Unit 2

Topic: Window Fundamentals

Unit 2/Lecture 1

Window Fundamentals

In this Unit, you will learn how to create and manage windows, manage fonts, output text, and utilize graphics. It also describes the various controls, such as scroll bars and push buttons, supported by the AWT. It also explains further aspects of Java's event handling mechanism. This unit also examines the AWT's imaging subsystem and animation. Although a common use of the AWT is in applets, it is also used to create stand-alone windows that run in a GUI environment, such as Windows. For the sake of convenience, most of the examples in unit chapter are contained in applets. To run them, you need to use an applet viewer or a Java-compatible web browser. A few examples will demonstrate the creation of stand-alone, windowed programs.

AWT Classes[RGPV Dec 2014(3)]

The AWT classes are contained in the **java.awt** package. It is one of Java's largest packages. Fortunately, because it is logically organized in a top-down, hierarchical fashion, it is easier to understand and use than you might at first believe. Table 23-1 lists some of the many AWT classes.

Class	Description
AWTEvent	Encapsulates AWT events.
AWTEventMulticaster	Dispatches events to multiple listeners.
BorderLayout	The border layout manager. Border layouts use five components: North, South, East, West, and Center.
Button	Creates a push button control.
Canvas	A blank, semantics-free window.
CardLayout	The card layout manager. Card layouts emulate index cards. Only the one on top is showing.
Checkbox	Creates a check box control.
CheckboxGroup	Creates a group of check box controls.
CheckboxMenuItem	Creates an on/off menu item.
Choice	Creates a pop-up list.
Color	Manages colors in a portable, platform-independent fashion.
Component	An abstract superclass for various AWT components.
Container	A subclass of **Component** that can hold other components.
Cursor	Encapsulates a bitmapped cursor.
Dialog	Creates a dialog window.
Dimension	Specifies the dimensions of an object. The width is stored in **width**, and the height is stored in **height**.
Event	Encapsulates events.
EventQueue	Queues events.
FileDialog	Creates a window from which a file can be selected.
FlowLayout	The flow layout manager. Flow layout positions components left to right, top to bottom.
Font	Encapsulates a type font.
FontMetrics	Encapsulates various information related to a font. This information helps you display text in a window.
Frame	Creates a standard window that has a title bar, resize corners, and a menu bar.

Class	Description
Graphics	Encapsulates the graphics context. This context is used by the various output methods to display output in a window.
GraphicsDevice	Describes a graphics device such as a screen or printer.
GraphicsEnvironment	Describes the collection of available **Font** and **GraphicsDevice** objects.
GridBagConstraints	Defines various constraints relating to the **GridBagLayout** class.
GridBagLayout	The grid bag layout manager. Grid bag layout displays components subject to the constraints specified by **GridBagConstraints**.
GridLayout	The grid layout manager. Grid layout displays components in a two-dimensional grid.
Image	Encapsulates graphical images.
Insets	Encapsulates the borders of a container.
Label	Creates a label that displays a string.
List	Creates a list from which the user can choose. Similar to the standard Windows list box.
MediaTracker	Manages media objects.
Menu	Creates a pull-down menu.
MenuBar	Creates a menu bar.
MenuComponent	An abstract class implemented by various menu classes.
MenuItem	Creates a menu item.
MenuShortcut	Encapsulates a keyboard shortcut for a menu item.
Panel	The simplest concrete subclass of **Container**.
Point	Encapsulates a Cartesian coordinate pair, stored in **x** and **y**.
Polygon	Encapsulates a polygon.
PopupMenu	Encapsulates a pop-up menu.
PrintJob	An abstract class that represents a print job.
Rectangle	Encapsulates a rectangle.
Robot	Supports automated testing of AWT-based applications.
Scrollbar	Creates a scroll bar control.
ScrollPane	A container that provides horizontal and/or vertical scroll bars for another component.
SystemColor	Contains the colors of GUI widgets such as windows, scroll bars, text, and others.
TextArea	Creates a multiline edit control.
TextComponent	A superclass for **TextArea** and **TextField**.
TextField	Creates a single-line edit control.
Toolkit	Abstract class implemented by the AWT.
Window	Creates a window with no frame, no menu bar, and no title.

Window Fundamentals

The AWT defines windows according to a class hierarchy that adds functionality and specificity with each level. The two most common windows are those derived from **Panel**, which is used by applets, and those derived from **Frame**, which creates a standard application window. Much of the functionality of these windows is derived from their parent classes. Thus, a description of the class hierarchies relating to these two classes is fundamental to their understanding. Figure 23-1 shows the class hierarchy for **Panel** and **Frame**. Let's look at each of these classes now.

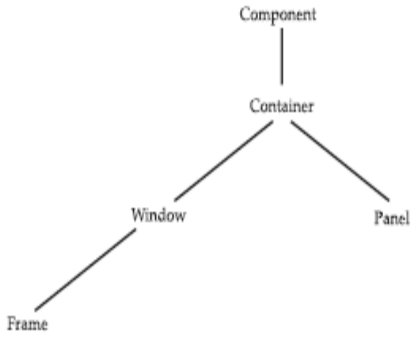
Component[RGPV Dec 2014(3)]

At the top of the AWT hierarchy is the **Component** class. **Component** is an abstract class that encapsulates all of the attributes of a visual component. All user interface elements such as, buttons, check boxes, pop-up menus, text fields etc., which are displayed on the screen and that interact with the user are subclasses of **Component**. It defines over a hundred public methods that are responsible for managing events, such as mouse and keyboard input, positioning and sizing the window, and repainting. A **Component** object is responsible for remembering the current foreground and background colors and the currently selected text

font.

Container[RGPV Dec 2014(3)]

The **Container** class is a subclass of **Component**. It has additional methods that allow other **Component** objects to be nested within it. Other **Container** objects can be stored inside of a **Container** (since they are themselves instances of **Component**). This makes for a multileveled containment system. A container is responsible for laying out (that is, positioning) any



components that it contains. It includes Applet Window, panels, dialog boxes, frames etc.

Panel

The **Panel** class is a concrete subclass of **Container**. It doesn't add any new methods; it simply implements **Container**. A **Panel** may be thought of as a recursively nestable, concrete screen component. **Panel** is the superclass for **Applet**. When screen output is directed to an applet, it is drawn on the surface of a **Panel** object. In essence, a **Panel** is a window that does not contain a title bar, menu bar, or border. This is why you don't see these items when an applet is run inside a browser. When you run an applet using an applet viewer, the applet viewer provides the title and border. Other components can be added to a **Panel** object by its **add( )** method (inherited from **Container**). Once these components have been added, you can position and resize them manually using the **setLocation( )**, **setSize( )**, **setPreferredSize( )**, or **setBounds( )** methods defined by **Component**.

Window

The**Window** class creates a top-level window. A*top-level window* is not contained within any other object; it sits directly on the desktop. Generally, you won't create **Window** objects directly. Instead, you will use a subclass of **Window** called **Frame**, described next.

Frame

Frame encapsulates what is commonly thought of as a "window." It is a subclass of**Window** and has a title bar, menu bar, borders, and resizing corners. If you create a **Frame** object from within an applet, it will contain a warning message, such as "Java Applet Window," to the user that an applet window has been created. This message warns users that the window they see was started by an applet and not by software running on their computer. (An applet that could

masquerade as a host-based application could be used to obtain passwords and other sensitive information without the user's knowledge.) When a **Frame** window is created by a stand-alone application rather than an applet, a normal window is created.

Canvas

Although it is not part of the hierarchy for applet or frame windows, there is one other type of window that you will find valuable: **Canvas**. **Canvas** encapsulates a blank window upon which you can draw.

S.NO	RGPV QUESTIONS	YEAR	MARKS
Q.1	What is AWT. Differentiate between component class & container class.	Dec 2014	3
Q.2	Explain in Brief container and Components in AWT Package.	DEC 2009	10
Q.3	Using AWT classes, Create a Closable Window to receive the following inputs, i.e, username, sex, qualification, address with submit and reset button	DEC 2009	12

Unit 2

Topic: Working with Frame Windows

Unit 2/Lecture 2

Working with Frame Windows

After the applet, the type of window you will most often create is derived from **Frame**. You will use it to create child windows within applets, and top-level or child windows for stand-alone applications. As mentioned, it creates a standard-style window.

Here are two of **Frame**'s constructors:

Frame( )
Frame(String *title*)

The first form creates a standard window that does not contain a title. The second form creates a window with the title specified by *title.* Notice that you cannot specify the dimensions of the window. Instead, you must set the size of the window after it has been created.

Creating a Frame Window in an Applet

Creating a new frame window from within an applet is actually quite easy. First, create a subclass of **Frame**. Next, override any of the standard applet methods, such as **init( )**, **start( )**, and **stop( )**, to show or hide the frame as needed. Finally, implement the **windowClosing( )** method of the **WindowListener** interface, calling **setVisible(false)** when the window is closed. Once you have defined a **Frame** subclass, you can create an object of that class. This causes a frame window to come into existence, but it will not be initially visible. You make it visible by calling **setVisible( )**. When created, the window is given a default height and width.

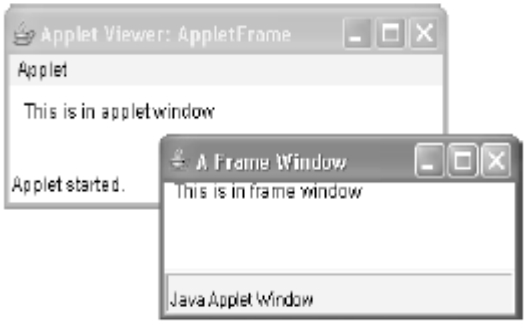
You can set the size of the window explicitly by calling the **setSize( )** method. The following applet creates a subclass of **Frame** called **SampleFrame**. A window of this subclass is instantiated within the **init( )** method of **AppletFrame**. Notice that **SampleFrame** calls **Frame**'s constructor. This causes a standard frame window to be created with the title passed in **title**. This example overrides the applet's **start( )** and **stop( )** methods so that they show and hide the child window, respectively. This causes the window to be removed automatically when you terminate the applet, when you close the window, or, if using a browser, when you move to another page. It also causes the child window to be shown when the browser returns to the applet.

```
// Create a child frame window from within an applet.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="AppletFrame" width=300 height=50>
```

```
</applet>
*/
// Create a subclass of Frame.
class SampleFrame extends Frame {
SampleFrame(String title) {
super(title);
// create an object to handle window events
MyWindowAdapter adapter = new MyWindowAdapter(this);
// register it to receive those events
addWindowListener(adapter);
}
public void paint(Graphics g) {
g.drawString("This is in frame window", 10, 40);
}
}
class MyWindowAdapter extends WindowAdapter {
SampleFrame sampleFrame;
public MyWindowAdapter(SampleFrame sampleFrame) {
this.sampleFrame = sampleFrame;
}
public void windowClosing(WindowEvent we) {
sampleFrame.setVisible(false);
}
}
// Create frame window.

public class AppletFrame extends Applet {
Frame f;
public void init() {
f = new SampleFrame("A Frame Window");
f.setSize(250, 250);
f.setVisible(true);
}
public void start() {
f.setVisible(true);
}
public void stop() {
f.setVisible(false);
}
public void paint(Graphics g) {
g.drawString("This is in applet window", 10, 20);
}
}
```

Sample output from this program is shown here.



