HBO Graduaat Informatica Optie Programmeren

Java Basics

How to create a class

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volwassenenonderwijs

Contents

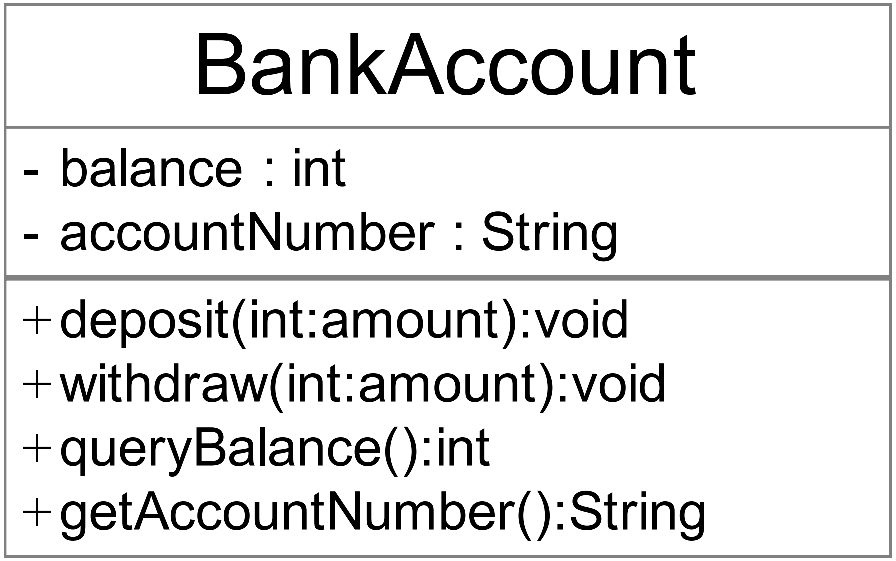
- Class Construction
  - Class Declaration
  - Class Body
- Understanding Instance and Class Members
  - Instance variables & instance methods
  - Class variable & class methods
  - Objects vs. Classes

Goals

- Class Construction
  - To be able create a class and describe all element of a class
- Understanding Instance & Class Members
  - to be able distinguish Instance and Class Members
  - to be able distinguish Objects and Classes

Class Construction

- UML Representation

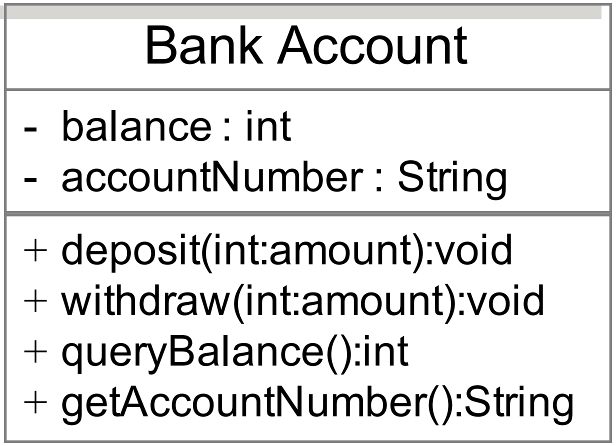


BankAccount

- balance : int
- accountNumber : String

+deposit(int:amount):void
+withdraw(int:amount):void
+queryBalance():int
+getAccountNumber():String

Class Construction



Bank Account

- balance : int
- accountNumber : String

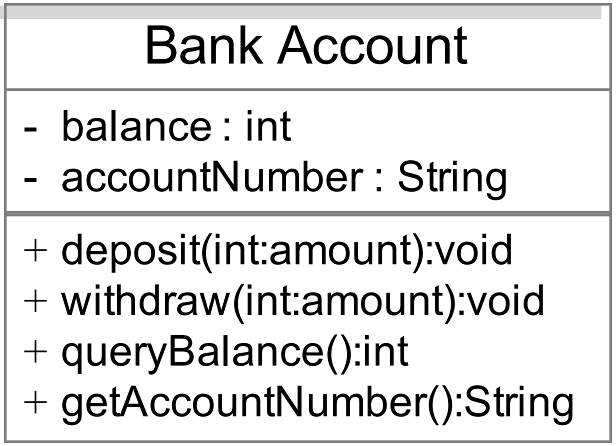
+ deposit(int:amount):void
+ withdraw(int:amount):void
+ queryBalance():int
+ getAccountNumber():String

```
public class BankAccount
{
    private int balance;
    private String accountNumber;

    public BankAccount (String accountNumber)
    {
        this.accountNumber = accountNumber;
    }
    public String getAccountNumber()
    {
        return this.accountNumber;
    }
    public int queryBalance()
    {
        return this.balance;
    }
```

```
    public void deposit (int amount)
    {
            this.balance += amount;
    }
    public void withdraw (int amount)
    {
            this.balance -= amount;
    }
}
```

Class Construction



Bank Account

- balance : int
- accountNumber : String

+ deposit(int:amount):void
+ withdraw(int:amount):void
+ queryBalance():int
+ getAccountNumber():String

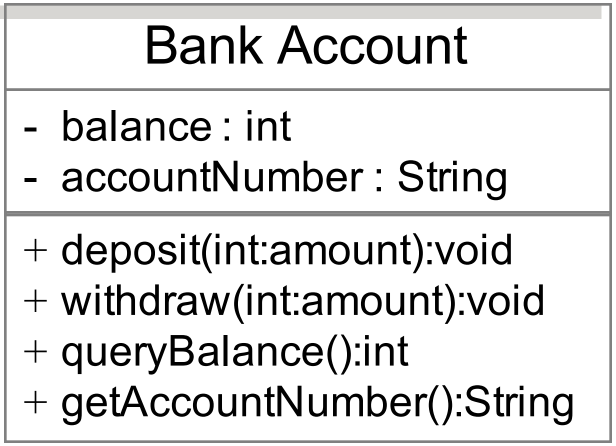
Class Declaration

```
public class BankAccount
{
    private int balance;
    private String accountNumber;

    public BankAccount (String accountNumber)
    {
        this.accountNumber = accountNumber;
    }
    public String getAccountNumber()
    {
        return this.accountNumber;
    }
    public int queryBalance()
    {
        return this.balance;
    }
```

```
    public void deposit (int amount)
    {
            this.balance += amount;
    }
    public void withdraw (int amount)
    {
            this.balance -= amount;
    }
}
```

