Planejamento

- Aula 1
  - Introdução
  - Conceitos Básicos
    - Classe, Objeto, Método,Herança, polimorfismo, Encapsulamento
  - Introdução a linguagem Java
- Aula 2
  - Introdução a Ambientes Integrados de Desenvolvimento
  - Introdução ao Ambiente Eclipse
  - Desenvolvimento de Programas básicos (modo texto)
    - Comandos de controle: if, while,forClasses: String, Integer, DateBibliotecas Básicas: System, java,
- Aula 3
  - Programando Interfaces Gráficas com Java – Parte I
- **Aula 4**
  - **Programando Interfaces Gráficas com Java – Parte II**
- Aula 5

  5.1. Introdução a Design Patterns

  5.2. Programação concorrente (Threads)

Aula 4 – Programando Interfaces Gráficas Orientadas a Objeto - Parte 2

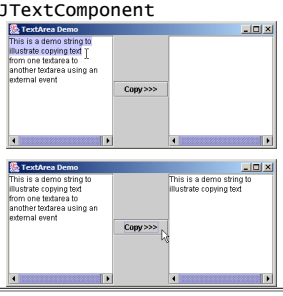
Sumário

4.1 Introdução

- Componentes GUI Avançados
  - Text areas
  - Sliders
  - Menus
- Multiple Document Interface (MDI)
- Layout Managers Avançados
  - `BoxLayout`
  - `GridBagLayout`

4.2 `JTextArea`

- `JTextArea`
  - Area for manipulating multiple lines of text
  - extends `JTextComponent`




```
1  // Fig. 4.1: TextAreaDemo.java
2  // Copying selected text from one textarea to another.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class TextAreaDemo extends JFrame {
8     private JTextArea textArea1, textArea2;
9     private JButton copyButton;
10
11    // set up GUI
12    public TextAreaDemo()
13    {
4       super( "TextArea Demo" );
15
16       Box box = Box.createHorizontalBox();
17
18       String string = "This is a demo string to\n" +
19          "illustrate copying text\nfrom one textarea to \n" +
20          "another textarea using an\nexternal event\n";
21
22       // set up textArea1
23       textArea1 = new JTextArea( string, 10, 15 );
24       box.add( new JScrollPane( textArea1 ) );
25
```

Create `Box` container for organizing GUI components

Populate `JTextArea` with `String`, then add to `Box`


```
26       // set up copyButton
27       copyButton = new JButton( "Copy >>>" );
28       box.add( copyButton );
29       copyButton.addActionListener(
30
31          new ActionListener() {  // anonymous inner class
32
33             // set text in textArea2 to selected text from textArea1
34             public void actionPerformed( ActionEvent event )
35             {
36                textArea2.setText( textArea1.getSelectedText() );
37             }
38
39          } // end anonymous inner class
40
41       ); // end call to addActionListener
42
43       // set up textArea2
44       textArea2 = new JTextArea( 10, 15 );
45       textArea2.setEditable( false );
46       box.add( new JScrollPane( textArea2 ) );
47
48       // add box to content pane
49       Container container = getContentPane();
50       container.add( box );   // place in BorderLayout.CENTER
51
```

When user presses `JButton`, `textArea1`'s highlighted text is copied into `textArea2`

Instantiate uneditable `JTextArea`

```
52        setSize( 425, 200 );
53        setVisible( true );
54
55     } // end constructor TextAreaDemo
56
57     public static void main( String args[] )
58     {
59        TextAreaDemo application = new TextAreaDemo();
60        application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
61     }
62
63  } // end class TextAreaDemo
```


4.3 Criando uma classe customizada de JPanel

- Extend `JPanel` to create new components
  - Dedicated drawing area
    - Method `paintComponent` of class `JComponent`


```
1  // Fig. 4.2: CustomPanel.java
2  // A customized JPanel class.
3  import java.awt.*;
4  import javax.swing.*;
5
6  public class CustomPanel extends JPanel {
7     public final static int CIRCLE = 1, SQUARE = 2;
8     private int shape;
9
10    // use shape to draw an oval or rectangle
11    public void paintComponent( Graphics g )
12    {
13       super.paintComponent( g );
14
15       if ( shape == CIRCLE )
16          g.fillOval( 50, 10, 60, 60 );
17       else if ( shape == SQUARE )
18          g.fillRect( 50, 10, 60, 60 );
19    }
20
21    // set shape value and repaint CustomPanel
22    public void draw( int shapeToDraw )
23    {
24       shape = shapeToDraw;
25       repaint();
26 }
27
28 } // end class CustomPanel
```

Store integer representing shape to draw

Override method `paintComponent` of class `JComponent` to draw oval or rectangle

Method `repaint` calls method `paintComponent`


```
1  // Fig. 4.3: CustomPanelTest.java
2  // Using a customized Panel object.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class CustomPanelTest extends JFrame {
8     private JPanel buttonPanel;
9     private CustomPanel myPanel;
10    private JButton circleButton, squareButton;
11
12    // set up GUI
13    public CustomPanelTest()
14    {
15       super( "CustomPanel Test" );
16
17       // create custom drawing area
18       myPanel = new CustomPanel();
19       myPanel.setBackground( Color.GREEN );
20
21       // set up squareButton
22       squareButton = new JButton( "Square" );
23       squareButton.addActionListener(
24
```

Instantiate `CustomPanel` object and set background to green


```
25          new ActionListener() {  // anonymous inner class
26
27             // draw a square
28             public void actionPerformed( ActionEvent event )
29             {
30                myPanel.draw( CustomPanel.SQUARE );
31             }
32
33          } // end anonymous inner class
34
35       ); // end call to addActionListener
36
37       circleButton = new JButton( "Circle" );
38       circleButton.addActionListener(
39
40          new ActionListener() {  // anonymous inner class
41
42             // draw a circle
43             public void actionPerformed( ActionEvent event )
44             {
45                myPanel.draw( CustomPanel.CIRCLE );
46             }
47
48          } // end anonymous inner class
49
50       ); // end call to addActionListener
51
```

When user presses `squareButton`, draw `square` on `CustomPanel`

When user presses `circleButton`, draw `circle` on `CustomPanel`


```
52       // set up panel containing buttons
53       buttonPanel = new JPanel();
54       buttonPanel.setLayout( new GridLayout( 1, 2 ) );
55       buttonPanel.add( circleButton );
56       buttonPanel.add( squareButton );
57
58       // attach button panel & custom drawing area to content pane
59       Container container = getContentPane();
60       container.add( myPanel, BorderLayout.CENTER );
61       container.add( buttonPanel, BorderLayout.SOUTH );
62
63       setSize( 300, 150 );
64       setVisible( true );
65
66    } // end constructor CustomPanelTest
67
68    public static void main( String args[] )
69    {
70       CustomPanelTest application = new CustomPanelTest();
71       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
72    }
73
74 } // end class CustomPanelTest
```

Use `GridLayout` to organize buttons

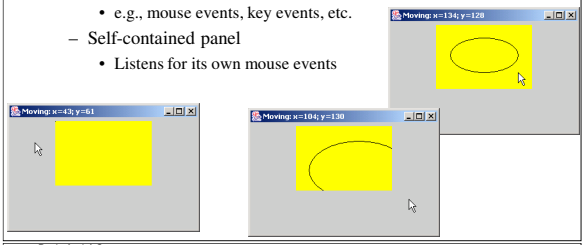
Exercício

- Pergunta: Porquê inicialmente não surge nenhuma forma (círculo ou quadrado) dentro do painel?
- Fazer com que o painel seja apresentado inicialmente com o círculo no seu interior
- Fazer inicialização de cor de fundo do painel na classe do próprio painel.