S.NO	RGPV QUESTIONS	YEAR	MARKS
Q.1	Explain the life cycle of applet.	Dec 2014	2

Unit 2

Topic: Handling Events in Frame Window

Unit 2/Lecture 3

Handling Events in a Frame Window[RGPV Dec 2014(2)]

Since **Frame** is a subclass of **Component**, it inherits all the capabilities defined by **Component**. This means that you can use and manage a frame window just like you manage an applet's main window. For example, you can override **paint( )** to display output, call **repaint( )** when you need to restore the window, and add event handlers. Whenever an event occurs in a window, the event handlers defined by that window will be called. Each window handles its own events. For example, the following program creates a window that responds to mouse events. The main applet window also responds to mouse events. When you experiment with this program, you will see that mouse events are sent to the window in which the event occurs.

```
// Handle mouse events in both child and applet windows.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="WindowEvents" width=300 height=50>
</applet>
*/
// Create a subclass of Frame.
class SampleFrame extends Frame
implements MouseListener, MouseMotionListener {
String msg = "";
int mouseX=10, mouseY=40;
int movX=0, movY=0;
SampleFrame(String title) {
super(title);
// register this object to receive its own mouse events
addMouseListener(this);
addMouseMotionListener(this);
// create an object to handle window events
MyWindowAdapter adapter = new MyWindowAdapter(this);
// register it to receive those events
addWindowListener(adapter);
}
// Handle mouse clicked.
public void mouseClicked(MouseEvent me) {
}
// Handle mouse entered.
public void mouseEntered(MouseEvent evtObj) {
// save coordinates
mouseX = 10;
```

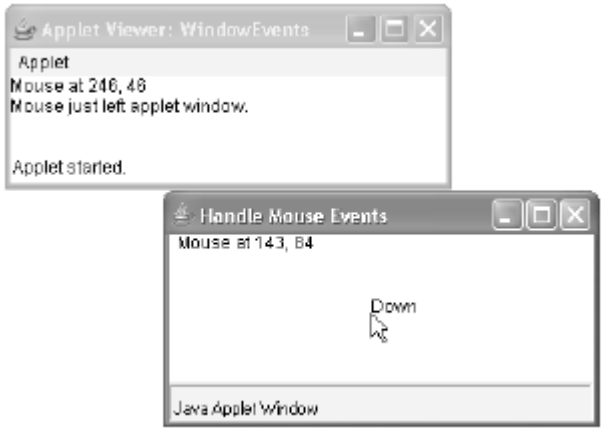
```
mouseY = 54;
msg = "Mouse just entered child.";
repaint();
}
// Handle mouse exited.
public void mouseExited(MouseEvent evtObj) {
// save coordinates
mouseX = 10;
mouseY = 54;
msg = "Mouse just left child window.";
repaint();
}
// Handle mouse pressed.
public void mousePressed(MouseEvent me) {
// save coordinates
mouseX = me.getX();
mouseY = me.getY();
msg = "Down";
repaint();
}
// Handle mouse released.
public void mouseReleased(MouseEvent me) {
// save coordinates
mouseX = me.getX();
mouseY = me.getY();
msg = "Up";
repaint();
}
// Handle mouse dragged.
public void mouseDragged(MouseEvent me) {
// save coordinates
mouseX = me.getX();
mouseY = me.getY();
movX = me.getX();
movY = me.getY();
msg = "*";
repaint();
}
// Handle mouse moved.
public void mouseMoved(MouseEvent me) {
// save coordinates
movX = me.getX();
movY = me.getY();
repaint(0, 0, 100, 60);
```

```
}
public void paint(Graphics g) {
g.drawString(msg, mouseX, mouseY);
g.drawString("Mouse at " + movX + ", " + movY, 10, 40);
}
}
class MyWindowAdapter extends WindowAdapter {
SampleFrame sampleFrame;
public MyWindowAdapter(SampleFrame sampleFrame) {
this.sampleFrame = sampleFrame;
}
public void windowClosing(WindowEvent we) {
sampleFrame.setVisible(false);
}
}
// Applet window.
public class WindowEvents extends Applet
implements MouseListener, MouseMotionListener {
SampleFrame f;
String msg = "";
int mouseX=0, mouseY=10;
int movX=0, movY=0;
// Create a frame window.
public void init() {
f = new SampleFrame("Handle Mouse Events");
f.setSize(300, 200);
f.setVisible(true);
// register this object to receive its own mouse events
addMouseListener(this);
addMouseMotionListener(this);
}
// Remove frame window when stopping applet.
public void stop() {
f.setVisible(false);
}
// Show frame window when starting applet.
public void start() {
f.setVisible(true);
}
// Handle mouse clicked.
public void mouseClicked(MouseEvent me) {
}
// Handle mouse entered.
public void mouseEntered(MouseEvent me) {
```

```
// save coordinates
mouseX = 0;
mouseY = 24;
msg = "Mouse just entered applet window.";
repaint();
}
// Handle mouse exited.
public void mouseExited(MouseEvent me) {
// save coordinates
mouseX = 0;
mouseY = 24;
msg = "Mouse just left applet window.";
repaint();
}
// Handle button pressed.
public void mousePressed(MouseEvent me) {
// save coordinates
mouseX = me.getX();
mouseY = me.getY();
msg = "Down";
repaint();
}
// Handle button released.
public void mouseReleased(MouseEvent me) {
// save coordinates
mouseX = me.getX();
mouseY = me.getY();
msg = "Up";
repaint();
}
// Handle mouse dragged.
public void mouseDragged(MouseEvent me) {
// save coordinates
mouseX = me.getX();
mouseY = me.getY();
movX = me.getX();
movY = me.getY();
msg = "*";
repaint();
}
// Handle mouse moved.
public void mouseMoved(MouseEvent me) {
// save coordinates
movX = me.getX();
```

```
movY = me.getY();
repaint(0, 0, 100, 20);
}
// Display msg in applet window.
public void paint(Graphics g) {
g.drawString(msg, mouseX, mouseY);
g.drawString("Mouse at " + movX + ", " + movY, 0, 10);
}
}
```

Sample output from this program is shown here:



S.NO	RGPV QUESTIONS	YEAR	MARKS
Q.1	What is an event in java	Dec 2014	2

Unit 2

Topic: AWT Controls

Unit 2/Lecture 4

AWT Controls

Controls are components that allow a user to interact with your application in various ways—for example, a commonly used control is the push button. A *layout manager* automatically positions components within a container. Thus, the appearance of a window is determined by a combination of the controls that it contains and the layout manager used to position them.

The AWT supports the following types of control.

- Lables
- Push Buttons
- Check Boxes
- Choice Lists
- Lists
- Scroll Bars
- Text Editing

Adding and Removing Controls

To include a control in a window, you must add it to the window. To do this, you must first create an instance of the desired control and then add it to a window by calling **add( )**, which is defined by **Container**. The **add( )** method has several forms. The following form is the one that is used for the first part of this chapter:

Component add(Component *compObj*)

Here, *compObj* is an instance of the control that you want to add. A reference to *compObj* is returned. Once a control has been added, it will automatically be visible whenever its parent window is displayed. Sometimes you will want to remove a control from a window when the control is no longer needed. To do this, call **remove( )**. This method is also defined by **Container**. It has this general form:

void remove(Component *obj*)

Here, *obj* is a reference to the control you want to remove. You can remove all controls by calling **removeAll( )**.

Label

The easiest control to use is a label. A *label* is an object of type **Label**, and it contains a string, which it displays. Labels are passive controls that do not support any interaction with the user. **Label** defines the following constructors:

Label( ) throws HeadlessException

Label(String *str*) throws HeadlessException
Label(String *str*, int *how*) throws HeadlessException

The first version creates a blank label. The second version creates a label that contains the string specified by *str.* This string is left-justified. The third version creates a label that contains the string specified by *str* using the alignment specified by *how.* The value of *how* must be one of these three constants: **Label.LEFT**, **Label.RIGHT**, or **Label.CENTER**. You can set or change the text in a label by using the **setText( )** method. You can obtain the current label by calling **getText( )**. These methods are shown here:

void setText(String *str*)
String getText( )

For **setText( )**, *str* specifies the new label. For **getText( )**, the current label is returned. You can set the alignment of the string within the label by calling **setAlignment( )**. To obtain the current alignment, call **getAlignment( )**. The methods are as follows:

void setAlignment(int *how*)
int getAlignment( )

```
// Demonstrate Labels
import java.awt.*;
import java.applet.*;
/*
<applet code="LabelDemo" width=300 height=200>
</applet>
*/
public class LabelDemo extends Applet {
public void init() {
Label one = new Label("One");
Label two = new Label("Two");
Label three = new Label("Three");
// add labels to applet window
add(one);
add(two);
add(three);
}}
```

Using Button

Perhaps the most widely used control is the push button. A *push button* is a component that contains a label and that generates an event when it is pressed. Push buttons are objects of type **Button**. **Button** defines these two constructors:

Button( ) throws HeadlessException
Button(String *str*) throws HeadlessException

The first version creates an empty button. The second creates a button that contains *str* as a label. After a button has been created, you can set its label by calling **setLabel( )**. You can retrieve its label by calling **getLabel( )**. These methods are as follows:

void setLabel(String *str*)
String getLabel( )

Here, *str* becomes the new label for the button.

