RICHARD ROBINSON

JAVA I EXAM PREPARATION

Contents

GUIs

Widgets

There are several classes in the `java.swing.*` toolkit, with the syntax

```
JComponent component = new Widget(String); // adds Widget
```

where `Widget` is the name of the widget. Interacting with such cases an event object to be created, handled by creating a listener for specific events. Such listener must be registered per widget, each causing different events. Event listeners must implement the corresponding interface and methods. The main method for a GUI application is

```
ClassName frame = new ClassName();
frame.pack();
frame.setVisible(true);
```

The `JButton, JCheckBox, JComboBox, JRadioButton` classes fire `ActionEvent` event objects, implement the interface `ActionListener` , and registered with the `addActionListener` method. For all other classes, the `MouseEvent` events are fired, the `MouseListener` interface is implemented, and uses the `addMouseListener` method. Typically, the `app` calls the `frame` which in turn calls the `panel`.

Containers

The main `JFrame` class represents a GUI window with title bar, resizable border, and border buttons. Apps extend this class to customize it using

```
public class ClassName extends JFrame implements ActionListener
```

The `JPanel` class is used to arrange widgets, and can also contain other panels and can be used to draw custom shapes. The `paintComponent` method is called to redraw elements and can be overridden to create custom appearances; it is called by `repaint()`. The listeners are used as follows:

```
public void actionPerformed(ActionEvent e) {
    Object src = e.getSource();
    switch (source == case); // switch-case conditional
}
```

Layout Managers

There are several types of layout managers, including:

- `FlowLayout` is arranged linearly and flows to next line if needed. It is based on the preferred size.
- `BorderLayout` adds components using cardinal directions and ignores preferred size.
- `GridLayout` arranged components in a grid and ignores preferred size.
- `BoxLayout` is similar to `FlowLayout` with advanced options, and is preferred size.

A layout manager is used via a class which appears as follows:

```
JButton btn;
public ClassName() { super("LayoutName");
    btn = new JButton("label");
    btn.addActionListener(this);
    JPanel panel = new JPanel();
    panel.setLayout(new LayoutName());
    panel.add(btn, LayoutName.methodName);
}
```

Definitions

Aggregation

Aggregation represents a *has a* relationship between two classes. A class is an aggregate if it has an attribute of a non-primitive type. This works as given by:

```
public class ClassName {
    private CustomType var; // attributes
    public ClassName(Type var) { this.var = var; } // constructor
}

// using the class in Main
CustomType var = new CustomType(values);
ClassName name = new Classname(vars);
```

With this code, you can call the attributes of the class via `name.var`. The `this` reference replaces the generic variable in a class with a version specific to the variable that is called. It is used when the attributes share names with the constructor parameters so as to disambiguate; `this.par` references the attribute / field version of `par`, not the parameter version. That is,

```
ClassName(Type a) { x = a; }
```

is equivalent to

```
ClassName(Type x) { this.x = x; } // assigns value of x to field
```

As well, `this` can be used to call another constructor in the same class so as to allow multiple number of arguments; for example,

```
public Struct() { this(1, 2); }
public Struct(int x, int y) { this.x = x; this.y = y }
```

allows `Struct` to have either 0 or 2 arguments. If the former, it calls the latter version with the arguments in `this` becoming the arguments of `Struct`.

Classes

Classes are used to define templates, and objects to instantiate classes. Objects are created and methods on objects are called. A template has common attributes (nouns) and behaviors (verbs). Each instance of a class has specific attribute values. An example is

```
public class Point {
    float x, y; // attributes from another class
    Point(float x, float y) { this.x = x; this.y = y } // constructor
    Type getFunc() { return z } // action returning value
    void actionName(Type var) { this.x = z; } // action modifying values
}
```

Then, in the main class, the object can be called via:

```
Point p1 = new Point(1, 2); // creating new instance of object
p1.getFunc(); // calling object without args
p1.actionName(var1); // calling object with args
p1.att // get attribute att of p1
```

Methods

The signature of a method consists of its return type, name, parameters, and parameter types of form

```
class ClassName { Type methodName(Type args) { } }
```

In another class, the method can be called via

```
ClassName name = new ClassName(args);
name.methodName(args);
```

There are three types of methods;

- A *constructor* has the same name as the class. It has no return type and initializes attributes via `className name = new className(args)`.
- A *mutator* changes attributes. It has a `void` return type and cannot be used when a value is expected, given by `name.change(args)`
- An *accessor* uses attributes for computations iwthout modifications. It has a non-`void` return type and explictly has a `return` statement, via `name.getComp()`
- A *specific attribute* gets the attribute of the instance via `name.att` of the general `this.att`.

