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DES103 LAB08
Event-Driven Programming 1

Learning Objectives

- To learn how to define a listener
- To learn how to register an appropriate listener to the source
- To learn how to implement appropriate methods and their details for the specified listener to perform the assigned task.

Remark: A *pointer finger* (☞) refers to an explanation between students and their teaching assistants (TA).

8.1 Event-Driven Programming:

A program in which the code is executed upon activation of events.

8.2 Events

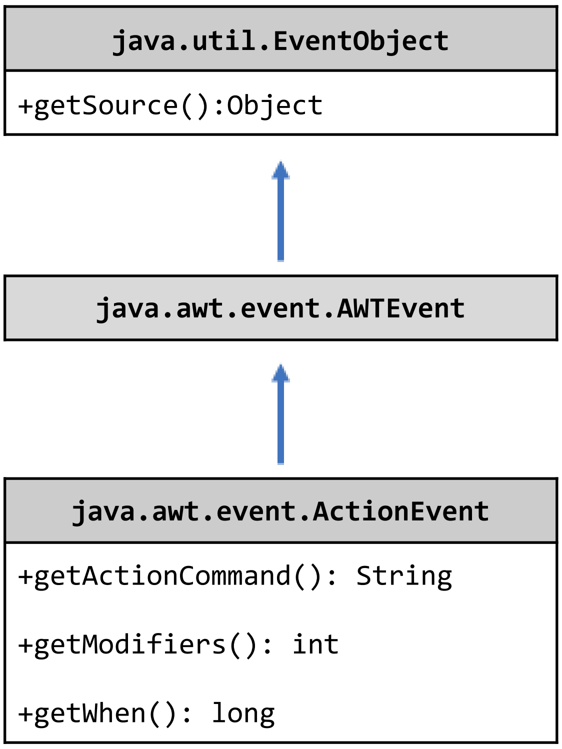
- An event can be defined as a type of signal to the program telling that something has happened.
- The event is generated by external user actions, such as mouse movements, mouse clicks, and
- keystrokes, or by the operating system, such as a timer.

8.3 Examples of sources and events

User actions	Source objects	Type of fired events
Click a button	`JButton`	`ActionEvent`
Click a checkbox	`JCheckBox`	`ItemEvent,` `ActionEvent`
Click a radio button	`JRadioButton`	`ItemEvent,` `ActionEvent`
Press return on a text field	`JTextField`	`ActionEvent`
Select a new item	`JComboBox`	`ItemEvent,` `ActionEvent`
Window opened, closed, etc.	`Window`	`WindowEvent`
Mouse pressed, released, dragged etc.	`Mouse`	`MouseEvent`
Key released, pressed, etc.	`Keyboard`	`KeyEvent`

8.4 EventObject

8.4.1 ActionEvent

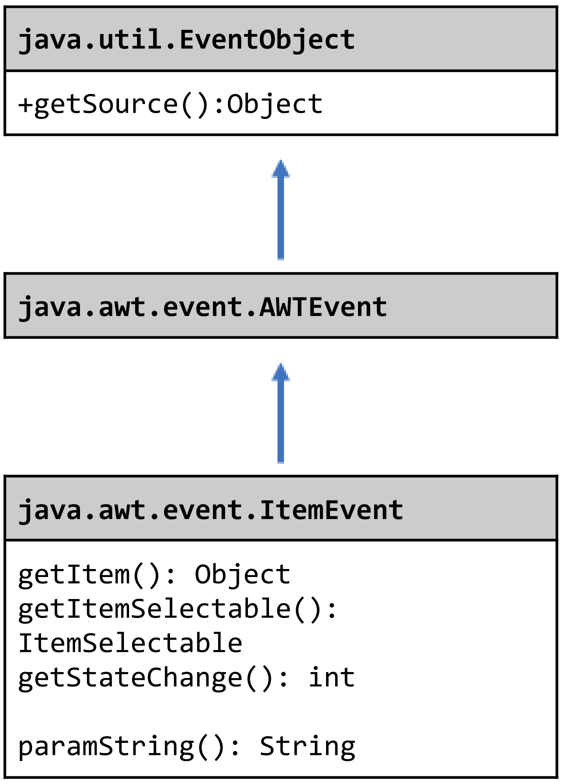


```
java.util.EventObject
+getSource():Object

java.awt.event.AWTEvent

java.awt.event.ActionEvent
+getActionCommand(): String
+getModifiers(): int
+getWhen(): long
```

- Returns the object on which the event initially occurred.

