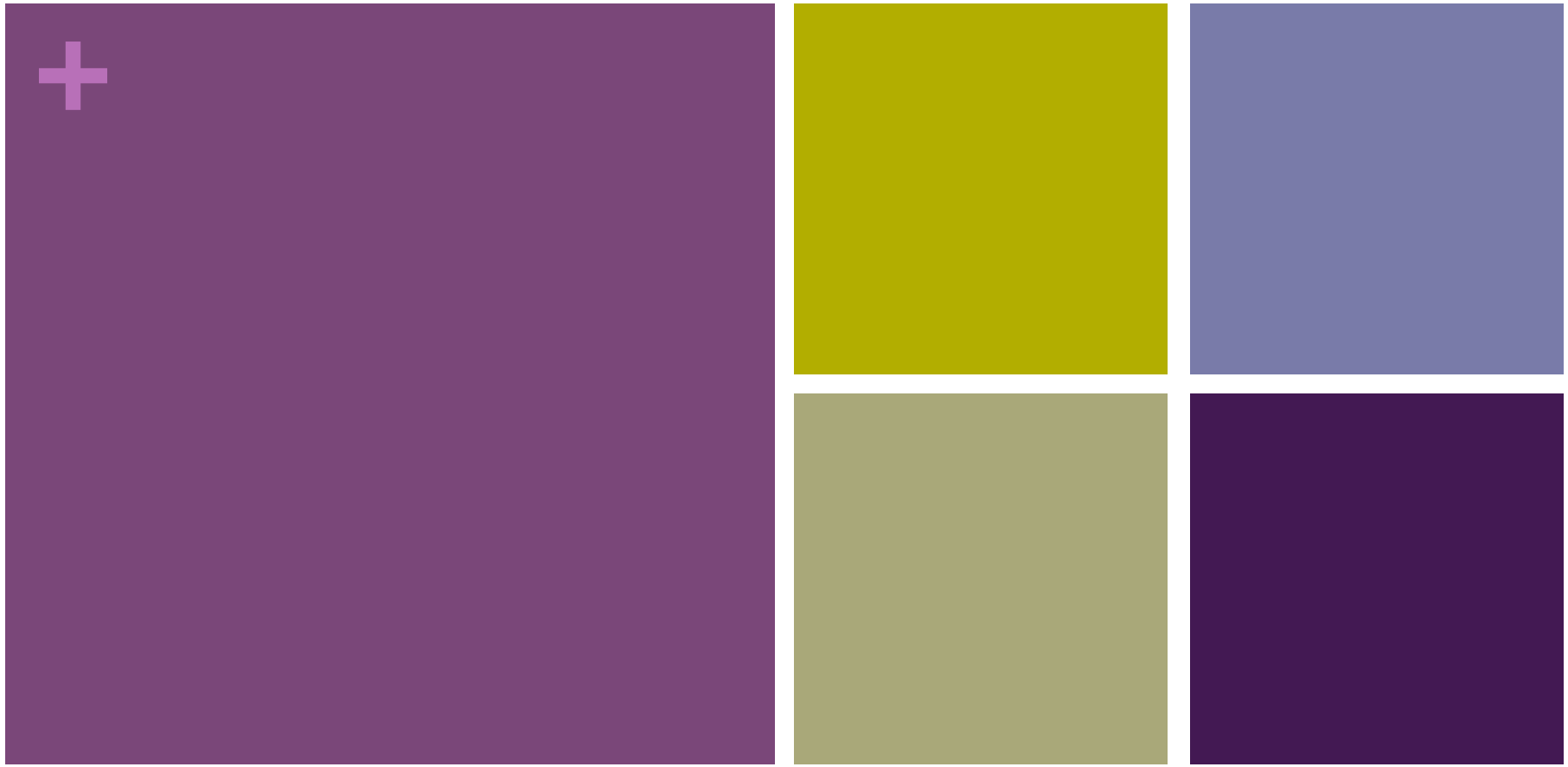


Objects

What is an Object?

- An object is an instance of a class.
- What is an instance?
  - An instance is a distinct example of the class that
    - is in memory
    - has specific assignments for the variables declared by the class it represents.
    - has functionality based on the class.
- What is a class?
  - A complex data type.
  - The design for objects of its type.