Inheritance

Subclasses

A child class may be described as an extension of a parent class. The former inherits all the features of the latter and can implement new features for its particular purpose. The child is a subclass of the parent superclass. When `child` inherits from `parent`, every feature of the latter is in the former and `child` **`extends`** `parent`. Specifically,

```
public class Child extends Parent { }
```

There are numerous types of access:

- **`public`**: all classes can access this feature
- **`private`**: only accessible to the class it is in
- **`protected`**: same as **`private`** in addition to its derived children.

The **`super`**`(args)` keyword is used in `child` to inherit the arguments of `parent`. Children classes are created so as to be able to use the methods of `parent` in addition to new methods or overriding current methods.

Child Methods

The child sometimes requires a method to modify or add new feature using `@Override`, in which the child keeps the parent's signature and return type. The child can access the parent's constructor features via

```
super(args) // first line in child constructor
```

and method features via

```
super.methodName(args)
```

Specifically, **`super`**`()` extends the behavior of the method. An example is given by:

```
public class ClassA { public void save() { } }

public class ClassB extends ClassA {
    private Object varB;
    @Override
    public void save() { super.save(); save(varB); }
}
```

Obligatory Methods

The `Object` class defines methods applicsable to and required by all Java classes. To ensure all classes have these obligatory methods, all classes implicity extend this class. Some obligatory methods include:

- `String .toString()`: The Object implementation outputs memory address
- `boolean .equals()`: Compares memory addresses.
- `int .hashCode()`: Determines location in hash Collections.

A program intended to handle `parent` objects will also be able to handle `child` objects with no modification. Both of the following are valid:

```
Parent varOne = new Parent();
Parent varTwo = new Child();
varTwo instanceof Child; // true
```

Polymorphism is the ability of a method to take on various forms, such as arguments of different types. It occurs when early binding targets a method in parent and late binding targets the method with the same signature in child.

Example

A culmonating example of classes is given:

```
Class ClassName {
    public Type args; // attribute
    public ClassName(Type args) { this.args = args; } // constructor
    public Type getAtt() { return this.args; } // accessor
    public void changeAtt(Type x) { this.args = x; } // mutator

    public static void main(String[] args) {
        ClassName object = new ClassName(Type vars);
        object.changeAtt(x);
        Type att = object.getAtt();
    }
}
```

Classes

Casting & Objects

It is neccessary to cast or bind methods to convert them to the proper Object which does have such method so as to not fail; for example,

```
Parent var = new Child ()
if (var instanceof ObjectName) {
    name = ((ObjectName) var).methodName
}
```

Early binding occurs at compile time and verifies the method in the class, and late binding occurs at run time only when explict inheretence is used and determines `var` points to the object and calls the method in the class instead. For most purposes, objects and constructors act similarly to macros so as to negate the need for repetition.

Abstraction

Interfaces define only method signatures, of which methods have no implemented body so as to allow the implementer to define class requirements to others. That is, an interface is a group of related methods iwth empty bodies, appearing as:

```
interface interfaceName {
    void methodOne(Type args);
    void methodTwo(Type args);
}
```

Then, the interface is implemented via

```
public class SpecificName implements interfaceName {
    Type args;
    void methodOne(Type args) { this.args = args; }
    void methodTwo(Type args) { this.args = args; }
}
```

The implementation must include all the methods of the interface, else the program will fail. Consequently, abstract classes (`public abstract class Name`) implement only some methods and allow implementers to implement some methods and define others. Lastly, in classes, all methods are implemented. The `final` tag prevents its class, method, or variable from being extended, overridden, or changed.