- Returns the *command* string associated with this action. For a button, its text is the command string.
- Returns the *modifier keys* held down during this action event.
- Returns the *timestamp* when this event occurred. The time is the number of milliseconds since January 1, 1970, 00:00:00GMT.

8.4.2 ItemEvent

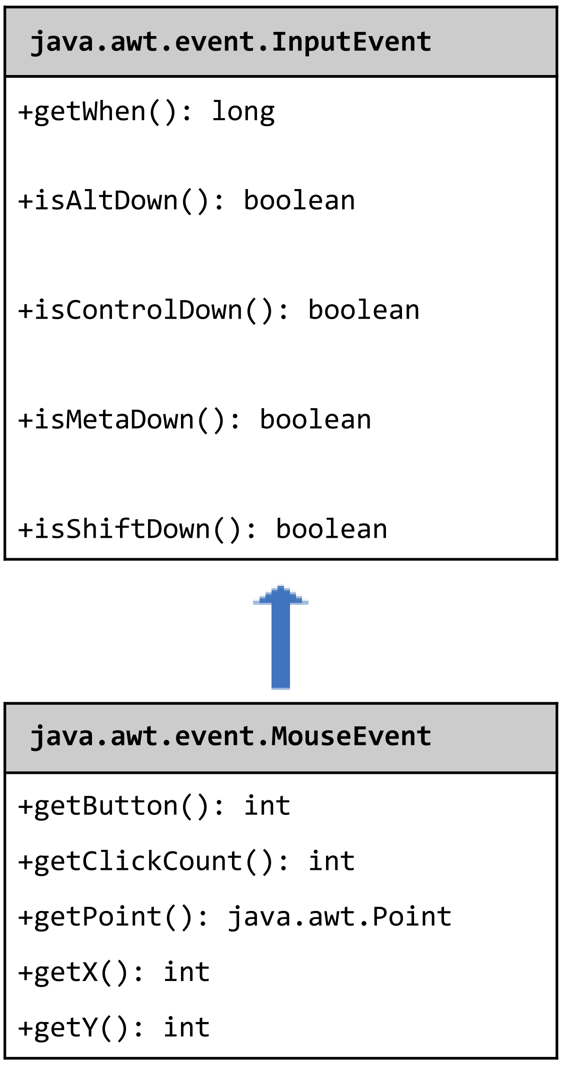


```
java.util.EventObject
+getSource():Object

java.awt.event.AWTEvent

java.awt.event.ItemEvent
getItem(): Object
getItemSelectable():
ItemSelectable
getStateChange(): int

paramString(): String
```

- Returns the object on which the event initially occurred.

- Returns the item affected by the event
- Returns the originator of the event
- Returns the type of state change (selected or deselected).
- Returns a parameter string identifying this item event.

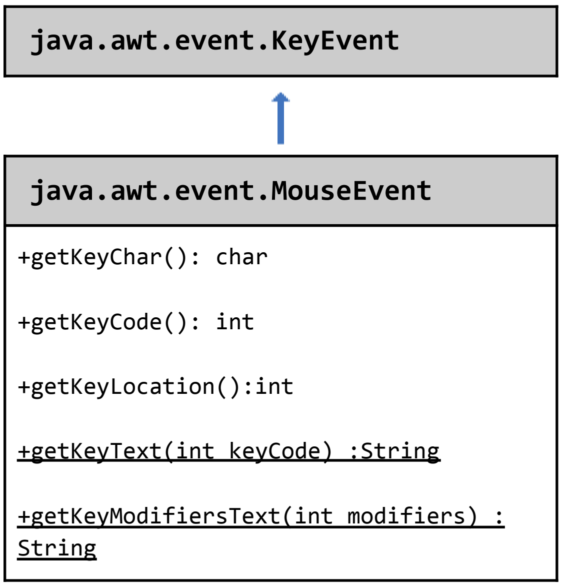
8.4.3 MouseEvent



- Returns the *timestamp* when this event occurred.
- Returns whether or not the *Alt modifier* is down on this event.
- Returns whether or not the *Control modifier* is down on this event.
- Returns whether or not the *Meta modifier* is down on this event
- Returns whether or not the *Shift modifier* is down on this event.

- Indicates which mouse button has been clicked.
- Returns the number of mouse clicks associated with this event.
- Returns a Point object containing the x and y coordinates.
- Returns the x-coordinate of the mouse pointer. Returns the y-coordinate of the mouse pointer.

