Object Oriented Programming

Graphical User Interface

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Event Handling

Events and Event Handling

- An event is an action initiated by the user interacting with the program.
- Examples
  - Keyboard events –
  - Mouse events –
  - GUI events –

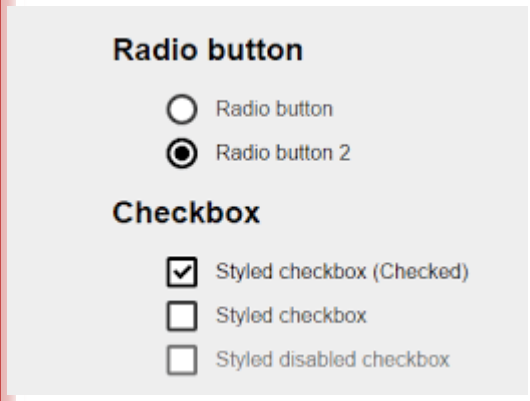
Event Handling is the mechanism that controls the **event** and decides what should happen if an **event** occurs

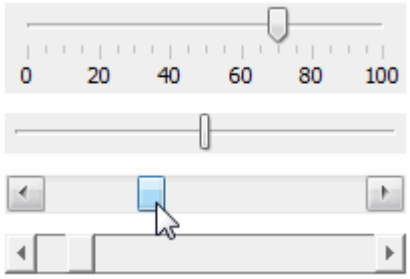
How Events are handled ?

- A **source generates** an Event and send it to **one or more listeners** registered with the source. Once event is received by the listener, they process the event and then return.
- Events are supported by a number of Java packages, like **java.util**, **java.awt** and **java.awt.event**.