- Lembrar do conceito de encapsulamento, comportamento específico de uma classe deve estar definido na própria classe e não externamente

4.4 Uma subclasse JPanel que trata seus próprios eventos

- `JPanel`
  - Does not support conventional events
    - e.g., events offered by buttons, text areas, etc.
  - Capable of recognizing lower-level events
    - e.g., mouse events, key events, etc.
  - Self-contained panel
    - Listens for its own mouse events




```
1  // Fig. 4.4: SelfContainedPanel.java
2  // A self-contained JPanel class that handles its own mouse events.
3
4
5  import java.awt.*;
6  import java.awt.event.*;
7  import javax.swing.*;
8
9  public class SelfContainedPanel extends JPanel {
10    private int x1, y1, x2, y2;
11
12    // set up mouse event handling for SelfContainedPanel
13    public SelfContainedPanel()
14    {
15       // set up mouse listener
16       addMouseListener(
17
18          new MouseAdapter() {  // anonymous inner class
19
20             // handle mouse press event
21             public void mousePressed( MouseEvent event )
22             {
23                x1 = event.getX();
24                y1 = event.getY();
25             }
26
```

Self-contained `JPanel` listens for `MouseEvents`

Save coordinates where user pressed mouse button


```
27             // handle mouse release event
28             public void mouseReleased( MouseEvent event )
29             {
30                x2 = event.getX();
31                y2 = event.getY();
32                repaint();
33             }
34
35          } // end anonymous inner class
36
37       ); // end call to addMouseListener
38
39       // set up mouse motion listener
40       addMouseMotionListener(
41
42          new MouseMotionAdapter() {  // anonymous inner class
43
44             // handle mouse drag event
45             public void mouseDragged( MouseEvent event )
46             {
47                x2 = event.getX();
48                y2 = event.getY();
49                repaint();
50             }
51
```

Save coordinates where user released mouse button, then repaint

Self-contained `JPanel` listens for when mouse moves

Save coordinates where user dragged mouse, then repaint


```
52          } // end anonymous inner class
53
54       ); // end call to addMouseMotionListener
55
56    } // end constructor SelfContainedPanel
57
58    // return preferred width and height of SelfContainedPanel
59    public Dimension getPreferredSize()
60    {
61       return new Dimension( 150, 100 );
62    }
63
64    // paint an oval at the specified coordinates
65    public void paintComponent( Graphics g )
66    {
67       super.paintComponent( g );
68
69       g.drawOval( Math.min( x1, x2 ), Math.min( y1, y2 ),
70          Math.abs( x1 - x2 ), Math.abs( y1 - y2 ) );
71    }
72
73 } // end class SelfContainedPanel
```

Draw oval


```
1  // Fig. 4.5: SelfContainedPanelTest.java
2  // Creating a self-contained subclass of JPanel that processes
3  // its own mouse events.
4  import java.awt.*;
5  import java.awt.event.*;
6  import javax.swing.*;
7
8
9
10 public class SelfContainedPanelTest extends JFrame {
11    private SelfContainedPanel myPanel;
12
13    // set up GUI and mouse motion event handlers for application window
14    public SelfContainedPanelTest()
15    {
16       // set up a SelfContainedPanel
17       myPanel = new SelfContainedPanel();
18       myPanel.setBackground( Color.YELLOW );
19
20       Container container = getContentPane();
21       container.setLayout( new FlowLayout() );
22       container.add( myPanel );
23
```

Instantiate `SelfContaintedPanel` object and set background to yellow

```
24       // set up mouse motion event handling
25       addMouseMotionListener(
26
27          new MouseMotionListener() {  // anonymous inner class
28
29             // handle mouse drag event
30             public void mouseDragged( MouseEvent event )
31             {
32                setTitle( "Dragging: x=" + event.getX() +
33                   "; y=" + event.getY() );
34             }
35
36             // handle mouse move event
37             public void mouseMoved( MouseEvent event )
38             {
39                setTitle( "Moving: x=" + event.getX() +
40                   "; y=" + event.getY() );
41             }
42
43          } // end anonymous inner class
44
45       ); // end call to addMouseMotionListener
46
47       setSize( 300, 200 );
48       setVisible( true );
49
50    } // end constructor SelfContainedPanelTest
```

Register anonymous-inner-class object to handle mouse motion events

Display `String` in title bar indicating *x*-*y* coordinate where mouse-motion event occurred


```
51
52    public static void main( String args[] )
53    {
54       SelfContainedPanelTest application = new SelfContainedPanelTest();
55       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
56    }
57
58 } // end class SelfContainedPanelTest
```


Perguntas

- Porque a barra de status não apresenta a informação de posição do mouse quando, este encontra-se sobre a parte amarela
- Como seria possível criar várias elipses ao invés de apenas uma ?

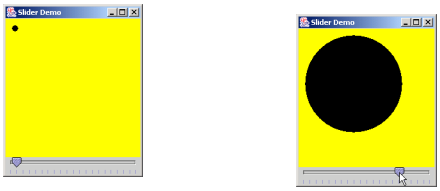
Exercício

- Criar ao invés de uma elipse um círculo, caso esteja sendo presionado a tecla Shift durante o "dragging" do mouse

4.5 `JSlider`

- `JSlider`
  - Enable users to select from range of integer values
  - Several features
    - Tick marks (major and minor)
    - Snap-to ticks
    - Orientation (horizontal and vertical)

Fig. 4.6 `JSlider` component with horizontal orientation



```
1  // Fig. 4.7: OvalPanel.java
2  // A customized JPanel class.
3  import java.awt.*;
4  import javax.swing.*;
5
6  public class OvalPanel extends JPanel {
7     private int diameter = 10;
8
9     // draw an oval of the specified diameter
10    public void paintComponent( Graphics g )
11    {
12       super.paintComponent( g );
13
14       g.fillOval( 10, 10, diameter, diameter );
15    }
16
17    // validate and set diameter, then repaint
18    public void setDiameter( int newDiameter )
19    {
20       // if diameter invalid, default to 10
21       diameter = ( newDiameter >= 0 ? newDiameter : 10 );
22       repaint();
23    }
24
```

Draw filled oval of `diameter`

Set `diameter`, then repaint


```
25    // used by layout manager to determine preferred size
26    public Dimension getPreferredSize()
27    {
28       return new Dimension( 200, 200 );
29    }
30
31    // used by layout manager to determine minimum size
32    public Dimension getMinimumSize()
33    {
34       return getPreferredSize();
35    }
36
37 } // end class OvalPanel
```



```
1  // Fig. 4.8: SliderDemo.java
2  // Using JSliders to size an oval.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6  import javax.swing.event.*;
7
8  public class SliderDemo extends JFrame {
9     private JSlider diameterSlider;
10    private OvalPanel myPanel;
11
12    // set up GUI
13    public SliderDemo()
14    {
15       super( "Slider Demo" );
16
17       // set up OvalPanel
18       myPanel = new OvalPanel();
19       myPanel.setBackground( Color.YELLOW );
20
21       // set up JSlider to control diameter value
22       diameterSlider =
23          new JSlider( SwingConstants.HORIZONTAL, 0, 200, 10 );
24       diameterSlider.setMajorTickSpacing( 10 );
25       diameterSlider.setPaintTicks( true );
26
```

