BLM 2562 OBJECT ORIENTED PROGRAMMING LECTURE NOTES

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GUI PROGRAMMING WITH JAVA
Part I – Frames and Panels

1

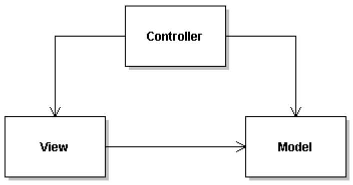
GUI PROGRAMMING WITH JAVA

- General information:
  - GUI editors in Java are not as easy to use as Microsoft's programming environments.
  - Learning curve of GUI operations in Java is rather steep.
  - Built-in GUI packages in Java are:
    - The java.awt package: It has become obsolote
    - The javax.swing package:
      - Current one since Java 1.2
      - Based on classes in java.awt.
      - Class names begin with J
        - javax.swing.JFrame
        - java.awt.Frame
        - Don't forget the J!
  - There are other 3rd party packages as well
    - such as SWT of the eclipse foundation
    - not to be covered in this course

2

GUI PROGRAMMING WITH JAVA

- General architecture of the Swing framework is based on the Model-View-Controller (MVC) design pattern.
- What is a design pattern?
  - It is a general reusable solution to a commonly occurring problem within a given context in software design.
  - A design pattern is not a finished design that can be transformed directly into code.
  - It can rather be seen as a template for leading you to a "good" design.
- What is MVC?



- Model class:
  - Represents raw information (data)
- View class:
  - Represents different representations of the data
- Controller class:
  - Receives user commands and handles them by reading and/or modifying data
- For more information, please refer to the classic GoF book and others.

3

GUI PROGRAMMING WITH JAVA

- Creating a basic window:
  - The class javax.swing.JFrame represents a basic window.
  - Create your own windows by inheriting from this class.

```
package oop08;
import javax.swing.*;
@SuppressWarnings("serial")
public class SimpleWindow extends JFrame {
   public static final int DEFAULT_WIDTH = 300;
   public static final int DEFAULT_HEIGHT = 200;
   public SimpleWindow( ) {
      setSize( DEFAULT_WIDTH, DEFAULT_HEIGHT );
   }
   public static void main(String[] args) {
      SimpleWindow window = new SimpleWindow( );
      window.setTitle("A Simple Window");
      window.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      window.setVisible(true);
   }
}
```

4

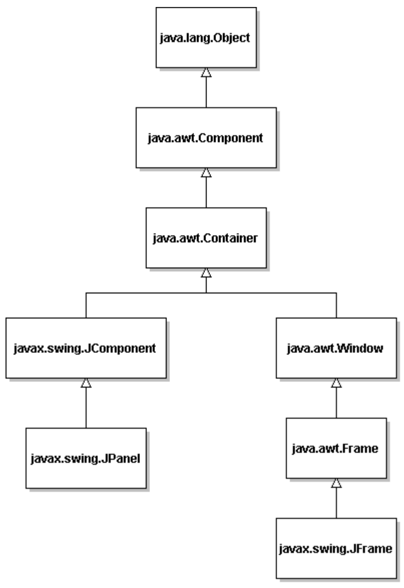
GUI PROGRAMMING WITH JAVA

- What have we just done?
  - We must set the size of the window in its constructor or in the main method by using the **setSize(int width, int height)** method.
    - Otherwise, its size will be 0 by 0!
  - We must show the window by using the **setVisible(boolean isVisible)** method.
    - Otherwise, it will not be shown in the screen.
  - We can set it's title by using the **setTitle(String title)** method.
  - We must use **setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE)**
    - Otherwise the program will continue to execute (check the red stop button in eclipse)

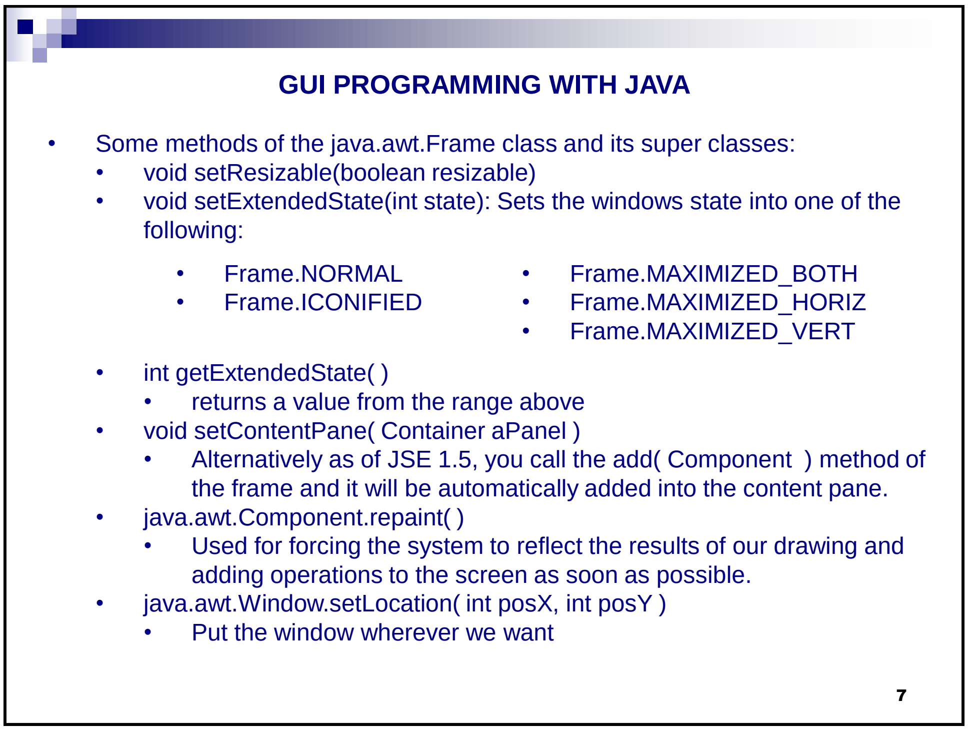
5

GUI PROGRAMMING WITH JAVA

- Frames and Panels:
  - The frame contains a top-level panel for you to put contents in it.
    - Hence its named the content panel.
    - A panel can contain other panels as well.
    - This opens up some possibilities in layout organization and code reuse.
  - The inheritance tree is shown on the left.



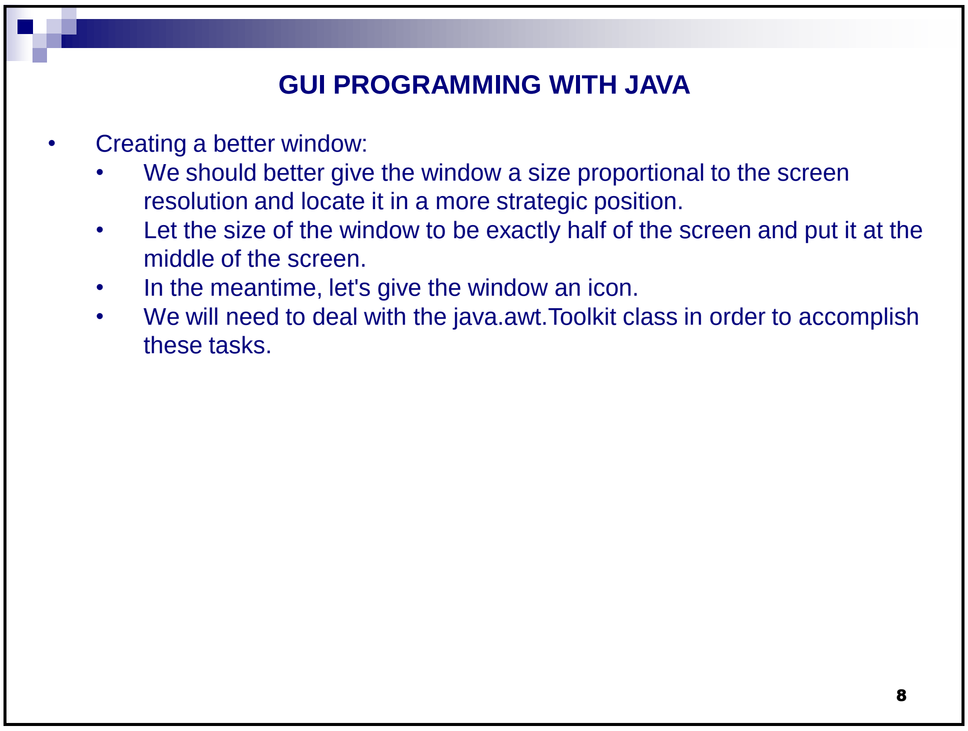
6



GUI PROGRAMMING WITH JAVA

- Some methods of the java.awt.Frame class and its super classes:
  - void setResizable(boolean resizable)
  - void setExtendedState(int state): Sets the windows state into one of the following:
    - Frame.NORMAL
    - Frame.ICONIFIED
    - Frame.MAXIMIZED_BOTH
    - Frame.MAXIMIZED_HORIZ
    - Frame.MAXIMIZED_VERT
  - int getExtendedState( )
    - returns a value from the range above
  - void setContentPane(Container aPanel)
    - Alternatively as of JSE 1.5, you call the add(Component) method of the frame and it will be automatically added into the content pane.
  - java.awt.Component.repaint( )
    - Used for forcing the system to reflect the results of our drawing and adding operations to the screen as soon as possible.
  - java.awt.Window.setLocation(int posX, int posY)
    - Put the window wherever we want

7



GUI PROGRAMMING WITH JAVA

- Creating a better window:
  - We should better give the window a size proportional to the screen resolution and locate it in a more strategic position.
  - Let the size of the window to be exactly half of the screen and put it at the middle of the screen.
  - In the meantime, let's give the window an icon.
  - We will need to deal with the java.awt.Toolkit class in order to accomplish these tasks.

8

GUI PROGRAMMING WITH JAVA

- Getting a Toolkit instance and learning the screen size:

```
Toolkit kit = Toolkit.getDefaultToolkit();
Dimension screenSize = kit.getScreenSize();
int screenHeight = screenSize.height;
int screenWidth = screenSize.width;
```

- Loading an image and designating it as an icon:

```
Image img = kit.getImage("icon.jpg");
setIconImage(img);
```

- Regarding to the relative location of the image:
  - Put in the project directory if working with an IDE

9

GUI PROGRAMMING WITH JAVA

- Putting them alltogether:

```
package oop08;
import java.awt.*;
import javax.swing.*;
@SuppressWarnings("serial")
public class SizedWindowWithIcon extends JFrame {
    public SizedWindowWithIcon( ) {
        Toolkit kit = Toolkit.getDefaultToolkit();
        Dimension screenSize = kit.getScreenSize();
        int screenHeight = screenSize.height;
        int screenWidth = screenSize.width;
        setSize(screenWidth / 2, screenHeight / 2);
        setLocation(screenSize.width / 4, screenSize.height / 4);
        Image img = kit.getImage("icon.jpg");
        setIconImage(img);
        setTitle("A Sized Window With Icon");
    }
    public static void main(String[] args) {
        SizedWindowWithIcon window = new SizedWindowWithIcon( );
        window.setVisible(true);
        window.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    }
}
```

10

GUI PROGRAMMING WITH JAVA

- The correct way to initialize Swing:
  - Swing components are rather complex, therefore we need to initialize GUI components in a separate thread.
  - This should be done from the *event dispatch thread.*
    - i.e., the thread of control that passes events such as mouse clicks and keystrokes to the user interface components.
  - Here is the code fragment used for this purpose:

```
EventQueue.invokeLater(new Runnable() {
    public void run() {
        /* statements */
    }
});
```

- Now, what was that?
  - We have just created *an anonymous inner class which implements the Runnable interface*.
  - You can omit this magic code and go ahead as our previous examples and everything can go normal, but better be safe than sorry.