Handling Buttons
Perhaps the most widely used control is the push button. A *push button* is a component that contains a label and that generates an event when it is pressed. Push buttons are objects of type **Button**. **Button** defines these two constructors:

Button( ) throws HeadlessException
Button(String *str*) throws HeadlessException

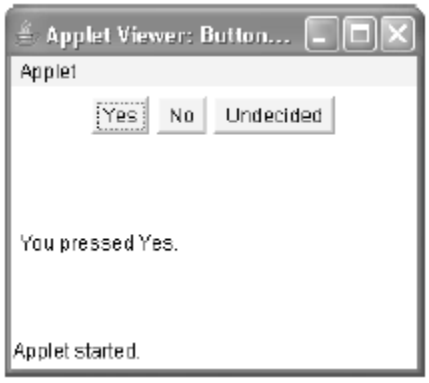
The first version creates an empty button. The second creates a button that contains *str* as a label. After a button has been created, you can set its label by calling **setLabel( )**. You can retrieve its label by calling

getLabel( ). These methods are as follows:
void setLabel(String *str*)
String getLabel( )

Here, *str* becomes the new label for the button.

```
// Demonstrate Buttons
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="ButtonDemo" width=250 height=150>
</applet>
*/
public class ButtonDemo extends Applet implements ActionListener {
String msg = "";
Button yes, no, maybe;
public void init() {
yes = new Button("Yes");
no = new Button("No");
maybe = new Button("Undecided");
add(yes);
```

```
add(no);
add(maybe);
yes.addActionListener(this);
no.addActionListener(this);
maybe.addActionListener(this);
}
public void actionPerformed(ActionEvent ae) {
String str = ae.getActionCommand();
if(str.equals("Yes")) {
msg = "You pressed Yes.";
}
else if(str.equals("No")) {
msg = "You pressed No.";
}
else {
msg = "You pressed Undecided.";
}
repaint();
}
public void paint(Graphics g) {
g.drawString(msg, 6, 100);
}
}
```



As mentioned, in addition to comparing button action command strings, you can also determine which button has been pressed, by comparing the object obtained from the **getSource( )** method to the button objects that you added to the window. To do this, you must keep a list of the objects when they are added. The following applet shows this approach:

```
// Recognize Button objects.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
```

```
<applet code="ButtonList" width=250 height=150>
</applet>
*/
public class ButtonList extends Applet implements ActionListener {
String msg = "";
Button bList[] = new Button[3];
public void init() {
Button yes = new Button("Yes");
Button no = new Button("No");
Button maybe = new Button("Undecided");
// store references to buttons as added
bList[0] = (Button) add(yes);
bList[1] = (Button) add(no);
bList[2] = (Button) add(maybe);
// register to receive action events
for(int i = 0; i < 3; i++) {
bList[i].addActionListener(this);
}
}
public void actionPerformed(ActionEvent ae) {
for(int i = 0; i < 3; i++) {
if(ae.getSource() == bList[i]) {
msg = "You pressed " + bList[i].getLabel();
}
}
repaint();
}
public void paint(Graphics g) {
g.drawString(msg, 6, 100);
}
}
```

In this version, the program stores each button reference in an array when the buttons are added to the applet window. (Recall that the **add( )** method returns a reference to the button when it is added.) Inside **actionPerformed( )**, this array is then used to determine which button has been pressed.

S.NO	RGPV QUESTION	YEAR	MARKS
Q.1	What do you mean by AWT controls? What are the various controls supported by AWT?	DEC 2012	8

Unit 2

Topic: Checkbox and Checkboxgroup Controls

Unit 2/Lecture 5

Applying Checkboxes

A *check box* is a control that is used to turn an option on or off. It consists of a small box that can either contain a check mark or not. There is a label associated with each check box that describes what option the box represents. You change the state of a check box by clicking on it. Check boxes can be used individually or as part of a group. Check boxes are objects of the **Checkbox** class.

Checkbox supports these constructors:
Checkbox( ) throws HeadlessException
Checkbox(String *str*) throws HeadlessException
Checkbox(String *str*, boolean *on*) throws HeadlessException
Checkbox(String *str*, boolean *on*, CheckboxGroup *cbGroup*) throws HeadlessException
Checkbox(String *str*, CheckboxGroup *cbGroup*, boolean *on*) throws HeadlessException

The first form creates a check box whose label is initially blank. The state of the check box is unchecked. The second form creates a check box whose label is specified by *str.* The state of the check box is unchecked. The third form allows you to set the initial state of the check box. If *on* is **true**, the check box is initially checked; otherwise, it is cleared. The fourth and fifth forms create a check box whose label is specified by *str* and whose group is specified by *cbGroup.* If this check box is not part of a group, then *cbGroup* must be **null**. (Check box groups are described in the next section.) The value of *on* determines the initial state of the check box. To retrieve the current state of a check box, call **getState( )**. To set its state, call **setState( )**. You can obtain the current label associated with a check box by calling **getLabel( )**. To set the label, call **setLabel( )**. These methods are as follows:
boolean getState( )
void setState(boolean *on*)
String getLabel( )
void setLabel(String *str*)

Here, if *on* is **true**, the box is checked. If it is **false**, the box is cleared. The string passed in *str* becomes the new label associated with the invoking check box.

The following program creates four check boxes. The initial state of the first box is checked. The status of each check box is displayed. Each time you change the state of a check box, the status display is updated.

```
// Demonstrate check boxes.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
```

```
<applet code="CheckboxDemo" width=250 height=200>
</applet>
*/
public class CheckboxDemo extends Applet implements ItemListener {
String msg = "";
Checkbox winXP, winVista, solaris, mac;
public void init() {
winXP = new Checkbox("Windows XP", null, true);
winVista = new Checkbox("Windows Vista");
solaris = new Checkbox("Solaris");
mac = new Checkbox("Mac OS");
add(winXP);
add(winVista);
add(solaris);
add(mac);
winXP.addItemListener(this);
winVista.addItemListener(this);
solaris.addItemListener(this);
mac.addItemListener(this);
}
public void itemStateChanged(ItemEvent ie) {
repaint();
}
// Display current state of the check boxes.
public void paint(Graphics g) {
msg = "Current state: ";
g.drawString(msg, 6, 80);
msg = " Windows XP: " + winXP.getState();
g.drawString(msg, 6, 100);
msg = " Windows Vista: " + winVista.getState();
g.drawString(msg, 6, 120);
msg = " Solaris: " + solaris.getState();
g.drawString(msg, 6, 140);
msg = " Mac OS: " + mac.getState();
g.drawString(msg, 6, 160);
}
}
```

CheckboxGroup

It is possible to create a set of mutually exclusive check boxes in which one and only one check box in the group can be checked at any one time. These check boxes are often called *radio buttons,* because they act like the station selector on a car radio—only one station can be selected at any one time. To create a set of mutually exclusive check boxes, you must first define the group to which they will belong and then specify that group when you construct the check boxes. Check box groups are objects of type **CheckboxGroup**. Only the default constructor is defined, which creates an empty group.

You can determine which check box in a group is currently selected by calling **getSelectedCheckbox( )**. You can set a check box by calling **setSelectedCheckbox( )**.

These methods are as follows:
Checkbox getSelectedCheckbox( )
void setSelectedCheckbox(Checkbox *which*)

Here, *which* is the check box that you want to be selected. The previously selected check box will be turned off. Here is a program that uses check boxes that are part of a group:

```
// Demonstrate check box group.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="CBGroup" width=250 height=200>
</applet>
*/
public class CBGroup extends Applet implements ItemListener {
```

```
String msg = "";
Checkbox winXP, winVista, solaris, mac;
CheckboxGroup cbg;
public void init() {
cbg = new CheckboxGroup();
winXP = new Checkbox("Windows XP", cbg, true);
winVista = new Checkbox("Windows Vista", cbg, false);
solaris = new Checkbox("Solaris", cbg, false);
mac = new Checkbox("Mac OS", cbg, false);
add(winXP);
add(winVista);
add(solaris);
add(mac);
winXP.addItemListener(this);
winVista.addItemListener(this);
solaris.addItemListener(this);
mac.addItemListener(this);
}
public void itemStateChanged(ItemEvent ie) {
repaint();
}
// Display current state of the check boxes.
public void paint(Graphics g) {
msg = "Current selection: ";
msg += cbg.getSelectedCheckbox().getLabel();
g.drawString(msg, 6, 100); } }
```

Choice Controls

The **Choice** class is used to create a *pop-up list* of items from which the user may choose. Thus, a **Choice** control is a form of menu. When inactive, a **Choice** component takes up only enough space to show the currently selected item. When the user clicks on it, the whole list of choices

pops up, and a new selection can be made. Each item in the list is a string that appears as a left-justified label in the order it is added to the **Choice** object. **Choice** only defines the default constructor, which creates an empty list. To add a selection to the list, call **add( )**. It has this general form:

void add(String *name*)
Here, *name* is the name of the item being added. Items are added to the list in the order in which calls to **add( )** occur.

To determine which item is currently selected, you may call either **getSelectedItem( )** or **getSelectedIndex( )**.

These methods are shown here:
String getSelectedItem( )
int getSelectedIndex( )

The **getSelectedItem( )** method returns a string containing the name of the item. **getSelectedIndex( )** returns the index of the item. The first item is at index 0. By default, the first item added to the list is selected.

To obtain the number of items in the list, call **getItemCount( )**. You can set the currently selected item using the **select( )** method with either a zero-based integer index or a string that will match a name in the list. These methods are shown here:

int getItemCount( )
void select(int *index*)
void select(String *name*)

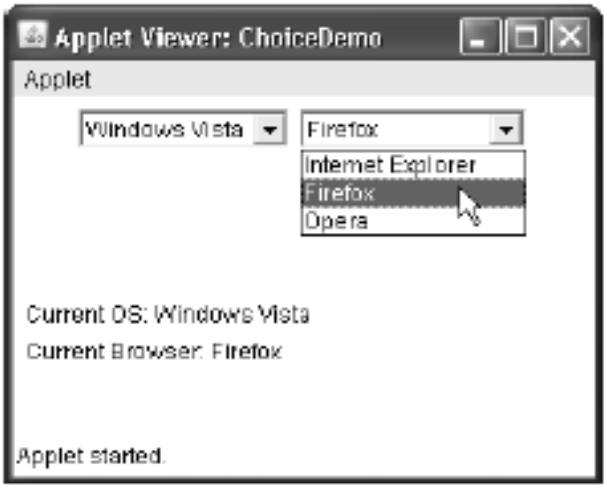
Given an index, you can obtain the name associated with the item at that index by calling **getItem( )**, which has this general form:
String getItem(int *index*)

Here, *index* specifies the index of the desired item.