Class Construction



Bank Account

- balance : int
- accountNumber : String

+ deposit(int:amount):void
+ withdraw(int:amount):void
+ queryBalance():int
+ getAccountNumber():String

Class Body

```
public class BankAccount
{
    private int balance;
    private String accountNumber;

    public BankAccount (String accountNumber)
    {
        this.accountNumber = accountNumber;
    }
    public String getAccountNumber()
    {
        return this.accountNumber;
    }
    public int queryBalance()
    {
        return this.balance;
    }
```

```
    public void deposit (int amount)
    {
            this.balance += amount;
    }
    public void withdraw (int amount)
    {
            this.balance -= amount;
    }
}
```

Class Construction

- The Class declaration

public	Class is public accessible
abstract	Class cannot be instantiated
final	Class cannot be subclassed
class NameOfClass	Name of the class
extends Super	Superclass of this class
implements Interfaces	Interfaces implemented by this class

{
ClassBody
}	

Class Construction

- The Class body
  - The class body contains all of the code :
    - constructors,
    - declarations for the variables,
    - methods.

    « ***Note* » *Constructors are not methods. Nor are they members***.

Class Construction

- The Class body
  - *Constructors*
    - All Java Classes have constructors
    - Initialize a new object of that type
    - The same name as the class
    - In the example we define a single constructor but we can define some constructors or zero constructor

Class Construction

```
public BankAccount(String accountNumber)
{
       this.accountNumber=accountNumber;
}
public BankAccount(String accountNumber,int initialBalance)
{
       this.accountNumber=accountNumber;
       this.balance=initialBalance;
}
```

Class Construction

- The Class body
  - *Constructors*
    - *Access specifiers for constructors*
      - *private*
      - *protected*
      - *public*
      - *package (default)*

Class Construction

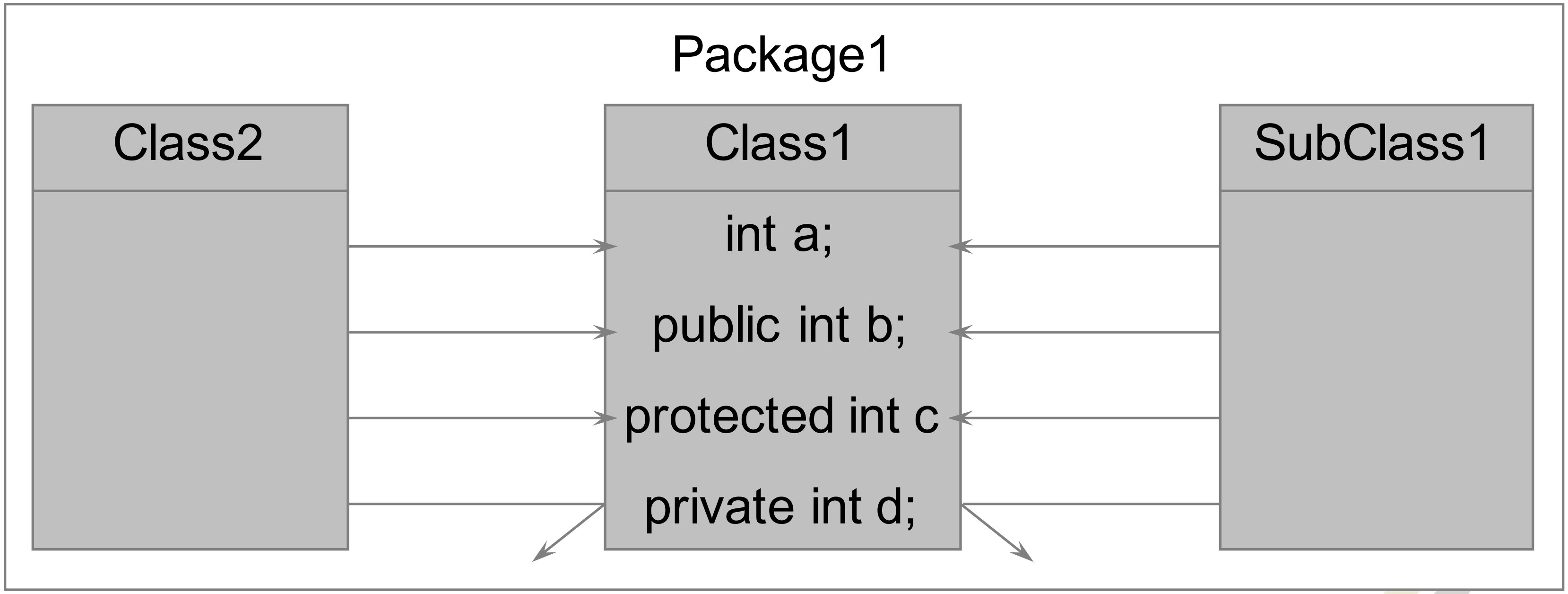
- The Class body
  - *Declaring Member Variables*
    - A class's state is represented by its member variables

```
public class BankAccount
{
        private int balance;
        private String accountNumber;
        ...
}
```

Declaration of Member Variable	
accessLevel	Indicates the access level for this member
static	Declares a class member
final	Indicates that is a constant
transient	This variable is transient
volatile	This variable is volatile
type name	the type and the name of the variable

