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Lab #10

Date: December 11, 2022

Objectives: The objective of this lab was to understand the design principles of graphical user interfaces (GUI); to be able to build GUI; to understand the packages containing GUI-related components, event handling classes, and interfaces; to be able to create and manipulate buttons, labels, lists, text fields, and panels; to understand and be able to use layout managers; to understand action events classes and methods. In this lab, I need to create a class called Calculator to create a calculator with buttons and a display. Then add the number buttons, the arithmetic function buttons (+, -, *, /), the trig function buttons (sin, cos, tan, ln), the clear, square root, power, and square buttons; add functionalities to action buttons so the calculator can perform various functions. Thus, to complete the lab, I need to know how to create a class, provide a constructor that enables an object of this class to be initialized when it is declared, and write a method and call it in the program. I also need to know how to create the GUI with labels, text fields, buttons, and panels. Then I need to have and be able to use layout managers. Finally, I need to know how to use event-handling classes and interfaces.

Program:

```

1 import java.awt.event.*;
2 import javax.swing.*;
3 import java.awt.*;
4 import java.lang.Math;
5 class calculator extends JFrame implements ActionListener {
6     // create a frame
7     static JFrame f;
8
9     // create a textfield
10    static JTextField l;
11
12    // store operator and operands
13    String s0, s1, s2;
14
15    // default constructor
16    calculator()
17    {
18        s0 = s1 = s2 = "";
19    }
20
21    // main function
22    public static void main(String args[])
23    {
24        // create a frame
25        f = new JFrame("calculator");
26
27        // create a object of class
28        calculator c = new calculator();
29
30        // create a textfield
31        l = new JTextField(32);
32
33        // set the textfield to non editable
34        l.setEditable(false);
35
36        // create number buttons and some operators
37        JButton b0, b1, b2, b3, b4, b5, b6, b7, b8, b9, ba, bs, bd, bm, be, beq, beq1, bSin, bCos, bTan, bLn, bSqr, bPow, bSqu;
38
39        // create number buttons
40        b0 = new JButton("0");
41        b1 = new JButton("1");
42        b2 = new JButton("2");
43        b3 = new JButton("3");
44        b4 = new JButton("4");
45        b5 = new JButton("5");
46        b6 = new JButton("6");
47        b7 = new JButton("7");
48        b8 = new JButton("8");
49        b9 = new JButton("9");
50
51        // equals button
52        beq1 = new JButton("=");
53
54        // create operator buttons
55        ba = new JButton("+");
56        bs = new JButton("-");
57        bd = new JButton("/");
58        bm = new JButton("*");
59        beq = new JButton("C");
60
61        // create . button
62        be = new JButton(".");
63
64        //create trig buttons
65        bCos = new JButton("cos");
66        bSin = new JButton("sin");
67        bTan = new JButton("tan");
68
69        //create exponent buttons
70        bSqr = new JButton("sqrt");
71        bSqu = new JButton("x^2");
72        bPow = new JButton("x^y");
73        bLn = new JButton("ln");
74