Instantiate `OvalPanel` object and set background to yellow

Instantiate horizontal `JSlider` object with min. value of 0, max. value of 200 and initial thumb location at 10


```
27       // register JSlider event listener
28       diameterSlider.addChangeListener(
29
30          new ChangeListener() {  // anonymous inne
31
32             // handle change in slider value
33             public void stateChanged( ChangeEvent e )
34             {
35                myPanel.setDiameter( diameterSlider.getValue() );
36             }
37
38          } // end anonymous inner class
39
40       ); // end call to addChangeListener
41
42       // attach components to content pane
43       Container container = getContentPane();
44       container.add( diameterSlider, BorderLayout.SOUTH );
45       container.add( myPanel, BorderLayout.CENTER );
46
47       setSize( 220, 270 );
48       setVisible( true );
49
50    } // end constructor SliderDemo
51
```

Register anonymous `ChangeListener` object to handle `JSlider` events

When user accesses `JSlider`, set `OvalPanel`'s `diameter` according to `JSlider` value


```
52    public static void main( String args[] )
53    {
54       SliderDemo application = new SliderDemo();
55       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
56    }
57
58 } // end class SliderDemo
```

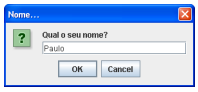

4.6 Caixas de Diálogo Simples - JOptionPane

- Utilização da classe
  - **javax.swing.JOptionPane**
- Caixa de Diálogo para Informação ao Usuário
  - JOptionPane.showMessageDialog
- Parâmetros:
  - (Component parentComponent, Object message, String title, int messageType);
  - Dois últimos argumentos podem ser omitidos
- Tipo de Mensagem (messageType)
  - JOptionPane.PLAIN_MESSAGE - nenhum ícone
  - JOptionPane.ERROR_MESSAGE - ícone de erro
  - JOptionPane.INFORMATION_MESSAGE - ícone de informação
  - JOptionPane.WARNING_MESSAGE - ícone de aviso
  - JOptionPane.QUESTION_MESSAGE - ícone de interrogação

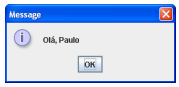
Caixas de Diálogo Simples - JOptionPane

- Caixa de Diálogo para Captar informação do Usuário
  - JOptionPane.showInputDialog
  - Parâmetros: (Component parentComponent, Object message, String title, int messageType);
  - Dois últimos argumentos podem ser omitidos
- Caixa de Diálogo para obter confirmação do Usuário
  - JOptionPane. showConfirmDialog
  - Parâmetros: (Component parentComponent, Object message, String title, int optionType, int messageType);
  - optionType: JOptionPane.YES_NO_OPTION ou YES_NO_CANCEL_OPTION
  - Três últimos argumentos podem ser omitidos
  - Retorna um inteiro indicando o valor digitado pelo usuário:
    - JOptionPane.YES_OPTION, JOptionPane.NO_OPTION, JOptionPane.CANCEL_OPTION

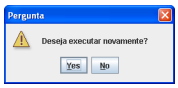
Caixas de Diálogo Úteis - JOptionPane



JOPtionPane.showInputDialog



JOPtionPane.showMessageDialog



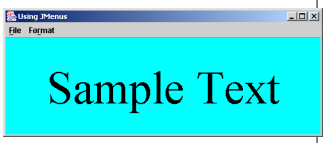
JOPtionPane.showConfirmDialog

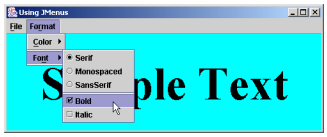
Exemplo

```
1 import javax.swing.JOptionPane;
2
3 public class Dialogos {
4
5   public static void main(String args[]) {
6         int continua;
7         do {
8          String resposta;
9         resposta = JOptionPane.showInputDialog(null, "Qual o seu nome?",
10                  "Nome...",JOptionPane.QUESTION_MESSAGE);
11
12        JOptionPane.showMessageDialog(null,"Olá, "+resposta);
13        continua=JOptionPane.showConfirmDialog(null,
14           "Deseja executar novamente?","Pergunta",
15                  JOptionPane.YES_NO_OPTION,JOptionPane.QUESTION_MESSAGE);
16
17
18      } while(continua==JOptionPane.YES_OPTION);
19 }
20
21 }
```


4.7 Usando Menus com Frames

- Menus
  - Allows for performing actions with cluttering GUI
  - Contained by menu bar
    - `JMenuBar`
  - Comprised of menu items
    - `JMenuItem`






```
1  // Fig. 4.9: MenuTest.java
2  // Demonstrating menus
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class MenuTest extends JFrame {
8     private final Color colorValues[] =
9        { Color.BLACK, Color.BLUE, Color.RED, Color.GREEN };
10    private JRadioButtonMenuItem colorItems[], fonts[];
11    private JCheckBoxMenuItem styleItems[];
12    private JLabel displayLabel;
13    private ButtonGroup fontGroup, colorGroup;
14    private int style;
15
16    // set up GUI
17    public MenuTest()
18    {
19       super( "Using JMenus" );
20
21       // set up File menu and its menu items
22       JMenu fileMenu = new JMenu( "File" );
23       fileMenu.setMnemonic( 'F' );
24
```

Instantiate **File** `JMenu`


```
25       // set up About... menu item
26       JMenuItem aboutItem = new JMenuItem( "About..." );
27       aboutItem.setMnemonic( 'A' );
28       fileMenu.add( aboutItem );
29       aboutItem.addActionListener(
30
31          new ActionListener() {  // anonymous inner class
32
33             // display message dialog when user selects About...
34             public void actionPerformed( ActionEvent event )
35             {
36                JOptionPane.showMessageDialog( MenuTest.this,
37                   "This is an example\nof using menus",
38                   "About", JOptionPane.PLAIN_MESSAGE );
39             }
40
41          } // end anonymous inner class
42
43       ); // end call to addActionListener
44
45       // set up Exit menu item
46       JMenuItem exitItem = new JMenuItem( "Exit" );
47       exitItem.setMnemonic( 'x' );
48       fileMenu.add( exitItem );
49       exitItem.addActionListener(
50
```

Instantiate **About...** `JMenuItem` to be placed in `fileMenu`

When user selects **About...** `JMenuItem`, display message dialog with appropriate text