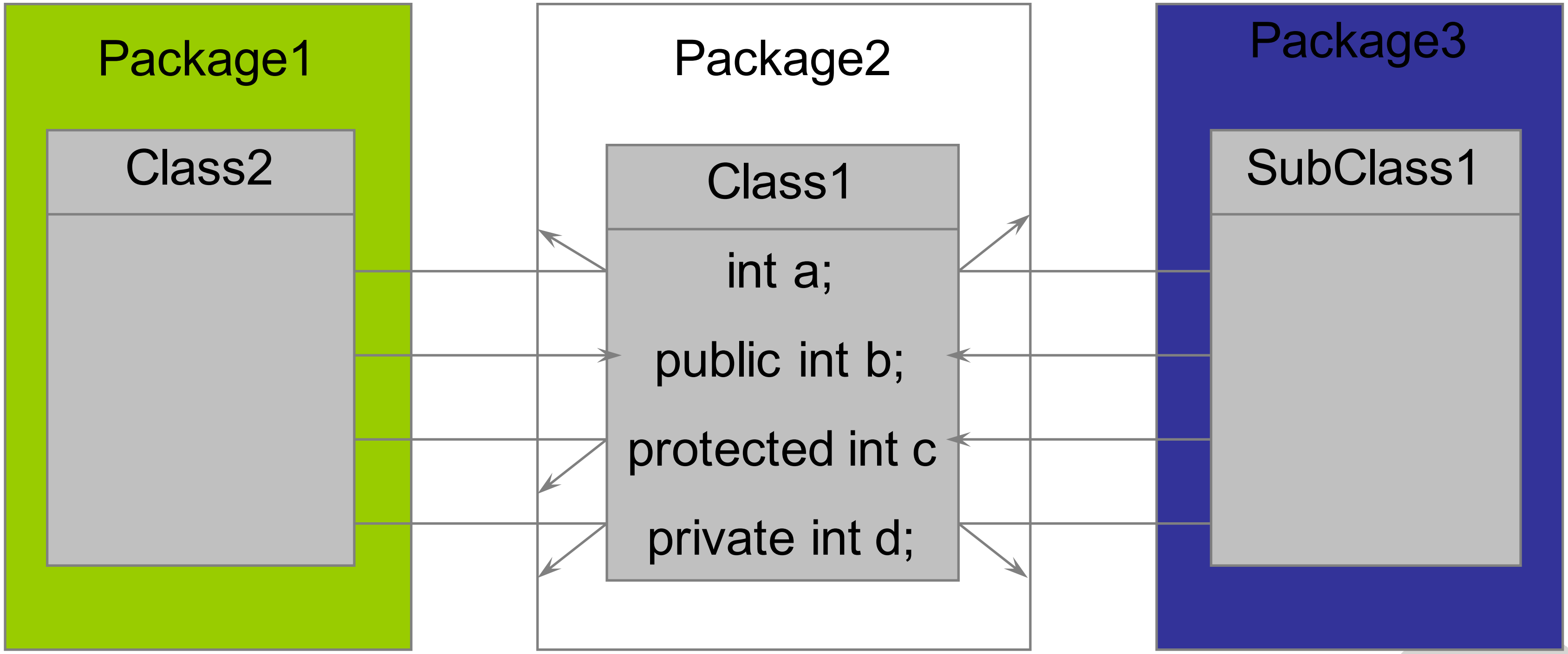
Class Construction

- The Class body
  - *Declaring Member Variables*
    - *AccessLevel*



Class Construction

- The Class body
  - *Declaring Member Variables*
    - *AccessLevel*



Class Construction

- The Class body
  - *Declaring Member Variables*
    - *static*
    - *final*
    - *transient*
    - *volatile*
    - *type*
    - *name*

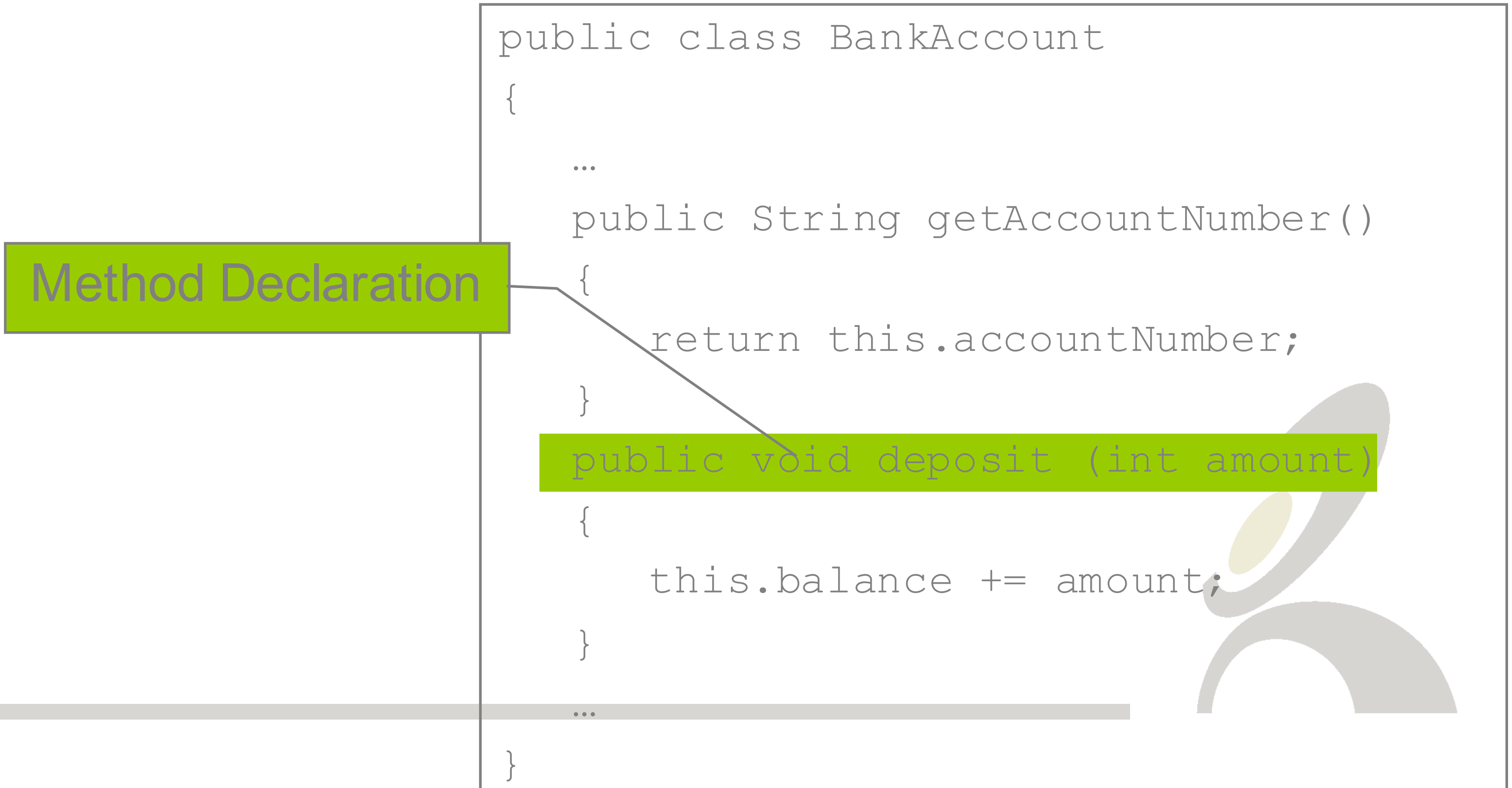
Class Construction

- The Class body
  - *Implementing Methods*
    - As you know, objects have behavior that is implemented by its methods.

```
public class BankAccount
{
   …
   public String getAccountNumber()
   {
      return this.accountNumber;
   }
   public void deposit (int amount)
   {
      this.balance += amount;
   }
   …
}
```

Class Construction

- The Class body
  - *Implementing Methods*
    - As you know, objects have behavior that is implemented by its methods.

