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| Пензенский государственный университет  Факультет вычислительной техники  Кафедра «Вычислительная техника» |
| Отчет  по лабораторной работе №5  по дисциплине «Программирование на языке Java»  на тему «Многопоточность в Java»  Вариант № 1 |
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| Пенза  2021 |

**Цель работы:** научиться создавать многопоточные приложения c использованием стандартных средств языка Java.

Задание: Модифицировать приложение из предыдущей лабораторной работы, реализовав вычисление определенного интеграла в нескольких дополнительных потоках (1), снимая нагрузку с основного потока и предотвращая "подвисание" графического интерфейса. Реализуют многопоточность путем наследования от класса Thread.

**Порядок выполнения работы:**

**Листинг:**

**NewJFrame.java:**

/\*

\* Click nbfs://nbhost/SystemFileSystem/Templates/Licenses/license-default.txt to change this license

\* Click nbfs://nbhost/SystemFileSystem/Templates/GUIForms/JFrame.java to edit this template

\*/

package lab1;

import javax.swing.table.DefaultTableModel;

import java.util.ArrayList;

import java.util.logging.Level;

import java.util.logging.Logger;

import javax.swing.JOptionPane;

import java.io.\*;

import javax.swing.JFileChooser;

import java.net.\*;

/\*\*

\*

\* @author dunke

\*/

public class NewJFrame extends javax.swing.JFrame {

public NewJFrame() {

initComponents();

}

@SuppressWarnings("unchecked")

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

private void initComponents() {

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();

jButton4 = new javax.swing.JButton();

jButton5 = new javax.swing.JButton();

jButton6 = new javax.swing.JButton();

jButton7 = new javax.swing.JButton();

jButton8 = new javax.swing.JButton();

jButton9 = new javax.swing.JButton();

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

jTextField1.setText("0");

jTextField2.setText("0");

jTextField3.setText("0");

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

new Object [][] {

},

new String [] {

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

}

));

jTable1.setName(""); // NOI18N

jTable1.addAncestorListener(new javax.swing.event.AncestorListener() {

public void ancestorAdded(javax.swing.event.AncestorEvent evt) {

none(evt);

}

public void ancestorMoved(javax.swing.event.AncestorEvent evt) {

}

public void ancestorRemoved(javax.swing.event.AncestorEvent evt) {

}

});

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);

}

});

jButton4.setText("Очистить");

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

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

jButton4ActionPerformed(evt);

}

});

jButton5.setText("Заполнить");

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

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

jButton5ActionPerformed(evt);

}

});

jButton6.setText("save bin");

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

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

jButton6ActionPerformed(evt);

}

});

jButton7.setText("load bin");

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

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

jButton7ActionPerformed(evt);

}

});

jButton8.setText("save text");

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

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

jButton8ActionPerformed(evt);

}

});

jButton9.setText("load text");

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

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

jButton9ActionPerformed(evt);

}

});

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

getContentPane().setLayout(layout);

layout.setHorizontalGroup(

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

.addGroup(layout.createSequentialGroup()

.addContainerGap()

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

.addGroup(layout.createSequentialGroup()

.addComponent(jTextField1, javax.swing.GroupLayout.PREFERRED\_SIZE, 178, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addGap(18, 18, 18)

.addComponent(jTextField3, javax.swing.GroupLayout.PREFERRED\_SIZE, 178, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addGap(18, 18, 18)

.addComponent(jTextField2, javax.swing.GroupLayout.PREFERRED\_SIZE, 178, javax.swing.GroupLayout.PREFERRED\_SIZE))

.addComponent(jScrollPane1, javax.swing.GroupLayout.PREFERRED\_SIZE, 813, javax.swing.GroupLayout.PREFERRED\_SIZE))

.addPreferredGap(javax.swing.LayoutStyle.ComponentPlacement.RELATED, 27, Short.MAX\_VALUE)

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

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

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

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

.addComponent(jButton3, javax.swing.GroupLayout.DEFAULT\_SIZE, 117, Short.MAX\_VALUE)

.addComponent(jButton4, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)

.addComponent(jButton5, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE))

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

.addComponent(jButton6, javax.swing.GroupLayout.Alignment.LEADING, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)

.addComponent(jButton7, javax.swing.GroupLayout.Alignment.LEADING, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, Short.MAX\_VALUE)

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

.addComponent(jButton9))

.addContainerGap())

);

layout.setVerticalGroup(

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

.addGroup(layout.createSequentialGroup()

.addGap(30, 30, 30)

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

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

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

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

.addPreferredGap(javax.swing.LayoutStyle.ComponentPlacement.RELATED, 16, Short.MAX\_VALUE)

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

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

.addGroup(layout.createSequentialGroup()

.addGap(11, 11, 11)

.addComponent(jButton1)

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

.addComponent(jButton2)

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

.addComponent(jButton3)

