CSE 215: Programming Language II Lab

Lab – 14 Interface and Generics

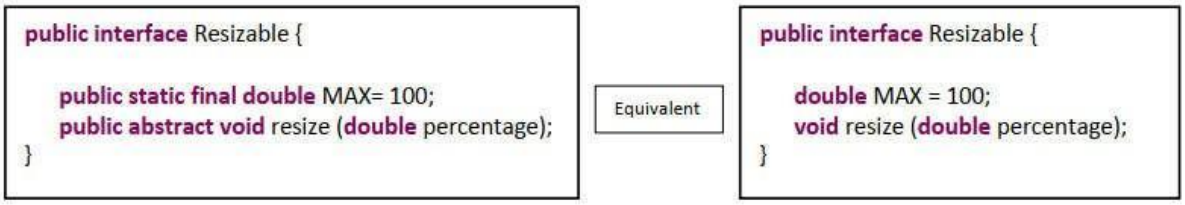
Objective:

- To understand interface and its usage
- To utilize interface to ensure reusability of existing code
- To detect errors at compile time
- Ensure reusability of code

Interface

An interface is a structure which specifies the **common behavior** of objects of different classes. It contains only the constants and the abstract methods just like an abstract class.
All data fields are **`public final static`** and all methods are **`public abstract`** in an interface. So if you miss to mention these, it will still work.

```
public class GeometricObject implements Resizable
```




```
public class Circle extends GeometricObject
implements Resizable{
              …….     …….
```

```
public void resize(double percentage){
if(percentage<=MAX){
    radius += radius*percentage/100;
  }
}
```

The Comparable Interface

```
public interface Comparable{    int
compareTo(GeometricObject o);
}
```

```
public class GeometricObject implements
Comparable <GeometricObject> {
……..
…..
}
```

```
public int compareTo(GeometricObject o){
if (getArea() > (o.getArea())
return 1;
  elseif (getArea()<(o.getArea())
return -1;   else
    return 0;
}
```

```
GeometricObject c1 = new Circle(20);
Circle c2 = new Circle(20);

System.out.println(c2.compareTo(c));  //
0
```

Multiple Interfaces

```
public class GeometricObject implements Comparable, Resizable, Movable, … … {
}
```

Generics

Generics enable you to detect errors at compile time rather than at runtime

```
package java.lang;
public interface Comparable {
public int compareTo(Object o) }
```

```
package java.lang;
public interface Comparable<T> {
public int compareTo(T o) }
```

Here, **<T>** represents a formal generic type, which can be replaced later with an actual concrete type.
Replacing a generic type is called a generic instantiation.
By convention, a single capital letter such as **E or T is used to denote a formal generic type.**

```
Comparable<Date> c = new Date();
System.out.println(c.compareTo("red"));
```

c is a reference variable whose type is **Comparable<Date>** and invokes the **compareTo** method to compare a **Date** object with a string. This code generates a compile error.

Define Generic class and Interfaces

GenericStack<E>	
-list: java.util.ArrayList<E>	An array list to store elements.
+GenericStack()	Creates an empty stack.
+getSize(): int	Returns the number of elements in this stack.
+peek(): E	Returns the top element in this stack.
+pop(): E	Returns and removes the top element in this stack.
+push(o: E): void	Adds a new element to the top of this stack.
+isEmpty(): boolean	Returns true if the stack is empty

GenericStack.java

```
public class GenericStack<E> {
  private java.util.ArrayList<E> list = new java.util.ArrayList<>();

  public int getSize() {
    return list.size();
  }

  public E peek() {
    return list.get(getSize() - 1);
  }

  public void push(E o) {
    list.add(o);
  }

  public E pop() {
    E o = list.get(getSize() - 1);
    list.remove(getSize() - 1);
    return o;
  }

  public boolean isEmpty() {
    return list.isEmpty();
  }

  @Override
  public String toString() {
    return "stack: " + list.toString();
  }
}
```

Main Method:

```
GenericStack<String> stack1 = new GenericStack<>();
stack1.push("London");
stack1.push("Paris");
stack1.push("Berlin");
GenericStack<Integer> stack2 = new GenericStack<>();
stack2.push(1); // autoboxing 1 to new Integer(1)
stack2.push(2);
stack2.push(3);
```

Generic Method

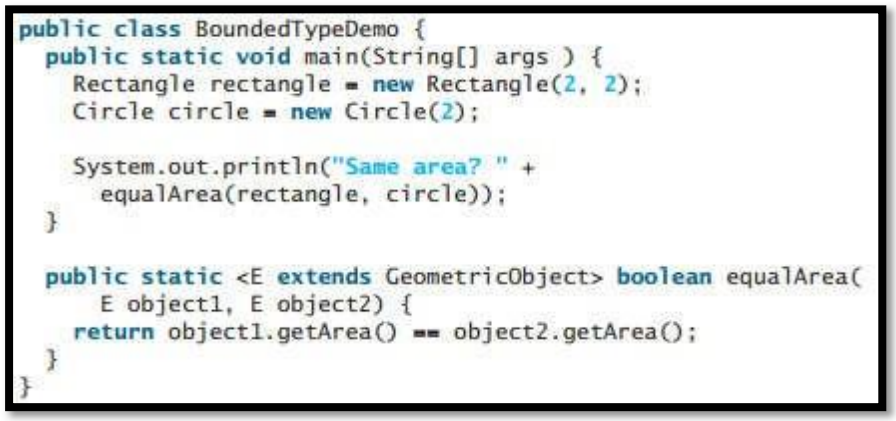
To declare a generic method, you place the generic type <E> immediately after the **keyword static** in the method header. For example,

```
public static <E> void print(E[] list)
```

To invoke a generic method, prefix the method name with the actual type in angle brackets. For example,

```
GenericMethodDemo.<Integer>print(integers);
GenericMethodDemo.<String>print(strings);
```

A generic type can be specified as a subtype of another type. Such a generic type is called **bounded.**
The bounded generic type **<E extends Object>** specifies that E is a generic subtype of Object.

