Министерство науки и высшего образования Российской Федерации

Пензенский государственный университет

Кафедра «Вычислительная техника»

**ОТЧЕТ**

по лабораторной работе №5

по курсу «Программирование на языке Java»

на тему «Многопоточность Java»

Вариант №6

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**Цель:** 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 (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.

**Задание по варианту:** Runnable

**Ход работы:**

1. Запустили и провели необходимые тесты для проверки правильности работы приложения.

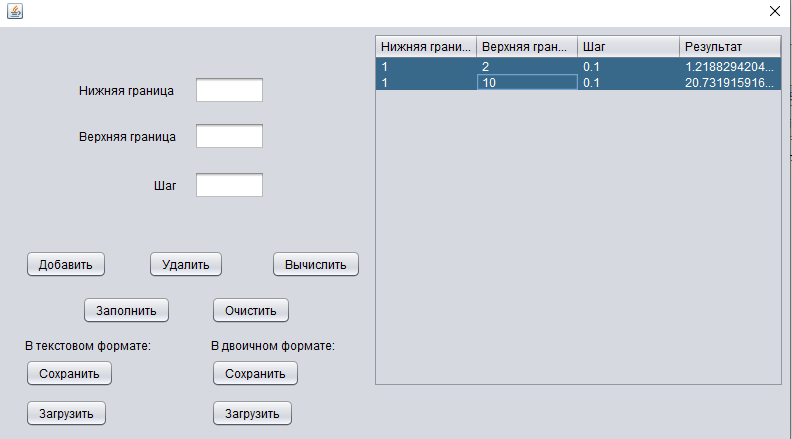
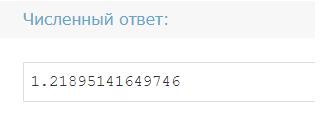


Рисунок 1 - Результат вычисления приложения



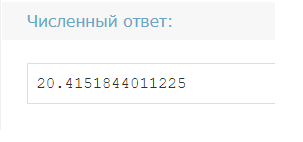


Рисунок 2 – Результат вычисления на сайте

Результаты вычислений с помощью многопоточности совпал с результатом проверки на сайте.

**Листинг myRunnable:**

public class myRunnable implements Runnable{

double bottomBorder;

double topBorder;

double step;

double result = 0.0;

myRunnable(double \_bottomBorder, double \_topBorder, double \_step) {

bottomBorder = \_bottomBorder;

topBorder = \_topBorder;

step = \_step;

}

@Override

public void run() {

System.out.println("Поток запущен");

for(double i = bottomBorder; i < topBorder; i += step)

result += step \* (Math.pow(i, 0.5) + Math.pow(i + step, 0.5)) / 2;

}

public synchronized double getResult() {

return result;

}

}

**Листинг laba:**

import javax.swing.table.DefaultTableModel;

import java.io.\*;

import java.lang.System.Logger.Level;

import java.util.LinkedList;

import java.util.logging.Logger;

import javax.swing.JOptionPane;

import javax.swing.JFileChooser;

public class laba extends javax.swing.JDialog {

private LinkedList<Object> Recintegral = new LinkedList<>();

public laba(java.awt.Frame parent, boolean modal) {

super(parent, modal);

initComponents();

}

public class ExceptionZnach extends Exception {

public ExceptionZnach(String message) {

JOptionPane.showMessageDialog(null, message, "Ошибка", JOptionPane.ERROR\_MESSAGE);

}

}

@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();

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();

jScrollPane1 = new javax.swing.JScrollPane();

jTable1 = new javax.swing.JTable();

jLabel1 = new javax.swing.JLabel();

jLabel2 = new javax.swing.JLabel();

jLabel3 = new javax.swing.JLabel();

jButton6 = new javax.swing.JButton();

jLabel4 = new javax.swing.JLabel();

jButton7 = new javax.swing.JButton();

jLabel5 = new javax.swing.JLabel();

jButton8 = new javax.swing.JButton();

jButton9 = new javax.swing.JButton();

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

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);

}

});

jTextField3.addActionListener(new java.awt.event.ActionListener() {

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

jTextField3ActionPerformed(evt);

}

});

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("Заполнить");

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);

}

});

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

new Object [][] {

},

new String [] {

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

}

));

jScrollPane1.setViewportView(jTable1);

jLabel1.setText("Нижняя граница");

jLabel2.setText("Верхняя граница");

jLabel3.setText("Шаг");

jButton6.setText("Сохранить");

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

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

jButton6ActionPerformed(evt);