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

.addComponent(jButton4)

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

.addComponent(jButton5)

.addGap(18, 18, 18)

.addComponent(jButton6)

.addGap(18, 18, 18)

.addComponent(jButton7)

.addGap(18, 18, 18)

.addComponent(jButton8)

.addGap(18, 18, 18)

.addComponent(jButton9)))

.addGap(33, 33, 33))

);

pack();

}// </editor-fold>

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

public class MyThread extends Thread {

@Override

public void run(){

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

int row = jTable1.getSelectedRow();

if(row != -1){

dt.setValueAt(integralList.get(row).integralCalculate(), row, 3);

}

try {

Thread.sleep(1000);

}

catch (InterruptedException e) {

System.out.println("Interrupt");

}

}

}

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

try

{

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

integralList.add(0, new RecIntegral(jTextField1.getText(),jTextField3.getText(),jTextField2.getText()));

dt.insertRow(0,new Object[]{jTextField1.getText(),jTextField3.getText(),jTextField2.getText()});

} catch (NumException ex) {

JOptionPane.showMessageDialog(null, ex);

}

}

private void none(javax.swing.event.AncestorEvent evt) {

}

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

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

int row = jTable1.getSelectedRow();

if(row != -1){

dt.removeRow(jTable1.getSelectedRow());

integralList.remove(row);

}

}

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

MyThread thread = new MyThread();

thread.start();

}

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

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

dt.setRowCount(0);

}

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

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

dt.setRowCount(0);

for (RecIntegral recInt : integralList)

{

dt.addRow(new Object[]{recInt.getLowStep(), recInt.getHighStep(), recInt.getIntegralStep(), recInt.getIntegralResult()});

}

}

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

JFileChooser fileChooser = new JFileChooser();

fileChooser.setDialogTitle("Save file binary");

int res = fileChooser.showSaveDialog(null);

if(res == JFileChooser.APPROVE\_OPTION)

{

File fopen = fileChooser.getSelectedFile();

ObjectOutputStream saveArray = null;

try{

saveArray = new ObjectOutputStream(new BufferedOutputStream(new FileOutputStream(fopen)));

saveArray.writeObject(integralList);

}catch(IOException e){

e.printStackTrace();

}finally{

try{

saveArray.close();

}catch(IOException e){

e.printStackTrace();

}

}

}

}

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

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

dt.setRowCount(0);

JFileChooser fileChooser = new JFileChooser();

fileChooser.setDialogTitle("Load file binary");

int res = fileChooser.showOpenDialog(null);

if(res == JFileChooser.APPROVE\_OPTION)

{

File fopen = fileChooser.getSelectedFile();

ObjectInputStream loadArray = null;

try{

loadArray = new ObjectInputStream(new BufferedInputStream(new FileInputStream(fopen)));

integralList = (ArrayList)loadArray.readObject();

}catch(IOException e){

e.printStackTrace();

}catch(ClassNotFoundException classErr){

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

}finally{

try{

loadArray.close();

}catch(IOException e){

e.printStackTrace();

}

}

for (RecIntegral recInt : integralList)

{

dt.addRow(new Object[]{recInt.getLowStep(), recInt.getHighStep(), recInt.getIntegralStep(), recInt.getIntegralResult()});

}

}

}

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

JFileChooser fileChooser = new JFileChooser();

fileChooser.setDialogTitle("Save file text");

int res = fileChooser.showSaveDialog(null);

if(res == JFileChooser.APPROVE\_OPTION)

{

File fopen = fileChooser.getSelectedFile();

FileWriter fwriter = null;

try

{

fwriter = new FileWriter(fopen);

for(RecIntegral recInt : integralList)

{

fwriter.write(recInt.getLowStep() + " " + recInt.getHighStep() + " " + recInt.getIntegralStep() + " " + recInt.getIntegralResult() + "\r\n");

}

fwriter.close();

}

catch(IOException e)

{

e.printStackTrace();

}

finally

{

if(fwriter != null)

{

try

{

fwriter.close();

}

catch(IOException e)

{

e.printStackTrace();

}

}

}

}

}

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

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

JFileChooser fileChooser = new JFileChooser();

fileChooser.setDialogTitle("Load file text");

int res = fileChooser.showOpenDialog(null);

if(res == JFileChooser.APPROVE\_OPTION)

{

File fopen = fileChooser.getSelectedFile();

BufferedReader bufread = null;

FileReader fread = null;

String line;

String[] values;

try

{

fread = new FileReader(fopen);

bufread = new BufferedReader(fread);

while(true)

{

line = bufread.readLine();

if(line == null)

break;

values = line.split(" ");

try

{

integralList.add(0, new RecIntegral(values[0], values[1], values[2], values[3]));

dt.addRow(new Object[]{values[0], values[1], values[2], values[3]});

}

catch (NumException e)

{

e.printStackTrace();

