(file);

ObjectOutputStream objectOutputStream = new ObjectOutputStream(outputStream);

objectOutputStream.writeObject(Line);

objectOutputStream.close();

outputStream.close();

}catch(IOException ex)

{

ex.printStackTrace();

}

}\*/

}

private void jButton8ActionPerformed(java.awt.event.ActionEvent evt) {

DefaultTableModel myTable = (DefaultTableModel) jTable1.getModel();

myTable.setRowCount(0);

JFileChooser fileopen = new JFileChooser();

int ret = fileopen.showDialog(null, "Cохранить файл");

if (ret == JFileChooser.APPROVE\_OPTION) {

File file = fileopen.getSelectedFile();

try {

FileInputStream fileInputStream = new FileInputStream(file);

ObjectInputStream objectInputStream = new ObjectInputStream(fileInputStream);

//Line = new ArrayList<>();

Line.clear();

while (true) {

try {

Line = (ArrayList<RecIntegral>) objectInputStream.readObject();

//Line.add((ArrayListRecIntegral) objectInputStream.readObject());

} catch (EOFException e) {

break;

}

}

objectInputStream.close();

for(RecIntegral rec: Line)

{

myTable.addRow(new Object[]{rec.a,rec.b,rec.h,rec.rez});

}

} catch (IOException | ClassNotFoundException ex) {

ex.printStackTrace();

}

}

}

/\*\*

\* @param args the command line arguments

\*/

public static void main(String args[]) {

/\* Set the Nimbus look and feel \*/

//<editor-fold defaultstate="collapsed" desc=" Look and feel setting code (optional) ">

/\* If Nimbus (introduced in Java SE 6) is not available, stay with the default look and feel.

\* For details see http://download.oracle.com/javase/tutorial/uiswing/lookandfeel/plaf.html

\*/

try {

for (javax.swing.UIManager.LookAndFeelInfo info : javax.swing.UIManager.getInstalledLookAndFeels()) {

if ("Nimbus".equals(info.getName())) {

javax.swing.UIManager.setLookAndFeel(info.getClassName());

break;

}

}

} catch (ClassNotFoundException ex) {

java.util.logging.Logger.getLogger(UI.class.getName()).log(java.util.logging.Level.SEVERE, null, ex);

} catch (InstantiationException ex) {

java.util.logging.Logger.getLogger(UI.class.getName()).log(java.util.logging.Level.SEVERE, null, ex);

} catch (IllegalAccessException ex) {

java.util.logging.Logger.getLogger(UI.class.getName()).log(java.util.logging.Level.SEVERE, null, ex);

} catch (javax.swing.UnsupportedLookAndFeelException ex) {

java.util.logging.Logger.getLogger(UI.class.getName()).log(java.util.logging.Level.SEVERE, null, ex);

}

//</editor-fold>

/\* Create and display the form \*/

java.awt.EventQueue.invokeLater(new Runnable() {

public void run() {

new UI().setVisible(true);

}

});

}

// Variables declaration - do not modify

private javax.swing.JButton jButton1;

private javax.swing.JButton jButton2;

private javax.swing.JButton jButton3;

private javax.swing.JButton jButton4;

private javax.swing.JButton jButton5;

private javax.swing.JButton jButton6;

private javax.swing.JButton jButton7;

private javax.swing.JButton jButton8;

private javax.swing.JButton jButton9;

private javax.swing.JLabel jLabel1;

private javax.swing.JLabel jLabel2;

private javax.swing.JLabel jLabel3;

private javax.swing.JLabel jLabel4;

private javax.swing.JLabel jLabel5;

private javax.swing.JLabel jLabel6;

private javax.swing.JPanel jPanel1;

private javax.swing.JScrollPane jScrollPane1;

private javax.swing.JTable jTable1;

private javax.swing.JTextField jTextField1;

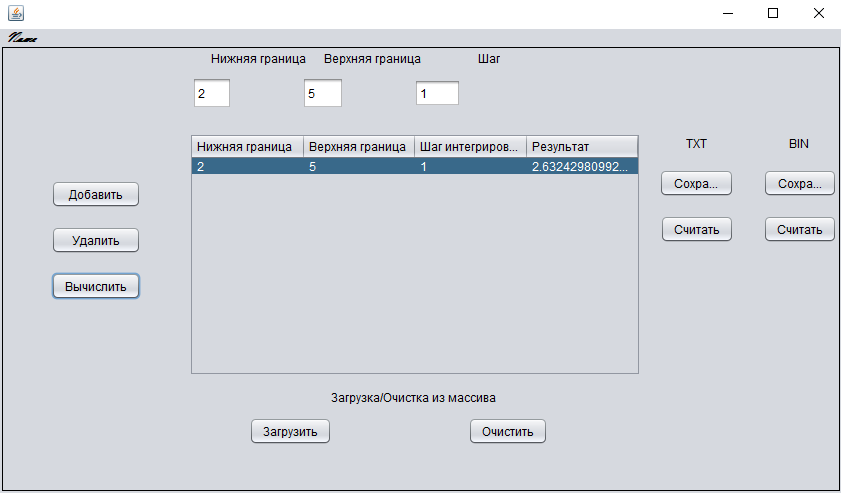
private javax.swing.JTextField jTextField2;

private javax.swing.JTextField jTextField3;

// End of variables declaration

}

**Результаты работы программы:**

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**Вывод:** в ходе выполнения лабораторной работы №3 мы научились разрабатывать приложения, обладающие графическим интерфейсом пользователя, с использованием библиотеки Swing. Результаты работы программ совпали с результатами трассировки, следовательно программы работают без ошибок**.**