Instantiate **Exit** `JMenuItem` to be placed in `fileMenu`

```
51          new ActionListener() {  // anonymous inner class
52
53             // terminate application when user clicks exitItem
54             public void actionPerformed( ActionEvent event )
55             {
56                System.exit( 0 );
57             }
58
59          }  // end anonymous inner class
60
61       ); // end call to addActionListener
62
63       // create menu bar and attach it to MenuTest window
64       JMenuBar bar = new JMenuBar();
65       setJMenuBar( bar );
66       bar.add( fileMenu );
67
68       // create Format menu, its submenus and menu items
69       JMenu formatMenu = new JMenu( "Format" );
70       formatMenu.setMnemonic( 'r' );
71
72       // create Color submenu
73       String colors[] = { "Black", "Blue", "Red", "Green" };
74
```

When user selects **Exit** `JMenuItem`, exit system

Instantiate `JMenuBar` to contain `JMenus`

Instantiate **Format** `JMenu`


```
75       JMenu colorMenu = new JMenu( "Color" );
76       colorMenu.setMnemonic( 'C' );
77
78       colorItems = new JRadioButtonMenuItem[ colors.length ];
79       colorGroup = new ButtonGroup();
80       ItemHandler itemHandler = new ItemHandler();
81
82       // create color radio button menu items
83       for ( int count = 0; count < colors.length; count++ ) {
84          colorItems[ count ] =
85             new JRadioButtonMenuItem( colors[ count ] );
86          colorMenu.add( colorItems[ count ] );
87          colorGroup.add( colorItems[ count ] );
88          colorItems[ count ].addActionListener( itemHandler );
89       }
90
91       // select first Color menu item
92       colorItems[ 0 ].setSelected( true );
93
94       // add format menu to menu bar
95       formatMenu.add( colorMenu );
96       formatMenu.addSeparator();
97
98       // create Font submenu
99       String fontNames[] = { "Serif", "Monospaced", "SansSerif" };
100
```

Instantiate **Color** `JMenu` (submenu of **Format** `JMenu`)

Instantiate `JRadioButtonMenuItems` for **Color** `JMenu` and ensure that only one menu item is selected at a time

Separator places line between `JMenuItems`


```
101      JMenu fontMenu = new JMenu( "Font" );
102      fontMenu.setMnemonic( 'n' );
103
104      fonts = new JRadioButtonMenuItem[ fontNames.length ];
105      fontGroup = new ButtonGroup();
106
107      // create Font radio button menu items
108      for ( int count = 0; count < fonts.length; count++ ) {
109         fonts[ count ] = new JRadioButtonMenuItem( fontNames[ count ] );
110         fontMenu.add( fonts[ count ] );
111         fontGroup.add( fonts[ count ] );
112         fonts[ count ].addActionListener( itemHandler );
113      }
114
115      // select first Font menu item
116      fonts[ 0 ].setSelected( true );
117
118      fontMenu.addSeparator();
119
120      // set up style menu items
121      String styleNames[] = { "Bold", "Italic" };
122
123      styleItems = new JCheckBoxMenuItem[ styleNames.length ];
124      StyleHandler styleHandler = new StyleHandler();
125
```

Instantiate **Font** `JMenu` (submenu of **Format** `JMenu`)

Instantiate `JRadioButtonMenuItems` for **Font** `JMenu` and ensure that only one menu item is selected at a time


```
126      // create style checkbox menu items
127      for ( int count = 0; count < styleNames.length; count++ ) {
128         styleItems[ count ] =
129            new JCheckBoxMenuItem( styleNames[ count ] );
130         fontMenu.add( styleItems[ count ] );
131         styleItems[ count ].addItemListener( styleHandler );
132      }
133
134      // put Font menu in Format menu
135      formatMenu.add( fontMenu );
136
137      // add Format menu to menu bar
138      bar.add( formatMenu );
139
140      // set up label to display text
141      displayLabel = new JLabel( "Sample Text", SwingConstants.CENTER );
142      displayLabel.setForeground( colorValues[ 0 ] );
143      displayLabel.setFont( new Font( "Serif", Font.PLAIN, 72 ) );
144
145      getContentPane().setBackground( Color.CYAN );
146      getContentPane().add( displayLabel, BorderLayout.CENTER );
147
148      setSize( 500, 200 );
149      setVisible( true );
150
151   } // end constructor
152
```



```
153   public static void main( String args[] )
154   {
155      MenuTest application = new MenuTest();
156      application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
157   }
158
159   // inner class to handle action events from menu items
160   private class ItemHandler implements ActionListener {
161
162      // process color and font selections
163      public void actionPerformed( ActionEvent event )
164      {
165         // process color selection
166         for ( int count = 0; count < colorItems.length; count++ )
167
168            if ( colorItems[ count ].isSelected() ) {
169               displayLabel.setForeground( colorValues[ count ] );
170               break;
171            }
172
173         // process font selection
174         for ( int count = 0; count < fonts.length; count++ )
175
176            if ( event.getSource() == fonts[ count ] ) {
177               displayLabel.setFont(
178                  new Font( fonts[ count ].getText(), style, 72 ) );
179               break;
180            }
```

Invoked when user selects `JMenuItem`

Determine which font or color menu generated event

Set font or color of `JLabel`, respectively


```
181
182         repaint();
183
184      } // end method actionPerformed
185
186   } // end class ItemHandler
187
188   // inner class to handle item events from check b
189   private class StyleHandler implements ItemListene
190
191      // process font style selections
192      public void itemStateChanged( ItemEvent e )
193      {
194         style = 0;
195
196         // check for bold selection
197         if ( styleItems[ 0 ].isSelected() )
198            style += Font.BOLD;
199
200         // check for italic selection
201         if ( styleItems[ 1 ].isSelected() )
202            style += Font.ITALIC;
203
204         displayLabel.setFont(
205            new Font( displayLabel.getFont().getName(), style, 72 ) );
```

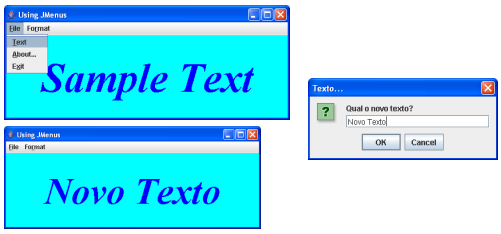
Invoked when user selects `JCheckBoxMenuItem`

Determine new font style

```
206
207         repaint();
208      }
209
210   } // end class StyleHandler
211
212 } // end class MenuTest
```

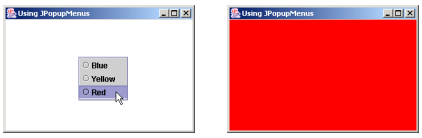

Exercício

- Introduza um novo item no Menu File. O item deve ser "Text", a tecla mnemônica deve ser 'T'. Ao ser acionado, o item abre uma caixa de diálogo que pede ao usuário um novo texto, o qual será utilizado para modificar o texto apresentado ao centro da janela. Mantendo a cor, estilo e fonte do texto.