Handling ChoiceList
Each time a choice is selected, an item event is generated. This is sent to any listeners that previously registered an interest in receiving item event notifications from that component. Each listener implements the **ItemListener** interface. That interface defines the **itemStateChanged( )** method. An **ItemEvent** object is supplied as the argument to this method. Here is an example that creates two **Choice** menus. One selects the operating system. The other selects the browser.

```
// Demonstrate Choice lists.
import java.awt.*;
```

```
import java.awt.event.*;
import java.applet.*;
/*
<applet code="ChoiceDemo" width=300 height=180>
</applet>
*/
public class ChoiceDemo extends Applet implements ItemListener {
Choice os, browser;
String msg = "";
public void init() {
os = new Choice();
browser = new Choice();
// add items to os list
os.add("Windows XP");
os.add("Windows Vista");
os.add("Solaris");
os.add("Mac OS");
// add items to browser list
browser.add("Internet Explorer");
browser.add("Firefox");
browser.add("Opera");
// add choice lists to window
add(os);
add(browser);
// register to receive item events
os.addItemListener(this);
browser.addItemListener(this);
}
public void itemStateChanged(ItemEvent ie) {
repaint();
}
// Display current selections.
public void paint(Graphics g) {
msg = "Current OS: ";
msg += os.getSelectedItem();
g.drawString(msg, 6, 120);
msg = "Current Browser: ";
msg += browser.getSelectedItem();
g.drawString(msg, 6, 140);
}
}
```


Applet Viewer: ChoiceDemo
Applet
Windows Vista
Firefox
Internet Explorer
Firefox
Opera
Current OS: Windows Vista
Current Browser: Firefox
Applet started.

Unit 2

Topic: Lists & Scrollbar Controls

Unit 2/Lecture 6

Using Lists

The **List** class provides a compact, multiple-choice, scrolling selection list. Unlike the **Choice** object, which shows only the single selected item in the menu, a **List** object can be constructed to show any number of choices in the visible window. It can also be created to allow multiple selections. **List** provides these constructors:

List( ) throws HeadlessException
List(int *numRows*) throws HeadlessException
List(int *numRows*, boolean *multipleSelect*) throws HeadlessException

The first version creates a **List** control that allows only one item to be selected at any one time. In the second form, the value of *numRows* specifies the number of entries in the list that will always be visible (others can be scrolled into view as needed). In the third form, if *multipleSelec*t is **true**, then the user may select two or more items at a time. If it is **false**, then only one item may be selected.

To add a selection to the list, call **add( )**. It has the following two forms:

void add(String *name*)
void add(String *name*, int *index*)

Here, *name* is the name of the item added to the list. The first form adds items to the end of the list. The second form adds the item at the index specified by *index.* Indexing begins at zero. You can specify –1 to add the item to the end of the list. For lists that allow only single selection, you can determine which item is currently
selected by calling either **getSelectedItem( )** or **getSelectedIndex( )**. These methods are
shown here:
String getSelectedItem( )
int getSelectedIndex( )

The **getSelectedItem( )** method returns a string containing the name of the item. If more than one item is selected, or if no selection has yet been made, **null** is returned.

The getSelectedIndex( ) returns the index of the item. The first item is at index 0. If more than one item is selected, or if no selection has yet been made, –1 is returned.

For lists that allow multiple selection, you must use either **getSelectedItems( )** or **getSelectedIndexes( )**, shown here, to determine the current selections:

String[ ] getSelectedItems( )
int[ ] getSelectedIndexes( )

getSelectedItems( ) returns an array containing the names of the currently selected items.
getSelectedIndexes( ) returns an array containing the indexes of the currently selected items.

To obtain the number of items in the list, call **getItemCount( )**. You can set the currently selected item by using the **select( )** method with a zero-based integer index. These methods are shown here:

int getItemCount( )
void select(int *index*)

Given an index, you can obtain the name associated with the item at that index by calling **getItem( )**, which has this general form:

String getItem(int *index*)
Here, *index* specifies the index of the desired item.

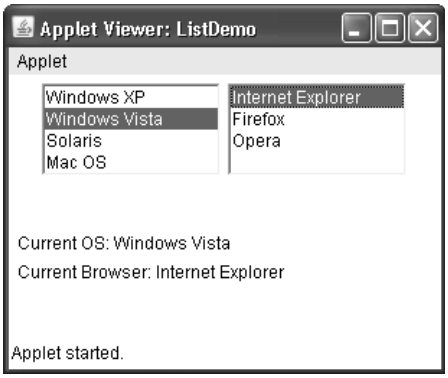
Handling Lists
To process list events, you will need to implement the **ActionListener** interface. Each time a **List** item is double-clicked, an **ActionEvent** object is generated. Its **getActionCommand( )** method can be used to retrieve the name of the newly selected item. Also, each time an item is selected or deselected with a single click, an **ItemEvent** object is generated. Its **getStateChange( )** method can be used to determine whether a selection or deselection triggered this event.

getItemSelectable( ) returns a reference to the object that triggered this event. Here is an example that converts the **Choice** controls in the preceding section into **List** components, one multiple choice and the other single choice:

```
// Demonstrate Lists.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="ListDemo" width=300 height=180>
</applet>
*/
public class ListDemo extends Applet implements ActionListener {
List os, browser;
String msg = "";
public void init() {
os = new List(4, true);
browser = new List(4, false);
// add items to os list
os.add("Windows XP");
```

```
os.add("Windows Vista");
os.add("Solaris");
os.add("Mac OS");
// add items to browser list
browser.add("Internet Explorer");
browser.add("Firefox");
browser.add("Opera");
browser.select(1);
// add lists to window
add(os);
add(browser);
// register to receive action events
os.addActionListener(this);
browser.addActionListener(this);
}
public void actionPerformed(ActionEvent ae) {
repaint();
}
// Display current selections.
public void paint(Graphics g) {
int idx[];
msg = "Current OS: ";
idx = os.getSelectedIndexes();
for(int i=0; i<idx.length; i++)
msg += os.getItem(idx[i]) + " ";
g.drawString(msg, 6, 120);
msg = "Current Browser: ";
msg += browser.getSelectedItem();
g.drawString(msg, 6, 140);
}
}
```

Sample output generated by the ListDemo applet is shown in Figure given below.



Managing Scroll Bars

Scroll bars are used to select continuous values between a specified minimum and maximum. Scroll bars may be oriented horizontally or vertically. A scroll bar is actually a composite of several individual parts. Each end has an arrow that you can click to move the current value of the scroll bar one unit in the direction of the arrow. The current value of the scroll bar relative to its minimum and maximum values is indicated by the *slider box* (or *thumb*) for the scroll bar. The slider box can be dragged by the user to a new position. The scroll bar will then reflect this value. In the background space on either side of the thumb, the user can click to cause the thumb to jump in that direction by some increment larger than 1. Typically, this action translates into some form of page up and page down. Scroll bars are encapsulated by the **Scrollbar** class.

Scrollbar defines the following constructors:
Scrollbar( ) throws HeadlessException
Scrollbar(int *style*) throws HeadlessException
Scrollbar(int *style*, int *initialValue*, int *thumbSize*, int *min*, int *max*) throws HeadlessException

The first form creates a vertical scroll bar. The second and third forms allow you to specify the orientation of the scroll bar. If *style* is **Scrollbar.VERTICAL**, a vertical scroll bar is created. If *style* is **Scrollbar.HORIZONTAL**, the scroll bar is horizontal. In the third form of the constructor, the initial value of the scroll bar is passed in *initialValue.* The number of units represented by the height of the thumb is passed in *thumbSize.* The minimum and maximum values for the scroll bar are specified by *min* and *max.*

If you construct a scroll bar by using one of the first two constructors, then you need to set its parameters by using **setValues( )**, shown here, before it can be used:

void setValues(int *initialValue*, int *thumbSize*, int *min*, int *max*)
The parameters have the same meaning as they have in the third constructor just described. To obtain the current value of the scroll bar, call **getValue( )**. It returns the current setting. To set the current value, call **setValue( )**. These methods are as follows:

int getValue( )
void setValue(int *newValue*)

Here, *newValue* specifies the new value for the scroll bar. When you set a value, the slider box inside the scroll bar will be positioned to reflect the new value. You can also retrieve the minimum and maximum values via **getMinimum( )** and **getMaximum( )**, shown here:

int getMinimum( )
int getMaximum( )

They return the requested quantity.

By default, 1 is the increment added to or subtracted from the scroll bar each time it is scrolled up or down one line. You can change this increment by calling **setUnitIncrement( )**. By default, page-up and page-down increments are 10.
You can change this value by calling **setBlockIncrement( )**. These methods are shown here:

void setUnitIncrement(int *newIncr*)
void setBlockIncrement(int *newIncr*)

Handling Scroll Bars
To process scroll bar events, you need to implement the **AdjustmentListener** interface. Each time a user interacts with a scroll bar, an **AdjustmentEvent** object is generated. Its **getAdjustmentType( )** method can be used to determine the type of the adjustment. The types of adjustment events are as follows:

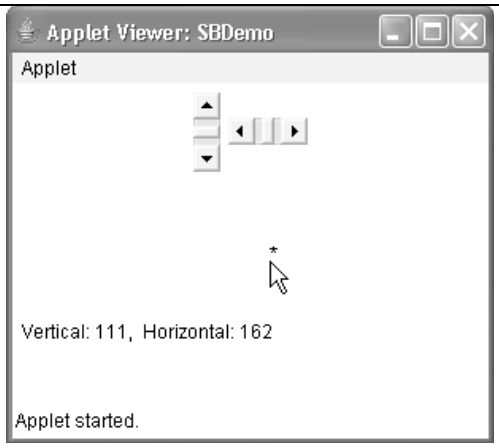
BLOCK_DECREMENT A page-down event has been generated.
BLOCK_INCREMENT A page-up event has been generated.
TRACK An absolute tracking event has been generated.
UNIT_DECREMENT The line-down button in a scroll bar has been pressed.
UNIT_INCREMENT The line-up button in a scroll bar has been pressed.

