Graphical User Interfaces

CSC 1051 – Data Structures and Algorithms I

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Course website:
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Graphical User Interface (GUI)

- A GUI component
  - an object that represents a screen element
  - examples: buttons, text fields, labels, panels, frames

- GUI-related classes from packages:
  - java.awt Abstract Windowing Toolkit (AWT): the original Java GUI package
  - javax.swing Swing provides additional and more versatile components
  - Both packages are needed to create a Java GUI-based program
GUI Container

A kind of component:
- hold and organize other components
- two main types:
  - frame: a container displayed as a separate window
    - It can be repositioned and resized on the screen as needed
    - has its own title bar with close-minimize-resize buttons
    - a heavyweight container: managed by the underlying operating system
  - panel – a container that cannot be displayed on its own but is used to organize other components
    - A panel must be added to another container (like a frame or another panel) to be displayed
    - a lightweight container: managed by the Java program itself
Other components: Labels

• A *label* is a GUI component that displays a line of text and/or an image

• Let's look at a program that organizes two labels in a panel and displays that panel in a frame

• This program is not interactive, but the frame can be repositioned and resized

• See [Authority.java](#)
import java.awt.*;
import javax.swing.*;

public class Authority
{
    // Displays some words of wisdom.
    public static void main (String[] args)
    {
        JFrame frame = new JFrame("Authority");
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

        JPanel primary = new JPanel();
        primary.setBackground(Color.yellow);
        primary.setPreferredSize(new Dimension(250, 75));
    }
}

continued
continued

JLabel label1 = new JLabel("Question authority,");
JLabel label2 = new JLabel("but raise your hand first.");

primary.add(label1);
primary.add(label2);

frame.getContentPane().add(primary);
frame.pack();
frame.setVisible(true);
} }
continued

JLabel label1 = new JLabel ("Question authority,");
JLabel label2 = new JLabel ("but raise your hand first.");

primary.add (label1);
primary.add (label2);

frame.getContentPane().add(primary);
frame.pack();
frame.setVisible(true);

} }
Nested Panels

• Containers that contain other components make up the containment hierarchy of an interface

• This hierarchy can be as intricate as needed to create the visual effect desired

• The following example nests two panels inside a third panel – note the effect this has as the frame is resized

• See NestedPanels.java
// Demonstrates a basic component hierarchy.

import java.awt.*;
import javax.swing.*;

public class NestedPanels
{
    public static void main (String[] args)
    {
        JFrame frame = new JFrame ("Nested Panels");
        frame.setDefaultCloseOperation (JFrame.EXIT_ON_CLOSE);

        // Set up first subpanel
        JPanel subPanel1 = new JPanel();
        subPanel1.setPreferredSize (new Dimension(150, 100));
        subPanel1.setBackground (Color.green);
        JLabel label1 = new JLabel ("One");
        subPanel1.add (label1);
    }
}
continued

    // Set up second subpanel
    JPanel subPanel2 = new JPanel();
    subPanel2.setPreferredSize (new Dimension(150, 100));
    subPanel2.setBackground (Color.red);
    JLabel label2 = new JLabel ("Two");
    subPanel2.add (label2);

    // Set up primary panel
    JPanel primary = new JPanel();
    primary.setBackground (Color.blue);
    primary.add (subPanel1);
    primary.add (subPanel2);

    frame.getContentPane().add(primary);
    frame.pack();
    frame.setVisible(true);
continued

// Set up second subpanel
JPanel subPanel2 = new JPanel();
subPanel2.setPreferredSize(new Dimension(150, 100));
subPanel2.setBackground(Color.red);
JLabel label2 = new JLabel("Two");
subPanel2.add(label2);

// Set up primary panel
JPanel primary = new JPanel();
primary.setBackground(Color.blue);
primary.add(subPanel1);
primary.add(subPanel2);
frame.getContentPane().add(primary);
frame.pack();
frame.setVisible(true);
Images

- Images can be displayed in a Java program in various ways.
- As we've seen, a JLabel object can be used to display a line of text.
- It can also be used to display an image.
- That is, a label can be composed of text, an image, or both at the same time.
Images

- The `ImageIcon` class is used to represent the image that is stored in a label

- If text is also included, the position of the text relative to the image can be set explicitly

- The alignment of the text and image within the label can be set as well

- See `LabelDemo.java`
import java.awt.*;
import javax.swing.*;

public class LabelDemo {
    // Creates and displays the primary application frame.
    public static void main (String[] args) {
        JFrame frame = new JFrame("Label Demo");
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        
        ImageIcon icon = new ImageIcon("devil.gif");
        
        JLabel label1, label2, label3;
        
        label1 = new JLabel("Devil Left", icon, SwingConstants.CENTER);
        
        continued
continued

    label2 = new JLabel("Devil Right", icon, SwingConstants.CENTER);
    label2.setHorizontalTextPosition(SwingConstants.LEFT);
    label2.setVerticalTextPosition(SwingConstants.BOTTOM);

    label3 = new JLabel("Devil Above", icon, SwingConstants.CENTER);
    label3.setHorizontalTextPosition(SwingConstants.CENTER);
    label3.setVerticalTextPosition(SwingConstants.BOTTOM);

    JPanel panel = new JPanel();
    panel.setBackground(Color.cyan);
    panel.setPreferredSize(new Dimension(200, 250));
    panel.add(label1);
    panel.add(label2);
    panel.add(label3);

    frame.getContentPane().add(panel);
    frame.pack();
    frame.setVisible(true);
label2 = new JLabel("Devil Right", icon, SwingConstants.CENTER);
label2.setHorizontalTextPosition(SwingConstants.LEFT);
label2.setVerticalTextPosition(SwingConstants.BOTTOM);

label3 = new JLabel("Devil Above", icon, SwingConstants.CENTER);
label3.setHorizontalTextPosition(SwingConstants.CENTER);
label3.setVerticalTextPosition(SwingConstants.BOTTOM);

JPanel panel = new JPanel();
panel.setBackground(Color.cyan);
panel.setPreferredSize(new Dimension(200, 250));
panel.add(label1);
panel.add(label2);
panel.add(label3);
frame.getContentPane().add(panel);
frame.pack();
frame.setVisible(true);