11

GUI PROGRAMMING WITH JAVA

- Drawing something *into the panel*:
  - You cannot draw into the frame directly, you draw into its top-level panel.
  - You should create a panel by inheriting from JPanel and overriding its paintComponent method.
  - Moreover, a panel is responsible from painting all components inside it.
    - The easiest way to do this is by calling the super.paintComponent method as the first command in the paintComponent method.
  - Drawing is done by using the parameter of type Graphics.
    - Displaying text is considered a special kind of drawing.
    - The Graphics class has a drawString method for this purpose:
      - g.drawString(String text, int xPos, int yPos)

```
class NotHelloWorldPanel extends JPanel {
    public void paintComponent(Graphics g) {
        super.paintComponent(g);
        g.drawString("Not a Hello, World program", 75, 100);
    }
}
```

12

GUI PROGRAMMING WITH JAVA

- Putting them alltogether:

```
package oop08;
import javax.swing.*;
import java.awt.*;
@SuppressWarnings("serial")
public class NotHelloWorld {
   public static void main(String[] args) {
      EventQueue.invokeLater(new Runnable() {
         public void run() {
            NotHelloWorldFrame frame = new NotHelloWorldFrame();
            frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
            frame.setVisible(true);
         }
      });
   }
}
//to be continued in the next slide
```

13

GUI PROGRAMMING WITH JAVA

- Putting them alltogether (cont'd):

```
//A frame that contains a message panel
class NotHelloWorldFrame extends JFrame {
    public NotHelloWorldFrame(){
        setTitle("NotHelloWorld");
        setSize(300, 200);
        NotHelloWorldPanel panel = new NotHelloWorldPanel();
        add(panel);
    }
}
//A component that displays a message.
class NotHelloWorldPanel extends JPanel {
    public void paintComponent(Graphics g){
        super.paintComponent(g);
        g.drawString("Not a Hello, World program", 60, 80);
    }
}
```

- PS: We have coded all classes in NotHelloWord.java

14

GUI PROGRAMMING WITH JAVA

- Handcoding coordinates of the text is somewhat awkward
  - Those who need to learn more about fonts, font metrics and details of working with 2D objects such as lines, rectangles, etc. can refer to the rest of the Section 7 of Core Java Vol.I
- We will proceed by learning how to react user input in the next week.

15

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GUI PROGRAMMING WITH JAVA
Part II – Event Handling

16

GUI PROGRAMMING WITH JAVA

- The examples in the previous section do not interact with user.
  - We need to take input from the user by means of graphical controls such as text boxes, buttons, etc.
  - But before that, we need to know about events and how to process them.
- All operating systems (OS) with GUI support work in terms of *events* and *actions*.
  - Each movement of the mouse, each click, each key press and release, is an event.
  - Whenever an event occurs, someone should make an action.
    - The OS catches all events and make and action.
    - Moreover, OS lets programming languages to intervene, i.e. it lets us to *handle* those *events*.
    - Different programming languages have different approaches for *event handling*.

17

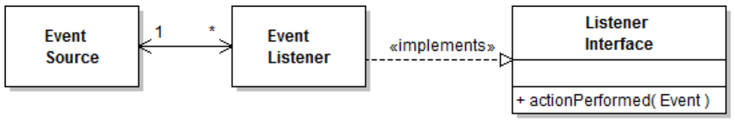
GUI PROGRAMMING WITH JAVA

- Event handling with Java:
  - Different types of event sources create different types of events.
    - GUI components such as JButton, JCheckBox, etc.
    - OS itself: Mouse and keyboard events, etc.
  - Event listeners listen to events of their preference.
    - Listeners should implement sub-interfaces of java.util.EventListener interface which are in java.awt.event package.
    - Code for handling events are written in the method(s) defined in those interfaces.
  - Programmer relates event sources with event listeners.
    - The general format is:
      - eventSourceObj.**add**EventName**Listener(**aListenerObj**);**

18

GUI PROGRAMMING WITH JAVA

- Relating event sources with event listeners:
  - Listeners of GUI events are associated with the GUI objects which is the source of that event.
  - Listeners of OS events are associated with JFrame or JPanel objects.
  - There can be *..* relation between event sources and listeners, but 1..* is suggested.

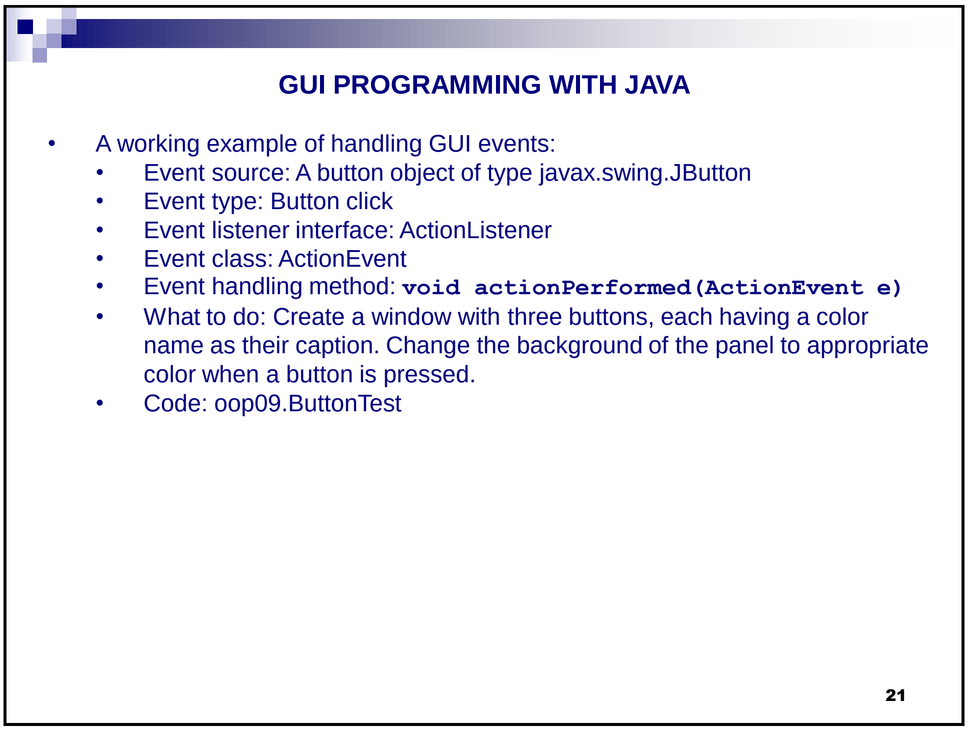


19

GUI PROGRAMMING WITH JAVA

- Events needed frequently …
  - ActionEvent
  - AdjustmentEvent
  - FocusEvent
  - ItemEvent
  - KeyEvent
  - MouseEvent
  - MouseWheelEvent
  - WindowEvent
- … and their listeners
  - ActionListener
  - AdjustmentListener
  - FocusListener
  - ItemListener
  - KeyListener
  - MouseListener
  - MouseWheelListener
  - WindowListener
  - WindowFocusListener
  - WindowStateListener
- All events and interfaces are within the java.awt.event package.

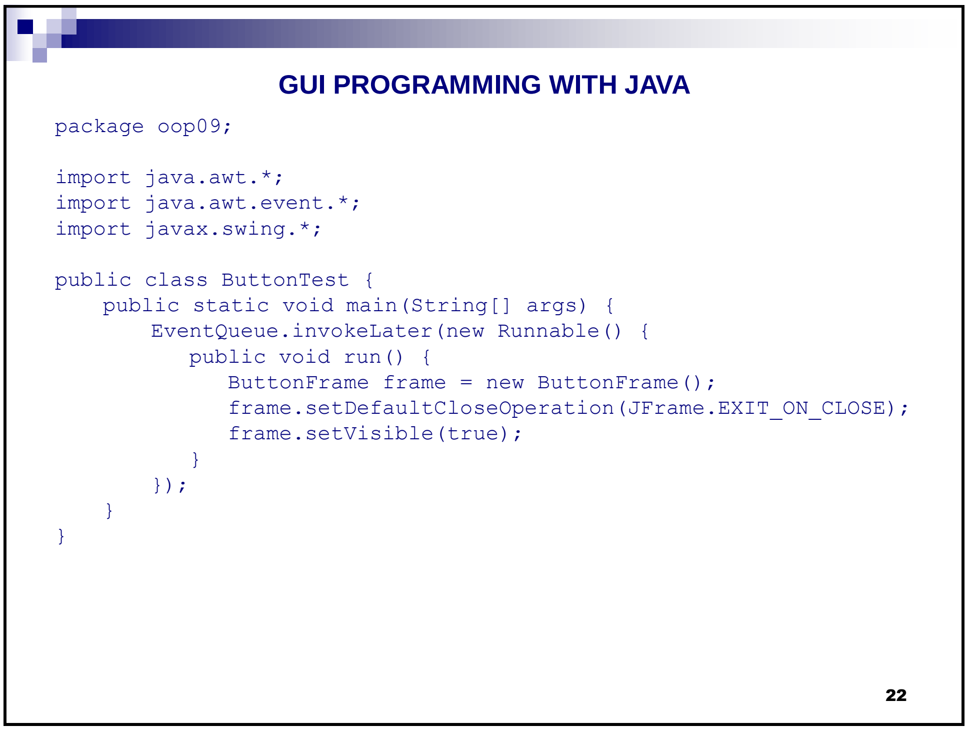
20



GUI PROGRAMMING WITH JAVA

- A working example of handling GUI events:
  - Event source: A button object of type javax.swing.JButton
  - Event type: Button click
  - Event listener interface: ActionListener
  - Event class: ActionEvent
  - Event handling method: **`void actionPerformed(ActionEvent e)`**
  - What to do: Create a window with three buttons, each having a color name as their caption. Change the background of the panel to appropriate color when a button is pressed.
  - Code: oop09.ButtonTest

21



GUI PROGRAMMING WITH JAVA

```java
package oop09;

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

public class ButtonTest {
    public static void main(String[] args) {
        EventQueue.invokeLater(new Runnable() {
           public void run() {
              ButtonFrame frame = new ButtonFrame();
              frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
              frame.setVisible(true);
           }
        });
    }
}
```

22

GUI PROGRAMMING WITH JAVA

```
@SuppressWarnings("serial")
class ButtonFrame extends JFrame {
    private JPanel buttonPanel;
    public static final int DEFAULT_WIDTH = 300;
    public static final int DEFAULT_HEIGHT = 200;

    public ButtonFrame() {
        setTitle("ButtonTest");
        setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);

        // create buttons
        JButton yellowButton = new JButton("Yellow");
        JButton blueButton = new JButton("Blue");
        JButton redButton = new JButton("Red");

        buttonPanel = new JPanel();

        // add buttons to panel
        buttonPanel.add(yellowButton);
        buttonPanel.add(blueButton);
        buttonPanel.add(redButton);

        //continues in the next slide
```

GUI PROGRAMMING WITH JAVA

```
        // add panel to frame
        add(buttonPanel);

        // create button actions
        ColorAction yellowAction = new ColorAction(Color.YELLOW);
        ColorAction blueAction = new ColorAction(Color.BLUE);
        ColorAction redAction = new ColorAction(Color.RED);

        // associate actions with buttons
        yellowButton.addActionListener(yellowAction);
        blueButton.addActionListener(blueAction);
        redButton.addActionListener(redAction);
    } //end of ButtonFrame constructor.

    //An action listener that sets the panel's background color.
    private class ColorAction implements ActionListener {
        private Color backgroundColor;
        public ColorAction(Color c){ backgroundColor = c; }
        public void actionPerformed(ActionEvent event){
            buttonPanel.setBackground(backgroundColor);
        }
    }/* coded as an inner class. You can write an alternative
        version with regular classes (ButtonTestV2) */
}
```

GUI PROGRAMMING WITH JAVA

- A working example of handling Window events:
  - Code: oop09.WindowEventTest
  - The WindowListener and WindowStateListener interfaces has been implemented

