

Activity 10: Classes

The String class provides methods for working with text. The Random class provides methods for generating random numbers. In this activity, you'll learn how to make your own classes that represent everyday objects.

Model 1 Common Mistakes

Program A	Program B
<pre>String greeting = "hello world"; greeting.toUpperCase(); System.out.println(greeting);</pre>	<pre>Scanner in = new Scanner(System.in); String line = in.nextLine(); char letter = line.charAt(1); System.out.println(letter);</pre>

Questions (10 min)

Start time: _____

1. Write the output of each program in the space under the table above. What is the logic error you see when you run Program A?
2. In Program A, what is returned by the string method? What happens to the return value?
3. Describe two different ways you can fix the logic error in #2.
4. In what cases will Program B throw an exception? What is the error message displayed?
5. Describe two different ways you can fix the run-time error in #4.

Model 2 Die objects

When you define a class in Java, you are defining a new data type. Classes have *attributes* (data) and *methods* (code). A *class diagram* is a graphical summary of the attributes and methods.

```
/**
 * Simulates a Die object.
 */
public class Die {

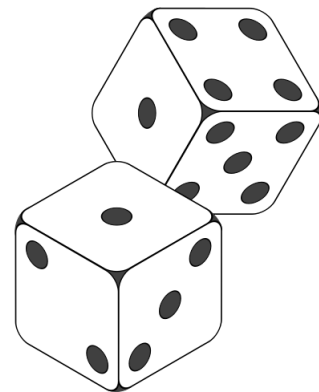
    private int face;

    /**
     * Constructs a new die with a random face value.
     */
    public Die() {
        this.face = 1;
    }

    /**
     * Gets the current face value of the die.
     *
     * @return current face value of the die
     */
    public int getFace() {
        return this.face;
    }

    /**
     * Simulates the roll of the die.
     *
     * @return new face value of the die
     */
    public int roll() {
        this.face = (int) (Math.random() * 6) + 1;
        return this.face;
    }
}
```

Die
-face: int
+Die() +getFace(): int +roll(): int



Questions (10 min)

Start time: _____

6. What are the attributes of Die? What are the methods?
7. In the class diagram, what do the - and + symbols represent? What does the : represent?
8. Write a statement that *declares* a Die variable named lucky.
9. Each *instance* of a class (in memory) is called an object. Write a statement that *instantiates* a `new` Die object and assigns it to lucky.
10. When you instantiate an object, you invoke a *constructor*. This method has no return type and has the same name as the class itself. What does the Die constructor do?
11. Notice how the roll method refers to face, yet that variable is not declared in the method. What does the roll method change, in terms of the Die object?
12. What is the purpose of the getFace method? Show how you would use it in a main method of another class.

Model 3 Circle objects

Unified Modeling Language (UML) provides a way of graphically illustrating a class's design, independent of the programming language.

Circle
-radius: double
+Circle(radius:double) +area(): double +circumference(): double +getRadius(): double +setRadius(radius:double): void

Questions (15 min)

Start time: _____

13. What are the attributes and methods of `Circle`, and what is their *visibility*?
14. Based on Model 2 and Model 3, what is typically `public` and what is typically `private`?
15. How would you declare a variable named `unit` that is a `Circle` object? How would you instantiate a circle with a radius of 1.0 and assign it to `unit`?
16. Write the code (inside `Circle.java`) that declares the `radius` attribute.
17. Write the code for `getRadius`. (Don't worry about Javadoc comments for this activity.)

18. Write the code for `setRadius`. Note there are two variables named `radius`: the parameter of `setRadius`, and `this.radius` for the object itself. Before you set the radius, first check if the parameter is negative, and if it is, set `this.radius` to zero instead.

19. Write the complete code for `area` and `circumference`. The area of a circle is πr^2 , and the circumference is $2\pi r$. Ideally, each method should be one line of code.

20. Write a `main` method that creates a `Circle` object with a radius of 2.0 and displays its area and circumference on the screen.

Model 4 Case Study: Let's Make a Deal

It was mid-semester and the pressure was on, not only in CS but in other classes. Jamie and Pat were each working on the programming assignment in the lab, but neither was having much success. Jamie had started several days ago, but he was having trouble debugging his current work. Pat had just started that day and knew that she would be turning it in late. Regardless, Pat offered to help Jamie work out the problems with his code.

Together, and after a couple of hours of work, they got the program to work. Pat said, "Now that yours is working, can you give me the code so that I can also get credit for this assignment?" When Jamie objected, Pat said, "Hey, you wouldn't have gotten it finished if it weren't for my help, and now mine will be even later!" So Jamie turned over a copy of the code. Pat made some changes to a few sections, and then turned in the final program.

Questions (10 min)

Start time: _____

21. Which, if any, of the students were at fault? Why?

22. Which specific Honor Code violations occurred?

23. What should Pat have done in this situation?

24. What should Jamie have done in this situation?