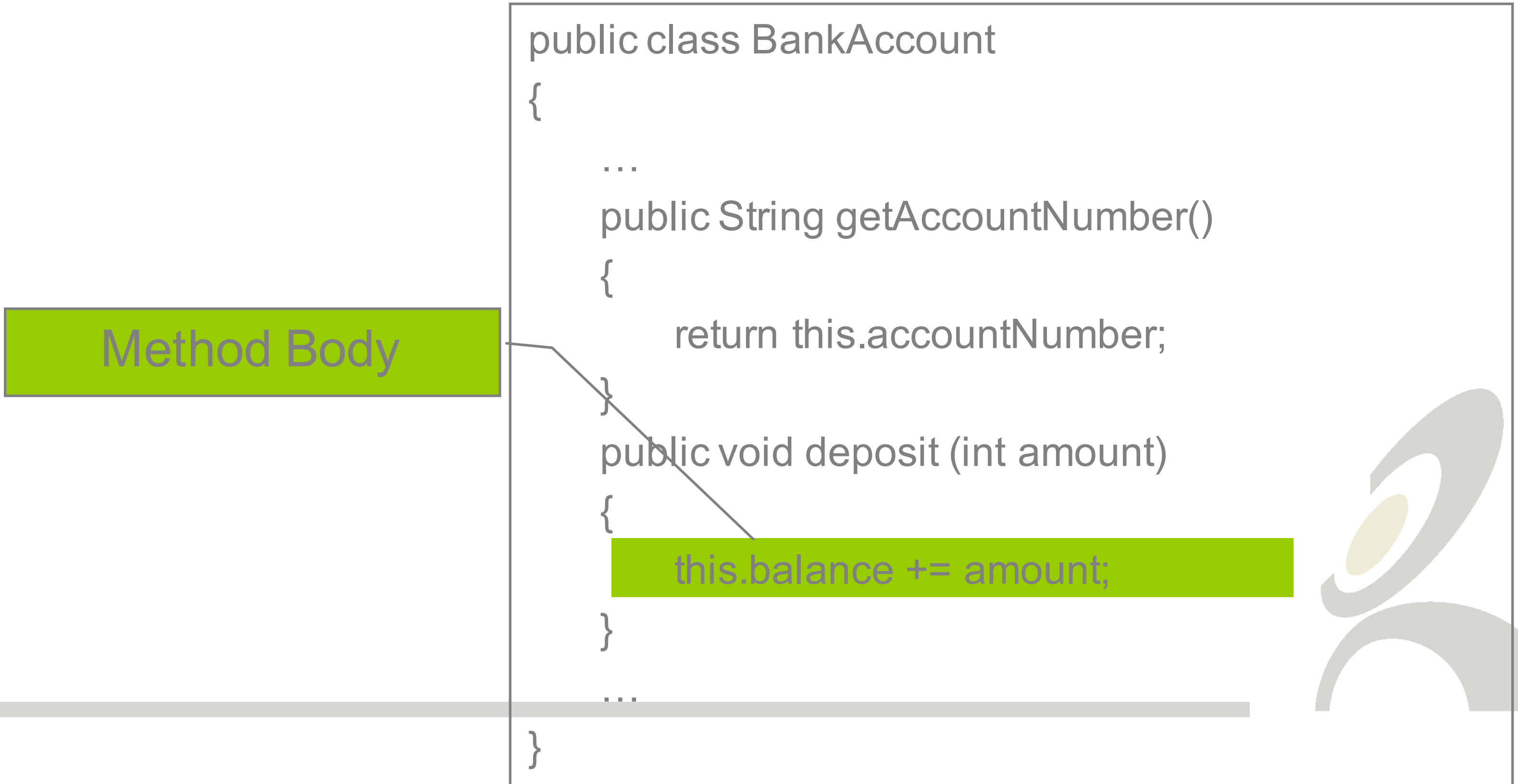


Method Declaration

```
public class BankAccount
{
    …
    public String getAccountNumber()
    {
        return this.accountNumber;
    }
    public void deposit (int amount)
    {
        this.balance += amount;
    }
    …
}
```

Class Construction

- The Class body
  - *Implementing Methods*
    - As you know, objects have behavior that is implemented by its methods.

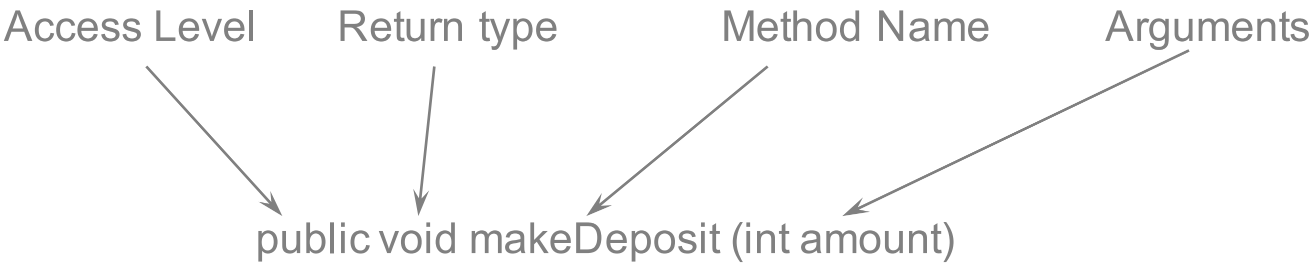


Method Body

```
public class BankAccount
{
    …
    public String getAccountNumber()
    {
        return this.accountNumber;
    }
    public void deposit (int amount)
    {
        this.balance += amount;
    }
    …
}
```

Class Construction

- The Class body
  - *Implementing Methods*
    - Method Declaration



Access Level

Return type

Method Name

Arguments

public void makeDeposit (int amount)