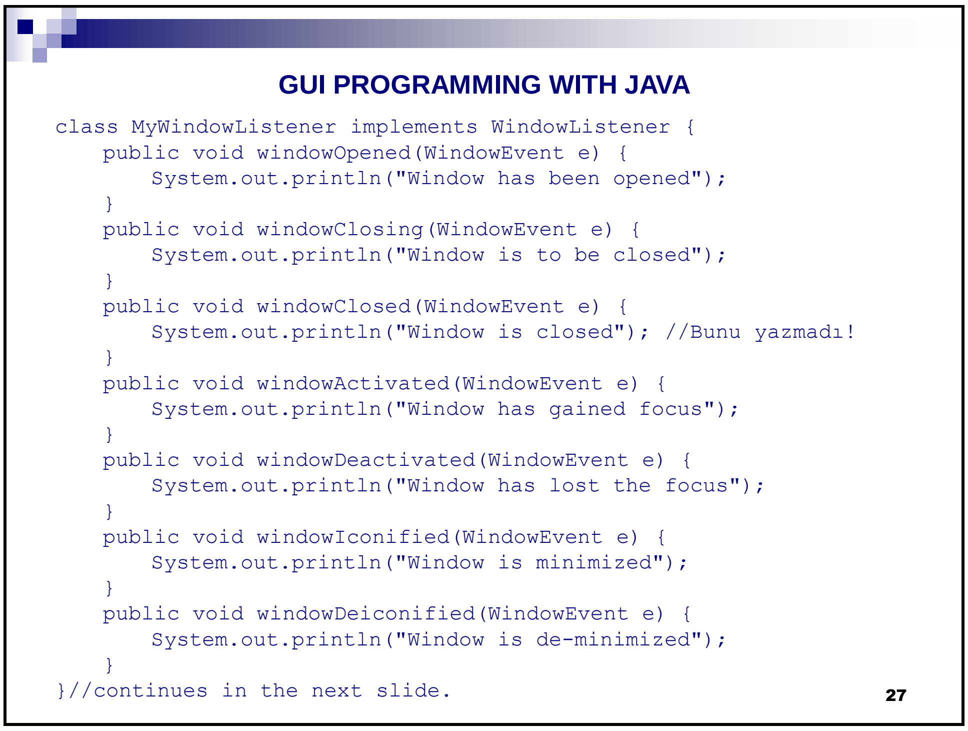
```
package oop09;
import java.awt.EventQueue;
import java.awt.event.*;
import javax.swing.*;

public class WindowEventTest {
    public static void main(String[] args) {
        EventQueue.invokeLater(new Runnable() {
            public void run() {
                CaptureWindowEventsFrame frame =
                new CaptureWindowEventsFrame();
                frame.setVisible(true);
            }
        });
    }
}
//continues in the next slide.
```

25

GUI PROGRAMMING WITH JAVA

```
class CaptureWindowEventsFrame extends JFrame {
    private static final long serialVersionUID = 1L;
    public static final int DEFAULT_WIDTH = 300;
    public static final int DEFAULT_HEIGHT = 200;
    public CaptureWindowEventsFrame(){
        setTitle("CaptureWindowEventsTest");
        setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
        addWindowListener( new MyWindowListener( ) );
        addWindowStateListener( new MyWindowStateListener( ) );
    }
}
//continues in the next slide.
```

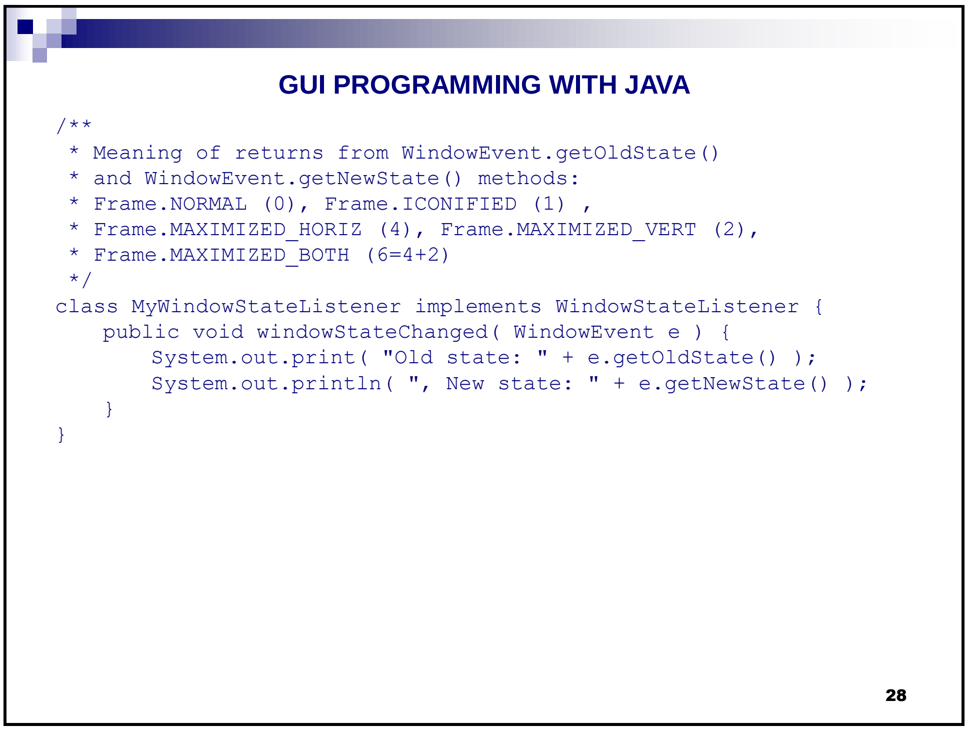
26



GUI PROGRAMMING WITH JAVA

```
class MyWindowListener implements WindowListener {
    public void windowOpened(WindowEvent e) {
        System.out.println("Window has been opened");
    }
    public void windowClosing(WindowEvent e) {
        System.out.println("Window is to be closed");
    }
    public void windowClosed(WindowEvent e) {
        System.out.println("Window is closed"); //Bunu yazmadı!
    }
    public void windowActivated(WindowEvent e) {
        System.out.println("Window has gained focus");
    }
    public void windowDeactivated(WindowEvent e) {
        System.out.println("Window has lost the focus");
    }
    public void windowIconified(WindowEvent e) {
        System.out.println("Window is minimized");
    }
    public void windowDeiconified(WindowEvent e) {
        System.out.println("Window is de-minimized");
    }
}//continues in the next slide.
```

27



GUI PROGRAMMING WITH JAVA

```
/**
 * Meaning of returns from WindowEvent.getOldState()
 * and WindowEvent.getNewState() methods:
 * Frame.NORMAL (0), Frame.ICONIFIED (1) ,
 * Frame.MAXIMIZED_HORIZ (4), Frame.MAXIMIZED_VERT (2),
 * Frame.MAXIMIZED_BOTH (6=4+2)
 */
class MyWindowStateListener implements WindowStateListener {
    public void windowStateChanged( WindowEvent e ) {
        System.out.print( "Old state: " + e.getOldState() );
        System.out.println( ", New state: " + e.getNewState() );
    }
}
```

28

GUI PROGRAMMING WITH JAVA

- About adapter classes:
  - Remember the `MyWindowListener` class implementing `WindowListener`.
  - It has 7 methods corresponding to 7 events.
  - What if you need to handle just 1 event?
  - In this case, create your listener class by inheriting from java.awt.event.WindowAdapter class.
    - This class has default implementations for all events.
    - You just override the method you need.
  - Check out this adapter:

```
package oop09;
import java.awt.event.*;
class MyWindowAdapter extends WindowAdapter {
    public void windowActivated(WindowEvent e) {
        System.out.println("Window has gained focus");
    }
    public void windowDeactivated(WindowEvent e) {
        System.out.println("Window has lost the focus");
    }
}
```

29

GUI PROGRAMMING WITH JAVA

- About adapter classes (cont'd):
  - Now we can create WindowEventTestV2 using the newly created adapter as a classroom exercise.
  - There are other adapters as well.
    - Those are left for you to explore.

30

GUI PROGRAMMING WITH JAVA

- Events are divided into two groups:
  - High-level (Logical) events:
    - These purpose of these events is to initiate a process related to business logic.
    - Clicking a button, resizing a window, advancing the scroll bar, etc.
  - Low-level events:
    - Keyboard and mouse events are of this type.
    - These come together and constitute high-level events.
    - For example, in order to click a button:
      - Move the mouse on top of the button.
      - Press the left mouse button.
      - Release the left mouse button.

GUI PROGRAMMING WITH JAVA

- Handling keyboard events:
  - Done via KeyListener interface or KeyAdapter class.
  - Right and left Shift/Control/Alt/AltGr keys are special keys.
    - You may need to control whether a key is pressed with a special key or not.
    - Pressing c is not the same as pressing CTRL-C
  - Example: oop09.KeyboardEventsTest

```
import java.awt.*;
import javax.swing.*;
import java.awt.event.*;
public class KeyboardEventsTest {
    public static void main(String[] args) {
        EventQueue.invokeLater(new Runnable() {
            public void run() {
                CaptureKeyboardEventsFrame frame = new
                                CaptureKeyboardEventsFrame();
                frame.setVisible(true);
            }
        });
    }
}
```

GUI PROGRAMMING WITH JAVA

```
@SuppressWarnings("serial")
class CaptureKeyboardEventsFrame extends JFrame {
    public static final int DEFAULT_WIDTH = 300;
    public static final int DEFAULT_HEIGHT = 200;
    public CaptureKeyboardEventsFrame(){
        setTitle("CaptureKeyboardEventsTest");
        setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
        addKeyListener(new SpecialKeyHandler() );
        addKeyListener(new KeyHandler() );
    }
}
```

- Notice that we have associated listeners with the frame.
  - Listeners can also be associated with panels, but this is rather tricky and not covered here.

33

GUI PROGRAMMING WITH JAVA

```
class KeyHandler implements KeyListener {
    int lastKey; char lastChar; static String keyText;
    public void keyPressed(KeyEvent event) {
        int keyCode = event.getKeyCode();
        if( keyCode != lastKey) {
                System.out.print( "Key pressed, code: " + keyCode );
                lastKey = keyCode;
        }
    }
    public void keyReleased(KeyEvent event) {
        int keyCode = event.getKeyCode();
        System.out.println( "\nKey released, logical code: " +
        KeyEvent.getKeyText(keyCode) );
    }
    public void keyTyped(KeyEvent event) {
        char keyChar = event.getKeyChar();
        if( keyChar != lastChar ) {
                System.out.print( "\nKey typed: " + keyChar );
                lastChar = keyChar;
        }
        else
                System.out.print( keyChar );
    }
}
```

34

GUI PROGRAMMING WITH JAVA

```
class SpecialKeyHandler extends KeyAdapter {
    public void keyTyped(KeyEvent event) {
        if( event.isShiftDown() )
                System.out.print("***Shift key is used***");
        if( event.isControlDown() )
                System.out.print("***Control key is used***");
        if( event.isAltDown() )
                System.out.print("***Alt key is used***");
        if( event.isAltGraphDown() )
                System.out.print("***AltGR key is used***");
        if( event.isMetaDown() )
                System.out.print("***Meta key is used***");
    }
}
```

35

GUI PROGRAMMING WITH JAVA

- Handling mouse events:
  - Pressing the buttons of the mouse and moving the mouse are handled via different listeners.
  - Clicks are handled via MouseListener interface or MouseAdapter class.
  - Movements are handled via MouseMotionListener interface or MouseMotionAdapter class
  - Meanwhile, pressing of special keyboard keys can also be checked.
  - Example: oop09.MouseEventsTest

```
package oop09;
import java.awt.*;
import javax.swing.*;
import java.awt.event.*;
public class MouseEventsTest {
  public static void main(String[] args) {
    EventQueue.invokeLater(new Runnable() {
       public void run() {
         CaptureMouseEventsFrame frame = new
                 CaptureMouseEventsFrame();
         frame.setVisible(true);
       }
    });
  }
}
```