8.4.3 MouseEvent

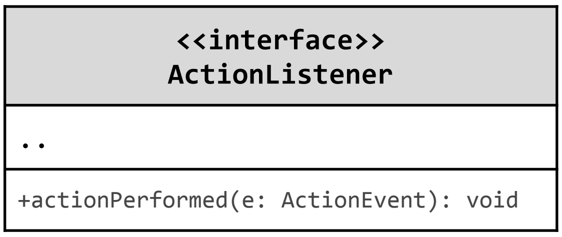

java.awt.event.KeyEvent
java.awt.event.MouseEvent
+getKeyChar(): char
+getKeyCode(): int
+getKeyLocation():int
+getKeyText(int keyCode) :String
+getKeyModifiersText(int modifiers) : String

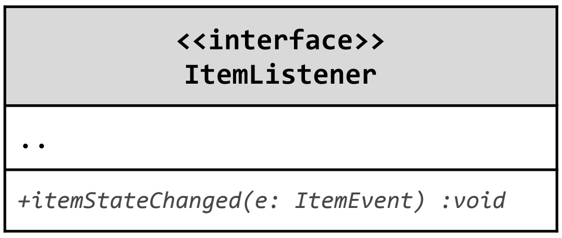
- Returns the character associated with the key in this event.
- Returns the integer keyCode associated with the key in this event.
- Returns the location of the key that originated this key event.
- Returns a String describing the keyCode, Ex., "HOME", "F1" or "A".
- Returns a String describing the modifier key(s), such as "Shift", or "Ctrl+Shift".

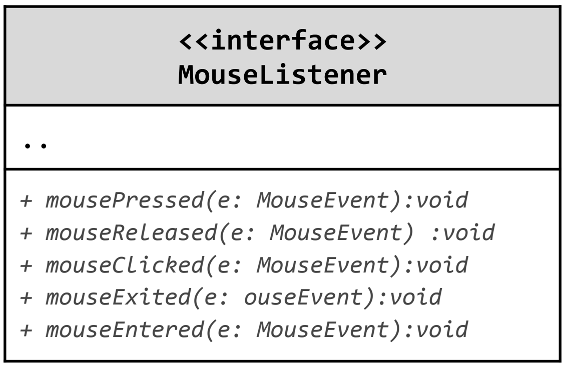
8.5 Interaction Between Source and Listener

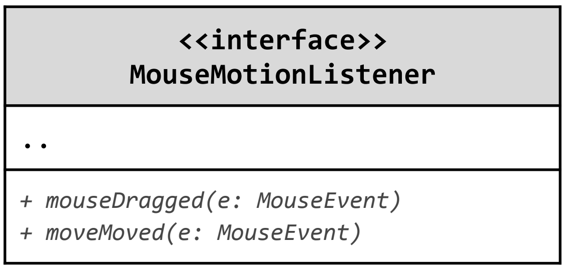
8.5.1 UML of Listener's Class

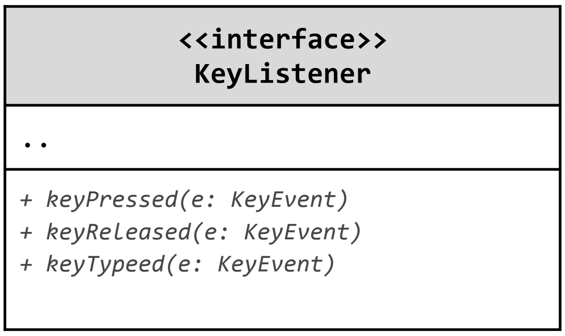
Listeners are defined as <<interface>>






<<interface>>
MouseListener
..
+ mousePressed(e: MouseEvent):void
+ mouseReleased(e: MouseEvent) :void
+ mouseClicked(e: MouseEvent):void
+ mouseExited(e: ouseEvent):void
+ mouseEntered(e: MouseEvent):void





