

Lecture 3: Java Graphics

CS 62

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Generics

- Enable classes and interfaces to be parameters to classes, interfaces, and methods.
 - No need for casting
 - Stronger type check
- `class Name<T1, T2, ..., Tn> {...}`
 - T can be used anywhere within the class
 - T can be class or interface
- T → Type, E → Element (common for data structures), K → Key, V → Value, N → number
- See **Association** class in Bailey `structure5` library
 - `public class Association<K,V>`
 - `Association<String, Integer> phoneBook = new Association<String, Integer>();`

Random Number Generator

- class **Random** in **java.util** package w/ method
 - **int nextInt(int n)** -- returns random k s.t. $0 \leq k < n$
 - See bottom of pg 30 in text.
- Create **Random** object once:
 - **Random rng = new Random();**
- send **nextInt** many times:
 - **int r = rng.nextInt(10);**
 - Repeat this step, not the creation of a new object
- See **LottoHelper** example.

Text Input

- **Scanner** class

- Constructor: `myScanner = new Scanner(System.in);`
 - can use file instead of `System.in`
 - `new Scanner(new File("filename"))`
 - Can use delimiters other than whitespaces
 - `useDelimiter(String pattern)`
- Read values:
 - `myScanner.nextInt()` -- returns an `int`
 - `myScanner.nextDouble()` -- returns a `double`
 - `myScanner.nextLine()` -- returns `String` -- to end of line
 - see [documentation](#) for more

New Unit Overview

- Graphical User Interfaces (GUI)
 - Components, e.g., **JButton**, **JTextField**, **JSlider**, **JChooser**, ...
 - Containers, e.g., **JFrame** (window), **JPanel** (grouping)
 - Layout managers, e.g., **FlowLayout** and **BorderLayout**
- Graphics
 - Drawing items on the screen
- Events
 - Generated by mouse actions, button clicks etc.
 - Use **MouseListener**, **MouseMotionListener**, **ActionListener**, etc. to respond

Graphical User Interfaces (GUIs)

- **AWT** - The Abstract Windowing Toolkit is found in the package **java.awt**.
 - Heavyweight components.
 - Implemented with native code written for that particular computer.
 - The AWT library was written in six weeks!
- **Swing** - Java 1.2 extended AWT with the **javax.swing** package.
 - Lightweight components
 - Written in Java

JFrame

- `javax.swing.JFrame` inherits from `java.awt.Frame`
- The outermost container in an application.
- To display a window in Java:
 - create a class that extends **JFrame**
 - set the size
 - set the location
 - set it visible

```
import javax.swing.JFrame;
public class MyFirstGUI extends JFrame{
    public MyFirstGUI() {
        super("First Frame");
        setSize(500, 300);
        setLocation(100, 100);
        setVisible(true);
    }
    public static void main(String[] args) {
        MyFirstGUI mfgui = new MyFirstGUI();
    }
}
```



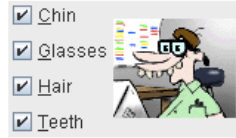
Closing a GUI

- The default operation of the quit button is to set the visibility to false
 - The program does not terminate!
- **setDefaultCloseOperation** can be used to control this behavior.
- `mfgui.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);`
 - Exits the application using `System.exit(0)`
- More options (hide, do nothing, etc).

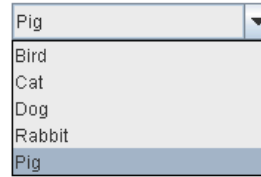
Basic Components



[JButton](#)



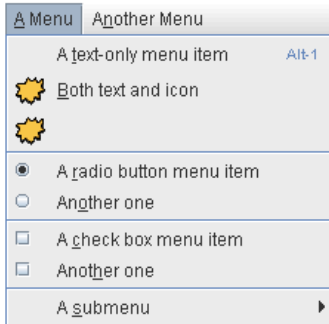
[JCheckBox](#)