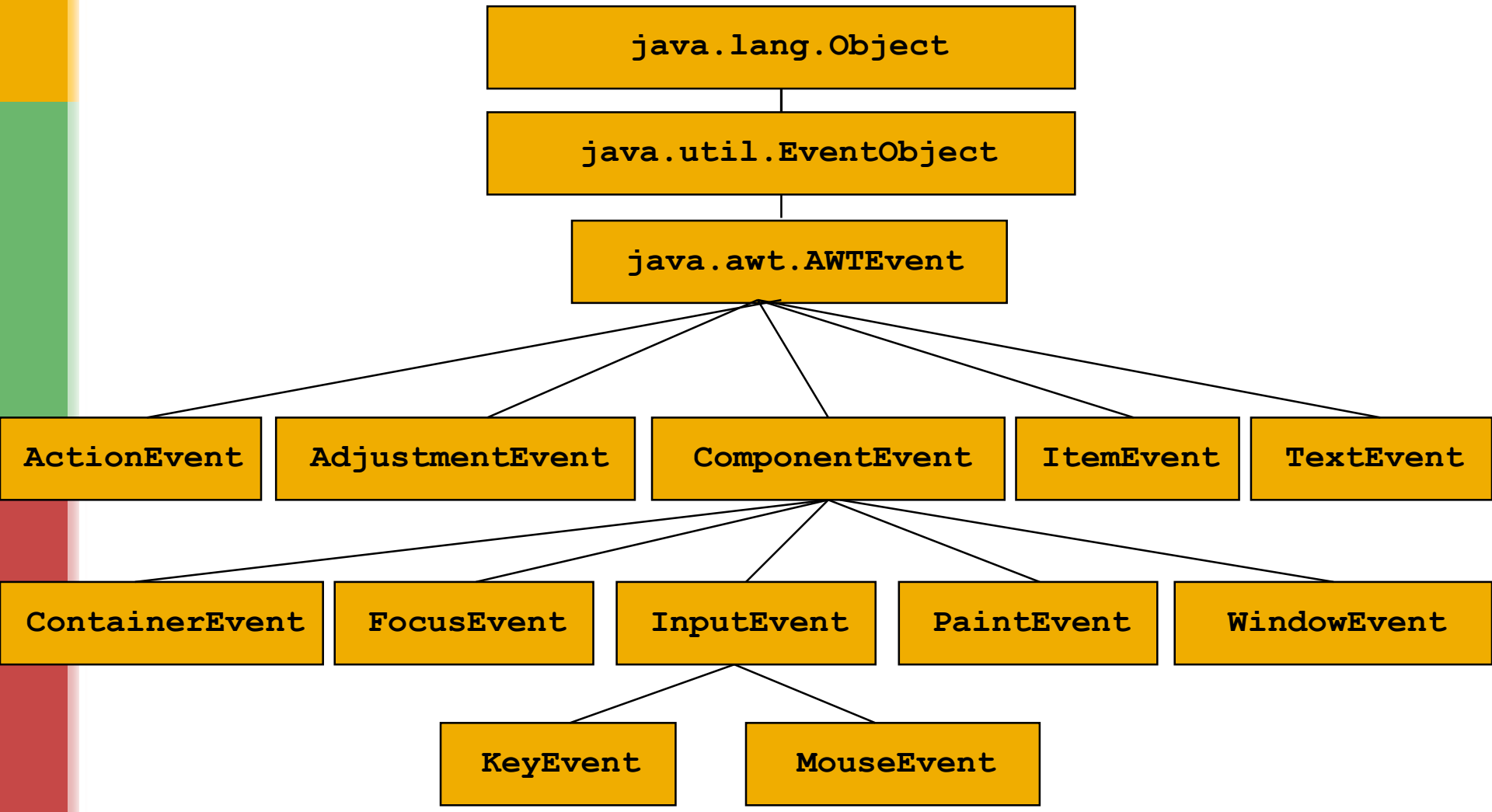
Event Sources

- The type of an event depends on its *source*
- Example of event sources:
  - the keyboard
  - the mouse
  - the GUI components – buttons, text fields, windows
- Event source is an object with the ability to determine when an event has occurred