Class Construction

- The Class body
  - *Implementing Methods*
    - Method Declaration

Elements of a Method Declaration	
accessLevel	Indicates the access level for this method
static	Declares a class method
abstract	This method is not implemented
final	Method cannot be overridden
native	Method implemented in another language
Synchronized	Method requires a monitor to run
returntype methodName	the return type and the method name
(paramlist)	the list of arguments
throws exceptions	The exceptions thrown by this method

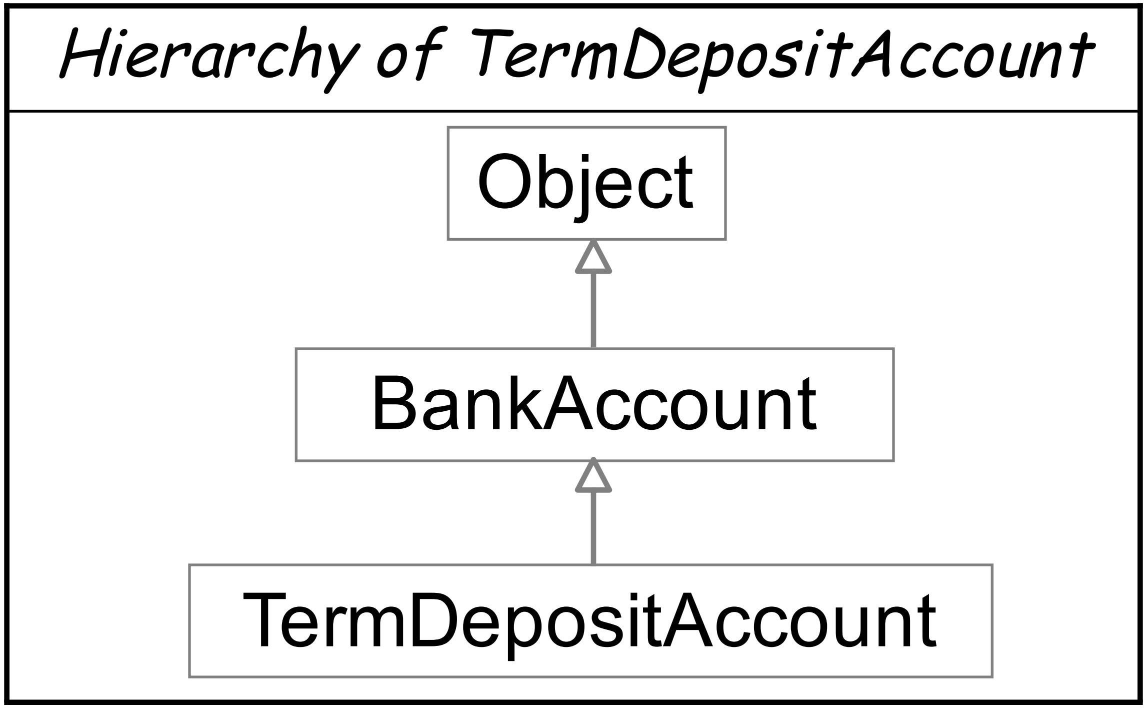
Class Construction

- The Class body
  - *Implementing Methods*
    - Returning a Value from a method
      - If method's return type is not **void** ➔ use the **return** operator to return the value

```
public class BankAccount
{
    …
    public String getAccountNumber()
    {
        return this.accountNumber;
    }
    public void deposit (int amount)
    {
        this.balance += amount;
    }
    …
}
```

Class Construction

- The Class body
  - *Implementing Methods*
    - Returning a Value from a method



    - the getAccountNumber method can return a TermDepositAccount but not a Object

Class Construction

- The Class body
  - *Implementing Methods*
    - Passing information into a Method
      - declare the type and name for each arguments in the **method signature**

```
public int computePerimeter(int side1, int
side2, int side3)
{
   return side1 + side2 + side3;
}
```

      - Argument types are valid Java data types like : primitive data types, reference data types (objects, arrays, interfaces)
      - Argument names is used to refer to the item into the method body.
      - if a method argument have the same name of a class's member the argument **hide** the class's member

Class Construction

- The Class body
  - *Implementing Methods*
    - Method Body
    - Local Variables
      - Within method body you can declare more variables

```
public int computePerimeter(int side1, int side2, int side3)
{
      int perimeter = side1 + side 2 + side3;
      return perimeter;
}
```

Class Construction

- The Class body
  - *The keywords this & super*
    - Use **this** to refer members in the current object
    - Use **super** to refer members in the superclass that the current class has hidden or overridden

Contents

- Class Construction
  - Class Declaration
  - Class Body
- Understanding Instance and Class Members
  - Instance variables & instance methods
  - Class variable & class methods
  - Objects vs. Classes

