Lecture 8

Interface

References:

1. Tony Gaddis, Chapter 10, Starting out with Java: From Control Structures through Objects, 7 edition
2. Herbert Schildt, Chapter 9, The Complete Reference Java 10 edition, McGraw Hill

1

Chapter Topics

- Interfaces
- Interfaces in UML
- Dynamic Method Dispatch with interfaces
- Extended Interfaces
- Default Interface Methods

2

Interfaces (1 of 6)

- An interface
  - Specify methods without any body
  - All the methods must be implemented by classes
- An interface like a “contract”
  - A class implementing an interface must adhere to the contract
- Interface similar to abstract class
  - Enforce classes to provide the same methods

3

Interfaces (2 of 6)

- An interface defined with
  - Keyword `interface` and Abstract methods

```
public interface name {
        return-type method-name1(parameter-list);
        return-type method-name2(parameter-list);
        ….
        type final-variable1 = value;
        type final-variable2 = value;
        ….
}
```

- All methods and variables are public or public by default

4

Interfaces (3 of 6)

- An interface can contain field declarations:
  - All fields automatically treated as `final` and `static`
  - Need an initialization value

```
public interface Doable
{
   int FIELD1 = 1, FIELD2 = 2;
   (Method headers...)
}
```

  - `FIELD1` and `FIELD2` are `final static int` variables

5

Interfaces (4 of 6)

- Keyword `implements`
  - A class implementing an interface

```
public class Animal implements Doable
```

- A class can define its own members
  - Together with an interface's methods
  - Additional variables and methods
- Polymorphism of interface
  - Any number of classes can implement an interface

6

Interfaces (5 of 6)

- TestIface Example - TestIface interface and Client class

```
interface Callback {
     void callback(int param);
}
class Client implements Callback {
   public void callback(int p) {
        System.out.println("callback called with " + p);
   }
   void nonIfaceMeth() {…}
}
```

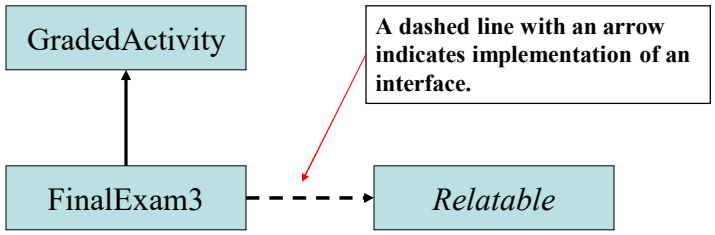

7

Interfaces (6 of 6)

- Example:
  - GradedActivity.java
  - Relatable.java
  - FinalExam3.java
  - RelatableExams.java

8

Interfaces in UML



9

Implementing Multiple Interfaces

- Java allows a class to implement multiple interfaces.
- To specify multiple interfaces in a class definition
  - List the names of the interfaces, separated by commas, after the implements key word

```
public class MyClass implements
Interface1,Interface2,Interface3
```

10

Why interfaces needed?

- To support dynamic method dispatch (DMD) at runtime
- Inheritance supports DMD as well, but
  - DMD requires class hierarchy
  - How to apply DMD to classes outside the class hierarchy?
- Thus, Interfaces defined separately from class hierarchy
  - Any classes can implement the same interface
  - Polymorphism

Dynamic Method Dispatch with Interfaces (1/2)

- Can declare an interface reference variable
  - Any object implementing the interface can be assigned to the variable
- An interface method determined at run time
  - By the type of object assigned to an interface reference variable
- E.g., TestIface2 program
- E.g., IFTest3 program
  - Fixed Stack and Dynamic Stack

Partial Implementation

- A class implementing an interface must be abstract
  - If it does not implement the interface completely

```
abstract class Incomplete implements Callback {
  int a, b;
  void show() {
    System.out.println(a + " " + b);
  }
}
```


Extended Interfaces

- One interface inherits another using the keyword `extends`
- A class should implement all methods required by the interface inheritance
- E.g., IFExtend program

Default Interface Methods

- Default Method implemented
  - In JDK 8: possible to add default methods to an interface
- Addition of default methods
  - Not change the key aspect of interface
  - Not maintain state information
    - Because an interface still cannot have instance variables

15

Default Interface Methods

- Preceded by the keyword `default`
  - Possible for a class to define its own implementation of a default method
  - E.g., DefaultMethodDemo program (with overriding default method)

16

Default Interface Methods

- Multiple Inheritance Issues
  - If a class implements an interface default method,
    - The class implementation takes priority over an interface default implementation
  - What will happen if a class implements multiple interfaces with the same default method, but it does not override the method
    - An error will result