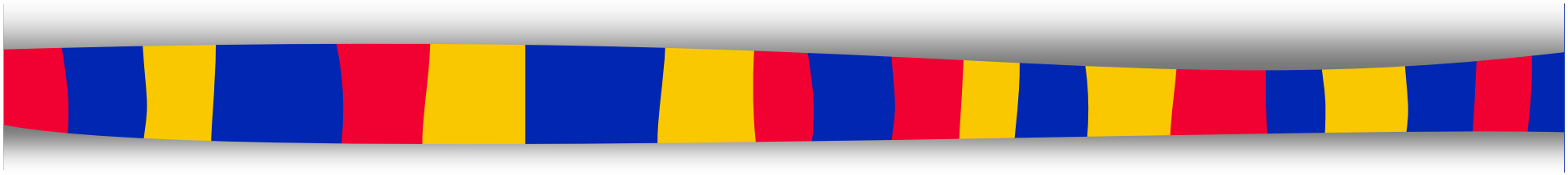
COMP-248
Object Oriented Programming I



Classes and Objects

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Adapted for Section EE by S. Ghaderpanah, Fall 2015

In this chapter, we will see:

1. Writing our own classes
   - 1.1 Classes and Objects
   - 1.2 Instance Variables
   - 1.3 Methods
2. Some notions of OOP
3. Passing and returning objects
4. Recap

Predefined classes

- Programmers can:
  use pre-defined classes
  develop their own classes

- a *class library* is a collection of pre-defined classes

- the *Java standard class library* (or *Java API* - Application Programming Interface) defines many classes
  ex:
  the **`System`** class
  the **`String`** class

Writing our own classes…

So far, our program had only 1 class with 1 method (**main**)

```
public class MyProgram
{
   public static void main (String[] args)
    { … }
}
```

For large problems…

- the program becomes large and difficult to understand
  e.g., repetition of instructions, variables are dispersed…

Solution:

- Decompose the problem into sub-problems.
- Use **methods** to implement the sub-problems
- Group related variables and methods into **classes**

Classes and Objects

- A class is a type and you can declare variables of a class type.

- A value of a class is called an objects. An object has 2 components:

  - *Data (instance variables)* - descriptive characteristics

  - *Actions (methods)* - what it can do (or what can be done to it)

Objects

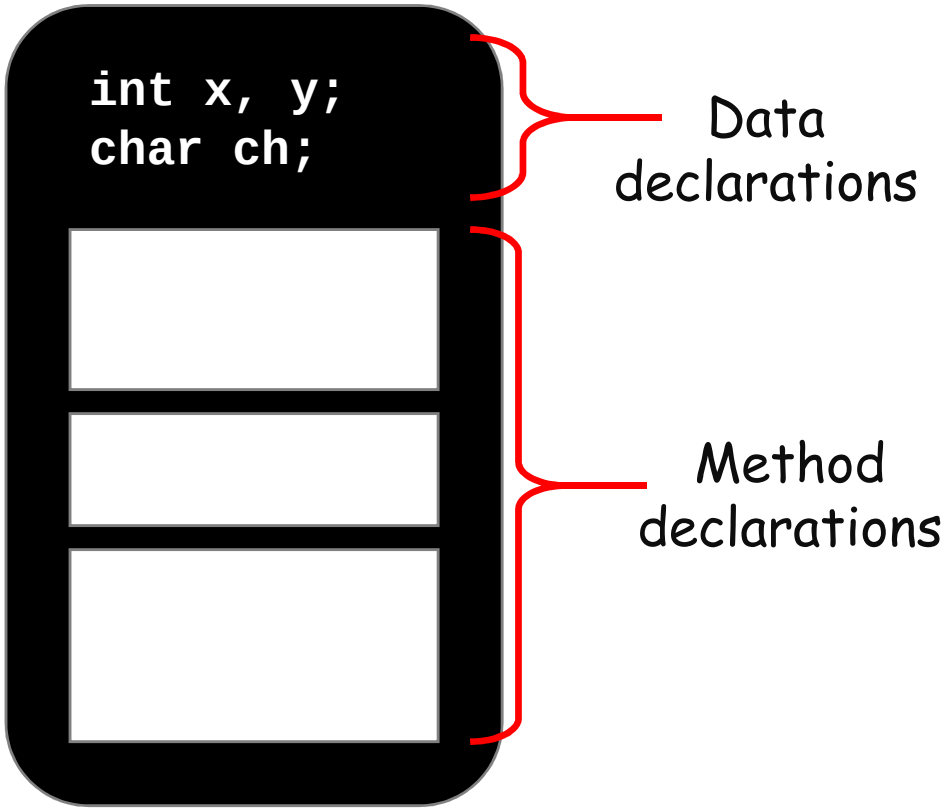
- An object is often referred to as an instance of the class

- Each object can have **different data**, but **all objects have the same actions**.