Understanding Instance and Class Members

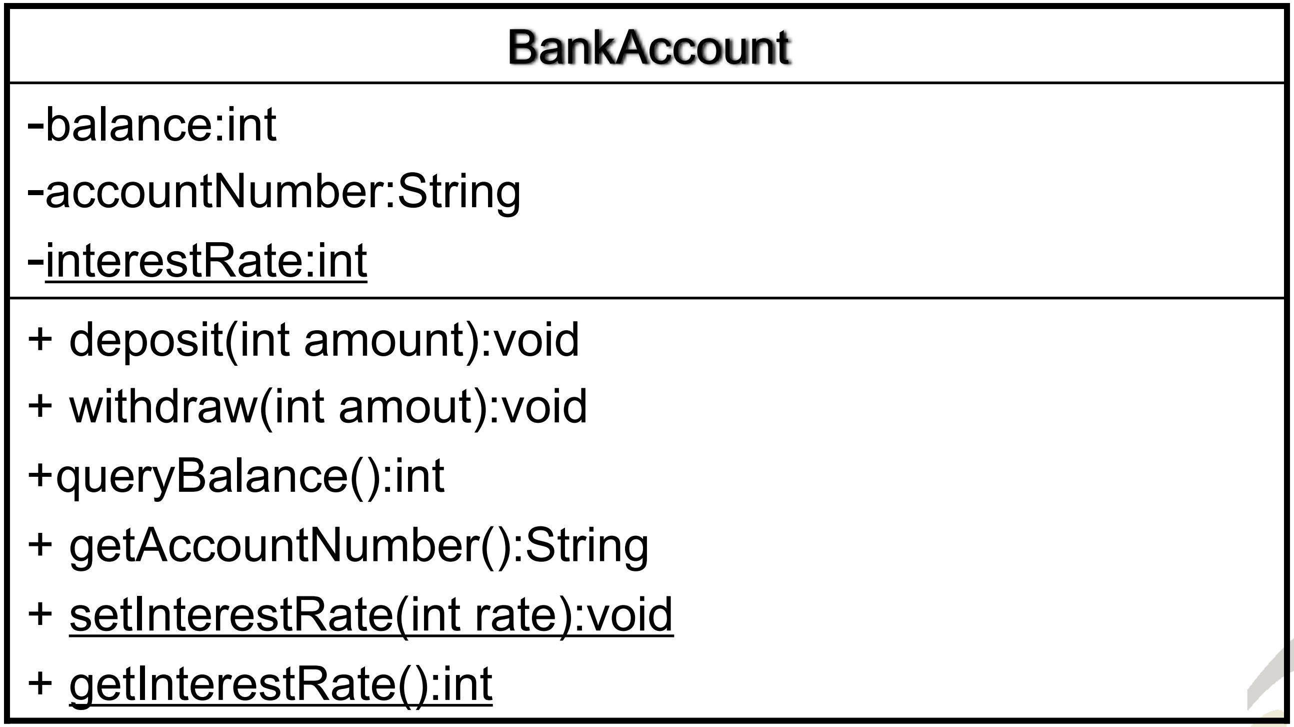
- Instance variables & instance methods
  - The values for instance variables are provided by each instance of the class.
  - When you create a class you must instantiate it before you can use it.
  - You can now invoke instance methods of this object
  - Instances of the same class share the same **instance method implementations**, which **reside in the class itself**

Understanding Instance and Class Members

- Class variable & class methods
  - Classes can also define class variables and class methods
  - You don’t have instantiate a class to use its class methods and variables
  - class methods use only class variables (not instances methods or variables)
  - Single copy of all class variables when the program use this class the first time

Understanding Instance and Class Members

- Class variable & class methods



BankAccount

-balance:int
-accountNumber:String
-interestRate:int

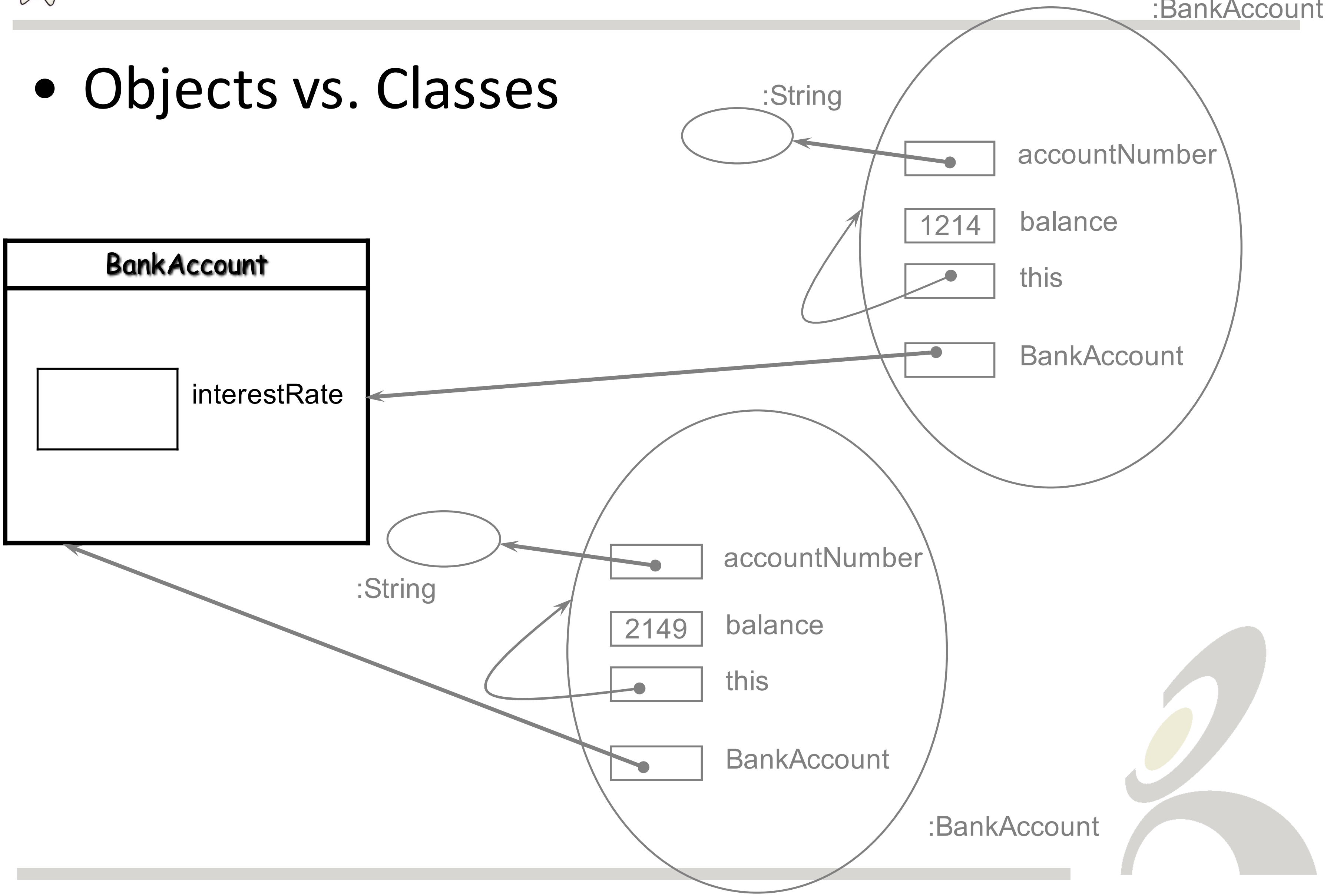
+ deposit(int amount):void
+ withdraw(int amout):void
+queryBalance():int
+ getAccountNumber():String
+ setInterestRate(int rate):void
+ getInterestRate():int

Understanding Instance and Class Members

- Objects vs. Classes
  - In the real world, the classes are not themselves the objects that they describe
    - A blueprint of a bank account is not a bank account.
  - Classes contain :
    - description of the ≠ variables and methods;
    - values of the class variables;
    - link to their superclass.
  - Objects contain :
    - the actual value of the instance variables;
    - a link to their class type