```

```

75         //set button sizes
76         b0.setPreferredSize(new Dimension(90, 50));
77         b1.setPreferredSize(new Dimension(90, 50));
78         b2.setPreferredSize(new Dimension(90, 50));
79         b3.setPreferredSize(new Dimension(90, 50));
80         b4.setPreferredSize(new Dimension(90, 50));
81         b5.setPreferredSize(new Dimension(90, 50));
82         b6.setPreferredSize(new Dimension(90, 50));
83         b7.setPreferredSize(new Dimension(90, 50));
84         b8.setPreferredSize(new Dimension(90, 50));
85         b9.setPreferredSize(new Dimension(90, 50));
86         ba.setPreferredSize(new Dimension(90, 50));
87         bs.setPreferredSize(new Dimension(90, 50));
88         bm.setPreferredSize(new Dimension(90, 50));
89         bd.setPreferredSize(new Dimension(90, 50));
90         beq1.setPreferredSize(new Dimension(90, 50));
91         be.setPreferredSize(new Dimension(90, 50));
92         bSin.setPreferredSize(new Dimension(90, 50));
93         bCos.setPreferredSize(new Dimension(90, 50));
94         bTan.setPreferredSize(new Dimension(90, 50));
95         bLn.setPreferredSize(new Dimension(90, 50));
96         bSqr.setPreferredSize(new Dimension(90, 50));
97         bSqu.setPreferredSize(new Dimension(90, 50));
98         bPow.setPreferredSize(new Dimension(90, 50));
99         beq.setPreferredSize(new Dimension(90, 50));
100
101     // create a panel
102     JPanel p = new JPanel();
103
104     // add action listeners
105     bm.addActionListener(c);
106     bd.addActionListener(c);
107     bs.addActionListener(c);
108     ba.addActionListener(c);
109     b9.addActionListener(c);
110     b8.addActionListener(c);
111     b7.addActionListener(c);
112     b6.addActionListener(c);
113     b5.addActionListener(c);
114     b4.addActionListener(c);
115     b3.addActionListener(c);
116     b2.addActionListener(c);
117     b1.addActionListener(c);
118     b0.addActionListener(c);
119     be.addActionListener(c);
120     beq.addActionListener(c);
121     beq1.addActionListener(c);
122     bSin.addActionListener(c);
123     bCos.addActionListener(c);
124     bTan.addActionListener(c);
125     bLn.addActionListener(c);
126     bSqr.addActionListener(c);
127     bSqu.addActionListener(c);
128     bPow.addActionListener(c);
129
130     // add elements to panel
131     p.add(l);
132     p.add(b7);
133     p.add(b8);
134     p.add(b9);
135     p.add(bd);
136     p.add(b4);
137     p.add(b5);
138     p.add(b6);
139     p.add(bm);
140     p.add(b1);
141     p.add(b2);
142     p.add(b3);
143     p.add(bs);
144     p.add(b0);
145     p.add(be);
146     p.add(beq1);
147     p.add(ba);
148     p.add(bSin);
149     p.add(bCos);
150     p.add(bTan);
151     p.add(bLn);
152     p.add(beq);
153     p.add(bSqr);
154     p.add(bPow);
155     p.add(bSqu);
156

```

```

157 // add panel to frame
158 f.add(p);
159
160 f.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
161 f.setSize(400, 400);
162 f.setVisible(true);
163 }
164 public void actionPerformed(ActionEvent e)
165 {
166     String s = e.getActionCommand();
167
168     // if the value is a number
169     if ((s.charAt(0) >= '0' && s.charAt(0) <= '9') || s.charAt(0) == '.') {
170         // if operand is present then add to second no
171         if (!s1.equals(""))
172             s2 = s2 + s;
173         else
174             s0 = s0 + s;
175
176         // set the value of text
177         l.setText(s0 + s1 + s2);
178     }
179     //if the value is clear
180     else if (s.charAt(0) == 'C') {
181         // clear the one letter
182         s0 = s1 = s2 = "";
183
184         // set the value of text
185         l.setText(s0 + s1 + s2);
186     }
187
188     //equal sign
189     else if (s.charAt(0) == '=') {
190
191         double te;
192
193         // store the value in 1st
194         if (s1.equals("+"))
195             te = (Double.parseDouble(s0) + Double.parseDouble(s2));
196         else if (s1.equals("-"))
197             te = (Double.parseDouble(s0) - Double.parseDouble(s2));
198         else if (s1.equals("/"))
199             te = (Double.parseDouble(s0) / Double.parseDouble(s2));
200         else if (s1.equals("x^y"))
201             te = Math.pow(Double.parseDouble(s0), Double.parseDouble(s2));
202         else
203             te = (Double.parseDouble(s0) * Double.parseDouble(s2));
204
205         // set the value of text
206         String text = Double.toString(te);
207         l.setText(text);
208
209         // convert it to string
210         s0 = Double.toString(te);
211
212         s1 = s2 = "";
213     }
214     //sin
215     else if (s.charAt(0) == 's' && s.charAt(1) == 'i' && s.charAt(2) == 'n') { //check if sin is selected
216         double res = Math.sin(Double.parseDouble(s0)); //calculate
217         String te = Double.toString(res); //convert result to string
218         l.setText(te); //display
219         s0 = te; //set s0 to the result
220         s1 = s2 = ""; //clear other fields
221     }
222     //cos
223     else if (s.charAt(0) == 'c' && s.charAt(1) == 'o' && s.charAt(2) == 's') { //check if cos is selected
224         double res = Math.cos(Double.parseDouble(s0)); //calculate
225         String te = Double.toString(res); //convert result to string
226         l.setText(te); //display
227         s0 = te; //set s0 to the result
228         s1 = s2 = ""; //clear other fields
229     }