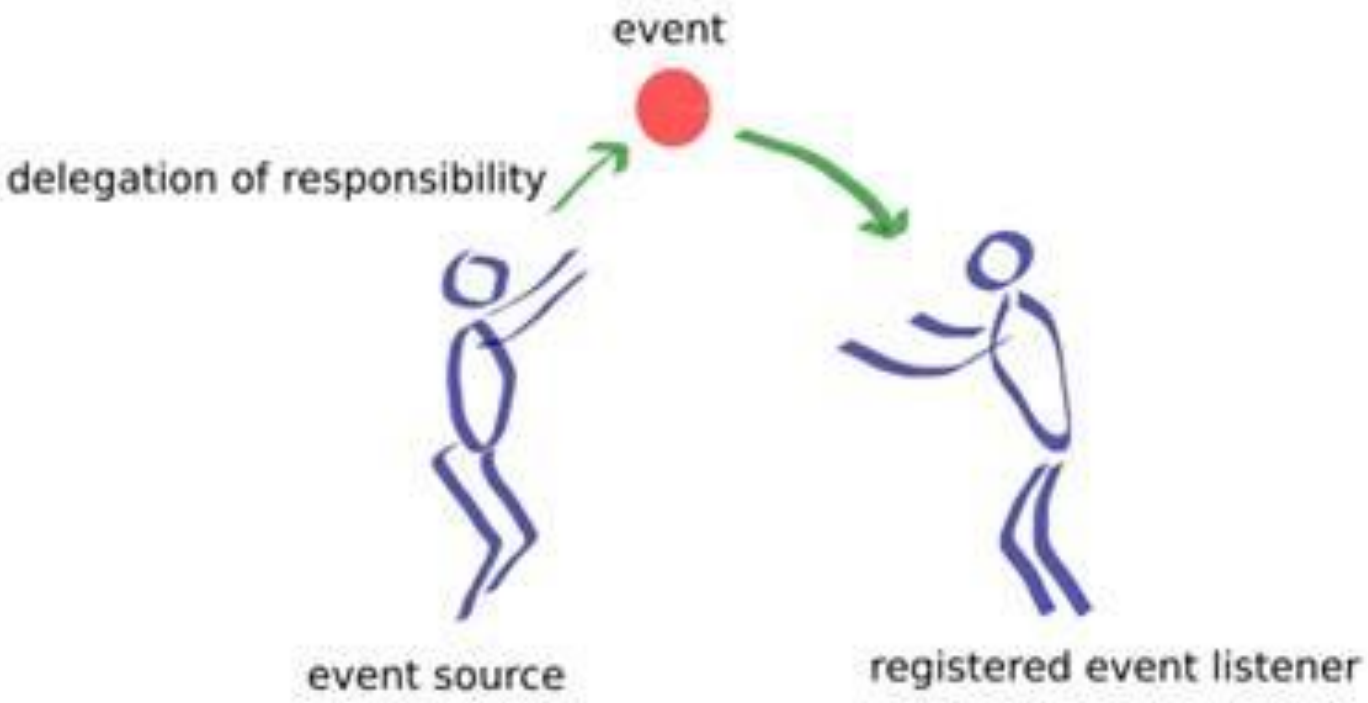




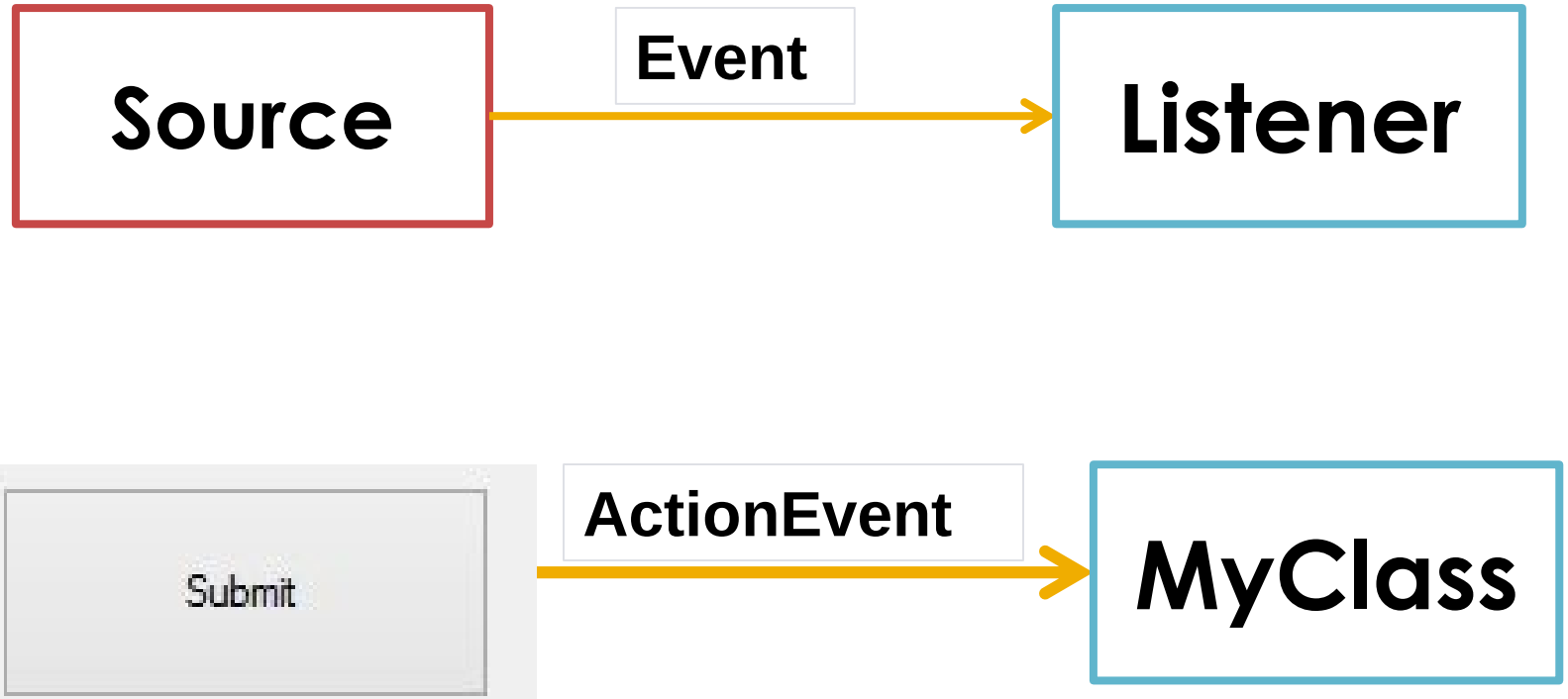
Event Hierarchy in Java

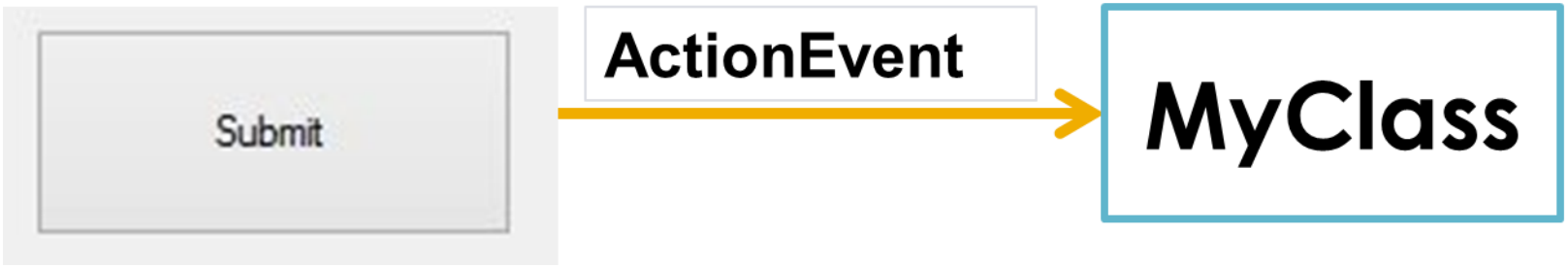


- https://docs.oracle.com/javase/tutorial/uiswing/events/eventsandcomponents.html


event
delegation of responsibility
event source
registered event listener

Delegation Event Model