Defining Your Own Object with Classes

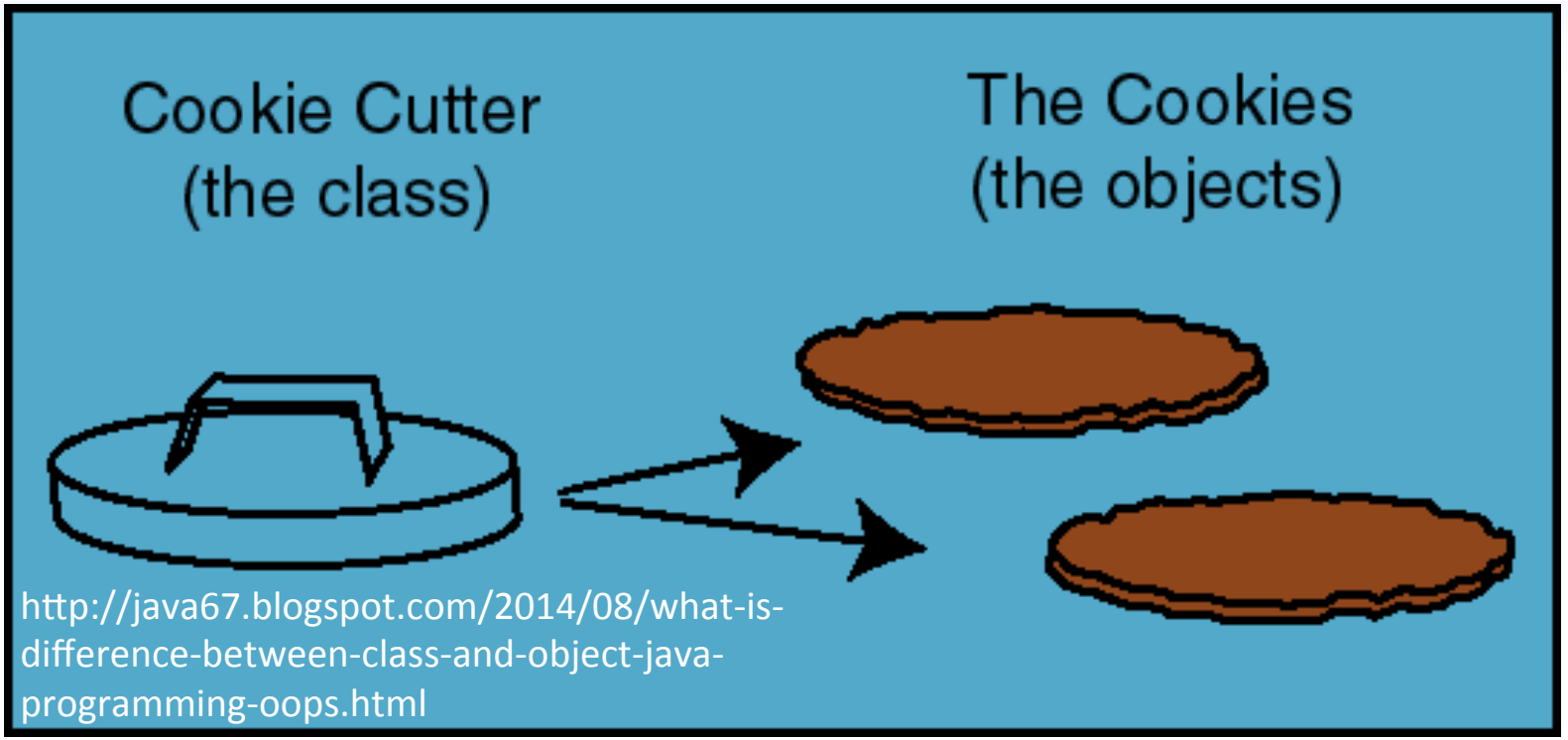
- Classes are blueprints or prototypes for new objects
- Classes define all field and method declarations

  … which are repeated for each new object created
- Classes DO NOT set the data values stored in fields

  … but they likely determine how
- Using a class to create a new object is called *instantiating* an object

  … creating a new object instance of the class
- Classes often model real-world items

Class vs. Object



Object Oriented Programming

- Objects are software bundles that wrap up all semantically related variables and functions.
  - Object variables are called fields
  - Object functions are called methods
- Objects can be created, named and referenced with variables
  - Very similar to standard data types
- An object's individual fields and methods are accessed using syntax called dot-notation

Class/Object

- Keyword class
- Data fields (class variables)
- Constructor
- Methods (class functions)
  - update
  - move
  - display/draw

```
class Point {
  // Fields
  int x;
  int y;
  Color c;

  // Constructor
  Point() {
    x = 0;
    y = 0;
    c = Color(255, 255, 255);
  }

  // Methods
  void update() {
  }

  void display() {
    noStroke;
    fill(c);
    ellipse(x, y, 10, 10);
  }
}
```

Creating New Objects with Classes

- To create a new instance of an object, use the ***new*** keyword and call the object Constructor

```
MyObjectName ob = new MyObjectName();
```

```
Point p1 = new Point();
Point p2 = new Point();
```

The Constructor

- A special function that always carries the same name as the class itself.
- Called automatically at the creation/instantiation of an object.
- Used to initialize all of the objects variables.

Defining Your Own Objects with Classes

```
// Defining a new class of object

class MyObjectName {

  // All field variable declarations go here;

  // Define a special function-like statement called
  // the class's Constructor.
  // It's name is same as object class name,
  // with no return value.

  MyObjectName( optional arguments ) {

    // Perform all initialization here

  }

  // Declare all method functions here.
}
```

```
// A Ball Class
class Ball {
  // Fields
  int w; int h; // width and height of ball
  float x;      // x position
  float y;      // y position
  float spdX;   // x velocity
  float spdY;   // y velocity
  float gravity = .03;

  // Constructor
  Ball() {
    w = h = 20;
    x = random(0, width/2); y = random(10, 20);
    spdX = random(0.5, 1.3); spdY = 0;
  }

  // Methods
  void update() {
    x += spdX;
    spdY += gravity;
    y += spdY;

    // Bounce off walls and floor
    if (x + w/2 > width || x - w/2  < 0) spdX = -spdX;
    if (y + h/2 > height || y - h/2 < 0) spdY = -spdY;
  }

  void display() {
    ellipse( x, y, w, h);
  }
}
```

Defining Your Own Object with Classes

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Constructor overloading

- Constructors can take arguments.
- More than one constructor can be written for a class.
- As long as they are differentiable in the number/type of parameters they take.
- There is a default constructor even if you don't write one
  - it doesn't do much though.
  - all basic data types are initialized to their default value (usually 0 or false), color is a basic data type in Processing
  - all Reference data types are initialized to null;

Examples