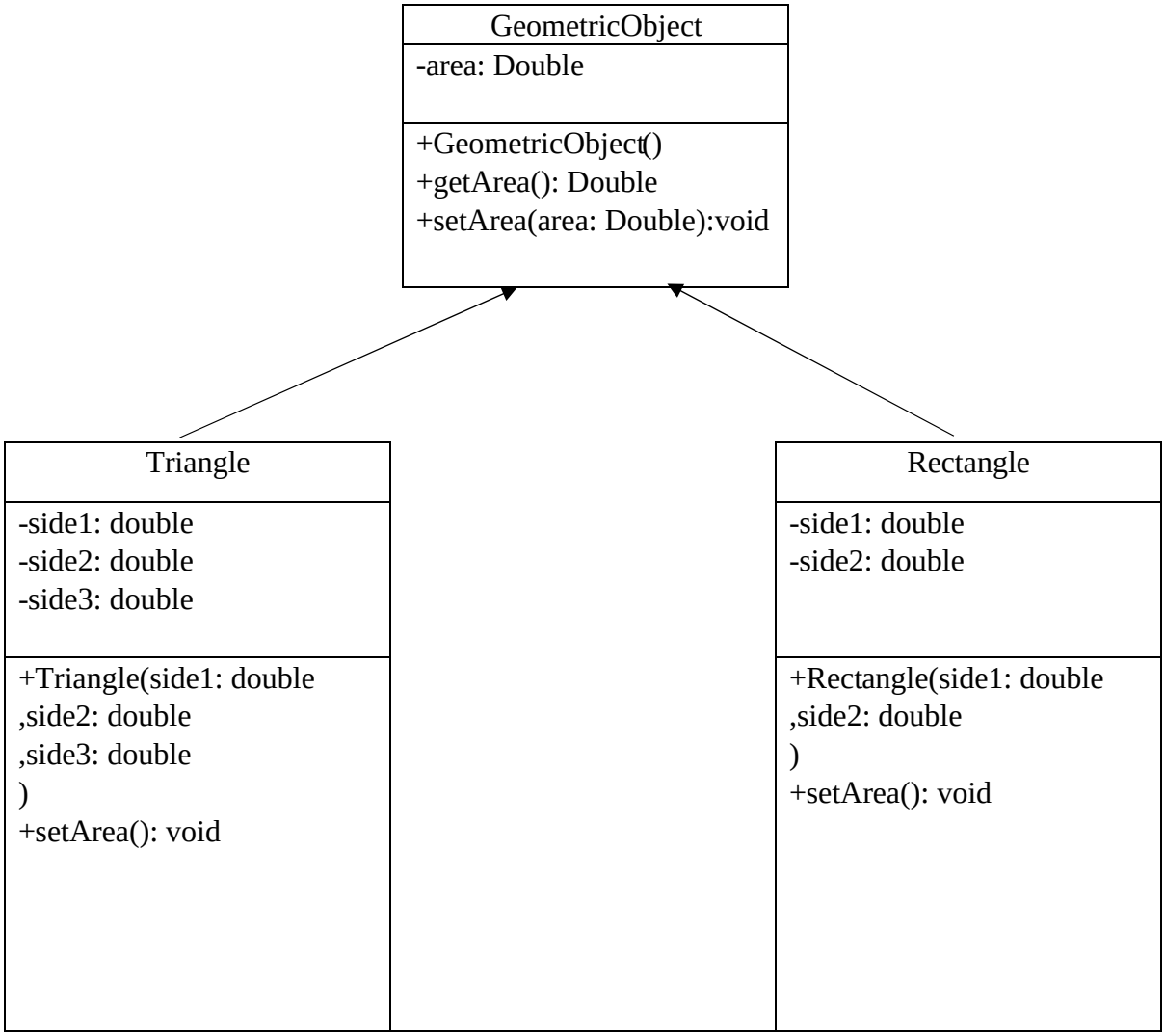


```
public class BoundedTypeDemo {
  public static void main(String[] args ) {
    Rectangle rectangle = new Rectangle(2, 2);
    Circle circle = new Circle(2);

    System.out.println("Same area? " +
      equalArea(rectangle, circle));
  }

  public static <E extends GeometricObject> boolean equalArea(
      E object1, E object2) {
    return object1.getArea() == object2.getArea();
  }
}
```

Lab Task



CompareAreaInterface
+<E extends GeometricObject)compareArea(triangle:E, rectangle:E):boolean

Write a test class that implements *CompareAreaInterface* interface; in the main method create two objects of a Triangle, and a rectangle. With the help of *compareArea()*, compare area of two objects and print appropriate message.