Introducing Classes, Objects and Methods

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- Class Fundamentals
- How Objects are Created
- Reference Variables and Assignment
- Methods
- Returning from a Method
- Returning Value
- Using Parameters
- Constructors
- Parameterized Constructors
- The new operator Revisited
- Garbage Collection and Finalizers
- The this Keyword

Class Fundamentals

- A ***class*** is a template that defines the form of an object.
- It specifies both data and the code that will operate on that data.
- Java uses a class specification to construct **objects.**
- **Objects** are instances of a class.
- **A class** is essentially a set of plans that specify how to build an objects

The general form of a class

```
class classname {
    // declare instance variables
    type var1;
    type varN;
        // declare methods
        type method1(parameters) {
        //body of method
        }
} //end class
```

Contd..

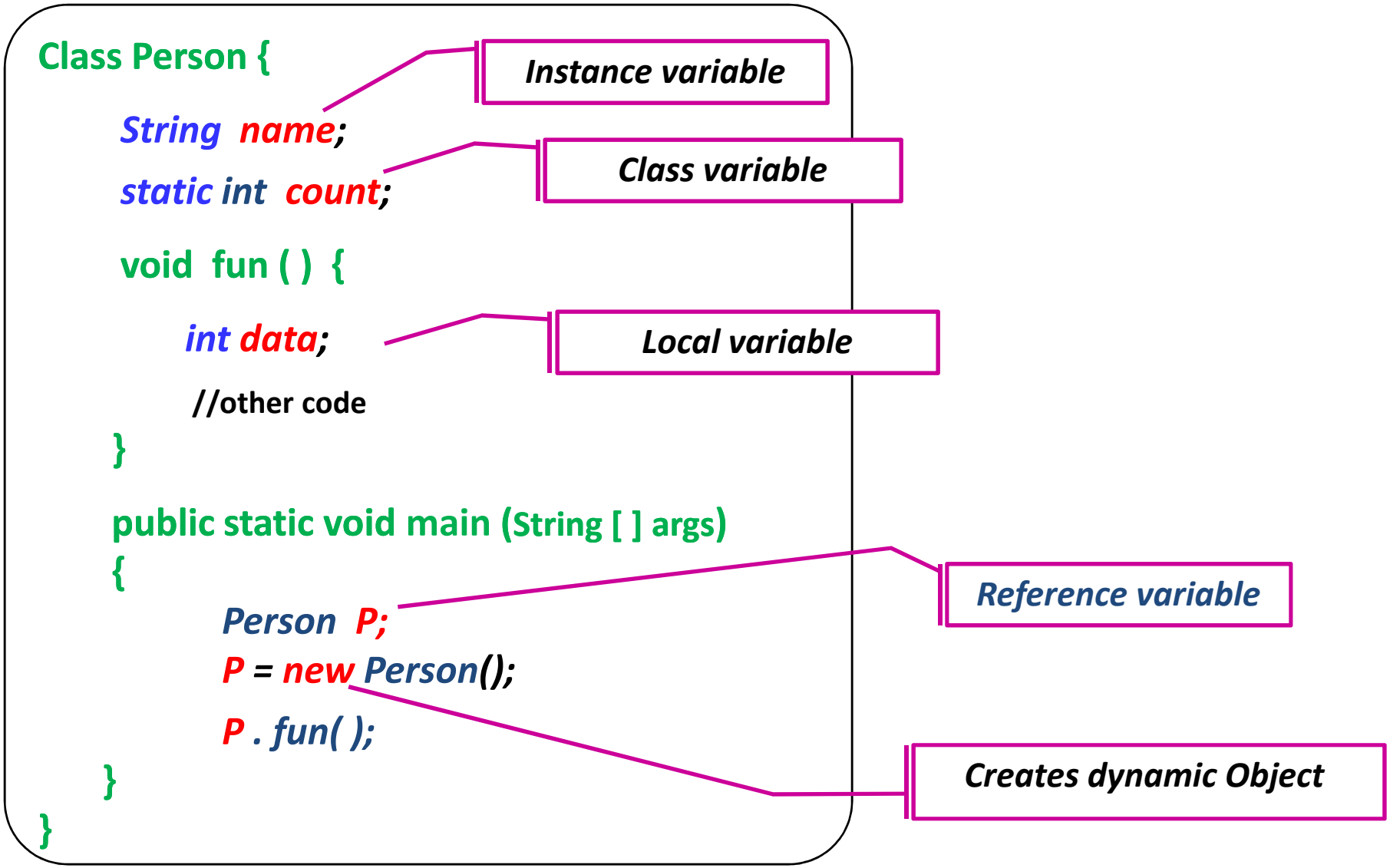
```
class Vehicle {
        int passengers; // number of passengers
        int fuelCap; // fuel capacity in litres
        int mpg; // fuel consumption in miles per litres
       }
```