4.8 JPopupMenu

- Context-sensitive popup menus
  - JPopupMenu
  - Menu generated depending on which component is accessed




```
1  // Fig. 4.10: PopupTest.java
2  // Demonstrating JPopupMenus
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class PopupTest extends JFrame {
8     private JRadioButtonMenuItem items[];
9     private final Color colorValues[] =
10       { Color.BLUE, Color.YELLOW, Color.RED };
11    private JPopupMenu popupMenu;
12
13    // set up GUI
14    public PopupTest()
15    {
16       super( "Using JPopupMenus" );
17
18       ItemHandler handler = new ItemHandler();
19       String colors[] = { "Blue", "Yellow", "Red" };
20
21       // set up popup menu and its items
22       ButtonGroup colorGroup = new ButtonGroup();
23       popupMenu = new JPopupMenu();
24       items = new JRadioButtonMenuItem[ 3 ];
25
```

Instantiate JPopupMenu object


```
26       // construct each menu item and add to popup menu; also
27       // enable event handling for each menu item
28       for ( int count = 0; count < items.length; count++ ) {
29          items[ count ] = new JRadioButtonMenuItem( colors[ count ] );
30          popupMenu.add( items[ count ] );
31          colorGroup.add( items[ count ] );
32          items[ count ].addActionListener( handler );
33       }
34
35       getContentPane().setBackground( Color.WHITE );
36
37       // declare a MouseListener for the window that displays
38       // a JPopupMenu when the popup trigger event occurs
39       addMouseListener(
40
41          new MouseAdapter() {  // anonymous inner class
42
43             // handle mouse press event
44             public void mousePressed( MouseEvent event )
45             {
46                checkForTriggerEvent( event );
47             }
48
49             // handle mouse release event
50             public void mouseReleased( MouseEvent event )
51             {
52                checkForTriggerEvent( event );
53             }
```

Create JRadioButtonMenuItem objects to add to JPopupMenu

Determine whether popup-trigger event occurred when user presses or releases mouse button


```
54
55          // determine whether event should trigger popup menu
56          private void checkForTriggerEvent( MouseEvent event )
57          {
58             if ( event.isPopupTrigger() )
59                popupMenu.show(
60                   event.getComponent(), event.getX(), event.getY() );
61          }
62
63       } // end anonymous inner clas
64
65    ); // end call to addMouseListener
66
67    setSize( 300, 200 );
68    setVisible( true );
69
70 } // end constructor PopupTest
71
72 public static void main( String args[] )
73 {
74    PopupTest application = new PopupTest();
75    application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
76 }
77
```

Show JPopupMenu if popup-trigger occurred

```
78    // private inner class to handle menu item events
79    private class ItemHandler implements ActionListener {
80
81       // process menu item selections
82       public void actionPerformed( ActionEvent event )
83       {
84          // determine which menu item was selected
85          for ( int i = 0; i < items.length; i++ )
86             if ( event.getSource() == items[ i ] ) {
87                getContentPane().setBackground( colorValues[ i ] );
88                return;
89             }
90       }
91
92    } // end private inner class ItemHandler
93
94 } // end class PopupTest
```

Invoked when user selects `JRadioButtonMenuItem`

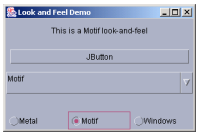
Determine which `JRadioButtonMenuItem` was selected, then set window background color

Exercício

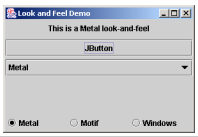
- Altere o código do exemplo anterior para incluir as opções Green, Black e White, no pop-up Menu e que ao serem selecionadas alterem a cor de fundo da janela para a cor correspondente

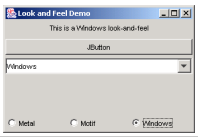
4.9 Pluggable Look-and-Feel

- É possível mudar a aparência de sua aplicação Swing em tempo de execução
  - Windows
  - Motif
  - Java



- UIManager.LookAndFeelInfo looks
- // recupera os LookAndFeel instalados
- looks=UIManager.getInstalledLookAndFeels();
- //muda o LookAndFeel
- UIManager.setLookAndFeel(look[i]);






```
1  // Fig. 4.11: LookAndFeelDemo.java
2  // Changing the look and feel.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class LookAndFeelDemo extends JFrame {
8     private final String strings[] = { "Metal", "Motif", "Windows" };
9     private UIManager.LookAndFeelInfo looks[];
10    private JRadioButton radio[];
11    private ButtonGroup group;
12    private JButton button;
13    private JLabel label;
14    private JComboBox comboBox;
15
16    // set up GUI
17    public LookAndFeelDemo()
18    {
19       super( "Look and Feel Demo" );
20
21       Container container = getContentPane();
22
23       // set up panel for NORTH of BorderLayout
24       JPanel northPanel = new JPanel();
25       northPanel.setLayout( new GridLayout( 3, 1, 0, 5 ) );
26
```

Hold installed look-and-feel information


```
27       // set up label for NORTH panel
28       label = new JLabel( "This is a Metal look-and-feel",
29          SwingConstants.CENTER );
30       northPanel.add( label );
31
32       // set up button for NORTH panel
33       button = new JButton( "JButton" );
34       northPanel.add( button );
35
36       // set up combo box for NORTH panel
37       comboBox = new JComboBox( strings );
38       northPanel.add( comboBox );
39
40       // create array for radio buttons
41       radio = new JRadioButton[ strings.length ];
42
43       // set up panel for SOUTH of BorderLayout
44       JPanel southPanel = new JPanel();
45       southPanel.setLayout( new GridLayout( 1, radio.length ) );
46
47       // set up radio buttons for SOUTH panel
48       group = new ButtonGroup();
49       ItemHandler handler = new ItemHandler();
50
```

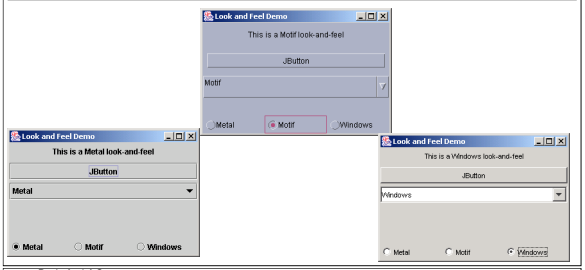


```
51       for ( int count = 0; count < radio.length; count++ ) {
52          radio[ count ] = new JRadioButton( strings[ count ] );
53          radio[ count ].addItemListener( handler );
54          group.add( radio[ count ] );
55          southPanel.add( radio[ count ] );
56       }
57
58       // attach NORTH and SOUTH panels to content pane
59       container.add( northPanel, BorderLayout.NORTH );
60       container.add( southPanel, BorderLayout.SOUTH );
61
62       // get installed look-and-feel information
63       looks = UIManager.getInstalledLookAndFeels();
64
65       setSize( 300, 200 );
66       setVisible( true );
67
68       radio[ 0 ].setSelected( true );
69
70    } // end constructor LookAndFeelDemo
71
72    // use UIManager to change look-and-feel of GUI
73    private void changeTheLookAndFeel( int value )
74    {
```

```
75       // change look and feel
76       try {
77          UIManager.setLookAndFeel( looks[ value ].getClassName() );
78          SwingUtilities.updateComponentTreeUI( this );
79       }
80
81       // process problems changing look and feel
82       catch ( Exception exception ) {
83          exception.printStackTrace();
84       }
85    }
86
87    public static void main( String args[] )
88    {
89       LookAndFeelDemo application = new LookAndFeelDemo();
90       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
91    }
92
93    // private inner class to handle radio button events
94    private class ItemHandler implements ItemListener {
95
96       // process user's look-and-feel selection
97       public void itemStateChanged( ItemEvent event )
98       {
99          for ( int count = 0; count < radio.length; count++ )
100
```