The following example creates both a vertical and a horizontal scroll bar. The current settings of the scroll bars are displayed. If you drag the mouse while inside the window, the coordinates of each drag event are used to update the scroll bars. An asterisk is displayed at the current drag position.

```
// Demonstrate scroll bars.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="SBDemo" width=300 height=200>
</applet>
*/
public class SBDemo extends Applet
implements AdjustmentListener, MouseMotionListener {
String msg = "";
Scrollbar vertSB, horzSB;
public void init() {
int width = Integer.parseInt(getParameter("width"));
int height = Integer.parseInt(getParameter("height"));
vertSB = new Scrollbar(Scrollbar.VERTICAL,
0, 1, 0, height);
horzSB = new Scrollbar(Scrollbar.HORIZONTAL,
0, 1, 0, width);
```

```
add(vertSB);
add(horzSB);
// register to receive adjustment events
vertSB.addAdjustmentListener(this);
horzSB.addAdjustmentListener(this);
addMouseMotionListener(this);
}
public void adjustmentValueChanged(AdjustmentEvent ae) {
repaint();
}
// Update scroll bars to reflect mouse dragging.
public void mouseDragged(MouseEvent me) {
int x = me.getX();
int y = me.getY();
vertSB.setValue(y);
horzSB.setValue(x);
repaint();
}
// Necessary for MouseMotionListener
public void mouseMoved(MouseEvent me) {
}
// Display current value of scroll bars.
public void paint(Graphics g) {
msg = "Vertical: " + vertSB.getValue();
msg += ", Horizontal: " + horzSB.getValue();
g.drawString(msg, 6, 160);
// show current mouse drag position
g.drawString("*", horzSB.getValue(),
vertSB.getValue());
}
}
```

Sample output from the **SBDemo** applet is shown in Figure given below.


Applet Viewer: SBDemo
Applet
Vertical: 111, Horizontal: 162
Applet started.

Unit 2

Topic: Using a TextField and TextArea

Unit 2/Lecture 7

Using a TextField

The **TextField** class implements a single-line text-entry area, usually called an *edit control.* Text fields allow the user to enter strings and to edit the text using the arrow keys, cut and paste keys, and mouse selections. **TextField** is a subclass of **TextComponent**. **TextField** defines the following constructors:

TextField( ) throws HeadlessException
TextField(int *numChars*) throws HeadlessException
TextField(String *str*) throws HeadlessException
TextField(String *str*, int *numChars*) throws HeadlessException

The first version creates a default text field. The second form creates a text field that is *numChars* characters wide. The third form initializes the text field with the string contained in *str.* The fourth form initializes a text field and sets its width.

TextField (and its superclass **TextComponent**) provides several methods that allow you to utilize a text field. To obtain the string currently contained in the text field, call **getText( )**.

To set the text, call **setText( )**. These methods are as follows:
String getText( )
void setText(String *str*)
Here, *str* is the new string.

The user can select a portion of the text in a text field. Also, you can select a portion of text under program control by using **select( )**. Your program can obtain the currently selected text by calling **getSelectedText( )**. These methods are shown here:

String getSelectedText( )
void select(int *startIndex*, int *endIndex*)

getSelectedText( ) returns the selected text. The **select( )** method selects the characters beginning at *startIndex* and ending at *endIndex*–1.

You can control whether the contents of a text field may be modified by the user by calling **setEditable( )**. You can determine editability by calling **isEditable( )**. These methods are shown here:

boolean isEditable( )
void setEditable(boolean *canEdit*)

isEditable( ) returns **true** if the text may be changed and **false** if not. In **setEditable( )**, if *canEdit*

is **true**, the text may be changed. If it is **false**, the text cannot be altered. There may be times when you will want the user to enter text that is not displayed, such as a password. You can disable the echoing of the characters as they are typed by calling **setEchoChar( )**. This method specifies a single character that the **TextField** will display when characters are entered (thus, the actual characters typed will not be shown). You can check a text field to see if it is in this mode with the **echoCharIsSet( )** method. You can retrieve the echo character by calling the **getEchoChar( )** method. These methods are as follows:

void setEchoChar(char *ch*)
boolean echoCharIsSet( )
char getEchoChar( )
Here, *ch* specifies the character to be echoed.

Handling a TextField

Since text fields perform their own editing functions, your program generally will not respond to individual key events that occur within a text field. However, you may want to respond when the user presses ENTER. When this occurs, an action event is generated.

Here is an example that creates the classic user name and password screen:

```
// Demonstrate text field.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="TextFieldDemo" width=380 height=150>
</applet>
*/
public class TextFieldDemo extends Applet
implements ActionListener {
TextField name, pass;
public void init() {
Label namep = new Label("Name: ", Label.RIGHT);
Label passp = new Label("Password: ", Label.RIGHT);
name = new TextField(12);
pass = new TextField(8);
pass.setEchoChar('?');
add(namep);
add(name);
add(passp);
add(pass);
// register to receive action events
name.addActionListener(this);
```

```
pass.addActionListener(this);
}
// User pressed Enter.
public void actionPerformed(ActionEvent ae) {
repaint();
}
public void paint(Graphics g) {
g.drawString("Name: " + name.getText(), 6, 60);
g.drawString("Selected text in name: "
+ name.getSelectedText(), 6, 80);
g.drawString("Password: " + pass.getText(), 6, 100);
}
}
```

Sample output from the **TextFieldDemo** applet is shown in Figure given below.

Using a TextArea

Sometimes a single line of text input is not enough for a given task. To handle these situations, the AWT includes a simple multiline editor called **TextArea**. Following are the constructors for **TextArea**:

TextArea( ) throws HeadlessException
TextArea(int *numLines*, int *numChars*) throws HeadlessException
TextArea(String *str*) throws HeadlessException
TextArea(String *str*, int *numLines*, int *numChars*) throws HeadlessException
TextArea(String *str*, int *numLines*, int *numChars*, int *sBars*) throws HeadlessException

Here, *numLines* specifies the height, in lines, of the text area, and *numChars* specifies its width, in characters. Initial text can be specified by *str.* In the fifth form, you can specify the scroll bars

that you want the control to have. *sBars* must be one of these values:

SCROLLBARS_BOTH SCROLLBARS_NONE
SCROLLBARS_HORIZONTAL_ONLY SCROLLBARS_VERTICAL_ONLY

TextArea is a subclass of **TextComponent**. Therefore, it supports the **getText( )**, **setText( )**, **getSelectedText( )**, **select( )**, **isEditable( )**, and **setEditable( )** methods described in the preceding section.
TextArea adds the following methods:

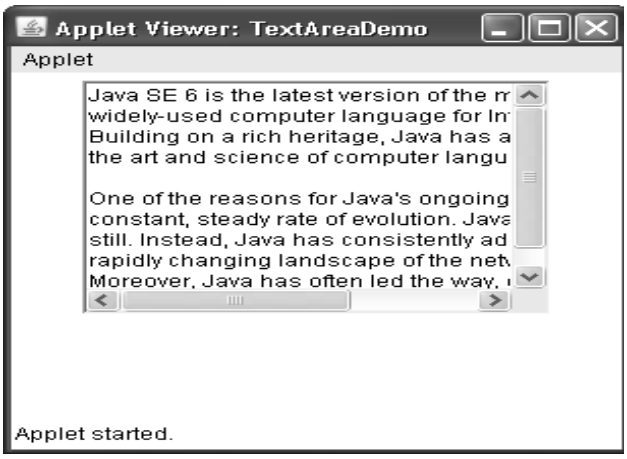
void append(String *str*)
void insert(String *str*, int *index*)
void replaceRange(String *str*, int *startIndex*, int *endIndex*)

The **append( )** method appends the string specified by *str* to the end of the current text. **insert( )** inserts the string passed in *str* at the specified index. To replace text, call **replaceRange( )**. It replaces the characters from *startIndex* to *endIndex*–1, with the replacement text passed in *str.*
Text areas are almost self-contained controls. Your program incurs virtually no management overhead. Text areas only generate got-focus and lost-focus events.
Normally, your program simply obtains the current text when it is needed. The following program creates a **TextArea** control:

```
// Demonstrate TextArea.
import java.awt.*;
import java.applet.*;
/*
<applet code="TextAreaDemo" width=300 height=250>
</applet>
*/
public class TextAreaDemo extends Applet {
public void init() {
String val =
"Java SE 6 is the latest version of the most\n" +
"widely-used computer language for Internet programming.\n" +
"Building on a rich heritage, Java has advanced both\n" +
"the art and science of computer language design.\n\n" +
"One of the reasons for Java's ongoing success is its\n" +
"constant, steady rate of evolution. Java has never stood\n" +
"still. Instead, Java has consistently adapted to the\n" +
"rapidly changing landscape of the networked world.\n" +
"Moreover, Java has often led the way, charting the\n" +
"course for others to follow.";
TextArea text = new TextArea(val, 10, 30);
```

```
add(text);
}
}
```

Here is sample output from the **TextAreaDemo** applet:



Unit 2

Topic: Layout Managers

Unit 2/Lecture 8

Layout Managers

All of the components that we have shown so far have been positioned by the default layout manager. As we mentioned at the beginning of this chapter, a layout manager automatically arranges your controls within a window by using some type of algorithm. If you have programmed for other GUI environments, such as Windows, then you are accustomed to laying out your controls by hand. While it is possible to lay out Java controls by hand, too, you generally won't want to, for two main reasons. First, it is very tedious to manually layout a large number of components. Second, sometimes the width and height information is not yet available when you need to arrange some control, because the native toolkit components haven't been realized. This is a chicken-and-egg situation; it is pretty confusing to figure out when it is okay to use the size of a given component to position it relative to another. Each **Container** object has a layout manager associated with it. A layout manager is an instance of any class that implements the **LayoutManager** interface. The layout manager is set by the **setLayout( )** method. If no call to **setLayout( )** is made, then the default layout manager is used. Whenever a container is resized (or sized for the first time), the layout manager is used to position each of the components within it.

The **setLayout( )** method has the following general form:
void setLayout(LayoutManager *layoutObj*)

Here, *layoutObj* is a reference to the desired layout manager. If you wish to disable the layout manager and position components manually, pass **null** for *layoutObj.* If you do this, you will need to determine the shape and position of each component manually, using the **setBounds( )** method defined by **Component**. Normally, you will want to use a layout manager.

FlowLayout

FlowLayout is the default layout manager. This is the layout manager that the preceding examples have used. **FlowLayout** implements a simple layout style, which is similar to how words flow in a text editor. The direction of the layout is governed by the container's component orientation property, which, by default, is left to right, top to bottom. Therefore, by default, components are laid out line-by-line beginning at the upper-left corner. In all cases, when a line is filled, layout advances to the next line. A small space is left between each component, above and below, as well as left and right. Here are the constructors for

FlowLayout: **[RGPV Dec 201473)]**
FlowLayout( )
FlowLayout(int *how*)
FlowLayout(int *how*, int *horz*, int *vert*)

The first form creates the default layout, which centers components and leaves five pixels of space between each component. The second form lets you specify how each line is aligned.