- A class definition creates a new data type. In this case, the **new data type** is called **Vehicle.**

Types of class members

- **Types of class members**
  - ***Local variables*** **- inside method**
  - ***Instance variables - common to class methods.***
  - ***Class variables - are static variables***
  - ***Reference variable - hold some reference***

Types of variables



How Objects are Created

- The following line is used to create object:

  Vehicle v =new Vehicle*( );*

  – *It declares variable called v of the class type Employee.*

  – *The declaration creates a physical copy of the object and assigns to v a reference to that object. This is done by using new operator.*

  – *the new keyword dynamically allocates memory for an object and returns a reference to it.*

Contd..

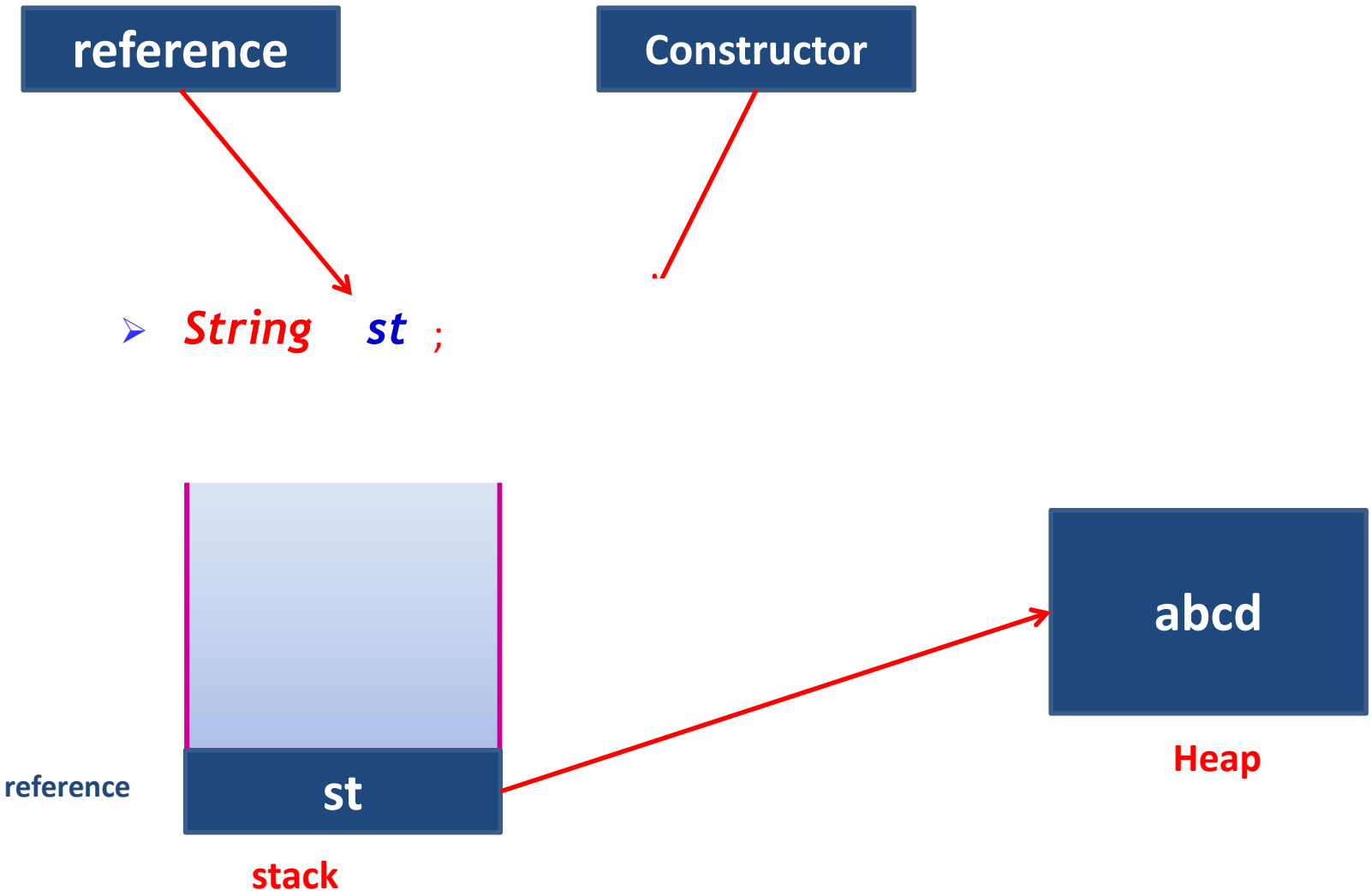
- Vehicle v; // declaring reference
- v = new Vehicle // allocating a vehicle object

  – The **dot operator(.)** links the name of an object with the name of a member.