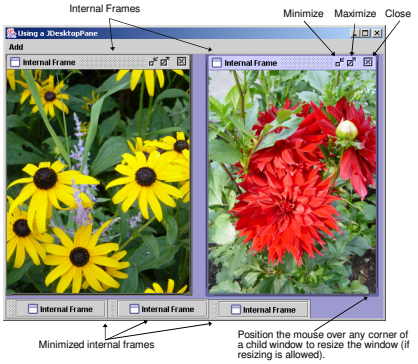
Change look-and-feel

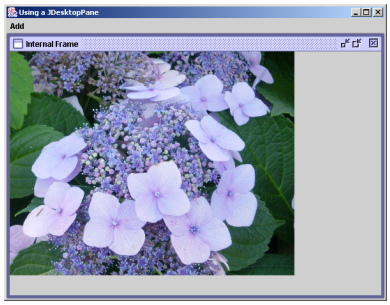

```
101          if ( radio[ count ].isSelected() ) {
102             label.setText( "This is a " +
103                strings[ count ] + " look-and-feel" );
104             comboBox.setSelectedIndex( count );
105             changeTheLookAndFeel( count );
106          }
107       }
108
109    } // end private inner class ItemHandler
110
111 } // end class LookAndFeelDemo
```



4.10 JDesktopPane and JInternalFrame

- Multiple document interface
  - Main (parent) window
  - Child windows
  - Switch freely among documents






```
1  // Fig. 4.12: DesktopTest.java
2  // Demonstrating JDesktopPane.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class DesktopTest extends JFrame {
8     private JDesktopPane theDesktop;
9
10    // set up GUI
11    public DesktopTest()
12    {
13       super( "Using a JDesktopPane" );
14
15       // create menu bar, menu and menu item
16       JMenuBar bar = new JMenuBar();
17       JMenu addMenu = new JMenu( "Add" );
18       JMenuItem newFrame = new JMenuItem( "Internal Frame" );
19
20       addMenu.add( newFrame );
21       bar.add( addMenu );
22
23       setJMenuBar( bar );
24
25       // set up desktop
26       theDesktop = new JDesktopPane();
27       getContentPane().add( theDesktop );
```

Manages JInternalFrame child windows displayed in JDesktopPane

```
28
29       // set up listener for newFrame menu item
30       newFrame.addActionListener(
31
32          new ActionListener() {  // anonymous inner class
33
34             // display new internal window
35             public void actionPerformed( ActionEvent event ) {
36
37                // create internal frame
38                JInternalFrame frame = new JInternalFrame(
39                   "Internal Frame", true, true, true, true );
40
41                // attach panel to internal frame content pane
42                Container container = frame.getContentPane();
43                MyJPanel panel = new MyJPanel();
44                container.add( panel, BorderLayout.CENTER );
45
46                // set size internal frame to size of its contents
47                frame.pack();
48
49                // attach internal frame to desktop and show it
50                theDesktop.add( frame );
51                frame.setVisible( true );
52             }
53
54          } // end anonymous inner class
```

Handle event when user selects `JMenuItem`

Invoked when user selects `JMenuItem`

Create `JInternalFrame`

`JPanel`s can be added to `JInternalFrame`s

Use preferred size for window

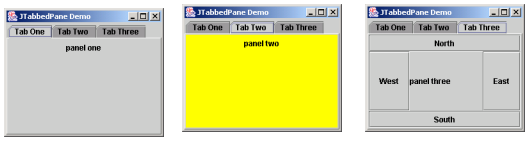

```
55
56       ); // end call to addActionListener
57
58       setSize( 600, 460 );
59       setVisible( true );
60
61    } // end constructor
62
63    public static void main( String args[] )
64    {
65       DesktopTest application = new DesktopTest();
66       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
67    }
68
69 } // end class DesktopTest
70
71 // class to display an ImageIcon on a panel
72 class MyJPanel extends JPanel {
73    private ImageIcon imageIcon;
74    private String[] images = { "yellowflowers.png", "purpleflowers.png",
75       "redflowers.png", "redflowers2.png", "lavenderflowers.png" };
76
77    // load image
78    public MyJPanel()
79    {
```



```
80       int randomNumber = ( int ) ( Math.random() * 5 );
81       imageIcon = new ImageIcon( images[ randomNumber ] );
82    }
83
84    // display imageIcon on panel
85    public void paintComponent( Graphics g )
86    {
87       // call superclass paintComponent method
88       super.paintComponent( g );
89
90       // display icon
91       imageIcon.paintIcon( this, g, 0, 0 );
92    }
93
94    // return image dimensions
95    public Dimension getPreferredSize()
96    {
97       return new Dimension( imageIcon.getIconWidth(),
98          imageIcon.getIconHeight() );
99    }
100
101 } // end class MyJPanel
```


4.11 JTabbedPane

- Arranges GUI components into layers
  - One layer visible at a time
  - Access each layer via a tab
  - `JTabbedPane`




```
1  // Fig. 4.13: JTabbedPaneDemo.java
2  // Demonstrating JTabbedPane.
3  import java.awt.*;
4  import javax.swing.*;
5
6  public class JTabbedPaneDemo extends JFrame  {
7
8     // set up GUI
9     public JTabbedPaneDemo()
10    {
11       super( "JTabbedPane Demo " );
12
13       // create JTabbedPane
14       JTabbedPane tabbedPane = new JTabbedPane();
15
16       // set up pane11 and add it to JTabbedPane
17       JLabel label11 = new JLabel( "panel one", SwingConstants.CENTER );
18       JPanel panel11 = new JPanel();
19       panel11.add( label11 );
20       tabbedPane.addTab( "Tab One", null, panel11, "First Panel" );
21
22       // set up panel2 and add it to JTabbedPane
23       JLabel label2 = new JLabel( "panel two", SwingConstants.CENTER );
24       JPanel panel2 = new JPanel();
25       panel2.setBackground( Color.YELLOW );
26       panel2.add( label2 );
27       tabbedPane.addTab( "Tab Two", null, panel2, "Second Panel" );
```

Create a `JTabbedPane`

Add the first panel

Add the second panel


```
28
29       // set up panel3 and add it to JTabbedPane
30       JLabel label3 = new JLabel( "panel three" );
31       JPanel panel3 = new JPanel();
32       panel3.setLayout( new BorderLayout() );
33       panel3.add( new JButton( "North" ), BorderLayout.NORTH );
34       panel3.add( new JButton( "West" ), BorderLayout.WEST );
35       panel3.add( new JButton( "East" ), BorderLayout.EAST );
36       panel3.add( new JButton( "South" ), BorderLayout.SOUTH );
37       panel3.add( label3, BorderLayout.CENTER );
38       tabbedPane.addTab( "Tab Three", null, panel3, "Third Panel" );
39
40       // add JTabbedPane to container
41       getContentPane().add( tabbedPane );
42
43       setSize( 250, 200 );
44       setVisible( true );
45
46    } // end constructor
47
48    public static void main( String args[] )
49    {
50       JTabbedPaneDemo tabbedPaneDemo = new JTabbedPaneDemo();
51       tabbedPaneDemo.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
52    }
53
54 } // end class CardDeck
```