```
Button b=new Button("Submit");

b.addActionListener(new MyClass());
```

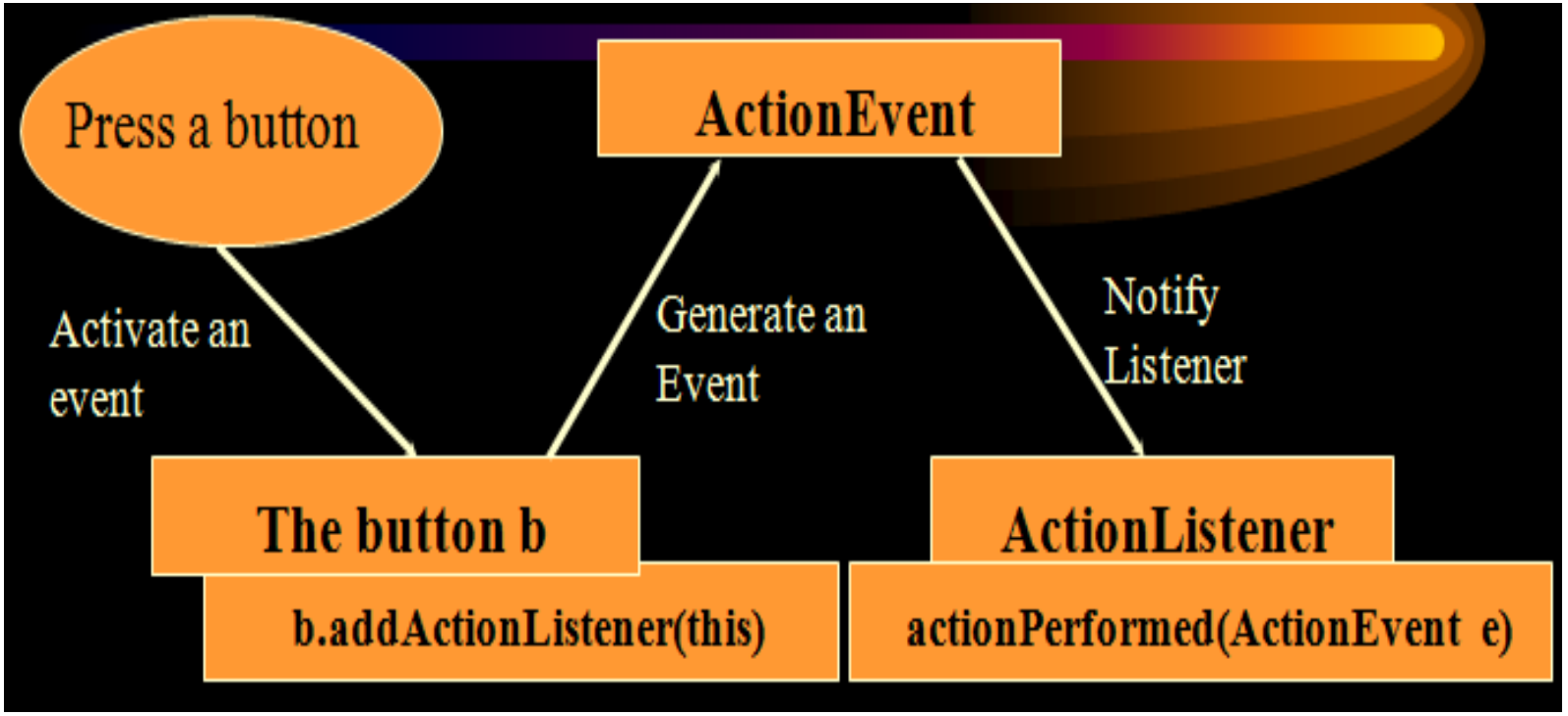
```
Class MyClass implements ActionListener{

Public void actionPerformed(ActionEvent e){
                    .
                    .
                    .
                    .
                    .


               }

}
```