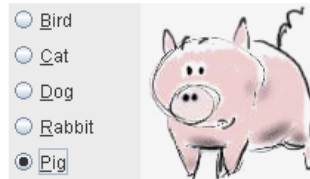
[JComboBox](#)



[JList](#)



[JMenu](#)



[JRadioButton](#)



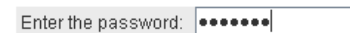
[JSlider](#)



[JSpinner](#)

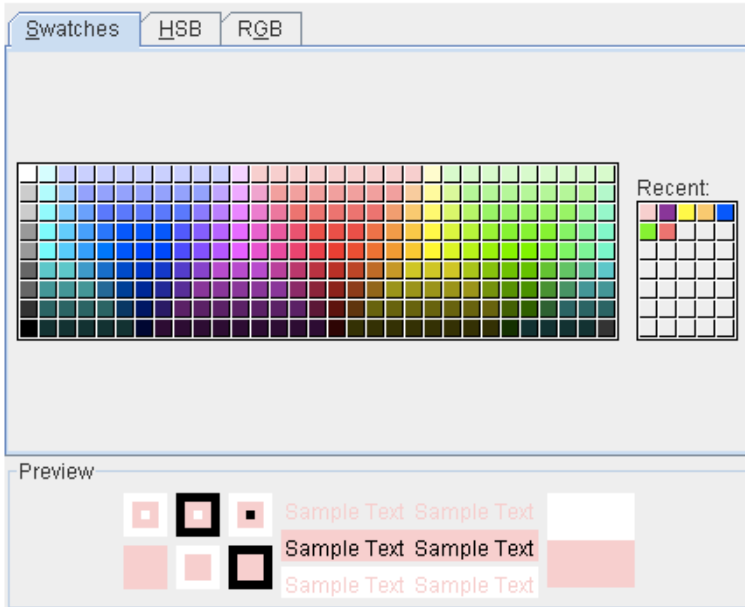


[JTextField](#)

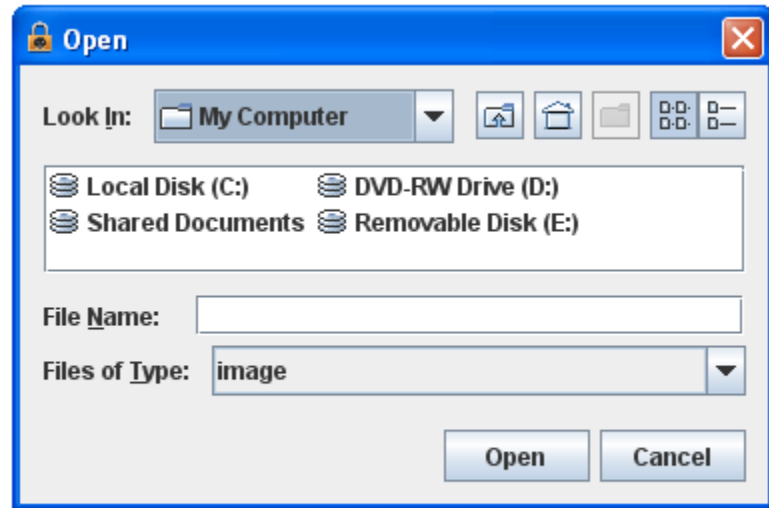


[JPasswordField](#)

Interactive Displays



[JColorChooser](#)



[JFileChooser](#)

Adding JComponents to JFrame

```
public class Demo extends JFrame{
    public Demo() {
        Container cp = getContentPane();
        cp.setLayout(new FlowLayout());
        cp.add(new JLabel("Demo"));
        cp.add(new JButton("Button"));
        //...
    }
}
```

```
public class Demo extends JFrame{
    public Demo() {
        JPanel mainPanel = new
            JPanel(new FlowLayout());
        myPanel.add(new JLabel("Demo"));
        myPanel.add(new JButton("Button"));
        setContentPane(myPanel);
        //...
    }
}
```

For more details

- See document on course web page associated with lecture.
- See GUI cheat sheet in documentation and handouts section.