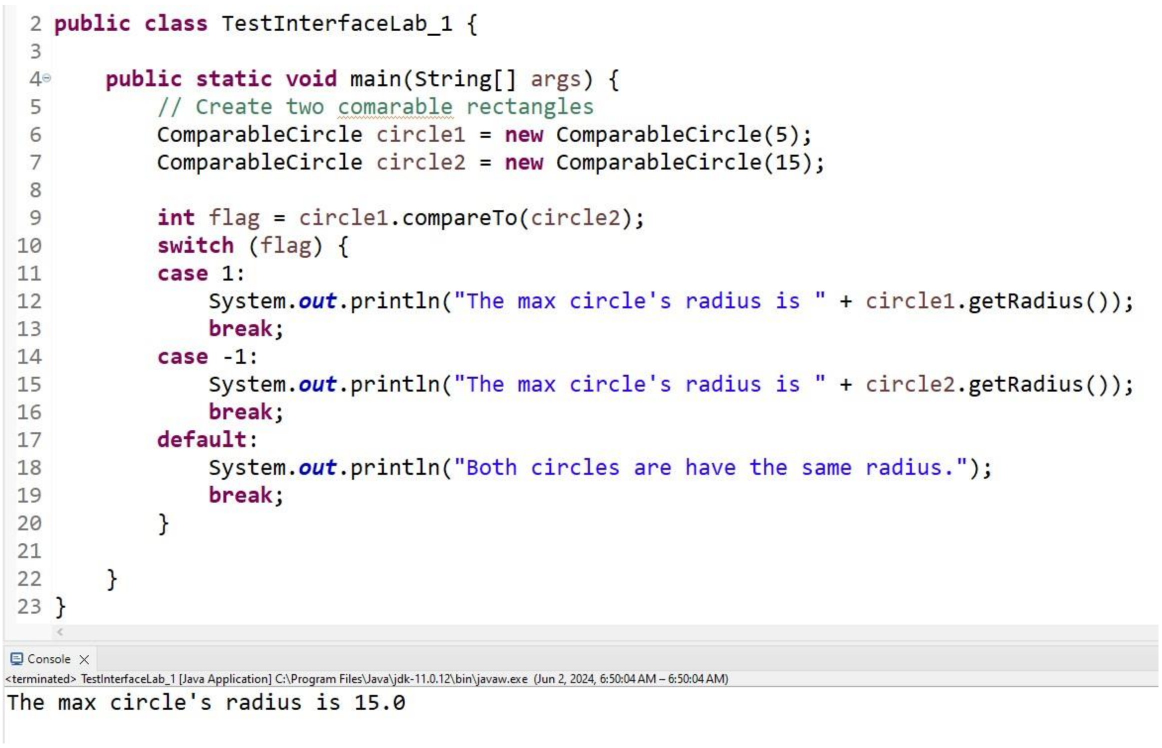
Lab: Interface

Objectives: To practice interface concept

1. (The **ComparableCircle** class) Define a class named **ComparableCircle** that extends **Circle** and implements **Comparable**. Draw the UML diagram and implement the **compareTo** method to compare the circles on the basis of radius. Write a test class to find the larger of two instances of **ComparableCircle** objects. (Given the Circle class)

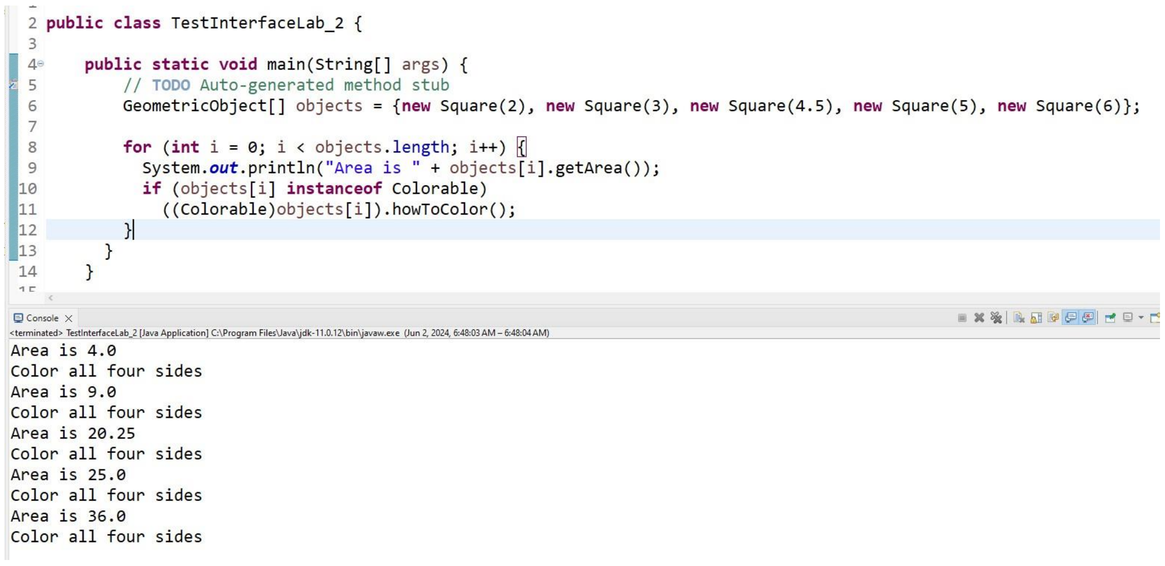


```java
public class TestInterfaceLab_1 {

    public static void main(String[] args) {
        // Create two comarable rectangles
        ComparableCircle circle1 = new ComparableCircle(5);
        ComparableCircle circle2 = new ComparableCircle(15);

        int flag = circle1.compareTo(circle2);
        switch (flag) {
        case 1:
            System.out.println("The max circle's radius is " + circle1.getRadius());
            break;
        case -1:
            System.out.println("The max circle's radius is " + circle2.getRadius());
            break;
        default:
            System.out.println("Both circles are have the same radius.");
            break;
        }

    }
}
```

```
Console
<terminated> TestInterfaceLab_1 [Java Application] C:\Program Files\Java\jdk-11.0.12\bin\javaw.exe (Jun 2, 2024, 6:50:04 AM – 6:50:04 AM)
The max circle's radius is 15.0
```