Example


Press a button
ActionEvent
Activate an event
Generate an Event
Notify Listener
The button b
ActionListener
b.addActionListener(this)
actionPerformed(ActionEvent e)

EVENTS	SOURCE	LISTENERS
Action Event	Button, List,MenuItem,Text field	ActionListener
Component Event	Component	Component Listener
Focus Event	Component	FocusListener
Item Event	Checkbox,CheckboxMenuItem, Choice, List	ItemListener
Key Event	when input is received from keyboard	KeyListener
Text Event	Text Component	TextListener
Window Event	Window	WindowListener
Mouse Event	Mouse related event	MouseListener

Listener Interface	Listener Methods
ActionListener	actionPerformed(ActionEvent)
ComponentListener	1. componentHidden(ComponentEvent) 2. componentMoved(ComponentEvent) 3. componentResized(ComponentEvent) 4. componentShown(ComponentEvent)
ItemListener	itemStateChanged(ItemEvent)
KeyListener	1. keyPressed(KeyEvent) 2. keyReleased(KeyEvent) 3. keyTyped(KeyEvent)
MenuKeyListener	1. menuKeyPressed(MenuKeyEvent) 2. menuKeyReleased(MenuKeyEvent) 3. menuKeyTyped(MenuKeyEvent)
MenuListener	1. menuCanceled(MenuEvent) 2. menuDeselected(MenuEvent) 3. menuSelected(MenuEvent)

Control/action	Listener interface
Button click	ActionListener
Scroll Bar	AdjustmentListener
Slider	ChangeListener
Text Field focus	FocusListener
Check Box	ItemListener
Text entered	KeyListener
Mouse click	MouseListener
Mouse wheel	MouseWheelListener
Window closes	WindowListener

```
1.import java.awt.*;
2.import java.awt.event.*;
3.public class ButtonExample {
4.public static void main(String[] args) {
5.    Frame f=new Frame("Button Example");
6.    final TextField tf=new TextField();
7.    tf.setBounds(50,50, 150,20);
8.    Button b=new Button("Click Here");
9.    b.setBounds(50,100,60,30);
10.    b.addActionListener(new ActionListener(){
11.    public void actionPerformed(ActionEvent e){
12.            tf.setText("Welcome to Pakistan.");
13.        }
14.    });
15.    f.add(b);f.add(tf);
16.    f.setSize(400,400);
17.    f.setLayout(null);
18.    f.setVisible(true);
19.}
20.}
```