8.5.2 Example: <object>.add<Listener>(this);

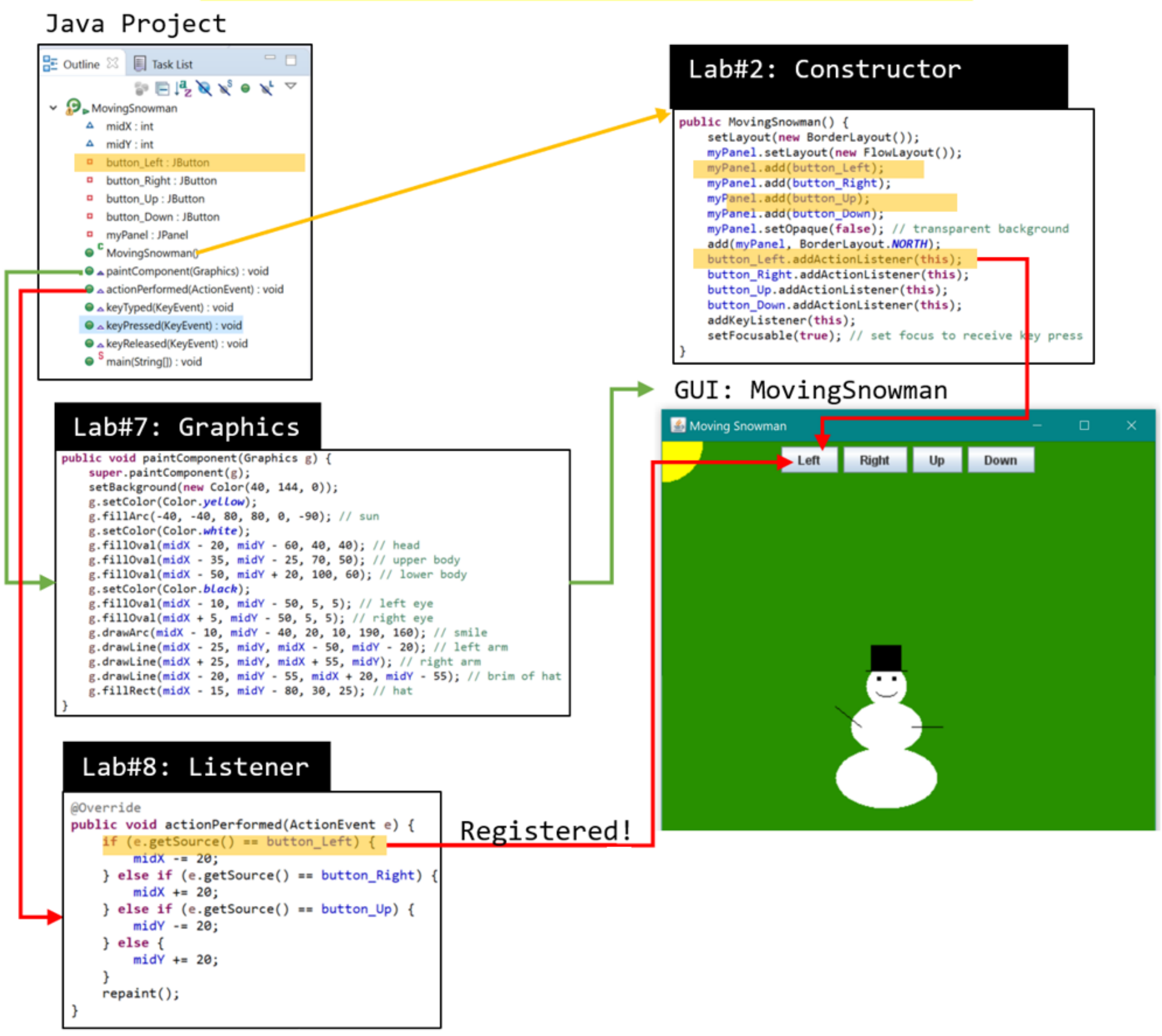
☞ To remember the type of your object and name, TA suggests defining your variables name as below format:

`<object>_<name>`

For example, `public JButton button_Left = new JButton("Left");`

☞ To explain your TA, student SHOULD try to understand the following example:

Example: `button_Left.addActionListener(this);`



```
MovingSnowman
    midX : int
    midY : int
    button_Left : JButton
    button_Right : JButton
    button_Up : JButton
    button_Down : JButton
    myPanel : JPanel
    MovingSnowman()
    paintComponent(Graphics) : void
    actionPerformed(ActionEvent) : void
    keyTyped(KeyEvent) : void
    keyPressed(KeyEvent) : void
    keyReleased(KeyEvent) : void
    main(String[]) : void
```