}

});

jLabel4.setText("В текстовом формате:");

jButton7.setText("Загрузить");

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

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

jButton7ActionPerformed(evt);

}

});

jLabel5.setText("В двоичном формате:");

jButton8.setText("Сохранить");

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

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

jButton8ActionPerformed(evt);

}

});

jButton9.setText("Загрузить");

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

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

jButton9ActionPerformed(evt);

}

});

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

jPanel1.setLayout(jPanel1Layout);

jPanel1Layout.setHorizontalGroup(

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

.addGroup(jPanel1Layout.createSequentialGroup()

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

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(74, 74, 74)

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

.addComponent(jLabel1)

.addComponent(jLabel2)

.addComponent(jLabel3, javax.swing.GroupLayout.Alignment.TRAILING))

.addGap(18, 18, 18)

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

.addComponent(jTextField2, javax.swing.GroupLayout.PREFERRED\_SIZE, 71, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addComponent(jTextField3, javax.swing.GroupLayout.PREFERRED\_SIZE, 71, javax.swing.GroupLayout.PREFERRED\_SIZE)

.addComponent(jTextField1, javax.swing.GroupLayout.PREFERRED\_SIZE, 71, javax.swing.GroupLayout.PREFERRED\_SIZE)))

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(20, 20, 20)

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

.addComponent(jButton6)

.addGroup(jPanel1Layout.createSequentialGroup()

.addComponent(jButton1)

.addGap(41, 41, 41)

.addComponent(jButton2)

.addGap(47, 47, 47)

.addComponent(jButton3))

.addComponent(jLabel4)

.addComponent(jButton7)))

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(77, 77, 77)

.addComponent(jButton4)

.addGap(40, 40, 40)

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

.addComponent(jButton5)

.addComponent(jLabel5)

.addComponent(jButton8)

.addComponent(jButton9))))

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

.addComponent(jScrollPane1, javax.swing.GroupLayout.DEFAULT\_SIZE, 411, Short.MAX\_VALUE))

);

jPanel1Layout.setVerticalGroup(

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

.addGroup(jPanel1Layout.createSequentialGroup()

.addGap(34, 34, 34)

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

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

.addComponent(jLabel1))

.addGap(18, 18, 18)

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

.addComponent(jLabel2)

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

.addGap(21, 21, 21)

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

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

.addComponent(jLabel3))

.addGap(51, 51, 51)

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

.addComponent(jButton1)

.addComponent(jButton2)

.addComponent(jButton3))

.addGap(18, 18, 18)

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

.addComponent(jButton4)

.addComponent(jButton5))

.addGap(13, 13, 13)

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

.addComponent(jLabel4)

.addComponent(jLabel5))

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

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

.addComponent(jButton6)

.addComponent(jButton8))

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

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

.addComponent(jButton7)

.addComponent(jButton9))

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

.addGroup(jPanel1Layout.createSequentialGroup()

.addComponent(jScrollPane1, javax.swing.GroupLayout.PREFERRED\_SIZE, 275, javax.swing.GroupLayout.PREFERRED\_SIZE)

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

);

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()

.addComponent(jPanel1, javax.swing.GroupLayout.PREFERRED\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.PREFERRED\_SIZE)

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

);

layout.setVerticalGroup(

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

.addGroup(layout.createSequentialGroup()

.addContainerGap()

.addComponent(jPanel1, javax.swing.GroupLayout.PREFERRED\_SIZE, javax.swing.GroupLayout.DEFAULT\_SIZE, javax.swing.GroupLayout.PREFERRED\_SIZE)

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

);

pack();

}// </editor-fold>

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

// TODO add your handling code here:

}

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

// TODO add your handling code here:

}

private void jTextField3ActionPerformed(java.awt.event.ActionEvent evt) {

// TODO add your handling code here:

}

// public double GetIntegral(double bottomBorder, double topBorder, double step)

// {

// double result = 0;

// for(double i = bottomBorder; i < topBorder; i += step)

// result += step \* (Math.pow(i, 0.5) + Math.pow(i + step, 0.5)) / 2;

//

// return result;

// }

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

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

// model.addRow( new Object[]{jTextField1.getText(), jTextField2.getText(), jTextField3.getText(), "0.0"});

try{

String \_field1 = jTextField1.getText();

String \_field2 = jTextField2.getText();

String \_field3 = jTextField3.getText();

double field1 = Double.parseDouble(\_field1);

double field2 = Double.parseDouble(\_field2);

double field3 = Double.parseDouble(\_field3);

if (((0.000001 < field1 )&(field1 < 1000000))&((0.000001 < field2 )&(field2 < 1000000))&((0.000001 < field3 )&(field3 < 1000000)))