Welcome
click me

Your Turn

Perform small example for sources:

- Lists
- Choices
- Checkbox

By using ItemListener

Additional Study Helpful for Projects

Summary of Event Source

Event Source	Description
Button	Generates action events when the button is pressed.
Checkbox	Generates item events when the check box is selected or deselected.
Choice	Generates item events when the choice is changed.
List	Generates action events when an item is double-clicked; generates item events when an item is selected or deselected.
Menu Item	Generates action events when a menu item is selected; generates item events when a checkable menu item is selected or deselected.
Scrollbar	Generates adjustment events when the scroll bar is manipulated.
Text components	Generates text events when the user enters a character.
Window	Generates window events when a window is activated, closed, deactivated, deiconified, iconified, opened, or quit.

Summary of Listener Interfaces

Interface	Description
ActionListener	Defines one method to receive action events.
AdjustmentListener	Defines one method to receive adjustment events.
ComponentListener	Defines four methods to recognize when a component is hidden, moved, resized, or shown.
ContainerListener	Defines two methods to recognize when a component is added to or removed from a container.
FocusListener	Defines two methods to recognize when a component gains or loses keyboard focus.
ItemListener	Defines one method to recognize when the state of an item changes.
KeyListener	Defines three methods to recognize when a key is pressed, released, or typed.
MouseListener	Defines five methods to recognize when the mouse is clicked, enters a component, exits a component, is pressed, or is released.
MouseMotionListener	Defines two methods to recognize when the mouse is dragged or moved.
MouseWheelListener	Defines one method to recognize when the mouse wheel is moved. (Added by Java 2, version 1.4)
TextListener	Defines one method to recognize when a text value changes.
WindowFocusListener	Defines two methods to recognize when a window gains or loses input focus. (Added by Java 2, version 1.4)
WindowListener	Defines seven methods to recognize when a window is activated, closed, deactivated, deiconified, iconified, opened, or quit.

Listener Interface	Listener Methods
ActionListener	actionPerformed(ActionEvent)
ComponentListener	1. componentHidden(ComponentEvent) 2. componentMoved(ComponentEvent) 3. componentResized(ComponentEvent) 4. componentShown(ComponentEvent)
ItemListener	itemStateChanged(ItemEvent)
KeyListener	1. keyPressed(KeyEvent) 2. keyReleased(KeyEvent) 3. keyTyped(KeyEvent)
MenuKeyListener	1. menuKeyPressed(MenuKeyEvent) 2. menuKeyReleased(MenuKeyEvent) 3. menuKeyTyped(MenuKeyEvent)
MenuListener	1. menuCanceled(MenuEvent) 2. menuDeselected(MenuEvent) 3. menuSelected(MenuEvent)

https://docs.oracle.com/javase/tutorial/uiswing/events/api.html

Event Classes	Description	Listener Interface
ActionEvent	generated when button is pressed, menu-item is selected, list-item is double clicked	ActionListener
MouseEvent	generated when mouse is dragged, moved,clicked,pressed or released and also when it enters or exit a component	MouseListener
KeyEvent	generated when input is received from keyboard	KeyListener
ItemEvent	generated when check-box or list item is clicked	ItemListener
TextEvent	generated when value of textarea or textfield is changed	TextListener
MouseWheelEvent	generated when mouse wheel is moved	MouseWheelListener

WindowEvent	**generated when window is activated, deactivated, deiconified, iconified, opened or closed**	**WindowListener**
ComponentEvent	**generated when component is hidden, moved, resized or set visible**	**ComponentEventListener**
ContainerEvent	**generated when component is added or removed from container**	**ContainerListener**
AdjustmentEvent	**generated when scroll bar is manipulated**	**AdjustmentListener**
FocusEvent	**generated when component gains or loses keyboard focus**	**FocusListener**

Questions