```

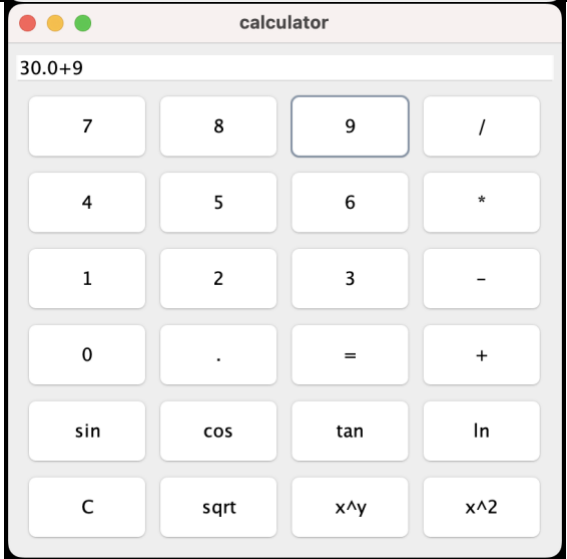
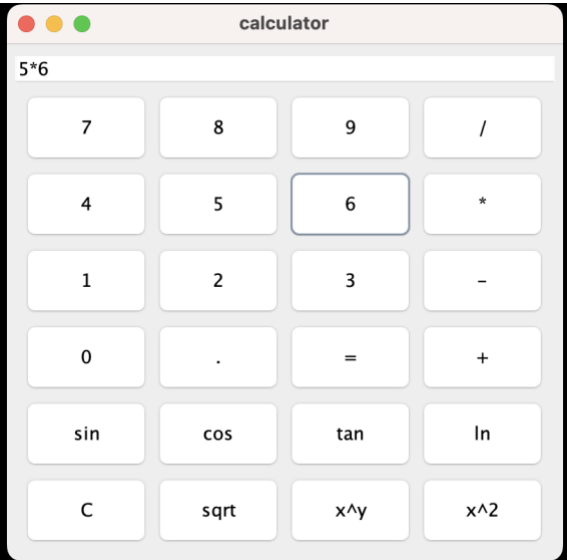
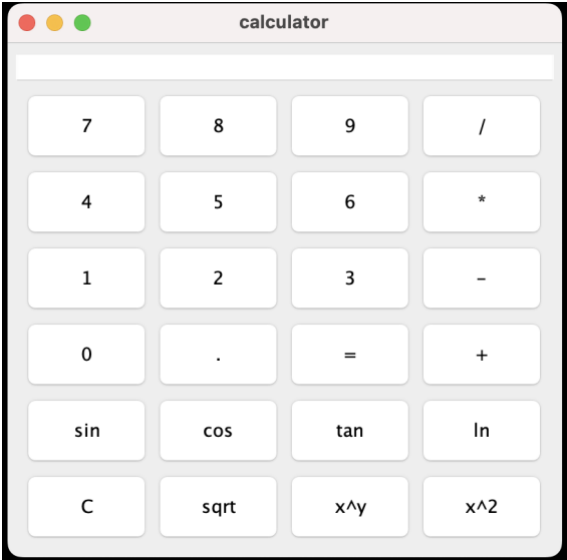
```

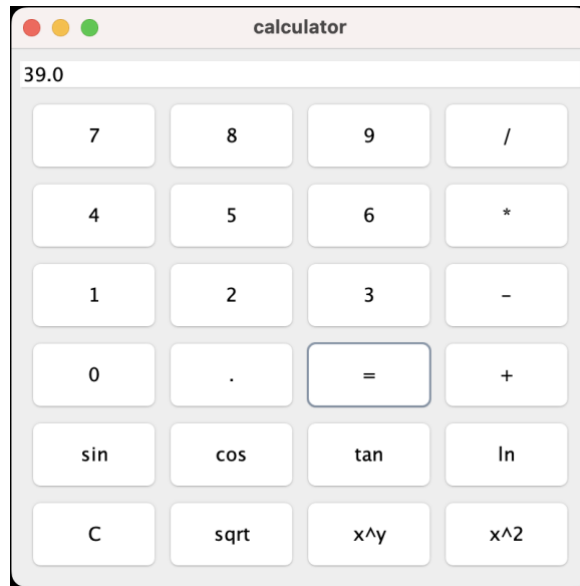
230 //natural log
231     else if(s.charAt(0) == 'l' && s.charAt(1) == 'n'){ //check if ln is selected
232         double res = Math.log(Double.parseDouble(s0)); //calculate
233         String te = Double.toString(res); //convert result to string
234         l.setText(te); //display
235         s0 = te; //set s0 to the result
236         s1 = s2 = ""; //clear other fields
237     }
238 //tan
239     else if(s.charAt(0) == 't' && s.charAt(1) == 'a' && s.charAt(2) == 'n'){ //check if tan is selected
240         double res = Math.tan(Double.parseDouble(s0)); //calculate
241         String te = Double.toString(res); //convert result to string
242         l.setText(te); //display
243         s0 = te; //set s0 to the result
244         s1 = s2 = ""; //clear other fields
245     }
246 //square root
247     else if(s.charAt(0) == 's' && s.charAt(1) == 'q' && s.charAt(2) == 'r' && s.charAt(3) == 't'){ //check if sqrt is selected
248         double res = Math.sqrt(Double.parseDouble(s0)); //calculate
249         String te = Double.toString(res); //convert result to string
250         l.setText(te); //display
251         s0 = te; //set s0 to the result
252         s1 = s2 = ""; //clear other fields
253     }
254 //square
255     else if(s.charAt(0) == 'x' && s.charAt(1) == '^' && s.charAt(2) == '2'){ //check if square is selected
256         double res = Math.pow(Double.parseDouble(s0),2); //calculate
257         String te = Double.toString(res); //convert result to string
258         l.setText(te); //display
259         s0 = te; //set s0 to the result
260         s1 = s2 = ""; //clear other fields
261     }
262     else {
263         // if there was no operand
264         if (s1.equals("") || s2.equals(""))
265             s1 = s;
266         // else evaluate
267         else {
268             double te;
269