Valid values for *how* are as follows:

FlowLayout.LEFT
FlowLayout.CENTER
FlowLayout.RIGHT
FlowLayout.LEADING
FlowLayout.TRAILING

These values specify left, center, right, leading edge, and trailing edge alignment, respectively. The third constructor allows you to specify the horizontal and vertical space left between components in *horz* and *vert,* respectively.

```
// Use left-aligned flow layout.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="FlowLayoutDemo" width=250 height=200>
</applet>
*/
public class FlowLayoutDemo extends Applet
implements ItemListener {
String msg = "";
Checkbox winXP, winVista, solaris, mac;
public void init() {
// set left-aligned flow layout
setLayout(new FlowLayout(FlowLayout.LEFT));
winXP = new Checkbox("Windows XP", null, true);
winVista = new Checkbox("Windows Vista");
solaris = new Checkbox("Solaris");
mac = new Checkbox("Mac OS");
add(winXP);
add(winVista);
add(solaris);
add(mac);
// register to receive item events
winXP.addItemListener(this);
winVista.addItemListener(this);
solaris.addItemListener(this);
mac.addItemListener(this);
}
// Repaint when status of a check box changes.
public void itemStateChanged(ItemEvent ie) {
repaint();
```

```
}
// Display current state of the check boxes.
public void paint(Graphics g) {
msg = "Current state: ";
g.drawString(msg, 6, 80);
msg = " Windows XP: " + winXP.getState();
g.drawString(msg, 6, 100);
msg = " Windows Vista: " + winVista.getState();
g.drawString(msg, 6, 120);
msg = " Solaris: " + solaris.getState();
g.drawString(msg, 6, 140);
msg = " Mac: " + mac.getState();
g.drawString(msg, 6, 160);
}
}
```

BorderLayout

The **BorderLayout** class implements a common layout style for top-level windows. It has four narrow, fixed-width components at the edges and one large area in the center. The four sides are referred to as north, south, east, and west. The middle area is called the center. Here are the constructors defined by **BorderLayout**:

BorderLayout( )
BorderLayout(int *horz*, int *vert*)

The first form creates a default border layout. The second allows you to specify the horizontal and vertical space left between components in *horz* and *vert,* respectively. **BorderLayout**

defines the following constants that specify the regions:

BorderLayout.CENTER	BorderLayout.SOUTH
BorderLayout.EAST	BorderLayout.WEST
BorderLayout.NORTH	

```
// Demonstrate BorderLayout.
import java.awt.*;
import java.applet.*;
import java.util.*;
/*
<applet code="BorderLayoutDemo" width=400 height=200>
</applet>
*/
public class BorderLayoutDemo extends Applet {
public void init() {
setLayout(new BorderLayout());
add(new Button("This is across the top."),
BorderLayout.NORTH);
add(new Label("The footer message might go here."),
BorderLayout.SOUTH);
add(new Button("Right"), BorderLayout.EAST);
add(new Button("Left"), BorderLayout.WEST);
String msg = "The reasonable man adapts " +
"himself to the world;\n" +
"the unreasonable one persists in " +
"trying to adapt the world to himself.\n" +
"Therefore all progress depends " +
"on the unreasonable man.\n\n" +
" - George Bernard Shaw\n\n";
add(new TextArea(msg), BorderLayout.CENTER);
}
}
```

GridLayout[RGPV Dec 2014(7)]

GridLayout lays out components in a two-dimensional grid. When you instantiate a **GridLayout**, you define the number of rows and columns. The constructors supported by **GridLayout** are shown here:

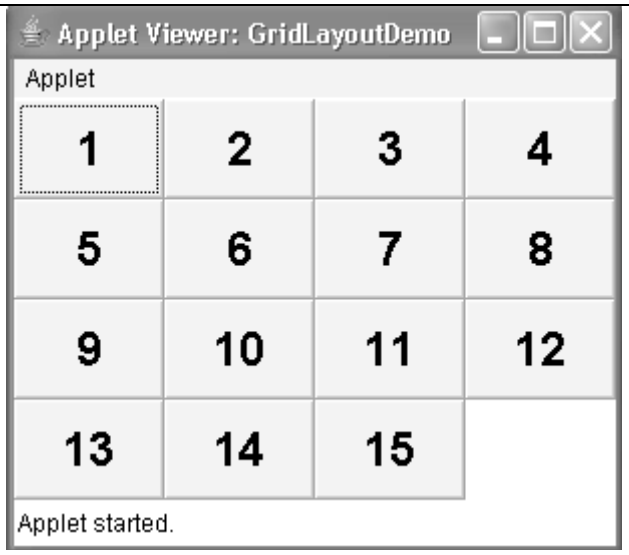
GridLayout( )
GridLayout(int *numRows*, int *numColumns*)
GridLayout(int *numRows*, int *numColumns*, int *horz*, int *vert*)

The first form creates a single-column grid layout. The second form creates a grid layout with the specified number of rows and columns. The third form allows you to specify the horizontal and vertical space left between components in *horz* and *vert,* respectively. Either *numRows* or *numColumns* can be zero. Specifying *numRows* as zero allows for unlimited-length columns.Specifying *numColumns* as zero allows for unlimited-length rows.

Here is a sample program that creates a 4×4 grid and fills it in with 15 buttons, each labeled with its index:

```
// Demonstrate GridLayout
import java.awt.*;
import java.applet.*;
/*
<applet code="GridLayoutDemo" width=300 height=200>
</applet>
*/
public class GridLayoutDemo extends Applet {
static final int n = 4;
public void init() {
setLayout(new GridLayout(n, n));
setFont(new Font("SansSerif", Font.BOLD, 24));
for(int i = 0; i < n; i++) {
for(int j = 0; j < n; j++) {
int k = i * n + j;
if(k > 0)
add(new Button("" + k));
}
}
}
}
```

Following is the output generated by the **GridLayoutDemo** applet:



CardLayout

The **CardLayout** class is unique among the other layout managers in that it stores several different layouts. Each layout can be thought of as being on a separate index card in a deck that can be shuffled so that any card is on top at a given time. This can be useful for user interfaces with optional components that can be dynamically enabled and disabled upon user input. You can prepare the other layouts and have them hidden, ready to be activated when needed.

CardLayout provides these two constructors:
CardLayout( )
CardLayout(int *horz*, int *vert*)

The first form creates a default card layout. The second form allows you to specify the horizontal and vertical space left between components in *horz* and *vert,* respectively. Use of a card layout requires a bit more work than the other layouts. The cards are typically held in an object of type **Panel**. This panel must have **CardLayout** selected as its layout manager. The cards that form the deck are also typically objects of type **Panel**. Thus, you must create a panel that contains the deck and a panel for each card in the deck. Next, you add to the appropriate panel the components that form each card. You then add these panels to the panel
for which **CardLayout** is the layout manager. Finally, you add this panel to the window. Once these steps are complete, you must provide some way for the user to select between cards. One common approach is to include one push button for each card in the deck. When card panels are added to a panel, they are usually given a name. Thus, most of the time, you will use this form of **add( )** when adding cards to a panel:

void add(Component *panelObj*, Object *name*)

Here, *name* is a string that specifies the name of the card whose panel is specified by *panelObj*. After you have created a deck, your program activates a card by calling one of the following

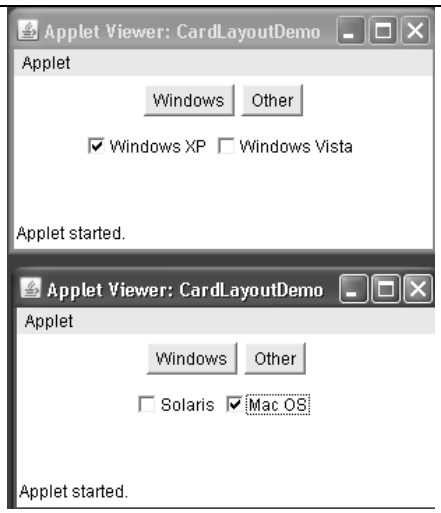
methods defined by **CardLayout**:

void first(Container *deck*)
void last(Container *deck*)
void next(Container *deck*)
void previous(Container *deck*)
void show(Container *deck*, String *cardName*)

Here, *deck* is a reference to the container (usually a panel) that holds the cards, and *cardName* is the name of a card. Calling **first( )** causes the first card in the deck to be shown. To show the last card, call **last( )**. To show the next card, call **next( )**. To show the previous card, call **previous( )**. Both **next( )** and **previous( )** automatically cycle back to the top or bottom of the deck, respectively. The **show( )** method displays the card whose name is passed in *cardName*.

```
// Demonstrate CardLayout.
import java.awt.*;
import java.awt.event.*;
import java.applet.*;
/*
<applet code="CardLayoutDemo" width=300 height=100>
</applet>
*/
public class CardLayoutDemo extends Applet
implements ActionListener, MouseListener {
Checkbox winXP, winVista, solaris, mac;
Panel osCards;
CardLayout cardLO;
Button Win, Other;
public void init() {
Win = new Button("Windows");
Other = new Button("Other");
add(Win);
add(Other);
cardLO = new CardLayout();
osCards = new Panel();
osCards.setLayout(cardLO); // set panel layout to card layout
winXP = new Checkbox("Windows XP", null, true);
winVista = new Checkbox("Windows Vista");
solaris = new Checkbox("Solaris");
mac = new Checkbox("Mac OS");
// add Windows check boxes to a panel
Panel winPan = new Panel();
winPan.add(winXP);
winPan.add(winVista);
```

```
// add other OS check boxes to a panel
Panel otherPan = new Panel();
otherPan.add(solaris);
otherPan.add(mac);
// add panels to card deck panel
osCards.add(winPan, "Windows");
osCards.add(otherPan, "Other");
// add cards to main applet panel
add(osCards);
// register to receive action events
Win.addActionListener(this);
Other.addActionListener(this);
// register mouse events
addMouseListener(this);
}
// Cycle through panels.
public void mousePressed(MouseEvent me) {
cardLO.next(osCards);
}
// Provide empty implementations for the other MouseListener methods.
public void mouseClicked(MouseEvent me) {
}
public void mouseEntered(MouseEvent me) {
}
public void mouseExited(MouseEvent me) {
}
public void mouseReleased(MouseEvent me) {
}
public void actionPerformed(ActionEvent ae) {
if(ae.getSource() == Win) {
cardLO.show(osCards, "Windows");
}
else {
cardLO.show(osCards, "Other");
}
}
}
```



S.NO	RGPV QUESTION	YEAR	MARKS
Q.1	What are the different types of Layout in Java?	DEC 2012	8
Q-2.	Explain the Layout Manager in Java. Also, describe the concept of menus.	June-2011	8
Q-3.	How many Layouts are available in AWT Package?	Dec-2009	10

Unit 2

Topic: Java Event Handling Model

Unit 2/Lecture 9

Java Event Handling Model[RGPV Dec 2014(7)]

The Delegation Event Model

The modern approach to handling events is based on the *delegation event model,* which defines standard and consistent mechanisms to generate and process events. Its concept is quite simple: a *source* generates an event and sends it to one or more *listeners.* In this scheme, the listener simply waits until it receives an event. Once an event is received, the listener processes the event and then returns. The advantage of this design is that the application logic that processes events is cleanly separated from the user interface logic that generates those events.