36

```
@SuppressWarnings("serial")
class CaptureMouseEventsFrame extends JFrame {
    public static final int DEFAULT_WIDTH = 300;
    public static final int DEFAULT_HEIGHT = 200;
    public CaptureMouseEventsFrame(){
        setTitle("CaptureMouseEventsTest");
        setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
        addMouseListener( new MouseHandler() );
        addMouseMotionListener( new MouseMotionHandler() );
    }
}
class MouseMotionHandler implements MouseMotionListener {
    public void mouseDragged(MouseEvent event) {
        double x,y;
        x = event.getPoint().getX();
        y = event.getPoint().getY();
        System.out.println("A mouse drag at ("+x+","+y+")");
    }
    public void mouseMoved(MouseEvent event) {
        double x,y;
        x = event.getPoint().getX();
        y = event.getPoint().getY();
        System.out.println("A mouse move at ("+x+","+y+")");
    }
}
```

```
class MouseHandler extends MouseAdapter {
   public void mouseClicked(MouseEvent event) {
      double x = event.getPoint().getX(); double y = event.getPoint().getY();
      int z = event.getClickCount();
      System.out.println("A mouse click at ("+x+","+y+")x"+z);
      int m = event.getButton();
      if( ( m == MouseEvent.BUTTON1) )
         System.out.println("This was a left-click.");
      if( ( m == MouseEvent.BUTTON3) )
         System.out.println("This was a right-click.");
      if( ( m == MouseEvent.BUTTON2) )
         System.out.println("This was a middle-click.");
      int e = event.getModifiersEx();
      if( (e & InputEvent.SHIFT_DOWN_MASK) != 0 )
         System.out.println("The shift key was also pressed");
      if( (e & InputEvent.CTRL_DOWN_MASK) != 0 )
         System.out.println("The control key was also pressed");
      if( (e & InputEvent.ALT_DOWN_MASK) != 0 )
         System.out.println("The alt key was also pressed.");
      if( (e & InputEvent.ALT_GRAPH_DOWN_MASK) != 0 )
         System.out.println("The altgr key was also pressed.");
      if( (e & InputEvent.META_DOWN_MASK) != 0 )
         System.out.println("The meta key was also pressed.");
      System.out.println("Summary of mods in click: " +
         InputEvent.getModifiersExText(e));
    }
}
```

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GUI PROGRAMMING WITH JAVA
Part III – Layout Management

GUI PROGRAMMING WITH JAVA

LAYOUT MANAGEMENT

- You can determine the positions of components in panel by using *layout managers*.
- The java.awt package includes various layout managers, each having different rules and therefore answering to different needs.
- We will examine some of those layout managers this week.
- General usage:
  - Assign a layout manager to a panel by using the Container.setLayout method
  - Add a GUI component to the panel by using the Container.add(aComponent, layoutRule) method.
  - By adding child panels into a parent and using different layout managers, you can fulfill complex layout requirements.

GUI PROGRAMMING WITH JAVA

FLOW LAYOUT:

- FlowLayout is the default layout manager
  - Adds components horizontally next to each other as long as there is enough space.
  - Advances to next line when no place is left
  - Example: oop10.Layout01FlowLayout
    - Same as the previous button example except the use of the layout manager.

41

GUI PROGRAMMING WITH JAVA

```
package oop10;

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

/**
 * FlowLayout manager lines the components horizontally until
 * there is no room and then starts a new row of components.
 */
public class Layout01FlowLayout {
    public static void main(String[] args) {
        EventQueue.invokeLater(new Runnable() {
           public void run() {
                Frame01 frame = new Frame01();
                frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
                frame.setVisible(true);
           }
        });
    }
}
```

42

GUI PROGRAMMING WITH JAVA

```
class Frame01 extends JFrame
{
    private static final long serialVersionUID = 1L;
    public static final int DEFAULT_WIDTH = 300;
    public static final int DEFAULT_HEIGHT = 200;

    public Frame01()
    {
        setTitle("ButtonTest");
        setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
        FlowLayoutPanel panel = new FlowLayoutPanel();
        add(panel);
    }
}
```

43

GUI PROGRAMMING WITH JAVA

```
class FlowLayoutPanel extends Jpanel {
    public FlowLayoutPanel() {
        //Bileşenleri eklemeden önce setLayout kullan.
        setLayout(new FlowLayout(FlowLayout.RIGHT));
        /*Alternatif değerler:
         * FlowLayout.LEFT
         * FlowLayout.CENTER (default),
         * FlowLayout.RIGHT
         *Alternatif kurucu:
         * FlowLayout(int align, int hgap, int vgap)
         * align: önceki değerler.
         * hgap: bileşenler arası yatay aralık.
         * vgap: dikey aralık.
         * Negatif aralıklar örtüşen bileşenlere sebep olur.
         * */

        JButton yellowButton = new JButton("Yellow");
        JButton blueButton = new JButton("Blue");
        JButton redButton = new JButton("Red");
```

44

GUI PROGRAMMING WITH JAVA

```
        JButton yellowButton = new JButton("Yellow");
        JButton blueButton = new JButton("Blue");
        JButton redButton = new JButton("Red");
        add(yellowButton);
        add(blueButton);
        add(redButton);

        ColorAction yellowAction = new ColorAction(Color.YELLOW);
        ColorAction blueAction = new ColorAction(Color.BLUE);
        ColorAction redAction = new ColorAction(Color.RED);

        yellowButton.addActionListener(yellowAction);
        blueButton.addActionListener(blueAction);
        redButton.addActionListener(redAction);
    }
```

45

GUI PROGRAMMING WITH JAVA

```
    private class ColorAction implements ActionListener
    {
        private Color backgroundColor;
        public ColorAction(Color c) {
                backgroundColor = c;
        }

        public void actionPerformed(ActionEvent event) {
                setBackground(backgroundColor);
        }
    }
}
```

46

GUI PROGRAMMING WITH JAVA

BORDER LAYOUT

- Introduces 5 areas as layout rules: CENTER, EAST, WEST, NORTH, SOUTH
- This layout manager enlarges the component so that it covers the entire area.
  - If we just need to position the component but not to enlarge it, we can put it in a panel with another layout manager and add that panel as a child of the first panel.
- Example: oop10.Layout02BorderLayout
  - This example uses an inner class while the previous example uses a regular class in the same java file. We could also use a regular class in its own java file. The result does not matter.
  - In order to show that the buttons work, the frame title is also changed in the button events.

GUI PROGRAMMING WITH JAVA

```
package oop10;

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

/**
 * NORTH, SOUTH: Yükseklik sabit, genişlik pencere genişliği.
 * EASTI, WEST: Yükseklik pencere yüksekliği, genişlik sabit.
 * CENTER: Diğer konumlardan geri kalan alanın tümü.
 */
    public class Layout02BorderLayout extends JFrame {
    private static final long serialVersionUID = 1L;
    public static final int DEFAULT_WIDTH = 300;
    public static final int DEFAULT_HEIGHT = 200;

    public Layout02BorderLayout() {
        setTitle("ButtonTest");
        setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
        BorderLayoutPanel panel = new BorderLayoutPanel();
        add(panel);
    }
```

GUI PROGRAMMING WITH JAVA

```
public static void main(String[] args)    {
   EventQueue.invokeLater(new Runnable() {
      public void run() {
        Layout02BorderLayout frame = new Layout02BorderLayout();
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setVisible(true);
      }
   });
}

class BorderLayoutPanel extends JPanel
{
    private static final long serialVersionUID = 1L;
    public BorderLayoutPanel()
    {
        setLayout(new BorderLayout());
        //veya BorderLayout( int hgap, int vgap )

        JButton yellowButton = new JButton("Yellow");
        JButton blueButton = new JButton("Blue");
        JButton redButton = new JButton("Red");
        JButton greenButton = new JButton("Green");
        JButton whiteButton = new JButton("White");
```

49

GUI PROGRAMMING WITH JAVA

```
        /* Renk değişikliği belli olsun istiyorsan
         * CENTER konumdakini remarkla.
         * Diğer konumlarda eleman
         * olmazsa o kısım hiç gösterilmiyor. */
        add(yellowButton, BorderLayout.WEST);
        add(blueButton, BorderLayout.CENTER);
        add(redButton, BorderLayout.EAST);
        add(greenButton, BorderLayout.NORTH);
        add(whiteButton, BorderLayout.SOUTH);

        ColorAction yellowAction = new ColorAction(Color.YELLOW);
        ColorAction blueAction = new ColorAction(Color.BLUE);
        ColorAction redAction = new ColorAction(Color.RED);
        ColorAction greenAction = new ColorAction(Color.GREEN);
        ColorAction whiteAction = new ColorAction(Color.WHITE);

        yellowButton.addActionListener(yellowAction);
        blueButton.addActionListener(blueAction);
        redButton.addActionListener(redAction);
        greenButton.addActionListener(greenAction);
        whiteButton.addActionListener(whiteAction);
    }
```

50

GUI PROGRAMMING WITH JAVA

```
        private class ColorAction implements ActionListener
        {
            private Color backgroundColor;
            public ColorAction(Color c) {
                backgroundColor = c;
            }

            public void actionPerformed(ActionEvent event) {
                setBackground(backgroundColor);
                setTitle("ButtonTest: (" + backgroundColor.getRed()
                + "," + backgroundColor.getGreen()
                + "," + backgroundColor.getBlue() + ")");
            }
        }
    }
}
```

51

GUI PROGRAMMING WITH JAVA

GRID LAYOUT

- This layout manager divides the area into rows and columns, i.e. cells, of equal size.
- Components are extended to cover their cells.
- As the window is resized, the cells are resized as well.
- You cannot target a special row and column when adding components.
  - Hint: You can leave a cell empty by adding an empty child panel into that cell.
- Example: oop10.Layout03GridLayout

52

GUI PROGRAMMING WITH JAVA

```
package oop10;

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

/**
 * Alanı satır ve sütunlara böler. Bileşenler eşit boyutta olur,
 * pencere büyüdükçe o oranda bileşenler de büyür.
 * Ortada biryerleri boş bırakmak istiyorsan oraya boş bir panel
 * eklemelisin.
 */
public class Layout03GridLayout {
    public static void main(String[] args)    {
       EventQueue.invokeLater(new Runnable() {
          public void run() {
               Frame03 frame = new Frame03();
               frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
               frame.setVisible(true);
          }
       });
    }
}
```

53

GUI PROGRAMMING WITH JAVA

```
class Frame03 extends JFrame
{
    private static final long serialVersionUID = 1L;
    public static final int DEFAULT_WIDTH = 300;
    public static final int DEFAULT_HEIGHT = 200;

    public Frame03()
    {
        setTitle("ButtonTest");
        setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
        GridLayoutPanel panel = new GridLayoutPanel();
        add(panel);

        /* Pencere boyutunu içindeki bileşenlerin tercih
         * edilen veya varsayılan boyutlarını dikkate
         * alacak şekilde, layout manager kurallarına da
         * dikkat ederek yeniden boyutlandırır.
         * */
        pack();
    }
}
```

54

GUI PROGRAMMING WITH JAVA

```
class GridLayoutPanel extends JPanel
{
    private static final long serialVersionUID = 1L;
    public GridLayoutPanel()
    {
        setLayout(new GridLayout(2,2));
        /* GridLayout( int satir, int sutun );
         * GridLayout( int row, int col, int hgap, int vgap );
         * */

        JButton yellowButton = new JButton("Yellow");
        JButton blueButton = new JButton("Blue");
        JButton redButton = new JButton("Red");
        JButton greenButton = new JButton("Green");
        JButton whiteButton = new JButton("White");

        add(yellowButton);
        add(blueButton);
        add(redButton);
        add(greenButton);
        add(whiteButton);
```

55

GUI PROGRAMMING WITH JAVA

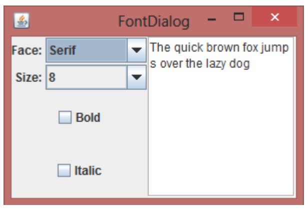
```
        ColorAction yellowAction = new ColorAction(Color.YELLOW);
        ColorAction blueAction = new ColorAction(Color.BLUE);
        ColorAction redAction = new ColorAction(Color.RED);
        ColorAction greenAction = new ColorAction(Color.GREEN);
        ColorAction whiteAction = new ColorAction(Color.WHITE);

        yellowButton.addActionListener(yellowAction);
        blueButton.addActionListener(blueAction);
        redButton.addActionListener(redAction);
        greenButton.addActionListener(greenAction);
        whiteButton.addActionListener(whiteAction);
    }
    private class ColorAction implements ActionListener {
        private Color backgroundColor;
        public ColorAction(Color c) {
                backgroundColor = c;
        }
        public void actionPerformed(ActionEvent event) {
                setBackground(backgroundColor);
        }
    }
}
```

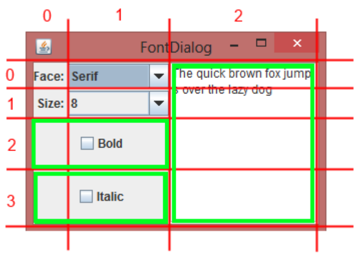
56

GUI PROGRAMMING WITH JAVA

GRIDBAG LAYOUT

- Using this layout manager is similar to designing HTML pages by using tables.
- Design the GUI on paper first, then divide it into rows and columns.
- Large components can extend multiple rows and/or columns.
- You can define constraints for individual cells:
  - To enlarge or not to enlarge the component it contains.
  - Alignment of the component within the cell (anchor)
  - Padding value





- Red: Cell borders
- **Green: Merged cells**

GUI PROGRAMMING WITH JAVA

GRIDBAG LAYOUT

- Best practice:
  - GridBagLayout object is not used directly as its cumbersome to do so.
  - We write a convenience class which models the constraints mentioned before and add the components with instances of that class.
  - Our convenience class is named GBC.
- Example: oop10.Layout04GridBagLayout
  - Focus on layout at the moment, although you can see a preview of using some GUI components.