270             // store the value in 1st
271             if (s1.equals("+"))
272                 te = (Double.parseDouble(s0) + Double.parseDouble(s2));
273             else if (s1.equals("-"))
274                 te = (Double.parseDouble(s0) - Double.parseDouble(s2));
275             else if (s1.equals("/"))
276                 te = (Double.parseDouble(s0) / Double.parseDouble(s2));
277             else if (s1.equals("cos"))
278                 te = Math.cos(Double.parseDouble(s0));
279             else
280                 te = (Double.parseDouble(s0) * Double.parseDouble(s2));
281
282             // convert it to string
283             s0 = Double.toString(te);
284
285             // place the operator
286             s1 = s;
287
288             // make the operand blank
289             s2 = "";
290         }
291
292         // set the value of text
293         l.setText(s0 + s1 + s2);
294     }
295 }
296

```

Results:

- The calculator application is created and it can run operation “+”, “-“, “*”, “/”, “sin”, “cos”, “tan”, “ln”, “sqrt”, “x^y”, x^2





Click “5”, “*”, “6”, “+”, “9”, “=” and result

Conclusion:

As a result, I have created a class called Calculator to create a calculator with buttons and a display. Then add the number buttons, the arithmetic function buttons (+, -, *, /), the trig function buttons (sin, cos, tan, ln), the clear, square root, power, and square buttons; add functionalities to action buttons so the calculator can perform various functions. To complete this lab, I need to know how to create a class, provide a constructor that enables an object of this class to be initialized when it is declared, and write a method and call it in the program. I also need to know how to create the GUI with labels, text fields, buttons, and panels. Then I need to have and be able to use layout managers. Finally, I need to know how to use event-handling classes and interfaces. After this lab, I believe I have understood the principles of every objective of this lab and completed them as required.