Lab#2: Constructor

```java
public MovingSnowman() {
    setLayout(new BorderLayout());
    myPanel.setLayout(new FlowLayout());
    myPanel.add(button_Left);
    myPanel.add(button_Right);
    myPanel.add(button_Up);
    myPanel.add(button_Down);
    myPanel.setOpaque(false); // transparent background
    add(myPanel, BorderLayout.NORTH);
    button_Left.addActionListener(this);
    button_Right.addActionListener(this);
    button_Up.addActionListener(this);
    button_Down.addActionListener(this);
    addKeyListener(this);
    setFocusable(true); // set focus to receive key press
}
```

Lab#7: Graphics

```java
public void paintComponent(Graphics g) {
    super.paintComponent(g);
    setBackground(new Color(40, 144, 0));
    g.setColor(Color.yellow);
    g.fillArc(-40, -40, 80, 80, 0, -90); // sun
    g.setColor(Color.white);
    g.fillOval(midX - 20, midY - 60, 40, 40); // head
    g.fillOval(midX - 35, midY - 25, 70, 50); // upper body
    g.fillOval(midX - 50, midY + 20, 100, 60); // lower body
    g.setColor(Color.black);
    g.fillOval(midX - 10, midY - 50, 5, 5); // left eye
    g.fillOval(midX + 5, midY - 50, 5, 5); // right eye
    g.drawArc(midX - 10, midY - 40, 20, 10, 190, 160); // smile
    g.drawLine(midX - 25, midY, midX - 50, midY - 20); // left arm
    g.drawLine(midX + 25, midY, midX + 55, midY); // right arm
    g.drawLine(midX - 20, midY - 55, midX + 20, midY - 55); // brim of hat
    g.fillRect(midX - 15, midY - 80, 30, 25); // hat
}
```

Lab#8: Listener

```java
@Override
public void actionPerformed(ActionEvent e) {
    if (e.getSource() == button_Left) {
        midX -= 20;
    } else if (e.getSource() == button_Right) {
        midX += 20;
    } else if (e.getSource() == button_Up) {
        midY -= 20;
    } else {
        midY += 20;
    }
    repaint();
}
```

LAB EXERCISES

Students should follow lab instructions and regulations. Students can ask their responsible TA to check the finished exercises and attach them to Google Classroom.

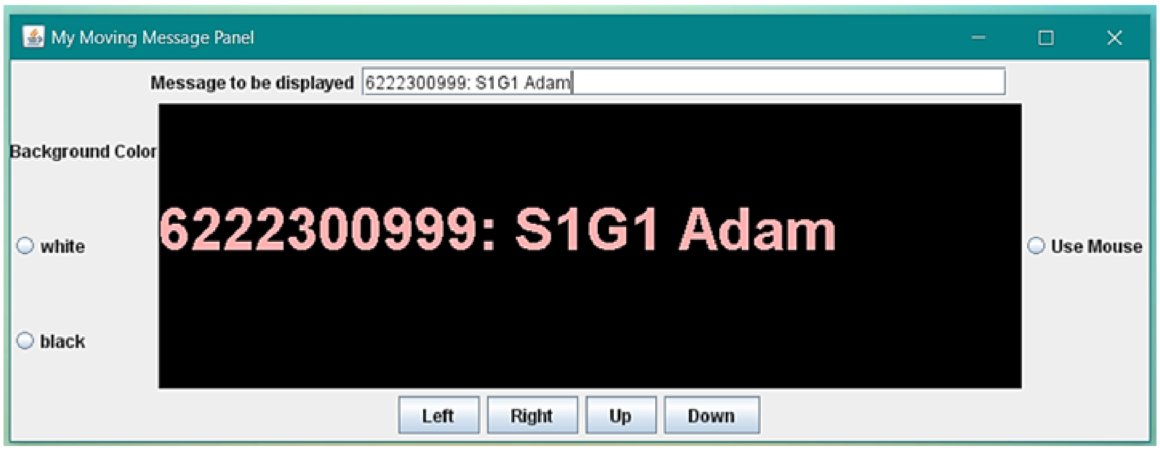
1. for all lab exercises, you need to define your *Java* project in the following name format:
   StudentID>_<Lab number>_<Exercise name>
   If your student's ID is 6422300208, the name format of your java project should be:
   6422300208_LAB08_ MovingMessagePanel for exercise 1,2,3,4 and 5

2. Before submitting the finished exercise, students MUST explain their understanding to your TA.
3. When your TA allows you to submit, students can attach your finished exercise to Google Class and click 'Turn-In'.