2. (The **Colorable** interface) Design an interface named **Colorable** with a void method named **howToColor**(). Every class of a colorable object must implement the **Colorable** interface. Design a class named **Square** that extends **GeometricObject** and implements **Colorable**. Implement **howToColor** to display the message “Color all four sides.” The **Square** class has a private double data field named side with its getter and setter methods. It has a no-arg constructor to create a **Square** with side 0, and another constructor that creates a Square with the specified side.

Draw a UML diagram that involves **Colorable**, **Square**, and **GeometricObject**. Write a test program that creates an array of five **GeometricObjects**. For each object in the array, display its area and invoke its **howToColor** method if it is colorable.



```java
public class TestInterfaceLab_2 {

    public static void main(String[] args) {
        // TODO Auto-generated method stub
        GeometricObject[] objects = {new Square(2), new Square(3), new Square(4.5), new Square(5), new Square(6)};

        for (int i = 0; i < objects.length; i++) {
          System.out.println("Area is " + objects[i].getArea());
          if (objects[i] instanceof Colorable)
            ((Colorable)objects[i]).howToColor();
        }
      }
    }
```

Console

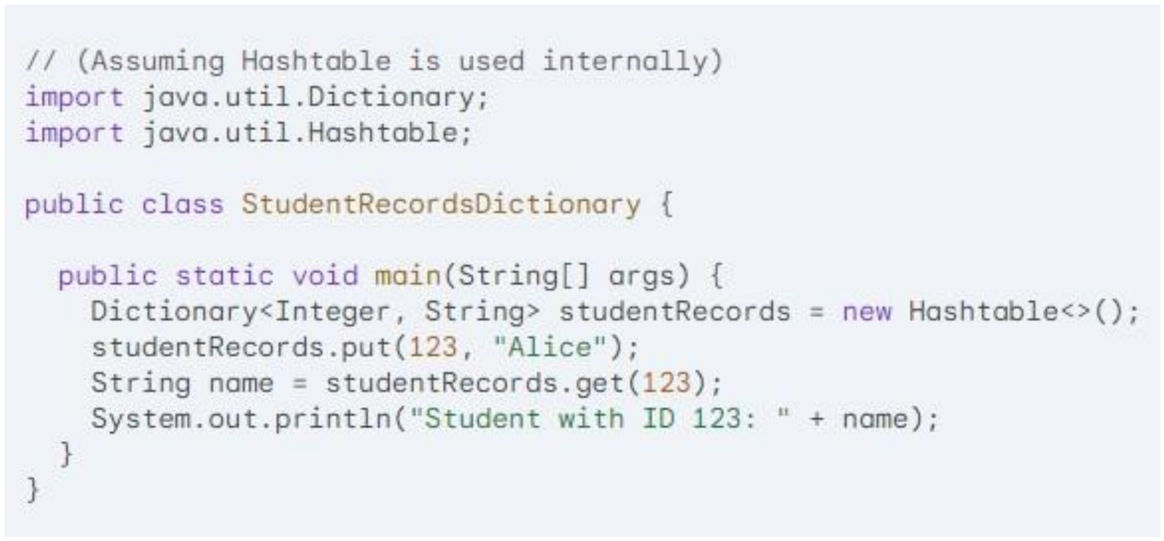
```
<terminated> TestInterfaceLab_2 [Java Application] C:\Program Files\Java\jdk-11.0.12\bin\javaw.exe (Jun 2, 2024, 6:48:03 AM – 6:48:04 AM)
Area is 4.0
Color all four sides
Area is 9.0
Color all four sides
Area is 20.25
Color all four sides
Area is 25.0
Color all four sides
Area is 36.0
Color all four sides
```

3. **Key-Value Storage Comparison:**

In Java, dictionaries and maps are used to store collections of key-value pairs. While dictionaries were used historically, maps offer a more modern and flexible approach.