GUI PROGRAMMING WITH JAVA

```
package oop10;

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

/**
 * GridBagConstraints için daha kolay kullanım sunan bir yardımcı sınıf yazılabilir.
 * Paketteki GBC sınıfı da böyle bir sınıftır.
 * GBC.gridx, gridy:
 * Bileşenin sol üst köşesi için ızgara koordinatları.
 * Izgaranın sol üstü (0,0), analitik sistemde 4. bölge.
 * GBC.gridwidth, gridheight:
 * Bileşenin kaç sütun ve kaç satır kaplayacağı.
 * HTML colspan ve rowspan gibi.
 * GBC.weightx, weighty:
 * Kalan boş alanın yüzde kaçının o sütun/satırın o yöndeki uzamasına atanacağı.
 *  Eğer alan hiç büyümesin istiyorsan o yöndekine 0 ver. Aksi halde 100 ver.
 *  Ara değerler pek deneme-yanılma için harcanan zamana değmiyor.
 * ÖNERİ: Her alana 100 ver, sonra çeşitli pencere ebatlarında büyümenin rahatsız
 *  ettiği bileşen ve yönler için 0 ver.
 *  Dikkat: Alan diyoruz, yani sütun veya satır. Bileşen değil.
 */
```

59

GUI PROGRAMMING WITH JAVA

```
/**
* GBC.fill:
*  Bileşenin büyüyüp tüm alanı kapsamasını istemiyorsan kullan.
*  Bu kısıtlama büyümeye izin verilen yönleri belirtir.
*  Değerler: GBC.NONE, GBC.HORIZONTAL, GBC.VERTICAL, GBC.BOTH
* GBC.anchor:
*  GBC.fill ayarları nedeniyle büyümeyen bileşenin o alanda
*  hangi konumda durmasını istiyorsan orayı ver.
*  Değerler: GBC.CENTER (default), GBC.NORTHEAST, ... yani tüm ana ve ara yönler.
*  1. gösterim:
*      NORTHWEST                 NORTH            NORTHEAST
*      WEST                      CENTER           EAST
*      SOUTHWEST                 SOUTH            SOUTHEAST
*  2. gösterim:
*      FIRST_LINE_START          LINE_START       FIRST_LINE_END
*      PAGE_START                CENTER           PAGE_END
*      LAST_LINE_START           LINE_END         LAST_LINE_END
* Yastıklama (dış):
*  Bileşenin etrafında ek boş alan olsun istiyorsan GBC.insets üyesini oluştur.
*  java.awt.Insets.Insets( int top, int left, int bottom, int right );
* GBC.ipadx, ipady:
*  İç yastıklama için. Bileşenin minimum boyutları senin için çok küçükse bu
*  değerleri ver, bileşenin min. boyutu eski min. boyut + yastık değeri olur.
*/
```

60

GUI PROGRAMMING WITH JAVA

```
public class Layout04GridBagLayout {
    public static void main(String[] args) {
        EventQueue.invokeLater(new Runnable() {
            public void run() {
                 Frame06 frame = new Frame06();
                 frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
                 frame.setVisible(true);
             }
        });
    }
}

/**
 A frame that uses a grid bag layout to arrange font selection components.
 */
class Frame06 extends JFrame
{
    private static final long serialVersionUID = 1L;
    public static final int DEFAULT_WIDTH = 300;
    public static final int DEFAULT_HEIGHT = 200;
    private JComboBox<String> face;
    private JComboBox<Integer> size;
    private JCheckBox bold;
    private JCheckBox italic;
    private JTextArea sample;
```

GUI PROGRAMMING WITH JAVA

```
    public Frame06()
    {
        setTitle("FontDialog");
        setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);

        GridBagLayout layout = new GridBagLayout();
        setLayout(layout);

        ActionListener listener = new FontAction();

        // construct components
        JLabel faceLabel = new JLabel("Face: ");
        face = new JComboBox<String>(new String[] { "Serif", "SansSerif",
                "Monospaced", "Dialog", "DialogInput"  });
        face.addActionListener(listener);

        JLabel sizeLabel = new JLabel("Size: ");
        size = new JComboBox<Integer>(new Integer[] {
                8, 10, 12, 15, 18, 24, 36, 48 });
        size.addActionListener(listener);
        bold = new JCheckBox("Bold");
        bold.addActionListener(listener);
        italic = new JCheckBox("Italic");
        italic.addActionListener(listener);
```

GUI PROGRAMMING WITH JAVA

```
        sample = new JTextArea();
        sample.setText("The quick brown fox jumps over the lazy dog");
        sample.setEditable(false);
        sample.setLineWrap(true);
        sample.setBorder(BorderFactory.createEtchedBorder());

        // add components to grid, using GBC convenience class
        add(faceLabel, new GBC(0, 0).setAnchor(GBC.EAST));
        add(face, new GBC(1, 0).setFill(GBC.HORIZONTAL).
                setWeight(100, 0).setInsets(1));
        add(sizeLabel, new GBC(0, 1).setAnchor(GBC.EAST));
        add(size, new GBC(1, 1).setFill(GBC.HORIZONTAL).
                setWeight(100, 0).setInsets(1));
        add(bold, new GBC(0, 2, 2, 1).setAnchor(GBC.CENTER).
                setWeight(100, 100));
        add(italic, new GBC(0, 3, 2, 1).setAnchor(GBC.CENTER).
                setWeight(100, 100));
        add(sample, new GBC(2, 0, 1, 4).setFill(GBC.BOTH).
                setWeight(100, 100));
    }
```

63

GUI PROGRAMMING WITH JAVA

```
    /**
     An action listener that changes the font of the
     sample text.
     */
    private class FontAction implements ActionListener
    {
        public void actionPerformed(ActionEvent event)
        {
                String fontFace = face.getItemAt( face.getSelectedIndex() );
                int fontStyle = (bold.isSelected() ? Font.BOLD : 0)
                        + (italic.isSelected() ? Font.ITALIC : 0);
                int fontSize = size.getItemAt( size.getSelectedIndex() );
                Font font = new Font(fontFace, fontStyle, fontSize);
                sample.setFont(font);
                sample.repaint();
        }
    }
}
```

64

GUI PROGRAMMING WITH JAVA

```
package oop10;

/*
GBC - A convenience class to tame the GridBagLayout
Copyright (C) 2002 Cay S. Horstmann (http://horstmann.com)
This program is free software; in terms of the GNU license.*/

import java.awt.*;

/**
This class simplifies the use of the GridBagConstraints
class.
*/
public class GBC extends GridBagConstraints {
    private static final long serialVersionUID = 1L;

    /**
     Constructs a GBC with a given gridx and gridy position and
     all other grid bag constraint values set to the default.
     @param gridx the gridx position
     @param gridy the gridy position
     */
    public GBC(int gridx, int gridy)   {
        this.gridx = gridx;
        this.gridy = gridy;
    }
```

65

GUI PROGRAMMING WITH JAVA

```
    /**
     Constructs a GBC with given gridx, gridy, gridwidth, gridheight
     and all other grid bag constraint values set to the default.
     @param gridx the gridx position
     @param gridy the gridy position
     @param gridwidth the cell span in x-direction
     @param gridheight the cell span in y-direction
     */
    public GBC(int gridx, int gridy, int gridwidth, int gridheight)   {
        this.gridx = gridx;
        this.gridy = gridy;
        this.gridwidth = gridwidth;
        this.gridheight = gridheight;
    }
    /**
     Sets the anchor.
     @param anchor the anchor value
     @return this object for further modification
     */
    public GBC setAnchor(int anchor)   {
        this.anchor = anchor;
        return this;
    }
```

66

GUI PROGRAMMING WITH JAVA

```
/**
 Sets the fill direction.
 @param fill the fill direction
 @return this object for further modification
 */
public GBC setFill(int fill)   {
    this.fill = fill;
    return this;
}

/**
 Sets the cell weights.
 @param weightx the cell weight in x-direction
 @param weighty the cell weight in y-direction
 @return this object for further modification
 */
public GBC setWeight(double weightx, double weighty)   {
    this.weightx = weightx;
    this.weighty = weighty;
    return this;
}
```

67

GUI PROGRAMMING WITH JAVA

```
/**
 Sets the insets of this cell.
 @param distance the spacing to use in all directions
 @return this object for further modification
 */
public GBC setInsets(int distance)   {
    this.insets = new Insets(distance, distance, distance, distance);
    return this;
}

/**
 Sets the insets of this cell.
 @param top the spacing to use on top
 @param left the spacing to use to the left
 @param bottom the spacing to use on the bottom
 @param right the spacing to use to the right
 @return this object for further modification
 */
public GBC setInsets(int top, int left, int bottom, int right)   {
    this.insets = new Insets(top, left, bottom, right);
    return this;
}
```

68

GUI PROGRAMMING WITH JAVA

```
    /**
     Sets the internal padding
     @param ipadx the internal padding in x-direction
     @param ipady the internal padding in y-direction
     @return this object for further modification
     */
    public GBC setIpad(int ipadx, int ipady)   {
        this.ipadx = ipadx;
        this.ipady = ipady;
        return this;
    }
}
```

69

BLM 2562 OBJECT ORIENTED PROGRAMMING LECTURE NOTES
Assist. Prof. Dr. Yunus Emre SELÇUK

GUI PROGRAMMING WITH JAVA
Part IV – Fundamental GUI Components

70

GUI PROGRAMMING WITH JAVA

LABELS AND TEXTBOXES

- The **javax.swing.JLabel** instances are used for labels
  - Constructors:
    - JLabel(String text);
    - JLabel(Icon icon);
    - JLabel(String text, int align);
      - align: JLabel.LEFT, JLabel.RIGHT, JLabel.CENTER
  - Some useful methods:
    - setFont(Font);
    - setText(String);
    - String getText( );

GUI PROGRAMMING WITH JAVA

LABELS AND TEXTBOXES

- The **javax.swing.JTextField** instances are used for one-lined texts
  - Constructors:
    - JTextField(String text);
    - JTextField(int columnCount); //not precise
    - JTextField(String text, int columnCount);
  - Some useful methods :
    - setFont(Font);
    - setText(String);
    - String getText( );
    - setEditable(boolean);
    - setEnabled(boolean);
- javax.swing.JTextField and JLabel inherit many useful methods from javax.swing.text.JTextComponent.
- JLabel and JTextField example: oop11.UIElements01_TextField_Label

GUI PROGRAMMING WITH JAVA

LABELS AND TEXTBOXES

```
package oop11;

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

public class UIElements01_TextField_Label extends JFrame {
  private static final long serialVersionUID = 1L;
  public static final int DEFAULT_WIDTH = 400;
  public static final int DEFAULT_HEIGHT = 200;

  public static void main(String[] args) {
      EventQueue.invokeLater(new Runnable() {
          public void run() {
               UIElements01_TextField_Label frame = new
                      UIElements01_TextField_Label();
               frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
               frame.setVisible(true);
          }
      });
  }
```

73

GUI PROGRAMMING WITH JAVA

LABELS AND TEXTBOXES

```
  public UIElements01_TextField_Label( ) {
    setTitle("TextField_Label_Test");
    setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
    Dimension screenSize =
        Toolkit.getDefaultToolkit().getScreenSize();
    setLocation(screenSize.width/10,screenSize.height/10);
    AnaPanel panel = new AnaPanel();
    add(panel);
  }
  //Panel class is coded as an inner class
  class AnaPanel extends JPanel {
    private static final long serialVersionUID = 1L;
    private JTextField TFsol;
    private JTextField TFsag;
    private JLabel Lsol;
    private JLabel Lsag;
    private JButton Bswap;
```