Declaration of Classes

A class contains:

1. data declarations (instance variables)
2. action declarations (methods)



Example: A class definition

```
public class Date
{
   public String month;
   public int day;
   public int year;

   public boolean isWeekEnd ()
   {
      …
   }

   public void printDate()
   {
      ...
   }
}
```

data declarations (instance variables)

action declarations (methods)

Exercise 1

- Write a class, Car, that can be used to create car objects.
- Each car has a make, model, color and year.
- Also create a printCar() that prints each of the car's instance variables.

Declaring Objects

- The new operator is used to create an object of a class and associate it with a variable

- Example:
  - `nameOfClass nameOfObject = new nameOfClass();`
  - `nameOfClass nameOfObject ;`
    `nameOfObject = new nameOfClass();`

Example: A driver file

```
public class DateFirstTryDemo
{
   public static void main(String[] args)
   {
      Date date1;
      date1 = new Date();
      Date date2 = new Date();

      date1.month = “December”;
      date1.day = 31;
      date1.year = 2012;
      date1.printDate( );

   }
}
```

declaration of 2 objects

usage of the object

Q: How many instance variable and methods does our object have?

Classes and files

- In general, we store each class in its own file
- Our example program has 2 files:

1. The **class definition file**:

   defines the data and methods of a class

2. The **driver file**:

   contains the **`main`** method

   declares and uses objects of the class
   controls the use of other parts of a program
   often used to test other parts of the program

Just checking …

The new operator:

A. allocates memory
B. is used to create an object of a class
C. associates an object with a variable that names it.
D. all of the above.

Exercise 1 cont'd …

- Write a driver class that declares 2 Car objects
- Set the instance variables for each car and use the printCar() method to print out the instance variables

In this chapter, we will see:

1. Writing our own classes
   - 1.1 Classes and Objects
   - 1.2 **Instance Variables**
   - 1.3 Methods
2. Some notions of OOP
3. Passing and returning objects
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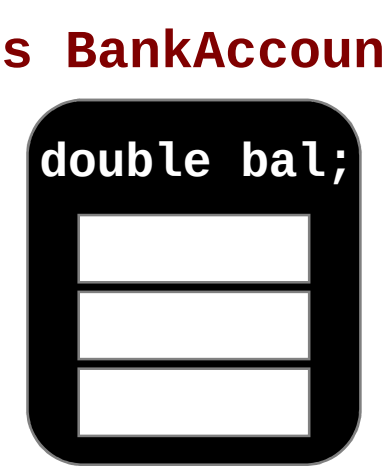
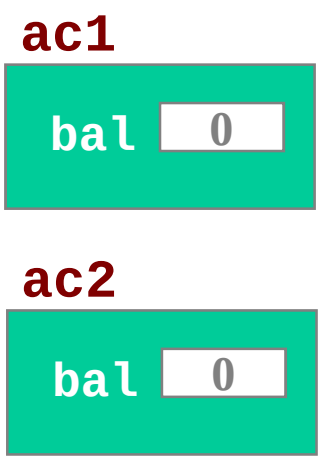
Instance Variables

- variables/constants declared inside the class **but not inside a specific method**
- also called attributes
- can be used by any method of the class
- initialized to 0 (false for booleans)
- each object (instance) of the class has its own instance data

Example:

```
BankAccount ac1=new BankAccount();
BankAccount ac2=new BankAccount();
```





