CSC 131 SP'19 **In-Class Activity**

Classes and UML

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.

Content Learning Objectives

After completing this activity, students should be able to:

- **Define the terms: attribute, method, constructor, instance.**
- **Implement non-static methods based on a UML diagram.**
- **Implement class inheritance based on a UML diagram.**

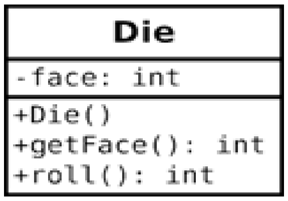
Process Skill Goals

During the activity, students should make progress toward:

- **Writing method signatures exactly as shown in a UML diagram. (Information Processing)**

Model 1 The Die Class

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) + return this.face;
}

}
```

Questions (15 min)   Start time: A quarter past a freckle

_____

1. What are the attributes of `Die`? What are the methods?

    Attributes: face

    Methods: getFace() & roll()

2. In the class diagram, what do the `-` and `+` symbols represent? What does the `:` represent?

    The - means private while the + means public. The : represents the type or return type of an attribute/function

3. Write a statement that *declares* a `Die` variable named `lucky`.

Die lucky;

4. 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`.

    lucky = new Die;

5. 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?

    `Constructs a new die object with a random value for face.`

6. 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?

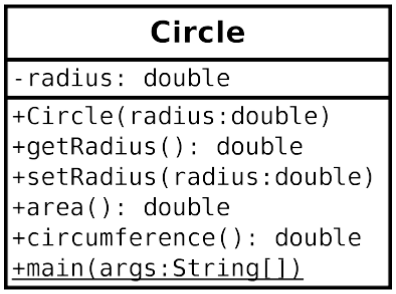
    It changes the face value of the die.

7. What is the purpose of the `getFace` method? Show how you would use it in a `main` method of another class.

    To get the current face value of the die. You would use it in a dice game class.

Model 2 The Circle Class

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



Questions (18 min) Start time: Half past a freckle

8. **What are the attributes and methods of `Circle`, and what is their *visibility*?**

radius (private)

Circumference (public), getRadius() (public), setRadius() (public), area(public)

9. **Based on Model 1 and Model 2, what is typically `public` and what is typically `private`?**

Public: Functions, Classes
Private: Variables

10. **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`?**

Circle unit = new Circle();
unit.setRadius(1.0);

11. Write the code inside `Circle.java` (you need to create this class in Eclipse) that declares the `radius` attribute.

```
public class Circle { private double radius;}
```

12. Write the code for `getRadius`. (Don't worry about Javadoc comments for this activity.)

```
public double getRadius() { return this.radius;}
```

13. 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.

```
public void setRadius(double newRadius) {this.radius = newRadius;}
```

14. Write the complete code for `area` and `circumference`. The area of a circle is *πr*2, and the circumference is 2*πr*. Ideally, each method should be one line of code. (In Java, you may use the final constant `Math.PI` for your convenience.)

```
public double area() { return (math.PI * this.radius * this.radius); }
public double circumference() { return (2 * math.PI * this.radius); }
```

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

```
main(){
    First_circle = new Circle;
    first_circle.setRadius(2);
    printf( 'Circumference of the Circle is: %s', circumference() );
}
```

Model 3 The Bicycle & Mountain Bike Classes

Unified Modeling Language also provides a way to represent inheritance between classes.

Questions (15 min) **Start time:** A freckle '45

16. What does diagram represent? (i.e., what is the name of this relationship?)

Parent and child class

17. In terms of Object-Oriented Programming, which one between Bicycle **and** MountainBike **is the super class?**

Bicycle

For question 18, 19, 20, please write the code in Eclipse.

18. A stub is a function that has the expected signature (i.e. name and accepted arguments). Try to create MountainBike **with method stubs.**

19. For each MountainBike **object, its initial** seatHeight **is** startHeight**. Complete the constructor.**

20. For each MountainBike **object, method** setHeight() **can update** seatHeight **to** newValue**. Complete method** setHeight()**.**

21. For MountainBike **class, its** toString() **is implemented as follows:**

```
public String toString(){
        return (super.toString()+
                "\nseat height is "+seatHeight);
}
```

What's the output when the following test **class is executed?**

```
public class Test{
    public static void main(String args[]){
        MountainBike mb = new MountainBike(3, 100, 25);
        System.out.println(mb.toString());
    }
}
```

No of gears are 3
speed of bicycle is 100
seat height is 25