Understanding Instance and Class Members

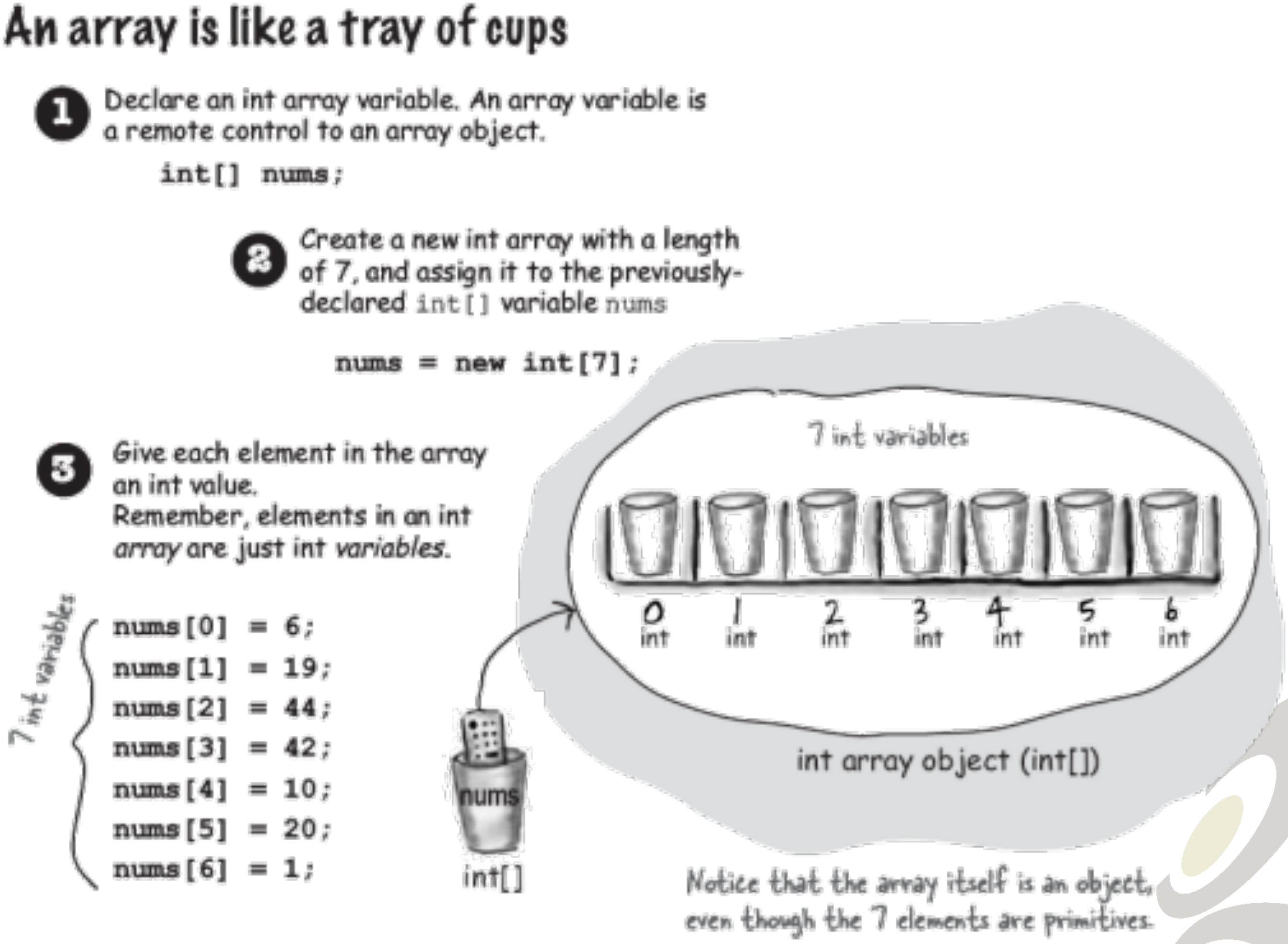
- Objects vs. Classes



Arrays

- Definition
  - Structure holding multiple values (same type)
  - Length established when created and fixed
  - *Array element* is one of value
  - *Array element* is accessed by it position

Arrays



An array is like a tray of cups

1. Declare an int array variable. An array variable is a remote control to an array object.

```
int[] nums;
```

2. Create a new int array with a length of 7, and assign it to the previously-declared `int[]` variable `nums`

```
nums = new int[7];
```

3. Give each element in the array an int value.
Remember, elements in an int *array* are just int *variables*.

```
nums[0] = 6;
nums[1] = 19;
nums[2] = 44;
nums[3] = 42;
nums[4] = 10;
nums[5] = 20;
nums[6] = 1;
```

Notice that the array itself is an object, even though the 7 elements are primitives.