74

GUI PROGRAMMING WITH JAVA

LABELS AND TEXTBOXES

```
//inner panel class continues
  public AnaPanel() {
      //JTextField( String text, int cols )
      //JTextField( int cols )
      TFsol = new JTextField("Sol",10);
      TFsag = new JTextField(10);
      // JLabel( String text );
      // JLabel( String text, int align );
      Lsol = new JLabel("Sol:");
      Lsag = new JLabel("Sağ:",JLabel.RIGHT);
      Lsol.setFont( new Font("Serif",Font.BOLD,12) );
      Lsag.setFont( new Font("Monospaced",Font.ITALIC,12) );
      Bswap = new JButton("Değiştir!");
      //JTextComponent.setEditable( boolean isEditable );
      TFsag.setEditable(false);
      add(Lsol); add(TFsol); add(Bswap); add(Lsag); add(TFsag);
      SwapAction action = new SwapAction();
      Bswap.addActionListener(action);
  }
```

75

GUI PROGRAMMING WITH JAVA

LABELS AND TEXTBOXES

```
  //inner panel class continues
    //action class is inner class of the panel class
    private class SwapAction implements ActionListener {
      public void actionPerformed(ActionEvent event) {
         String StrTmp;
         StrTmp = TFsol.getText();
         TFsol.setText( TFsag.getText() );
         TFsag.setText(StrTmp);
      }
    }
  }
}
```

76

GUI PROGRAMMING WITH JAVA

FORMATTED TEXTBOXES

- You can guarantee the contents of a textbox to be of a desired type by using **javax.swing.JFormattedTextField** instances, which collaborates with **java.text.NumberFormat** instances.
- You can refer to Core Java Vol.I or other sources for details.

TEXTBOXES FOR PASSWORDS

- Passwords must not be openly displayed.
- **javax.swing. JPasswordField** instances hide their contents by displaying * instead of its characters.
- Contents of a JPasswordField can be obtained by using char arrays only.
  - The reason for not using Strings is security: Strings reside in the memory until the garbage collector executes.
- Code snippet (refer to Core Java Vol.I or other sources for details) :

```
char[] buf; String parola;           //... When you are done:
JPasswordField PFcevap;              Arrays.fill(buf,'X');
buf = PFcevap.getPassword( );        parola = new String(buf);
parola = new String(buf);            //(for security reasons)
//use the password ...
```

77

GUI PROGRAMMING WITH JAVA

TEXT AREAS AND SCROLL BARS

- **javax.swing.JTextArea** instances are used for multiple-lined text.
- In order to add scroll bar(s), we "decorate" a JTextArea instance with a **javax.swing.JScrollPane** instance.
  - Examine the decorator design pattern in order to understand the rationale of this approach.
- Contents of the text area can be wrapped by words, letters or not wrapped at all.
- Example: oop11.UIElements02_TextArea

```
package oop11;
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
public class UIElements02_TextArea extends JFrame {
   private static final long serialVersionUID = 1L;
   public static final int DEFAULT_WIDTH = 400;
   public static final int DEFAULT_HEIGHT = 200;
   private JTextArea textArea;
   private JScrollPane scrollPane;
   private JPanel buttonPanel;
   private JButton wrapButton, wrapModeButton;
```

78

GUI PROGRAMMING WITH JAVA

TEXT AREAS AND SCROLL BARS

```
public static void main(String[] args) {
   EventQueue.invokeLater(new Runnable() {
     public void run() {
       UIElements02_TextArea frame = new UIElements02_TextArea();
          frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
          frame.setVisible(true);
     }
   });
}
public UIElements02_TextArea() {
   setTitle("TextArea Test");
   setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
   Dimension screenSize =
            Toolkit.getDefaultToolkit().getScreenSize();
   setLocation(screenSize.width/10,screenSize.height/10);
   buttonPanel = new JPanel();
//constructor continues in the next slide
```

79

TEXT AREAS AND SCROLL BARS

```
//constructor is continued from the next slide
    //add a button to append text into the text area
    JButton insertButton = new JButton("Insert");
    buttonPanel.add(insertButton);
    insertButton.addActionListener( new ActionListener() {
       public void actionPerformed(ActionEvent event) {
         textArea.append("Bu yoğurdu sarımsaklasak da mı "
            + " saklasak, sarımsaklamasak da mı saklasak? ");
       }
    });
    // add button to turn line wrapping on and off
    wrapButton = new JButton("Wrap");
    buttonPanel.add(wrapButton);
    wrapButton.addActionListener(new ActionListener() {
       public void actionPerformed(ActionEvent event) {
         boolean wrap = !textArea.getLineWrap();
         /* Sözcük kaydırmayı açar veya kapatır.*/
         textArea.setLineWrap(wrap);
         scrollPane.revalidate();
         wrapButton.setText(wrap ? "No Wrap" : "Wrap");
      }
    });
//constructor continues in the next slide
```

80

GUI PROGRAMMING WITH JAVA

TEXT AREAS AND SCROLL BARS

```
//constructor is continued from the next slide
    // add button to alter line wrapping style
    wrapModeButton = new JButton("Wrap by words");
    buttonPanel.add(wrapModeButton);
    wrapModeButton.addActionListener(new ActionListener() {
       public void actionPerformed(ActionEvent event) {
          boolean wrap = !textArea.getWrapStyleWord();
          /* Kaydırma için kelime sınırlarının mı (true)
          * yoksa pencere sınırlarının mı (false)
          * kullanılacağını belirler.*/
          textArea.setWrapStyleWord(wrap);
          scrollPane.revalidate();
          wrapModeButton.setText(!wrap ? "Wrap by words"
                     : "Wrap by characters");
       }
    });
    add(buttonPanel, BorderLayout.SOUTH);
//constructor continues in the next slide
```

81

```
//constructor is continued from the next slide
    // add a text area with scroll bars:
       textArea = new JTextArea("Bu deneme mesajıdır.", 8, 40);
    /* javax.swing.JTextArea
     * JTextArea( int rows, int cols )
     * JTextArea( String text, int rows, int cols )
     * text: İlk olarak gözükecek metin.
     * rows: tercih edilen satır sayısı.
     * cols: tercih edilen sütun sayısı. */

    scrollPane = new JScrollPane(textArea);
    /* javax.swing.JScrollPane
     * Bir bileşene kaydırma çubuğu eklemek için
     * o bileşeni bu şekilde JScrollPane içine eklersin. */

    /* İçinde bileşen barındıran kaydırma panelini de
     * eklemeyi unutma.*/
    add(scrollPane, BorderLayout.CENTER);

    /* JTextComponent metodları kalıtımla mevcut.
     * \n gibi karakterlerde sorun yok. */
    textArea.setText(textArea.getText()
            +"\nÖzel\tkarakterler\tdenemesi!\n");
 }//end of constructor
}//end of class
```

82

GUI PROGRAMMING WITH JAVA

CHECK BOXES

- **javax.swing.JCheckBox** instances are used for check boxes
- Constructor: JCheckBox(String label);
- Get the state of the checkbox: boolean isSelected( );
- Example: oop11.UIElements03_CheckBox

```
package oop11;

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

public class UIElements03_CheckBox extends JFrame {
   private static final long serialVersionUID = 1L;
   public static final int DEFAULT_WIDTH = 400;
   public static final int DEFAULT_HEIGHT = 200;
   private JLabel label;
   private JCheckBox bold;
   private JCheckBox italic;
   private static final int FONTSIZE = 12;
```

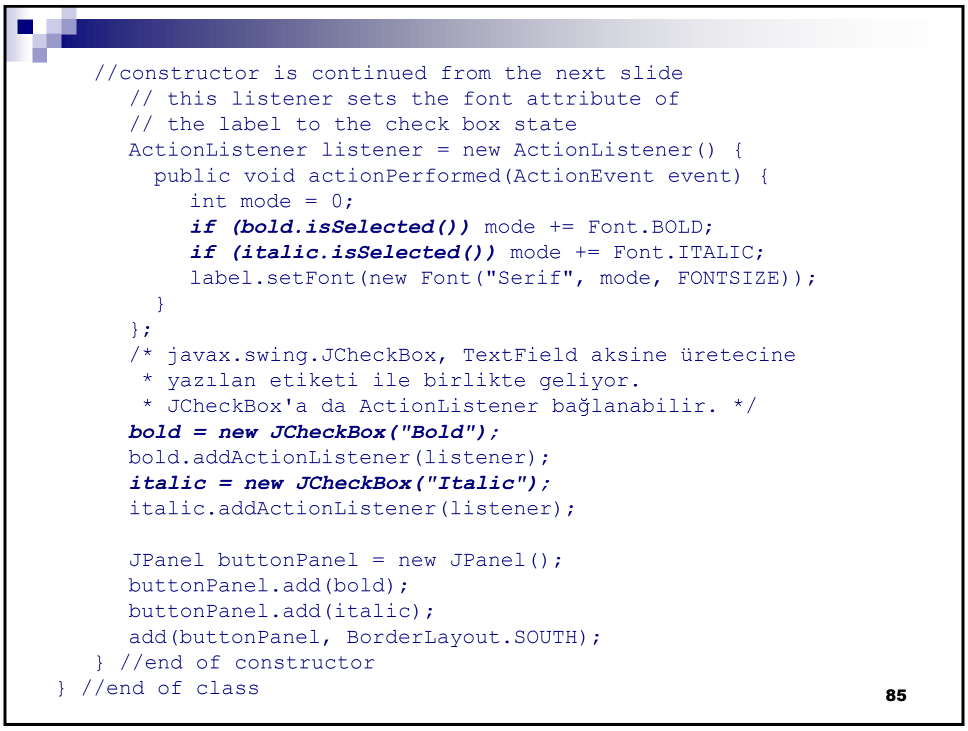
83

GUI PROGRAMMING WITH JAVA

CHECK BOXES

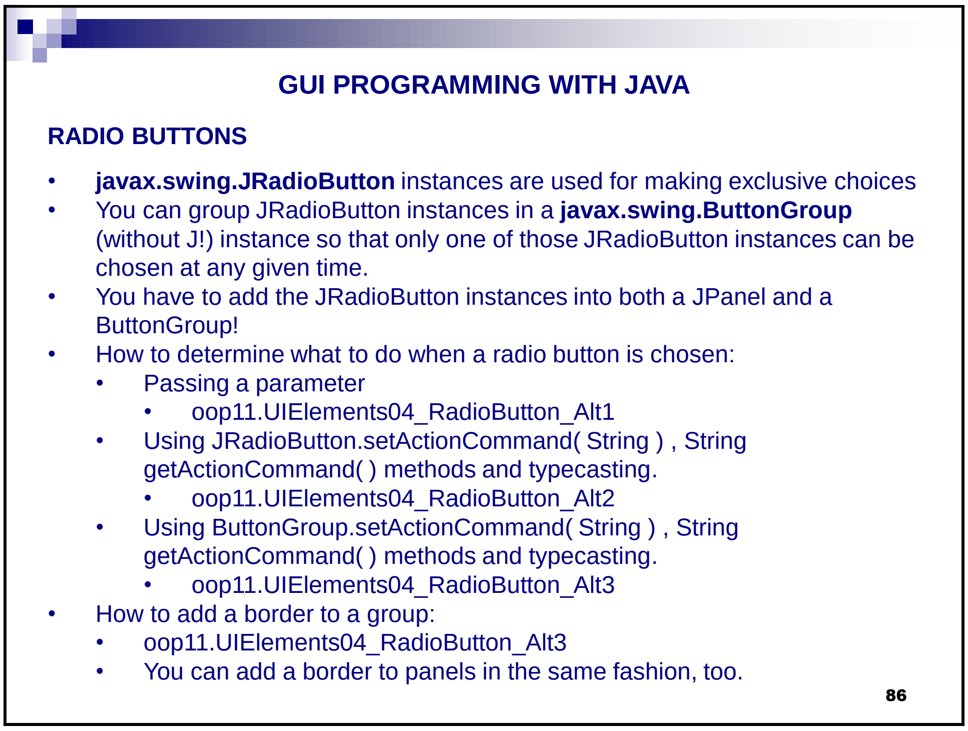
```
   public static void main(String[] args) {
      EventQueue.invokeLater(new Runnable() {
          public void run() {
          UIElements03_CheckBox frame = new UIElements03_CheckBox();
             frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
             frame.setVisible(true);
          }
       });
   }
   public UIElements03_CheckBox() {
      setTitle("CheckBoxTest");
      setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
      Dimension screenSize =
               Toolkit.getDefaultToolkit().getScreenSize();
      setLocation(screenSize.width/10,screenSize.height/10);

      label = new JLabel("The quick brown fox jumps "
        + "over the lazy dog.");
      label.setFont(new Font("Serif", Font.PLAIN, FONTSIZE));
      add(label, BorderLayout.CENTER);
   //constructor continues in the next slide
```