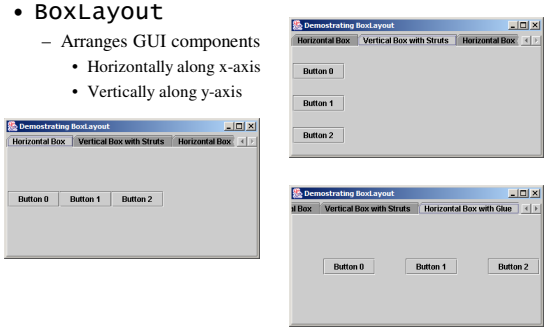
Add the third panel

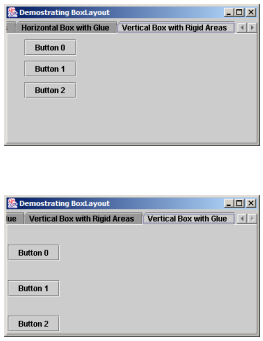
4.12 Layout Managers: BoxLayout e GridBagLayout

- Dois Novos Layout Managers
  - BoxLayout:
    - Permite que os componentes GUI sejam arranjados da esquerda para direita ou de cima para baixo em um container. A classe Box declara um container com BoxLayout como Layout padrão e provê métodos estáticos para criar Box com BoxLayout vertical ou horizontal
  - GridBagLayout:
    - Similar a GridLayout, porém cada componente pode variar de tamnho e os componentes podem ser adicionados em qualquer ordem.

BoxLayout Layout Manager

- BoxLayout
  - Arranges GUI components
    - Horizontally along x-axis
    - Vertically along y-axis






```
1  // Fig. 4.15: BoxLayoutDemo.java
2  // Demonstrating BoxLayout.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class BoxLayoutDemo extends JFrame {
8
9     // set up GUI
10    public BoxLayoutDemo()
11    {
12       super( "Demostrating BoxLayout" );
13
14       // create Box containers with BoxLayout
15       Box horizontal1 = Box.createHorizontalBox();
16       Box vertical1 = Box.createVerticalBox();
17       Box horizontal2 = Box.createHorizontalBox();
18       Box vertical2 = Box.createVerticalBox();
19
20       final int SIZE = 3; // number of buttons on each Box
21
22       // add buttons to Box horizontal1
23       for ( int count = 0; count < SIZE; count++ )
24          horizontal1.add( new JButton( "Button " + count ) );
25
```

Create BOxes

Add three JButtons to horizontal Box


```
26       // create strut and add buttons to Box vertical1
27       for ( int count = 0; count < SIZE; count++ ) {
28          vertical1.add( Box.createVerticalStrut( 25 ) );
29          vertical1.add( new JButton( "Button " + count ) );
30       }
31
32       // create horizontal glue and add buttons to Box horizontal
33       for ( int count = 0; count < SIZE; count++ ) {
34          horizontal2.add( Box.createHorizontalGlue() );
35          horizontal2.add( new JButton( "Button " + count ) );
36       }
37
38       // create rigid area and add buttons to Box vertical2
39       for ( int count = 0; count < SIZE; count++ ) {
40          vertical2.add( Box.createRigidArea( new Dim
41          vertical2.add( new JButton( "Button " + count ) );
42       }
43
44       // create vertical glue and add buttons to panel
45       JPanel panel = new JPanel();
46       panel.setLayout( new BoxLayout( panel, BoxLayout.Y_AXIS ) );
47
48       for ( int count = 0; count < SIZE; count++ ) {
49          panel.add( Box.createGlue() );
50          panel.add( new JButton( "Button " + count ) );
51       }
52
```

Add three JButtons to vertical Box

Strut guarantees space between components

Add three JButtons to horizontal Box

Glue guarantees expandable space between components

Add three JButtons to vertical Box

Rigid area guarantees fixed component size


```
53       // create a JTabbedPane
54       JTabbedPane tabs = new JTabbedPane(
55          JTabbedPane.TOP, JTabbedPane.SCROLL_TAB_LAYOUT );
56
57       // place each container on tabbed pane
58       tabs.addTab( "Horizontal Box", horizontal1 );
59       tabs.addTab( "Vertical Box with Struts", vertical1 );
60       tabs.addTab( "Horizontal Box with Glue", horizontal2 );
61       tabs.addTab( "Vertical Box with Rigid Areas", vertical2 );
62       tabs.addTab( "Vertical Box with Glue", panel );
63
64       getContentPane().add( tabs );  // place tabbed pane on content pane
65
66       setSize( 400, 220 );
67       setVisible( true );
68
69    } // end constructor
70
71    public static void main( String args[] )
72    {
73       BoxLayoutDemo application = new BoxLayoutDemo();
74       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
75    }
76
77 } // end class BoxLayoutDemo
```

Create a JTabbedPane to hold the BOxes

GridBagLayout Layout Manager

- GridBagLayout
  - Flexible GridBagLayout
    - Components can vary in size
    - Components can occupy multiple rows and columns
    - Components can be added in any order
  - Uses GridBagConstraints
    - Specifies how component is placed in GridBagLayout

Fig. 4.16 Designing a GUI that will use GridBagLayout

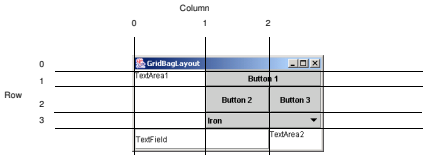
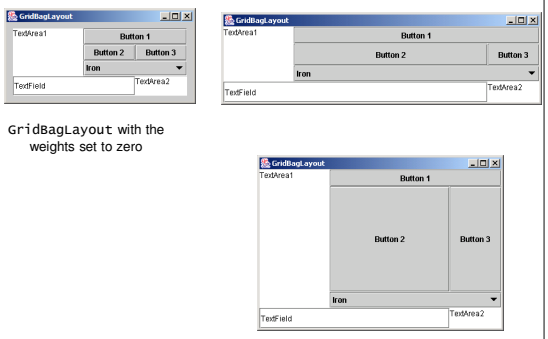


Fig. 4.17 GridBagConstraints fields

GridBagConstraints field	Description
fill	Resize the component in specified direction (NONE, HORIZONTAL, VERTICAL, BOTH) when the display area is larger than the component.
gridx	The column in which the component will be placed.
gridy	The row in which the component will be placed.
gridwidth	The number of columns the component occupies.
gridheight	The number of rows the component occupies.
weightx	The portion of extra space to allocate horizontally. The grid slot can become wider when extra space is available.
weighty	The portion of extra space to allocate vertically. The grid slot can become taller when extra space is available.