[1] What are the result of each snippet code?

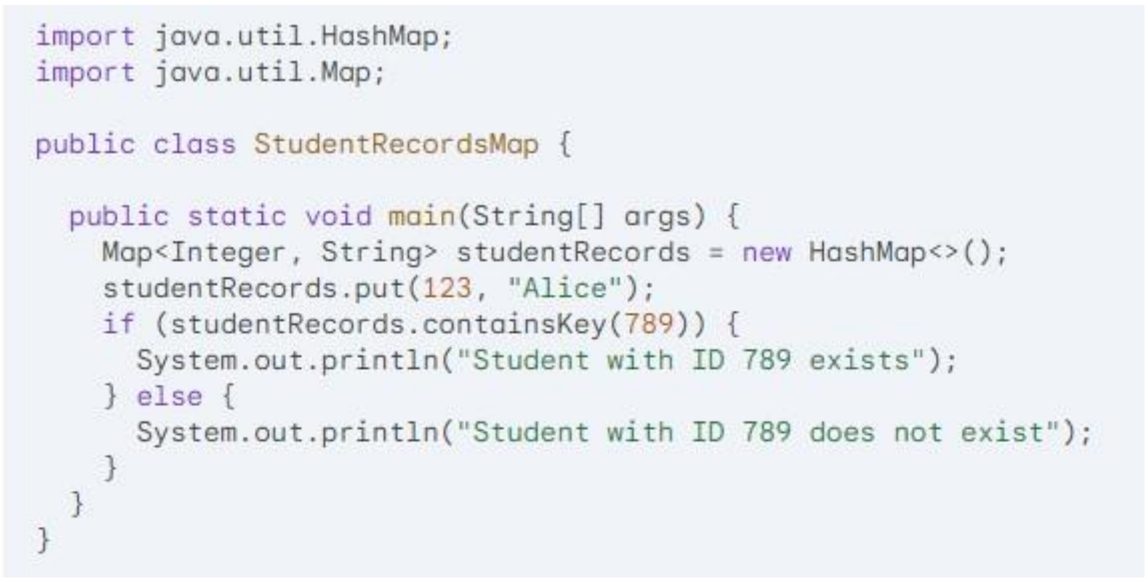
Snippet 1 (Dictionary Class):



```java
// (Assuming Hashtable is used internally)
import java.util.Dictionary;
import java.util.Hashtable;

public class StudentRecordsDictionary {

  public static void main(String[] args) {
    Dictionary<Integer, String> studentRecords = new Hashtable<>();
    studentRecords.put(123, "Alice");
    String name = studentRecords.get(123);
    System.out.println("Student with ID 123: " + name);
  }
}
```

Result: Student with ID 123 is Alice

Snippet 2 (Map Interface):



```java
import java.util.HashMap;
import java.util.Map;

public class StudentRecordsMap {

  public static void main(String[] args) {
    Map<Integer, String> studentRecords = new HashMap<>();
    studentRecords.put(123, "Alice");
    if (studentRecords.containsKey(789)) {
      System.out.println("Student with ID 789 exists");
    } else {
      System.out.println("Student with ID 789 does not exist");
    }
  }
}
```

Result: Student with ID 789 dose not exists.

[2] Based on your analysis, list three key differences between using the Dictionary class and the Map interface for storing student records.

1.**Inheritance**:

- **Dictionary class**: It is an abstract class that was introduced in the early versions of Java. It is part of the java.util package, but it has been largely replaced by the more modern Map interface. Dictionary is a parent class of classes like Hashtable.

- **Map interface**: It is a more modern and flexible interface introduced in Java 2 (Java Collections Framework). It is a part of the java.util package and provides a more standardized way of handling key-value pairs. Popular implementations include HashMap, TreeMap, and LinkedHashMap.

2. **Thread Safety**:

- **Dictionary class**: Many implementations of the Dictionary class, such as Hashtable, are **synchronized** by default, meaning they are thread-safe, which can lead to overhead when multiple threads are accessing the collection concurrently.

- **Map interface**: The Map interface itself is **not synchronized**, and thread safety must be handled explicitly, either by using ConcurrentHashMap or synchronizing the Map externally if required.

3.**Flexibility and Modern Usage**:

- **Dictionary class**: The Dictionary class is considered **legacy** and is no longer recommended for use in modern Java programming. It lacks many of the features and improvements that the Map interface provides.

- **Map interface**: The Map interface offers greater **flexibility** and is more widely used in modern Java development. It includes various implementations that provide more control over performance, ordering, and other features, such as HashMap (unordered), TreeMap (sorted), and LinkedHashMap (maintains insertion order).

[3] Which approach (Dictionary class or Map interface) do you think is more modern and flexible? Why?

The Map interface is definitely more modern, flexible, and better suited for a wide variety of use cases. It is part of the Java Collections Framework, has better performance, and offers more options in terms of implementing different types of maps to meet specific needs. The Dictionary class, on the other hand, is outdated and should be avoided in favor of Map for new code.