A user interface element is able to "delegate" the processing of an event to a separate piece of code. In the delegation event model, listeners must register with a source in order to receive an event notification. This provides an important benefit: notifications are sent only to listeners that want to receive them. This is a more efficient way to handle events than the design used by the old Java 1.0 approach. Previously, an event was propagated up the containment hierarchy until it was handled by a component. This required components to receive events that they did not process, and it wasted valuable time. The delegation event model eliminates this overhead.

Events

In the delegation model, an *event* is an object that describes a state change in a source. It can be generated as a consequence of a person interacting with the elements in a graphical user interface. Some of the activities that cause events to be generated are pressing a button, entering a character via the keyboard, selecting an item in a list, and clicking the mouse. Many other user operations could also be cited as examples. Events may also occur that are not directly caused by interactions with a user interface. For example, an event may be generated when a timer expires, a counter exceeds a value, a software or hardware failure occurs, or an operation is completed. You are free to define events that are appropriate for your application.

Event Sources

A*source* is an object that generates an event. This occurs when the internal state of that object changes in some way. Sources may generate more than one type of event.

A source must register listeners in order for the listeners to receive notifications about a specific type of event. Each type of event has its own registration method. Here is the general form:

public void add*Type*Listener(*Type*Listener *el*)

Here, *Type* is the name of the event, and *el* is a reference to the event listener. For example, the method that registers a keyboard event listener is called **addKeyListener( )**. The method that

registers a mouse motion listener is called **addMouseMotionListener( )**. When an event occurs, all registered listeners are notified and receive a copy of the event object. This is known as *multicasting* the event. In all cases, notifications are sent only to listeners that register to receive them.

Event Listeners

A *listener* is an object that is notified when an event occurs. It has two major requirements. First, it must have been registered with one or more sources to receive notifications about specific types of events. Second, it must implement methods to receive and process these notifications.

The methods that receive and process events are defined in a set of interfaces found in **java.awt.event**. For example, the **MouseMotionListener** interface defines two methods to receive notifications when the mouse is dragged or moved. Any object may receive and process one or both of these events if it provides an implementation of this interface.

Event Classes

At the root of the Java event class hierarchy is **EventObject**, which is in **java.util**. It is the superclass for all events. Its one constructor is shown here:

EventObject(Object *src*)
Here, *src* is the object that generates this event. **EventObject** contains two methods:
getSource( ) and **toString( )**.

The **getSource( )** method returns the source of the event. Its general form is shown here:
Object getSource( ) As expected, **toString( )** returns the string equivalent of the event.

The class **AWTEvent**, defined within the **java.awt** package, is a subclass of **EventObject**. It is the superclass (either directly or indirectly) of all AWT-based events used by the delegation event model. Its **getID( )** method can be used to determine the type of the event. The signature of this method is shown here:

int getID( )

Additional details about **AWTEvent** are provided at the end of Chapter 24. At this point, it is important to know only that all of the other classes discussed in this section are subclasses of **AWTEvent**.

To summarize:
• **EventObject** is a superclass of all events.
• **AWTEvent** is a superclass of all AWT events that are handled by the delegation event model.

The package **java.awt.event** defines many types of events that are generated by various user

interface elements.

Action Event Class

An **ActionEvent** is generated when a button is pressed, a list item is double-clicked, or a menu item is selected. The **ActionEvent** class defines four integer constants that can be used to identify any modifiers associated with an action event: **ALT_MASK**, **CTRL_MASK**, **META_MASK**, and **SHIFT_MASK**. In addition, there is an integer constant, **ACTION_ PERFORMED**, which can be used to identify action events.

ActionEvent has these three constructors:

ActionEvent(Object *src*, int *type*, String *cmd*)
ActionEvent(Object *src*, int *type*, String *cmd*, int *modifiers*)
ActionEvent(Object *src*, int *type*, String *cmd*, long *when*, int *modifiers*)

Here, *src* is a reference to the object that generated this event. The type of the event is specified by *type,* and its command string is *cmd.* The argument *modifiers* indicates which modifier keys (ALT, CTRL, META, and/or SHIFT) were pressed when the event was generated. The *when* parameter specifies when the event occurred.

You can obtain the command name for the invoking **ActionEvent** object by using the **getActionCommand( )** method, shown here:

String getActionCommand( )

For example, when a button is pressed, an action event is generated that has a command name equal to the label on that button.

The **getModifiers( )** method returns a value that indicates which modifier keys (ALT, CTRL, META, and/or SHIFT) were pressed when the event was generated. Its form is shown here:

int getModifiers( )

The AdjustmentEvent Class
An **AdjustmentEvent** is generated by a scroll bar. There are five types of adjustment events. The **AdjustmentEvent** class defines integer constants that can be used to identify them. The constants and their meanings are shown here:

BLOCK_DECREMENT	The user clicked inside the scroll bar to decrease its value.
BLOCK_INCREMENT	The user clicked inside the scroll bar to increase its value.
TRACK	The slider was dragged.
UNIT_DECREMENT	The button at the end of the scroll bar was clicked to decrease its value.
UNIT_INCREMENT	The button at the end of the scroll bar was clicked to increase its value.

In addition, there is an integer constant, **ADJUSTMENT_VALUE_CHANGED**, that indicates that a change has occurred.

Here is one **AdjustmentEvent** constructor:

AdjustmentEvent(Adjustable *src*, int *id*, int *type*, int *data*)

Here, *src* is a reference to the object that generated this event. The *id* specifies the event. The type of the adjustment is specified by *type,* and its associated data is *data.* The **getAdjustable( )** method returns the object that generated the event. Its form is
shown here:

Adjustable getAdjustable( )

The type of the adjustment event may be obtained by the **getAdjustmentType( )** method. It returns one of the constants defined by **AdjustmentEvent**. The general form is shown here:

int getAdjustmentType( )

The amount of the adjustment can be obtained from the **getValue( )** method, shown here:

int getValue( )

For example, when a scroll bar is manipulated, this method returns the value represented by that change.

The ContainerEvent Class

A **ContainerEvent** is generated when a component is added to or removed from a container. There are two types of container events. The **ContainerEvent** class defines **int** constants that can be used to identify them: **COMPONENT_ADDED** and **COMPONENT_REMOVED**.
They indicate that a component has been added to or removed from the container.

ContainerEvent is a subclass of **ComponentEvent** and has this constructor:
ContainerEvent(Component *src*, int *type*, Component *comp*)
Here, *src* is a reference to the container that generated this event. The type of the event is specified by *type,* and the component that has been added to or removed from the container is

comp.
You can obtain a reference to the container that generated this event by using the **getContainer( )** method, shown here:

Container getContainer( )
The **getChild( )** method returns a reference to the component that was added to or removed from the container. Its general form is shown here:

Component getChild( )

The FocusEvent Class
A**FocusEvent** is generated when a component gains or loses input focus. These events are identified by the integer constants **FOCUS_GAINED** and **FOCUS_LOST**.

FocusEvent is a subclass of **ComponentEvent** and has these constructors:
FocusEvent(Component *src*, int *type*)
FocusEvent(Component *src*, int *type*, boolean *temporaryFlag*)
FocusEvent(Component *src*, int *type*, boolean *temporaryFlag*, Component *other*)

Here, *src* is a reference to the component that generated this event. The type of the event is specified by *type.* The argument *temporaryFlag* is set to **true** if the focus event is temporary. Otherwise, it is set to **false**. (A temporary focus event occurs as a result of another user interface operation. For example, assume that the focus is in a text field. If the user moves the mouse to adjust a scroll bar, the focus is temporarily lost.)

The other component involved in the focus change, called the *opposite component,* is passed in *other.* Therefore, if a **FOCUS_GAINED** event occurred, *other* will refer to the component that lost focus. Conversely, if a **FOCUS_LOST** event occurred, *other* will refer to the component that gains focus.

You can determine the other component by calling **getOppositeComponent( )**, shown here:

Component getOppositeComponent( )
The opposite component is returned.

The **isTemporary( )** method indicates if this focus change is temporary. Its form is shown here:

boolean isTemporary( )

The method returns **true** if the change is temporary. Otherwise, it returns **false**.

The InputEvent Class
The abstract class **InputEvent** is a subclass of **ComponentEvent** and is the superclass for

component input events. Its subclasses are **KeyEvent** and **MouseEvent**.

InputEvent defines several integer constants that represent any modifiers, such as the control key being pressed, that might be associated with the event. Originally, the **InputEvent** class defined the following eight values to represent the modifiers:

ALT_MASK BUTTON2_MASK META_MASK
ALT_GRAPH_MASK BUTTON3_MASK SHIFT_MASK
BUTTON1_MASK CTRL_MASK

However, because of possible conflicts between the modifiers used by keyboard events and mouse events, and other issues, the following extended modifier values were added:
ALT_DOWN_MASK BUTTON2_DOWN_MASK META_DOWN_MASK
ALT_GRAPH_DOWN_MASK BUTTON3_DOWN_MASK SHIFT_DOWN_MASK
BUTTON1_DOWN_MASK CTRL_DOWN_MASK

When writing new code, it is recommended that you use the new, extended modifiers rather than the original modifiers. To test if a modifier was pressed at the time an event is generated, use the **isAltDown( )**, **isAltGraphDown( )**, **isControlDown( )**, **isMetaDown( )**, and **isShiftDown( )** methods. The forms of these methods are shown here:

boolean isAltDown( )
boolean isAltGraphDown( )
boolean isControlDown( )
boolean isMetaDown( )
boolean isShiftDown( )

You can obtain a value that contains all of the original modifier flags by calling the **getModifiers( )** method. It is shown here:

int getModifiers( )

You can obtain the extended modifiers by calling **getModifiersEx( )**, which is shown here:

int getModifiersEx( )

The ItemEvent Class
An **ItemEvent** is generated when a check box or a list item is clicked or when a checkable menu item is selected or deselected. (Check boxes and list boxes are described later in this book.) There are two types of item events, which are identified by the following integer constants:

DESELECTED The user deselected an item.
SELECTED The user selected an item.