For today's exercises, students are going to:

- draw a panel of moving messages by using `paintComponent` and methods of a graphics object learned in class,
- register appropriate listeners for moving messages.

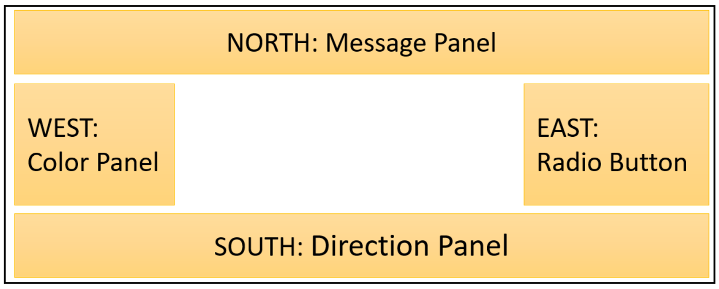
The final output should look like this:



Exercise 1: (*2 points*)

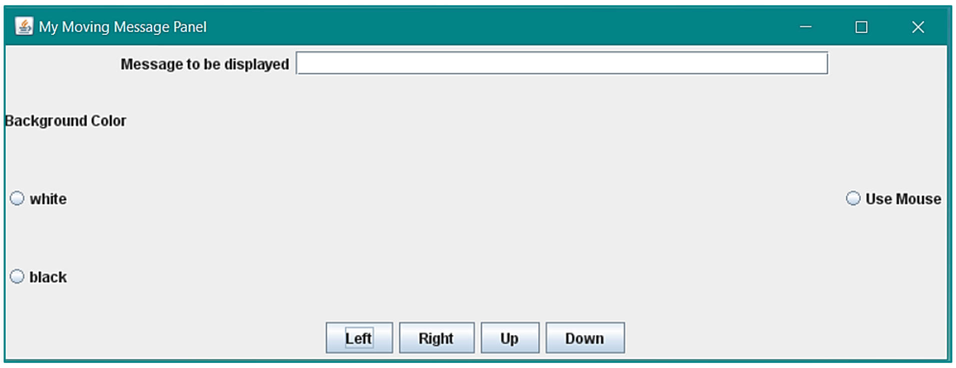
Java Project: <Student_ID>_ LAB08_MovingMessagePanel
Objective: To learn how to use `LayoutManagers` to arrange the components in the Container
Instruction: Write code in the following tasks.

a. Add a new java class `MovingMessagePanel` that makes the following GUI design.



Moving Message Panel

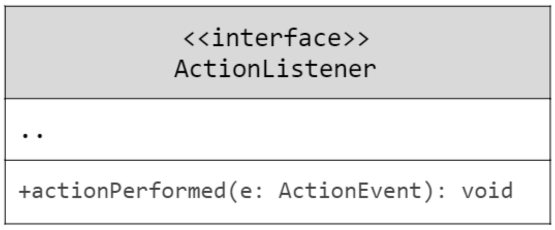
b. Add a new java class `MovingMessagePanelTesting,` and write a `main` method for a running output of the `MovingMessagePanel` GUI as shown below:



Exercise 2: (*2 points*)

Java Project: <Student_ID>_ LAB08_MovingMessagePanel
Objective: To learn how to register an appropriate listener to the source, and implement appropriate methods and their details for the specified listener to perform the assigned task.
Instruction: Write code in the following tasks.

a. Make the `MovingMessagePanel` class to be a subclass of the interface `ActionListener`.



b. Register the text field with itself, which acts as the `ActionListener` using an appropriate method.
c. Override the implementation details of the overridden method of `ActionListener`. Your program should get the text from the text field when the user writes a text into the text field box and hits enter.

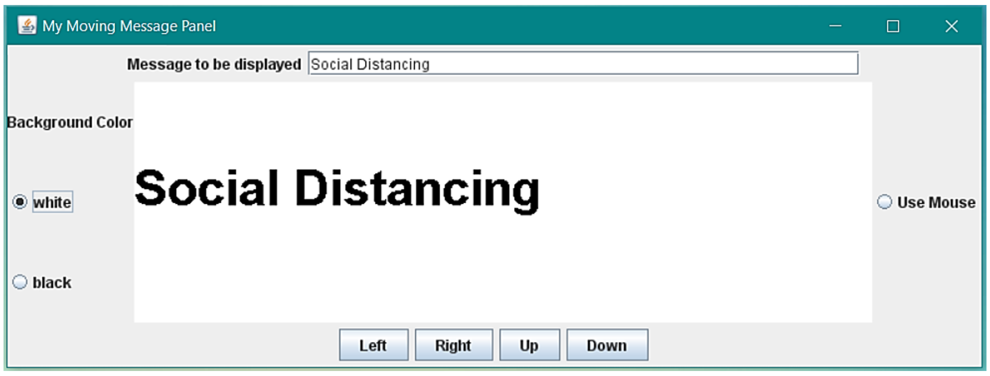
Exercise 3: (*2 points*)