84



```
   //constructor is continued from the next slide
      // this listener sets the font attribute of
      // the label to the check box state
      ActionListener listener = new ActionListener() {
        public void actionPerformed(ActionEvent event) {
           int mode = 0;
           if (bold.isSelected()) mode += Font.BOLD;
           if (italic.isSelected()) mode += Font.ITALIC;
           label.setFont(new Font("Serif", mode, FONTSIZE));
        }
      };
      /* javax.swing.JCheckBox, TextField aksine üretecine
       * yazılan etiketi ile birlikte geliyor.
       * JCheckBox'a da ActionListener bağlanabilir. */
      bold = new JCheckBox("Bold");
      bold.addActionListener(listener);
      italic = new JCheckBox("Italic");
      italic.addActionListener(listener);

      JPanel buttonPanel = new JPanel();
      buttonPanel.add(bold);
      buttonPanel.add(italic);
      add(buttonPanel, BorderLayout.SOUTH);
   } //end of constructor
} //end of class
```

85



GUI PROGRAMMING WITH JAVA

RADIO BUTTONS

- **javax.swing.JRadioButton** instances are used for making exclusive choices
- You can group JRadioButton instances in a **javax.swing.ButtonGroup** (without J!) instance so that only one of those JRadioButton instances can be chosen at any given time.
- You have to add the JRadioButton instances into both a JPanel and a ButtonGroup!
- How to determine what to do when a radio button is chosen:
  - Passing a parameter
    - oop11.UIElements04_RadioButton_Alt1
  - Using JRadioButton.setActionCommand(String) , String getActionCommand( ) methods and typecasting.
    - oop11.UIElements04_RadioButton_Alt2
  - Using ButtonGroup.setActionCommand(String) , String getActionCommand( ) methods and typecasting.
    - oop11.UIElements04_RadioButton_Alt3
- How to add a border to a group:
  - oop11.UIElements04_RadioButton_Alt3
  - You can add a border to panels in the same fashion, too.

86

RADIO BUTTONS (Alt.1)

```
package oop11;
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;

// Her düğmeye ayrı olay dinleyicisi atayan bir çözüm.
public class UIElements04_RadioButton_Alt1 extends JFrame {
   private static final long serialVersionUID = 1L;
   public static final int DEFAULT_WIDTH = 800;
   public static final int DEFAULT_HEIGHT = 200;
   private JPanel buttonPanel;
   private ButtonGroup group;
   private JLabel label;
   private static final int DEFAULT_SIZE = 12;
   public static void main(String[] args) {
      EventQueue.invokeLater(new Runnable() {
          public void run() {
             UIElements04_RadioButton_Alt1 frame = new
                       UIElements04_RadioButton_Alt1();
             frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
             frame.setVisible(true);
          }
      });
   }
```

87

RADIO BUTTONS (Alt.1)

```
   public UIElements04_RadioButton_Alt1() {
      setTitle("RadioButtonTest");
      setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
      Dimension screenSize =
               Toolkit.getDefaultToolkit().getScreenSize();
      setLocation(screenSize.width/10,screenSize.height/10);
      label = new Jlabel
               ("The quick brown fox jumps over the lazy dog.");
      label.setFont(new Font("Serif", Font.PLAIN, DEFAULT_SIZE));
      add(label, BorderLayout.CENTER);

      // add the radio buttons
      buttonPanel = new JPanel();
      group = new ButtonGroup();
      /* Kendi metodumuz olan addRadioButton üç ana iş
       * yapacak: Düğmeyi gruba ekleme, düğmeyi panele
       * ekleme ve düğmeye ActionListener atama. */
      addRadioButton("Small", 8);
      addRadioButton("Medium", 12);
      addRadioButton("Large", 18);
      addRadioButton("Extra large", 36);
      add(buttonPanel, BorderLayout.SOUTH);
   }
```

88

RADIO BUTTONS (Alt.1)

```
   public void addRadioButton(String name, final int size){
      boolean selected = size == DEFAULT_SIZE;
      /* javax.swing.JRadioButton da üretecine
       * yazılan etiketi ile birlikte geliyor.
       * JRadioButton(String name, boolean isSelected)  */
      JRadioButton button = new JRadioButton(name, selected);
      // JRadioButton, grubuna ve paneline ayrı ayrı eklenmelidir.
      group.add(button);
      buttonPanel.add(button);
      button.setActionCommand(name);

      // this listener sets the label font size
      ActionListener listener = new ActionListener() {
         public void actionPerformed(ActionEvent event) {
           label.setFont(new Font("Serif", Font.PLAIN, size));
         }
      };
      button.addActionListener(listener);
   }
}
```

89

RADIO BUTTONS (Alt.2)

```
package oop11;
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
/**
 * Burada tüm düğmelere tek bir ActionListener örneği atayacağız.
 * Hangi düğmenin basıldığını tetiklenen olaydan öğrenip
 * seçilen değeri o düğmenin eylem komutundan öğreneceğiz.
 */
public class UIElements04_RadioButton_Alt2 extends JFrame {
   private static final long serialVersionUID = 1L;
   public static final int DEFAULT_WIDTH = 800;
   public static final int DEFAULT_HEIGHT = 200;
   private JPanel buttonPanel;
   private ButtonGroup group;
   private JLabel label;
   private static final int DEFAULT_SIZE = 12;
   private MyRadioButtonListener listener;

   @SuppressWarnings("unused")
   private MyRadioButton RBsmall, RBmed, RBlarge, RBxlarge;
```

90

RADIO BUTTONS (Alt.2)

```
public static void main(String[] args) {
   EventQueue.invokeLater(new Runnable() {
       public void run() {
          UIElements04_RadioButton_Alt2 frame = new
                   UIElements04_RadioButton_Alt2();
          frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
          frame.setVisible(true);
       }
    });
}
```

91

RADIO BUTTONS (Alt.2)

```
public UIElements04_RadioButton_Alt2() {
   setTitle("RadioButtonTestV2");
   setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
   Dimension screenSize =
     Toolkit.getDefaultToolkit().getScreenSize();
     setLocation(screenSize.width/10,screenSize.height/10);
     label = new Jlabel
            ("The quick brown fox jumps over the lazy dog.");
     label.setFont(new Font("Serif", Font.PLAIN, DEFAULT_SIZE));
     add(label, BorderLayout.CENTER);

   // add the radio buttons
   buttonPanel = new JPanel();
   group = new ButtonGroup();
   listener = new MyRadioButtonListener();

   RBsmall = new MyRadioButton("Small", 8);
   RBmed = new MyRadioButton("Medium", 12);
   RBlarge = new MyRadioButton("Large", 18);
   RBxlarge = new MyRadioButton("Extra large", 36);

   add(buttonPanel, BorderLayout.SOUTH);
}
```

92

RADIO BUTTONS (Alt.2)

```
/**
 * İç sınıf yapmasaydık size ve DEFAULT_SIZE bilgilerini
 * kurucuya parametre vermeliydik. */
private class MyRadioButton extends JRadioButton {
   private static final long serialVersionUID = 1L;

   public MyRadioButton( String name, int size ) {
      super(name, size == DEFAULT_SIZE);
      group.add(this);
      buttonPanel.add(this);
      addActionListener(listener);

      /* setActionCommand mutlaka çalıştırılmalı
       * çünkü radyo düğmesinin modelinde eylem
       * komutu null'dır. Halbuki JButton'da eylem
       * komutu düğmenin etiketi ile aynıydı. */
      setActionCommand(String.valueOf(size));
   }
}
```

93

RADIO BUTTONS (Alt.2)

```
   private class MyRadioButtonListener implements ActionListener {
      public void actionPerformed(ActionEvent event) {
         Object source = event.getSource();
         /* (JRadioButton)source).getActionCommand() ile
          * komut alınıyor. Gerisi String->int yapmak ve
          * font boyutunu atamaktır. */
         label.setFont(new Font("Serif", Font.PLAIN, Integer.valueOf
                (((JRadioButton)source).getActionCommand())));
      }
   }
}
```

94

RADIO BUTTONS (Alt.3)

```
package oop11;
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
import javax.swing.border.Border;

/**
 * Burada tüm düğmelere tek bir ActionListener örneği atayacağız.
 * Hangi düğmenin basıldığını düğmenin grubundan öğrenip
 * seçilen değeri o düğmenin eylem komutundan öğreneceğiz. */
public class UIElements04_RadioButton_Alt3 extends JFrame {
    private static final long serialVersionUID = 1L;
    public static final int DEFAULT_WIDTH = 800;
    public static final int DEFAULT_HEIGHT = 200;
    private JPanel buttonPanel;
    private ButtonGroup group;
    private JLabel label;
    private static final int DEFAULT_SIZE = 12;

    @SuppressWarnings("unused")
    private MyRadioButton RBsmall, RBmed, RBlarge, RBxlarge;
    private MyRadioButtonListener listener;
```

95

RADIO BUTTONS (Alt.3)

```
    public static void main(String[] args) {
        EventQueue.invokeLater(new Runnable() {
            public void run() {
                UIElements04_RadioButton_Alt3 frame = new
                        UIElements04_RadioButton_Alt3();
                frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
                frame.setVisible(true);
            }
        });
    }
```

96

RADIO BUTTONS (Alt.3)

```
public UIElements04_RadioButton_Alt3() {
    setTitle("RadioButtonTestV3");
    setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
    Dimension screenSize =
            Toolkit.getDefaultToolkit().getScreenSize();
    setLocation(screenSize.width/10,screenSize.height/10);
    label = new Jlabel
            ("The quick brown fox jumps over the lazy dog.");
    label.setFont(new Font("Serif", Font.PLAIN, DEFAULT_SIZE));
    add(label, BorderLayout.CENTER);
    // add the radio buttons
    buttonPanel = new JPanel(); group = new ButtonGroup();
    listener = new MyRadioButtonListener();
    RBsmall = new MyRadioButton("Small", 8);
    RBmed = new MyRadioButton("Medium", 12);
    RBlarge = new MyRadioButton("Large", 18);
    RBxlarge = new MyRadioButton("Extra large", 36);
    // setup a border using the decorator pattern.
    Border etched = BorderFactory.createEtchedBorder();
    Border titled = BorderFactory.createTitledBorder(
            etched, "Size options:");
    buttonPanel.setBorder(titled);
    add(buttonPanel, BorderLayout.SOUTH);
}
```

97

RADIO BUTTONS (Alt.3)

```
/* İç sınıf yapmasaydık size ve DEFAULT_SIZE bilgilerini
 * kurucuya parametre vermeliydik. */
private class MyRadioButton extends JRadioButton {
    private static final long serialVersionUID = 1L;
    public MyRadioButton( String name, int size ) {
       super(name, size == DEFAULT_SIZE);
       group.add(this);
       buttonPanel.add(this);
       addActionListener(listener);

       /* setActionCommand mutlaka çalıştırılmalı
        * çünkü radyo düğmesinin modelinde eylem
        * komutu null'dır. Halbuki JButton'da eylem
        * komutu düğmenin etiketi ile aynıydı. */
      setActionCommand(String.valueOf(size));
   }
}
private class MyRadioButtonListener implements ActionListener {
    public void actionPerformed(ActionEvent event) {
      label.setFont(new Font("Serif", Font.PLAIN,
      Integer.valueOf(group.getSelection().getActionCommand())));
    }
}
}
```