In addition, **ItemEvent** defines one integer constant, **ITEM_STATE_CHANGED**, that signifies a change of state.

ItemEvent has this constructor:
ItemEvent(ItemSelectable *src*, int *type*, Object *entry*, int *state*)

Here, *src* is a reference to the component that generated this event. For example, this might be a list or choice element. The type of the event is specified by *type.* The specific item that generated the item event is passed in *entry.* The current state of that item is in *state.* The **getItem( )** method can be used to obtain a reference to the item that generated an event. Its signature is shown here:
Object getItem( )

The **getItemSelectable( )** method can be used to obtain a reference to the **ItemSelectable** object that generated an event. Its general form is shown here:
ItemSelectable getItemSelectable( )
Lists and choices are examples of user interface elements that implement the **ItemSelectable** interface.

The **getStateChange( )** method returns the state change (that is, **SELECTED** or **DESELECTED**) for the event. It is shown here:

int getStateChange( )

The KeyEvent Class
A **KeyEvent** is generated when keyboard input occurs. There are three types of key events, which are identified by these integer constants: **KEY_PRESSED**, **KEY_RELEASED**, and **KEY_TYPED**. The first two events are generated when any key is pressed or released. The last event occurs only when a character is generated. Remember, not all keypresses result in characters. For example, pressing SHIFT does not generate a character.

There are many other integer constants that are defined by **KeyEvent**. For example, **VK_0** through **VK_9** and **VK_A** through **VK_Z** define the ASCII equivalents of the numbers and letters. Here are some others:

VK_ALT VK_DOWN VK_LEFT VK_RIGHT
VK_CANCEL VK_ENTER VK_PAGE_DOWN VK_SHIFT
VK_CONTROL VK_ESCAPE VK_PAGE_UP VK_UP

The **VK** constants specify *virtual key codes* and are independent of any modifiers, such as control, shift, or alt.

KeyEvent is a subclass of **InputEvent**. Here is one of its constructors:
KeyEvent(Component *src*, int *type*, long *when*, int *modifiers*, int *code*, char *ch*)

Here, *src* is a reference to the component that generated the event. The type of the event is specified by *type.* The system time at which the key was pressed is passed in *when.* The *modifiers* argument indicates which modifiers were pressed when this key event occurred. The virtual key code, such as **VK_UP**, **VK_A**, and so forth, is passed in *code.* The character equivalent (if one exists) is passed in *ch.* If no valid character exists, then *ch* contains

CHAR_UNDEFINED.

For **KEY_TYPED** events, *code* will contain **VK_UNDEFINED**.
The **KeyEvent** class defines several methods, but the most commonly used ones are **getKeyChar( )**, which returns the character that was entered, and **getKeyCode( )**, which returns the key code. Their general forms are shown here:
char getKeyChar( )
int getKeyCode( )

If no valid character is available, then **getKeyChar( )** returns **CHAR_UNDEFINED**. When a **KEY_TYPED** event occurs, **getKeyCode( )** returns **VK_UNDEFINED**.

The MouseEvent Class
There are eight types of mouse events. The **MouseEvent** class defines the following integer constants that can be used to identify them:
MOUSE_CLICKED The user clicked the mouse.
MOUSE_DRAGGED The user dragged the mouse.
MOUSE_ENTERED The mouse entered a component.
MOUSE_EXITED The mouse exited from a component.
MOUSE_MOVED The mouse moved.
MOUSE_PRESSED The mouse was pressed.
MOUSE_RELEASED The mouse was released.
MOUSE_WHEEL The mouse wheel was moved.

MouseEvent is a subclass of **InputEvent**. Here is one of its constructors:

MouseEvent(Component *src*, int *type*, long *when*, int *modifiers*,
int *x*, int *y*, int *clicks*, boolean *triggersPopup*)

Here, *src* is a reference to the component that generated the event. The type of the event is specified by *type.* The system time at which the mouse event occurred is passed in *when.* The *modifiers* argument indicates which modifiers were pressed when a mouse event occurred. The coordinates of the mouse are passed in *x* and *y.* The click count is passed in *clicks.* The *triggersPopup* flag indicates if this event causes a pop-up menu to appear on this platform. Two commonly used methods in this class are **getX( )** and **getY( )**. These return the X and Y coordinates of the mouse within the component when the event occurred. Their forms are

shown here:

int getX( )
int getY( )

Alternatively, you can use the **getPoint( )** method to obtain the coordinates of the mouse. It is shown here:

Point getPoint( )
It returns a **Point** object that contains the X,Y coordinates in its integer members: **x** and **y**. The **translatePoint( )** method changes the location of the event. Its form is shown here:

void translatePoint(int *x*, int *y*)
Here, the arguments *x* and *y* are added to the coordinates of the event.
The **getClickCount( )** method obtains the number of mouse clicks for this event.
Its signature is shown here:
int getClickCount( )
The **isPopupTrigger( )** method tests if this event causes a pop-up menu to appear on this platform. Its form is shown here:
boolean isPopupTrigger( )

Also available is the **getButton( )** method, shown here:
int getButton( )
It returns a value that represents the button that caused the event. The return value will be one of these constants defined by **MouseEvent**:

NOBUTTON BUTTON1 BUTTON2 BUTTON3

The **NOBUTTON** value indicates that no button was pressed or released.
Java SE 6 added three methods to **MouseEvent** that obtain the coordinates of the mouse relative to the screen rather than the component. They are shown here:

Point getLocationOnScreen( )
int getXOnScreen( )
int getYOnScreen( )

The **getLocationOnScreen( )** method returns a **Point** object that contains both the X and Y coordinate. The other two methods return the indicated coordinate.

The MouseWheelEvent Class

The **MouseWheelEvent** class encapsulates a mouse wheel event. It is a subclass of **MouseEvent**. Not all mice have wheels. If a mouse has a wheel, it is located between the left

and right buttons. Mouse wheels are used for scrolling. **MouseWheelEvent** defines these two integer constants:

WHEEL_BLOCK_SCROLL A page-up or page-down scroll event occurred.
WHEEL_UNIT_SCROLL A line-up or line-down scroll event occurred.

Here is one of the constructors defined by **MouseWheelEvent**:
MouseWheelEvent(Component *src*, int *type*, long *when*, int *modifiers*,
int *x*, int *y*, int *clicks*, boolean *triggersPopup*,
int *scrollHow*, int *amount*, int *count*)

Here, *src* is a reference to the object that generated the event. The type of the event is specified by *type.* The system time at which the mouse event occurred is passed in *when.* The *modifiers* argument indicates which modifiers were pressed when the event occurred. The coordinates of the mouse are passed in *x* and *y.* The number of clicks the wheel has rotated is passed in *clicks.* The *triggersPopup* flag indicates if this event causes a pop-up menu to appear on this platform. The *scrollHow* value must be either **WHEEL_UNIT_SCROLL** or **WHEEL_BLOCK_ SCROLL**. The number of units to scroll is passed in *amount.* The *count* parameter indicates the number of rotational units that the wheel moved.

MouseWheelEvent defines methods that give you access to the wheel event. To obtain the number of rotational units, call **getWheelRotation( )**, shown here:

int getWheelRotation( )
It returns the number of rotational units. If the value is positive, the wheel moved counterclockwise. If the value is negative, the wheel moved clockwise.

To obtain the type of scroll, call **getScrollType( )**, shown next:
int getScrollType( )

It returns either **WHEEL_UNIT_SCROLL** or **WHEEL_BLOCK_SCROLL**.
If the scroll type is **WHEEL_UNIT_SCROLL**, you can obtain the number of units to scroll by calling **getScrollAmount( )**. It is shown here:

int getScrollAmount( )

The TextEvent Class
Instances of this class describe text events. These are generated by text fields and text areas when characters are entered by a user or program. **TextEvent** defines the integer constant **TEXT_VALUE_CHANGED**.

The one constructor for this class is shown here:

TextEvent(Object *src*, int *type*)

Here, *src* is a reference to the object that generated this event. The type of the event is specified by *type.*

The **TextEvent** object does not include the characters currently in the text component that generated the event. Instead, your program must use other methods associated with the text component to retrieve that information. This operation differs from other event objects discussed in this section. For this reason, no methods are discussed here for the **TextEvent** class. Think of a text event notification as a signal to a listener that it should retrieve information from a specific text component.

The WindowEvent Class

There are ten types of window events. The**WindowEvent** class defines integer constants that can be used to identify them. The constants and their meanings are shown here:

WINDOW_ACTIVATED The window was activated.
WINDOW_CLOSED The window has been closed.
WINDOW_CLOSING The user requested that the window be closed.
WINDOW_DEACTIVATED The window was deactivated.
WINDOW_DEICONIFIED The window was deiconified.
WINDOW_GAINED_FOCUS The window gained input focus.
WINDOW_ICONIFIED The window was iconified.
WINDOW_LOST_FOCUS The window lost input focus.
WINDOW_OPENED The window was opened.
WINDOW_STATE_CHANGED The state of the window changed.

WindowEvent is a subclass of **ComponentEvent**. It defines several constructors. The first is

WindowEvent(Window *src*, int *type*)
Here, *src* is a reference to the object that generated this event. The type of the event is *type*.
The next three constructors offer more detailed control:
WindowEvent(Window *src*, int *type*, Window *other*)
WindowEvent(Window *src*, int *type*, int *fromState*, int *toState*)
WindowEvent(Window *src*, int *type*, Window *other*, int *fromState*, int *toState*)
Here, *other* specifies the opposite window when a focus or activation event occurs. The *fromState* specifies the prior state of the window, and *toState* specifies the new state that the window will have when a window state change occurs.

A commonly used method in this class is **getWindow( )**. It returns the **Window** object

that generated the event. Its general form is shown here:
Window getWindow( )
WindowEvent also defines methods that return the opposite window (when a focus or activation event has occurred), the previous window state, and the current window state. These methods are shown here:
Window getOppositeWindow( )
int getOldState( )
int getNewState( )

S.NO	RGPV QUESTION	YEAR	MARKS
Q.1	What are the major components of event delegation model? Discuss with suitable example.	DEC 2014	7
Q.2	Explain the following with the help of small program. a) Form Layout b). Flow Layout c). Grid Layout	DEC 2014	7
Q.3	What are the following components of Deligation Event Model of Java? Explain with the help of Example. a). Event b). Event Source c). Event Listeners	DEC 2012	12
Q.4	What is Event? Explain different components of an Event	DEC 2010	8

References:

Book	Authr	Priority
Java Programming	Herbertt Schield	1
Java	E Balaguruswamy	2
Java	Khalid Mugal	3