}

}

}

catch(IOException e)

{

e.printStackTrace();

}

finally

{

try

{

fread.close();

bufread.close();

}

catch(IOException e)

{

e.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(NewJFrame.class.getName()).log(java.util.logging.Level.SEVERE, null, ex);

} catch (InstantiationException ex) {

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

} catch (IllegalAccessException ex) {

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

} catch (javax.swing.UnsupportedLookAndFeelException ex) {

java.util.logging.Logger.getLogger(NewJFrame.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 NewJFrame().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.JScrollPane jScrollPane1;

private javax.swing.JTable jTable1;

private javax.swing.JTextField jTextField1;

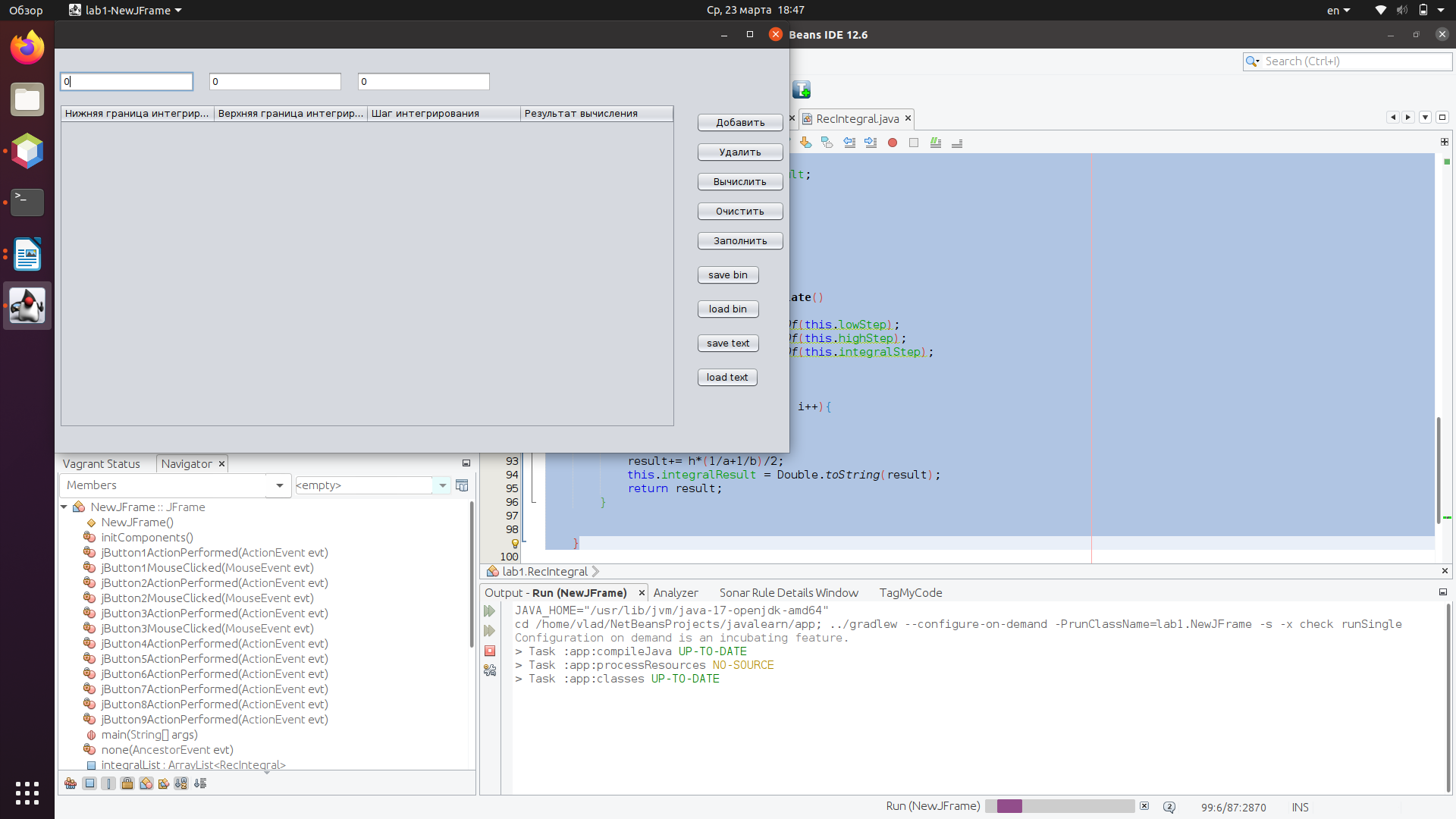
private javax.swing.JTextField jTextField2;

private javax.swing.JTextField jTextField3;

// End of variables declaration

}

Результат работы программы:

Рисунок 1. Результат работы программы.

# Вывод: В ходе выполнения лабораторной работы научились создавать многопоточные приложения c использованием стандартных средств языка Java.