Arrays

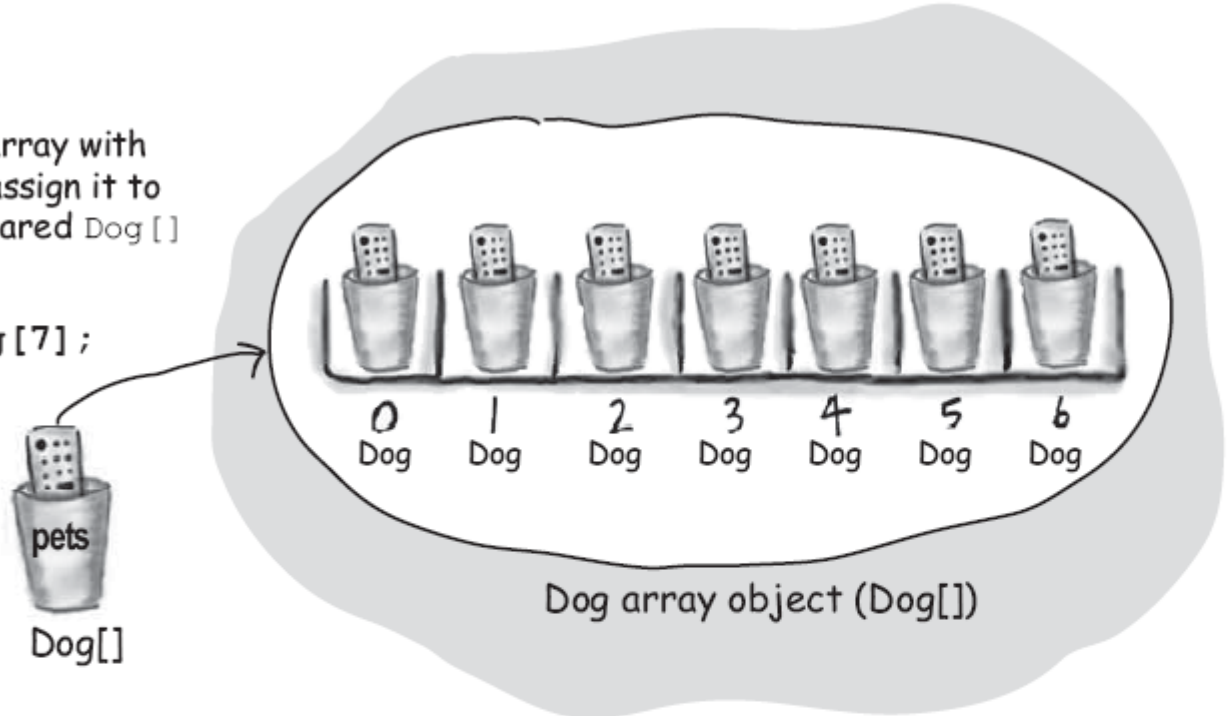
Make an array of Dogs

1. Declare a Dog array variable

```
Dog[] pets;
```

2. Create a new Dog array with a length of 7, and assign it to the previously-declared `Dog[]` variable `pets`

```
pets = new Dog[7];
```



What's missing?

Dogs! We have an array of Dog *references*, but no actual Dog *objects*!

Arrays

3. Create new Dog objects, and assign them to the array elements.
Remember, elements in a Dog *array* are just Dog reference *variables*. We still need Dogs!

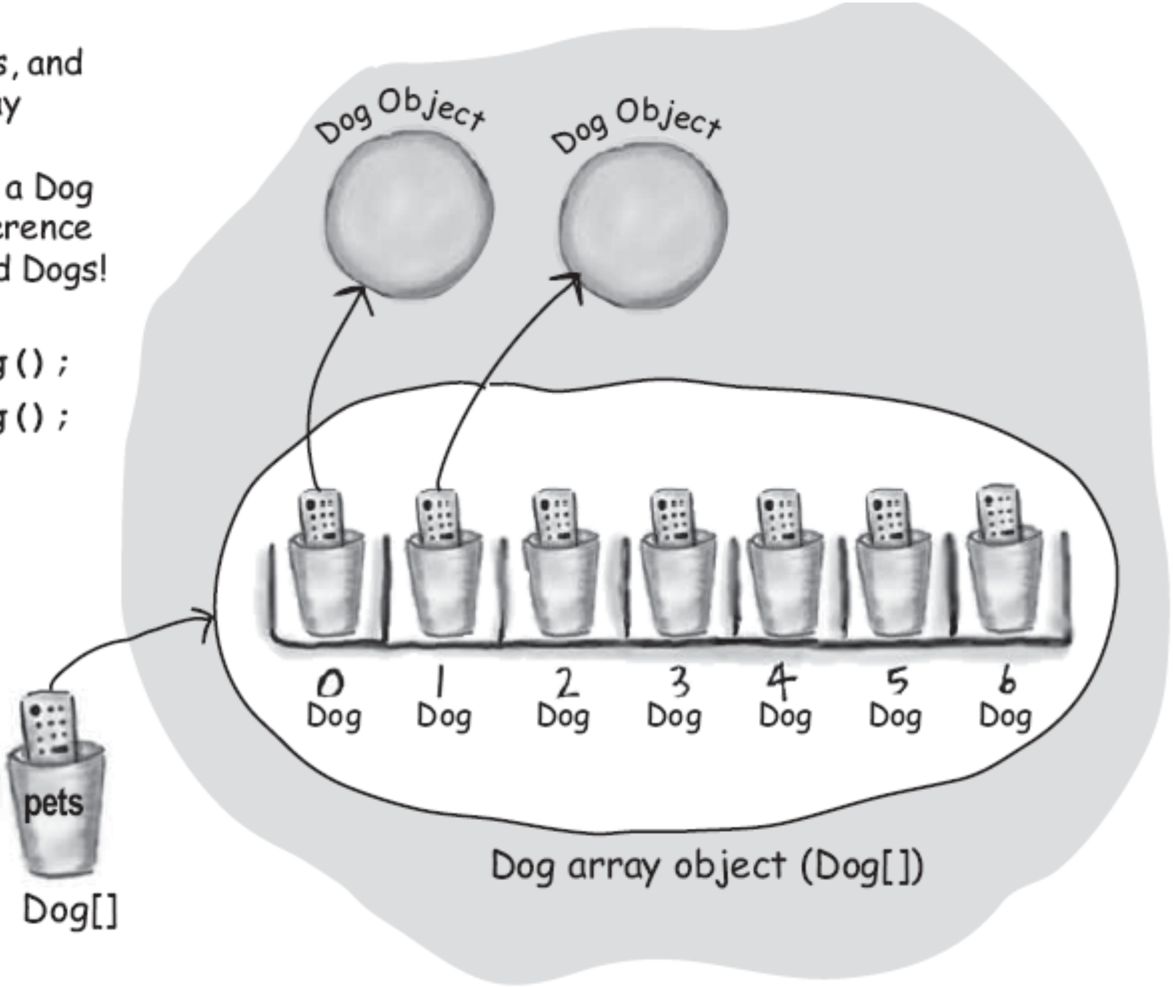
```
pets[0] = new Dog();
pets[1] = new Dog();
```

Sharpen your pencil

What is the current value of pets[2]? ____________

What code would make pets[3] refer to one of the two existing Dog objects?

____



Arrays

- Creating and Using Arrays

```java
public class ArrayDemo {
 public static void main(String[] args) {
 int[] anArray;
 anArray = new int[10];

 for (int i = 0; i < anArray.length; i++) {
  anArray[i] = i;
  System.out.print(anArray[i] + " ");
 }
 System.out.println();
 }
}
```

Arrays

- Getting the Size of an Array
  - anArray.length
- Array Initializers
  - boolean[ ] answers = {true, false, true, true};

Questions ??