Java Project: <Student_ID>_ LAB08_MovingMessagePanel
Objective: To learn how to register an appropriate listener to the source and implement appropriate methods and their details for the specified listener to perform the assigned task.
Instruction: Write code in the following tasks.

a. Make the `MovingMessagePanel` class also a subclass of the interface `ItemListener`

<<interface>>
ItemListener
..
+itemStateChanged(e: ItemEvent) :void

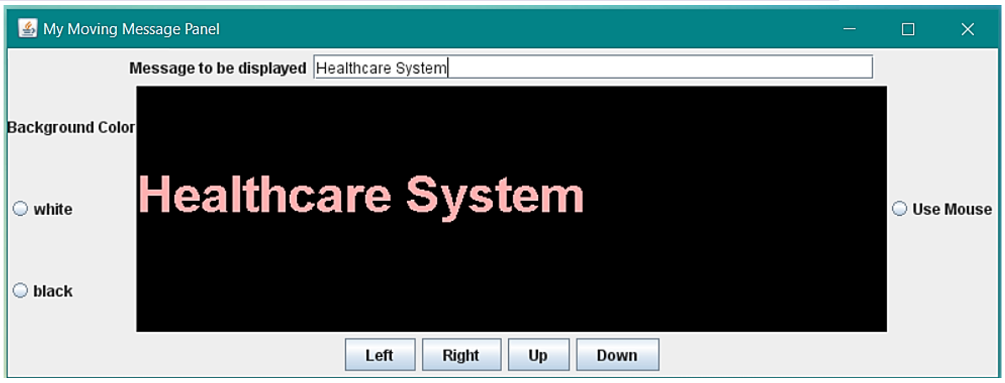
b. Register the black and white radio buttons with themselves, which acts as the `ItemListener` using an appropriate method.
c. Add in the implementation details of the overridden method of `ItemListener`.
d. When the white radio button is selected, your program should change the background of the display panel to `white` and set the font color to `black`.
☞ To check with TA, the student SHOULD show the following figure:



Message to be displayed: Social Distancing

Social Distancing

e. When the black radio button is selected, your program should change the background of the display panel to `black` and set the font color to `pink`.
☞ To check with TA, the student SHOULD show the following figure:



Message to be displayed: Healthcare System

Healthcare System

Exercise 4: (*2 points*)

Java Project: <Student_ID>_ LAB08_MovingMessagePanel
Objective: To learn how to register an appropriate listener to the source and implement appropriate methods and their details for the specified listener to perform the assigned task.
Suggestion: To define your variables name as below format:

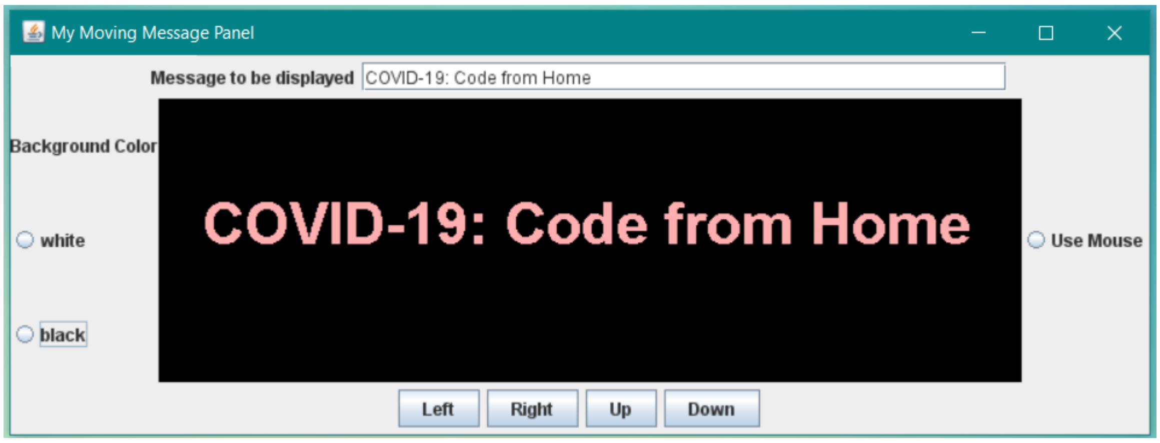
`<object>_<name>`

For example, public `JButton button_Left = new JButton("Left");`

Instruction: Write code in the following tasks that continue from Exercise 3,

a. Register the four `buttons`: `Left, Right, Up,` and `Down` with itself which acts as the `ActionListener` using an appropriate method.
b. Add in the implementation details of the overridden method of `ActionListener`.
c. Your program should move the message to 4 directions according to the corresponding directions from 4 buttons: `Left, Right, Up,` and `Down`.

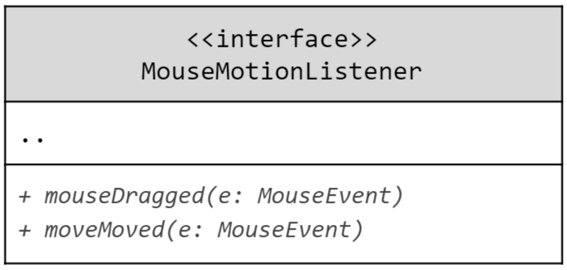
☞ To check with TA, the student SHOULD show the following figure:


My Moving Message Panel
Message to be displayed: COVID-19: Code from Home
Background Color
white
black
COVID-19: Code from Home
Use Mouse
Left
Right
Up
Down

Exercise 5: (*2 points*)

Java Project: <Student_ID>_ LAB08_MovingMessagePanel
Objective: To learn how to register an appropriate listener to the source and implement appropriate methods and their details for the specified listener to perform the assigned task.
Instruction: Write code in the following tasks that continue from Exercise 4.

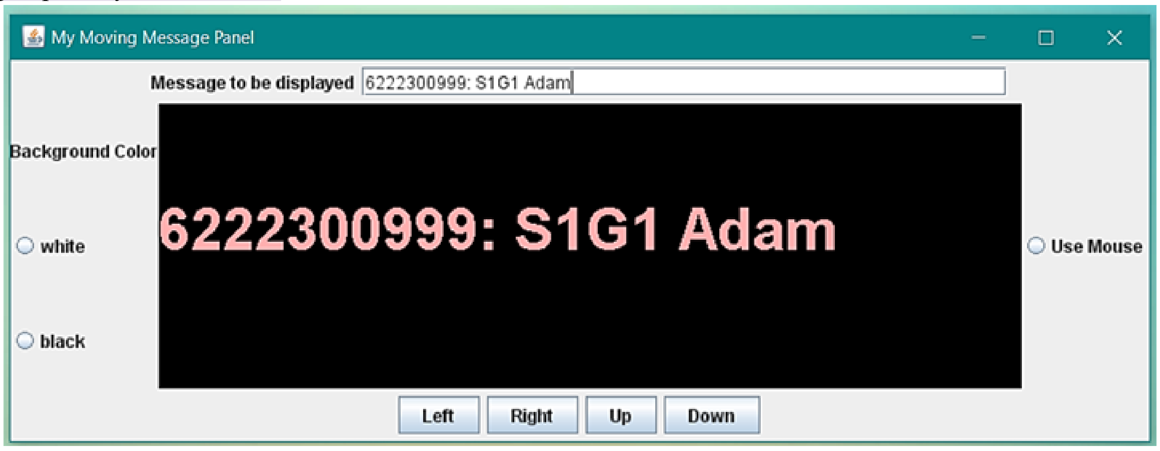
a. Make the `MovingMessagePanel` class also a subclass of the interface `MouseMotionListener`



```
<<interface>>
MouseMotionListener
..
+ mouseDragged(e: MouseEvent)
+ moveMoved(e: MouseEvent)
```

b. Register the display panel(itself) with itself, which acts as the `MouseMotionListener` using an appropriate method.
c. Add in the implementation details of the overridden method of `MouseMotionListener`. When the `use-mouse radio button` is selected and the user drags the mouse, your program should move the message to the location of the mouse.

☞ To check with TA, the student SHOULD show the following figure that displays student ID, section group, and your nickname:



My Moving Message Panel
Message to be displayed: 6222300999: S1G1 Adam
Background Color
6222300999: S1G1 Adam