{

model.addRow( new Object[]{jTextField1.getText(), jTextField2.getText(), jTextField3.getText(), "0.0"});

Recintegral.add(jTextField1.getText());

Recintegral.add(jTextField2.getText());

Recintegral.add(jTextField3.getText());

jTextField1.setText("");

jTextField2.setText("");

jTextField3.setText("");

}

else

{

throw new ExceptionZnach("Вы ввели числа отличные от диапазона 0,000001 - 1000000");

}

} catch(ExceptionZnach e){}

}

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

// TODO add your handling code here:

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

dtm.removeRow(jTable1.getSelectedRow());

int nRow = jTable1.getSelectedRow();

for(int i = 0; i < 3; ++i)

Recintegral.remove(nRow \* 3 + 3);

}

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

// TODO add your handling code here:

int rowNumber = jTable1.getRowCount();

double res;

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

{

if (jTable1.getValueAt(i, 1)!=null)

{

myRunnable Thread = new myRunnable(

Double.parseDouble((String)jTable1.getValueAt(i, 0)),

Double.parseDouble((String)jTable1.getValueAt(i, 1)),

Double.parseDouble((String)jTable1.getValueAt(i, 2)));

Thread.run();

res = Thread.getResult();

jTable1.setValueAt(res,i, 3);

}

}

}

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

// TODO add your handling code here:

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

for (int i = 0; i< Recintegral.size (); i+=3)

{

model.addRow( new Object[]{Recintegral.get(i), Recintegral.get(i+1), Recintegral.get(i+2), "0.0"});

}

}

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

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

dtm.setRowCount(0);

}

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

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

int[] rowCount = jTable1.getSelectedRows();

try(PrintWriter fwrite = new PrintWriter("save.txt"))

{

for (int item : rowCount){

for(int i = 0; i < 4; i++)

{

fwrite.println(model.getValueAt(item, i));

}

}

fwrite.close();

}

catch(IOException e){}

}

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

// TODO add your handling code here:

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

JFileChooser chooser = new JFileChooser();

chooser.showOpenDialog(null);

String myfile = chooser.getSelectedFile().toString();

int cnt = 0; //для подсчета строк в файле

try (FileReader fr = new FileReader(myfile);){

LineNumberReader lineNumberReader = new LineNumberReader(fr);

while ( lineNumberReader.readLine() != null)

{

cnt = lineNumberReader.getLineNumber(); // кол-во строк

}

lineNumberReader.close();

} catch (IOException e) {}

try(BufferedReader fread = new BufferedReader (new FileReader(myfile))) //в буфер пишутся данные

{

String[] buf = new String[cnt];

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

{

buf[i] = fread.readLine();

}

for(int i = 0; i < cnt; i+=4) //добавить

{

model.addRow(new Object[]{buf[i], buf[i+1], buf[i+2], buf[i+3]});

}

fread.close();

}

catch(IOException e){

throw new RuntimeException(e); }

}

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

try{

ObjectOutputStream out = null;

out = new ObjectOutputStream(new FileOutputStream("download.ser"));

out.writeObject(Recintegral);

}

catch (IOException ex)

{

ex.printStackTrace();

}

}

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

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

JFileChooser chooser = new JFileChooser();

chooser.showOpenDialog(null);

File myfile = chooser.getSelectedFile();

try{

ObjectInputStream in = new ObjectInputStream(new BufferedInputStream(new FileInputStream(myfile)));

Recintegral = (LinkedList<Object>) in.readObject();

}

catch (IOException | ClassNotFoundException ex){}

for (int i = 0; i< Recintegral.size (); i+=3)

{

model.addRow( new Object[]{Recintegral.get(i), Recintegral.get(i+1), Recintegral.get(i+2), "0.0"});

}

}

public static void main(String args[]) {

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

} catch (InstantiationException ex) {

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

} catch (IllegalAccessException ex) {

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

} catch (javax.swing.UnsupportedLookAndFeelException ex) {

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

}

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

public void run() {

laba dialog = new laba(new javax.swing.JFrame(), true);

dialog.addWindowListener(new java.awt.event.WindowAdapter() {

@Override

public void windowClosing(java.awt.event.WindowEvent e) {

System.exit(0);

}

});

dialog.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.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

}

**Вывод:** научились создавать многопоточные приложения c использованием стандартных средств языка Java.