GridBagLayout with the weights set to zero


```
1  // Fig. 4.19: GridBagDemo.java
2  // Demonstrating GridBagLayout.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class GridBagDemo extends JFrame {
8     private Container container;
9     private GridBagLayout layout;
10    private GridBagConstraints constraints;
11
12    // set up GUI
13    public GridBagDemo()
14    {
15       super( "GridBagLayout" );
16
17       container = getContentPane();
18       layout = new GridBagLayout();
19       container.setLayout( layout );
20
21       // instantiate gridbag constraints
22       constraints = new GridBagConstraints();
23
24       // create GUI components
25       JTextArea textArea1 = new JTextArea( "TextArea1", 5, 10 );
26       JTextArea textArea2 = new JTextArea( "TextArea2", 2, 2 );
27
```

Set GridBagLayout as layout manager

Used to determine component location and size in grid


```
28       String names[] = { "Iron", "Steel", "Brass" };
29       JComboBox comboBox = new JComboBox( names );
30
31       JTextField textField = new JTextField( "TextField" );
32       JButton button1 = new JButton( "Button 1" );
33       JButton button2 = new JButton( "Button 2" );
34       JButton button3 = new JButton( "Button 3" );
35
36       // weightx and weighty for textArea1 are both 0: the d
37       // anchor for all components is CENTER: the default
38       constraints.fill = GridBagConstraints.BOTH;
39       addComponent( textArea1, 0, 0, 1, 3 );
40
41       // weightx and weighty for button1 are both 0: the default
42       constraints.fill = GridBagConstraints.HORIZONTAL;
43       addComponent( button1, 0, 1, 2, 1 );
44
45       // weightx and weighty for comboBox are both 0: the default
46       // fill is HORIZONTAL
47       addComponent( comboBox, 2, 1, 2, 1 );
48
49       // button2
50       constraints.weightx = 1000;   // can grow wider
51       constraints.weighty = 1;      // can grow taller
52       constraints.fill = GridBagConstraints.BOTH;
53       addComponent( button2, 1, 1, 1, 1 );
54
```

If user resizes Container, first JTextArea is filled entire allocated area in grid

First JTextArea spans one row and three columns

If user resizes Container, first JButton fills horizontally in grid

First JButton spans two rows and one column

If user resizes Container, second JButton fills extra space

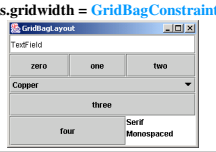
```
55       // fill is BOTH for button3
56       constraints.weightx = 0;
57       constraints.weighty = 0;
58       addComponent( button3, 1, 2, 1, 1 );
59
60       // weightx and weighty for textField are both 0, fill is BOTH
61       addComponent( textField, 3, 0, 2, 1 );
62
63       // weightx and weighty for textArea2 are both 0, fill is BOTH
64       addComponent( textArea2, 3, 2, 1, 1 );
65
66       setSize( 300, 150 );
67       setVisible( true );
68
69    } // end constructor GridBagDemo
70
71    // method to set constraints on
72    private void addComponent( Component component,
73       int row, int column, int width, int height )
74    {
75       // set gridx and gridy
76       constraints.gridx = column;
77       constraints.gridy = row;
78
```



```
79       // set gridwidth and gridheight
80       constraints.gridwidth = width;
81       constraints.gridheight = height;
82
83       // set constraints and add component
84       layout.setConstraints( component, constraints );
85       container.add( component );
86    }
87
88    public static void main( String args[] )
89    {
90       GridBagDemo application = new GridBagDemo();
91       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
92    }
93
94 } // end class GridBagDemo
```


GridBagConstraints Constants RELATIVE and REMAINDER

- Constants RELATIVE and REMAINDER
  - Usados em substituição a gridx e gridy
  - RELATIVE
    - Especifica proximidade necessária ao último componente adicionado
      constraints.gridwidth = GridBagConstraints.RELATIVE;
    - layout.setConstraints(component, constraints);
    - Container.add(component);
  - REMAINDER
    - Especifica que o componente deve ser o último da linha ou coluna
    - constraints.gridwidth = GridBagConstraints.REMAINDER;




```
1  // Fig. 4.20: GridBagDemo2.java
2  // Demonstrating GridBagLayout constants.
3  import java.awt.*;
4  import java.awt.event.*;
5  import javax.swing.*;
6
7  public class GridBagDemo2 extends JFrame {
8     private GridBagLayout layout;
9     private GridBagConstraints constraints;
10    private Container container;
11
12    // set up GUI
13    public GridBagDemo2()
14    {
15       super( "GridBagLayout" );
16
17       container = getContentPane();
18       layout = new GridBagLayout();
19       container.setLayout( layout );
20
21       // instantiate gridbag constraints
22       constraints = new GridBagConstraints();
23
24       // create GUI components
25       String metals[] = { "Copper", "Aluminum", "Silver" };
26       JComboBox comboBox = new JComboBox( metals );
27
```

Set GridBagLayout as layout manager

Used to determine component location and size in grid


```
28       JTextField textField = new JTextField( "TextField" );
29
30       String fonts[] = { "Serif", "Monospaced" };
31       JList list = new JList( fonts );
32
33       String names[] = { "zero", "one", "two", "three", "four" };
34       JButton buttons[] = new JButton[ names.length ];
35
36       for ( int count = 0; count < buttons.length; count++ )
37          buttons[ count ] = new JButton( names[ count ] );
38
39       // define GUI component constraints for textFiel
40       constraints.weightx = 1;
41       constraints.weighty = 1;
42       constraints.fill = GridBagConstraints.BOTH;
43       constraints.gridwidth = GridBagConstraints.REMAINDER;
44       addComponent( textField );
45
46       // buttons[0] -- weightx and weighty are 1: fill is BOTH
47       constraints.gridwidth = 1;
48       addComponent( buttons[ 0 ] );
49
50       // buttons[1] -- weightx and weighty are 1: fill is BOTH
51       constraints.gridwidth = GridBagConstraints.RELATIVE;
52       addComponent( buttons[ 1 ] );
53
```

Specify textField as last (only) component in first row

Place button[0] as first component in second row

Place button[1] right next to button[0]


```
54       // buttons[2] -- weightx and weighty are 1: fill is BOTH
55       constraints.gridwidth = GridBagConstraints.REMAINDER;
56       addComponent( buttons[ 2 ] );
57
58       // comboBox -- weightx is 1: fill is BOTH
59       constraints.weighty = 0;
60       constraints.gridwidth = GridBagConstraints.REMAINDER;
61       addComponent( comboBox );
62
63       // buttons[3] -- weightx is 1: fill is BOTH
64       constraints.weighty = 1;
65       constraints.gridwidth = GridBagConstraints.REMAINDER;
66       addComponent( buttons[ 3 ] );
67
68       // buttons[4] -- weightx and weighty are 1: fill is BOTH
69       constraints.gridwidth = GridBagConstraints.RELATIVE;
70       addComponent( buttons[ 4 ] );
71
72       // list -- weightx and weighty are 1: fill is BOTH
73       constraints.gridwidth = GridBagConstraints.REMAINDER;
74       addComponent( list );
75
76       setSize( 300, 200 );
77       setVisible( true );
78
79    } // end constructor
80
```

Place button[2] right next to button[1]

Specify comboBox as last (only) component in third row

Specify buttons[3] as last (only) component in fourth row

Place button[4] as first component in fifth row

Specify list as last component in fifth row

```
81    // add a Component to the container
82    private void addComponent( Component component )
83    {
84       layout.setConstraints( component, constraints );
85       container.add( component );      // add component
86    }
87
88    public static void main( String args[] )
89    {
90       GridBagDemo2 application = new GridBagDemo2();
91       application.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
92    }
93
94 }  // end class GridBagDemo2
```