98

GUI PROGRAMMING WITH JAVA

COMBO BOXES

- **javax.swing.JComboBox** instances are used for making an exclusive selection by taking up less space than radio button groups.
- There are two ways to add elements into a combo box:
    - The direct but slower way: Using the addItem method
        - Example: oop11.UIElements05_ComboBox_Alt1
    - The indirect but faster way: Using the **model** of a combo box
        - Example: oop11.UIElements05_ComboBox_Alt2

AN INTERLUDE: INTRODUCTION OF THE MVC DESIGN PATTERN

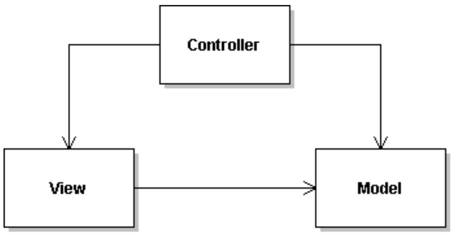
DESIGN PATTERNS:

- A **design pattern** is a solution to a general design problem.
- The benefits of studying design patterns:
    - You don't need to reinvent the wheel.
    - Leads you to a better design, so that you can come up with a more flexible and maintainable solution.
    - Gives a good way of transferring experience of veterans to newbies
    - Constructs a common dictionary among professionals.
- There is a formal way of documenting design pattern:
    - A pattern must have a descriptive and preferably short name
    - A pattern must first give a description of the problem it solves.
    - Then alternative solutions must be described in a way that presents their pros and cons relative to each other and according to different sub-cases.
    - Source code and UML schemas are needed for a good description.
    - Please refer to Gang of Four's classical book and other books which have additional, detailed examples.
        - Design Patterns – Elements of Reusable OO Software, Erich Gamma et.al (Gang of Four), Addison-Wesley, 1994

AN INTERLUDE: INTRODUCTION OF THE MVC DESIGN PATTERN

THE MODEL – VIEW – CONTROLLER DESIGN PATTERN:

- The problem:
  - We need to present the same data in different ways.
  - Meanwhile, we need to give the users the ability to choose which part of this data is to be presented and how.
- Solution: Model the data, how it is represented and how the representation is controlled in three kinds of components:
  - Model class: Represents the raw data.
  - View class: Represents how data is displayed.
  - Controller class: Handles commands of the user.



101

COMBO BOXES

- Example of adding items to combo boxes directly:

```
package oop11;
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
public class UIElements05_ComboBox_Alt1 extends JFrame {
   private static final long serialVersionUID = 1L;
   public static final int DEFAULT_WIDTH = 400;
   public static final int DEFAULT_HEIGHT = 200;
   private JComboBox<String> faceCombo;
   private JLabel label;
   private static final int DEFAULT_SIZE = 12;

   public static void main(String[] args) {
      EventQueue.invokeLater(new Runnable() {
          public void run() {
             UIElements05_ComboBox_Alt1 frame =
                new UIElements05_ComboBox_Alt1();
             frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
             frame.setVisible(true);
          }
       });
}
```

102

COMBO BOXES

```
public UIElements05_ComboBox_Alt1() {
   setTitle("ComboBoxTest");
   setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
   Dimension screenSize =
       Toolkit.getDefaultToolkit().getScreenSize();
   setLocation(screenSize.width/10,screenSize.height/10);
   label = new JLabel(
       "The quick brown fox jumps over the lazy dog.");
   label.setFont(new Font("Serif", Font.PLAIN, DEFAULT_SIZE));
   add(label, BorderLayout.CENTER);

   // make a combo box and add face names
   faceCombo = new JComboBox<String>();
   /* Alternative constructors:
    * JComboBox(E[] items)
    * JComboBox(Vector<E> items) */

   /* Let this JComboBox to be editable. */
   faceCombo.setEditable(true);
```

103

COMBO BOXES

```
      /* Add an item to the end of the list.
       * Use insertItemAt(<E> item, int index) for insertion
       * index=0 means adding to the top.
       * You can add/remove items even at runtime.
       * Use JComboBox.removeItem(<E> item) or
       * JComboBox.removeItemAt(int index) for removal. */
      faceCombo.addItem("Serif");
      faceCombo.addItem("SansSerif");
      faceCombo.addItem("Monospaced");
      faceCombo.addItem("Dialog");
      /* the combo box listener changes the label font
       * to the selected face name. */
      faceCombo.addActionListener(newActionListener() {
         public void actionPerformed(ActionEvent event) {
           label.setFont(new Font(
                faceCombo.getItemAt(faceCombo.getSelectedIndex()),
                        Font.PLAIN, DEFAULT_SIZE));
        }
      });
      JPanel comboPanel = new JPanel();
      comboPanel.add(faceCombo);
      add(comboPanel, BorderLayout.SOUTH);
   }
}
```

104

COMBO BOXES

- Example of adding items to a combo box indirectly via its model:
  - Changing the constructor as shown below is enough:

```
/* Adım 1: Boş JComboBox oluştur. */
faceCombo = new JComboBox<String>();
faceCombo.setEditable(true);
/* Adım 2: DefaultComboBoxModel oluştur. */
DefaultComboBoxModel<String> model = new
    DefaultComboBoxModel<String>();
/* Adım 3: Model'e elemanları ekle */
model.addElement("Serif");
model.addElement("SansSerif");
model.addElement("Monospaced");
model.addElement("Dialog");
/* Adım 4: ComboBox'a modeli ata. */
faceCombo.setModel(model);
```

105

GUI PROGRAMMING WITH JAVA

MENU OPERATIONS

- Menus are created by using three classes in Java:
  - javax.swing.JMenuBar instance represents the main menu bar
  - javax.swing.JMenu instances represent top level menu choices
  - javax.swing.JMenuItem sınıfı: instances represent menu items
- Moreover, menu items must be associated with some program code by using the addActionListener method.
  - You can create a menu item directly from an action object.
- Example:
  - oop11. UIElements06_Menu

```
package oop11;

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

public class UIElements06_Menu extends JFrame {
   private static final long serialVersionUID = 1L;
   public static final int DEFAULT_WIDTH = 400;
   public static final int DEFAULT_HEIGHT = 200;
```

106

GUI PROGRAMMING WITH JAVA

MENU OPERATIONS

```
public static void main(String[] args) {
   EventQueue.invokeLater(new Runnable() {
      public void run() {
      UIElements06_Menu frame = new UIElements06_Menu();
          frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
          frame.setVisible(true);
        }
     });
}
public UIElements06_Menu() {
   setTitle("MenuTest");
   setSize(DEFAULT_WIDTH, DEFAULT_HEIGHT);
   Dimension screenSize =
     Toolkit.getDefaultToolkit().getScreenSize();
   setLocation(screenSize.width/10,screenSize.height/10);
```

107

GUI PROGRAMMING WITH JAVA

MENU OPERATIONS

```
// Adım 1: Bir javax.swing.JMenuBar oluşturup Frame'e ata.
JMenuBar menuBar = new JMenuBar();
this.setJMenuBar(menuBar);

/* Adım 2: Her menü için bir javax.swing.JMenu
 * nesnesi oluştur. */
JMenu fileMenu = new JMenu("File");
JMenu editMenu = new JMenu("Edit");

/* Adım 3: Üst düzey menüleri JMenuBar'a ekle. */
menuBar.add(fileMenu);
menuBar.add(editMenu);

/* Adım 4: Üst düzey menülere menü seçenekleri
 * ekle: javax.swing.JMenuItem. */
JMenuItem newItem = new JMenuItem("New");
JMenuItem openItem = new JMenuItem("Open");
fileMenu.add(newItem);
fileMenu.add(openItem);
```

108

GUI PROGRAMMING WITH JAVA

MENU OPERATIONS

```
/* Adım 5: Ayraç da ekleyebilirsin. */
fileMenu.addSeparator();

/* Adım 6: Alt menüler de ekleyebilirsin. */
JMenu optionsMenu = new JMenu("Options");
fileMenu.add(optionsMenu);

JMenuItem readOnlyItem = new JMenuItem("Read Only");
optionsMenu.add(readOnlyItem);
fileMenu.addSeparator();

/* Adım 7: Gerekli eylemleri tanımla. Burada anonim iç
 * sınıf olarak tanımlandı. Eylemin adaptör sınıfı olan
 * javax.swing.AbstractAction'ı hatırla. Bu eylem sonra
 * menü seçeneği olacağı için kurucusuna etiket verdik */
Action exitAction = new AbstractAction("Exit") {
   private static final long serialVersionUID = 1L;
      public void actionPerformed(ActionEvent event) {
         System.exit(0);
      }
};
```

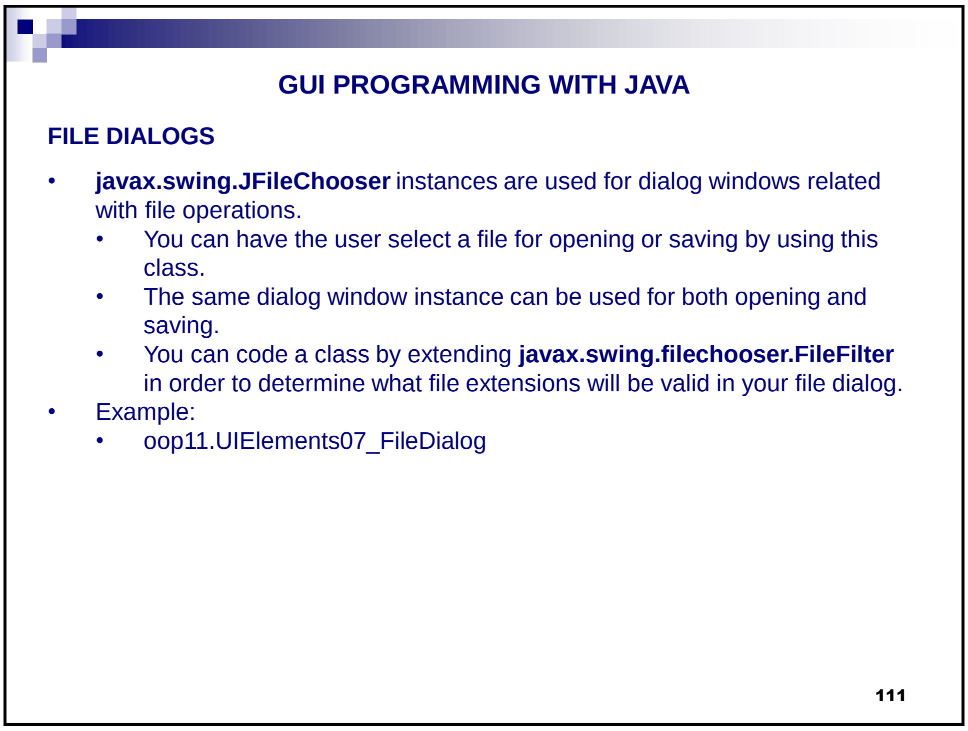
109

GUI PROGRAMMING WITH JAVA

MENU OPERATIONS

```
        /* Adım 8: Eylemleri ata.
         * Alternatif 8a: Eylemden hemen menü seçeneği yapmak */
        fileMenu.add(exitAction);
        /* Adım 8: Eylemleri ata.
         * Alternatif 8b: Mevcut menü seçeneğine eylem atamak */
        JMenuItem testItem = new JMenuItem("Test");
        testItem.addActionListener(new TestAction01("Test"));
        editMenu.add(testItem);

        /* File menüsünün eylemlerini de atayalım */
        newItem.addActionListener( new TestAction01("New") );
        openItem.addActionListener( new TestAction01("Open") );
        readOnlyItem.addActionListener(new TestAction01("Read Only"));
    }
}
class TestAction01 extends AbstractAction {
   private static final long serialVersionUID = 1L;
   public TestAction01(String name) { super(name); }
   public void actionPerformed(ActionEvent event) {
      System.out.println(getValue(Action.NAME) + " selected.");
   }
}
```

110



GUI PROGRAMMING WITH JAVA

FILE DIALOGS

- **javax.swing.JFileChooser** instances are used for dialog windows related with file operations.
  - You can have the user select a file for opening or saving by using this class.
  - The same dialog window instance can be used for both opening and saving.
  - You can code a class by extending **javax.swing.filechooser.FileFilter** in order to determine what file extensions will be valid in your file dialog.
- Example:
  - oop11.UIElements07_FileDialog

111