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   - 1.2 Instance Variables
   - 1.3 **Methods**
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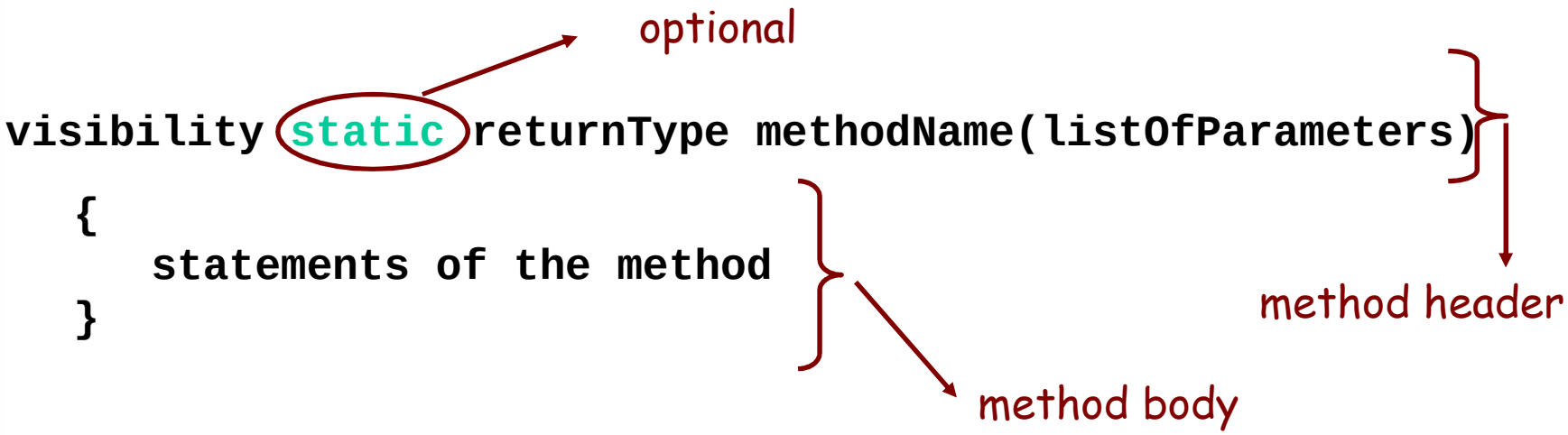
Methods

- Implement the behavior of all objects of a particular class
- All objects of a class share the method definitions
- Some methods are a bit special…
  (ex: constructor)
- Group of statements that are given a name
- A method is defined once, but can be used (called/invoked) several times

Definition of a method

- Method header and method body




```
public void sayHi()
{
  System.out.print("Hi");
}
```

```
public static void main(String[] args)
{
   …
}
```

Methods cont'd…

There are two kinds of methods:

- Methods that compute and **return a value**
- Methods that perform an **action**
  does not return a value
  is called a `void` method

Methods that return a result

- Must specify the type of that value in its heading:
  `public typeReturned methodName(paramList)`

- Examples:

  description: determines if the coin is a tail (1==tail, 0==heads)
  name: **`isTail`**
  result: **`boolean`**

```
public boolean isTail()
{
  if (face == 1)
     return true;
  else
     return false;
}
```

  description: returns the value of the face
  name: **`getFace`**
  result: **`int`**

```
public int getFace()
{
   return (face);
}
```

The return statement

Allows the method to "return" a result

syntax: **`return expression;`**

1. the expression is evaluated
2. the value of the expression is returned as the result of the method
3. the method is exited

```
public boolean isTail()
{
  if (face == 1)
     return true;
  else
     return false;
}
```

```
public int getFace()
{
   return (face);
}
```

```
public boolean isTail()
{
  return (_____________________________);
}
```

Another way of writing the method **`isTail()`** is …. ?

Methods that return no result

they perform an action performed, but do not "evaluate" to a value

ex: they display something, change the value of an attribute, …

They officially return **void**

They use no **return expression;**

or: **return;**

```
public void flip()
{
   face = (int)(Math.random()*2);
}
```

```
public _____ printFace()
{
  System.out.print(face);
}
```

```
public void flip()
{
    face = (int)(Math.random()*2);
    return;
}
```

Exercise 1 cont'd …

- Modify your Car class to add a method called getYear() that returns the year of a given car object

Next class, we will see:

1. Writing our own classes
   - 1.1 Classes and Objects
   - 1.2 Instance Variables
   - 1.3 **Methods (More)**
2. Some notions of OOP
3. Passing and returning objects
4. Recap