  – The general form of the **dot operator** is
  object.member

  – In general the dot(.)operator is used to access **both instance variables and methods.**

Creating object



What should be the filename?

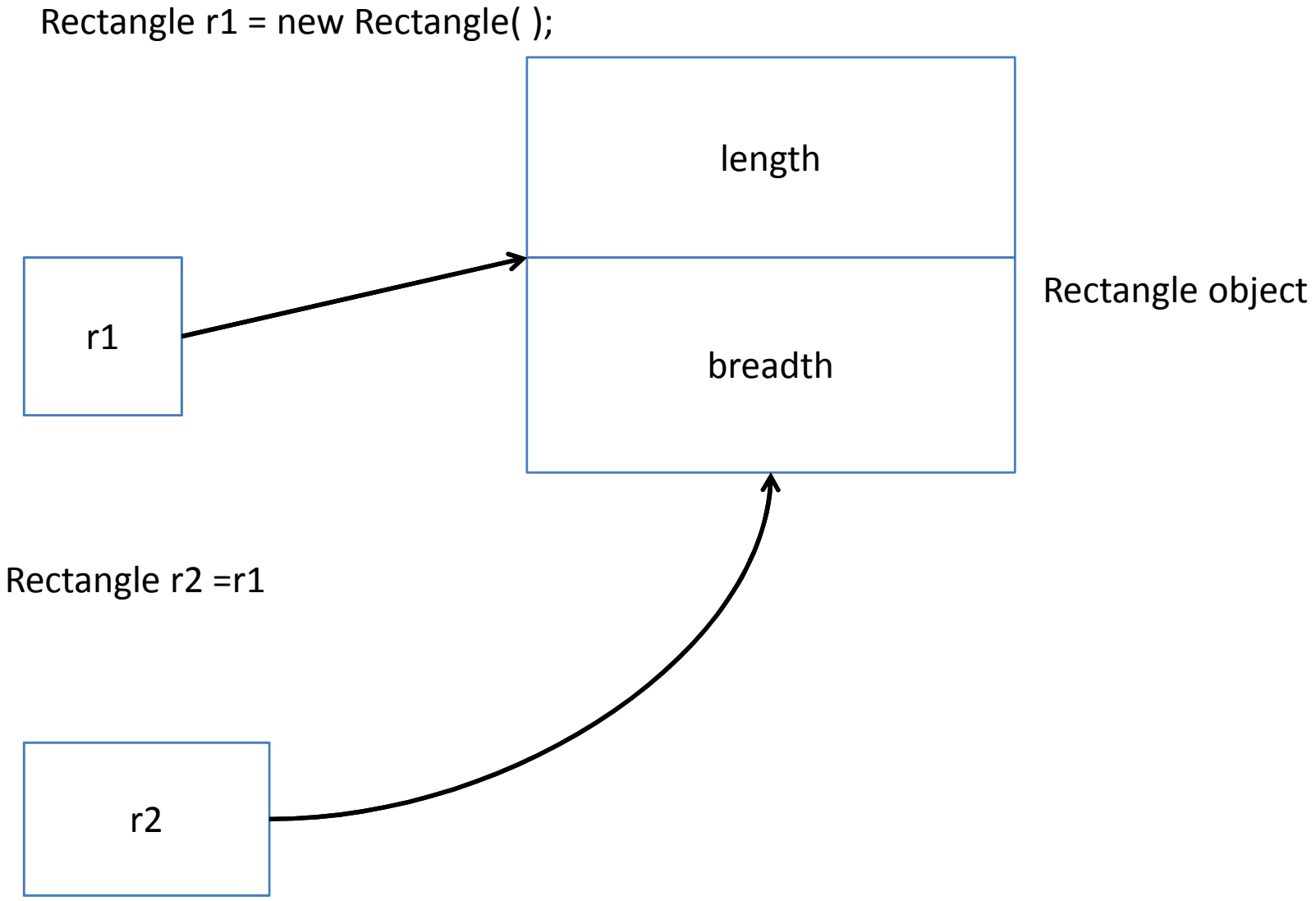
```
class Vehicle {
    int passengers;
    int fuelCap;
    int mpg;
}
class VehicleDemo {
    public static void main(String[] args) {
        Vehicle v = new Vehicle();
            int range;
              v.passengers = 7;
              v.fuelCap = 16;
              v.mpg = 21;
              range = v.fuelCap * v.mpg;
    System.out.println("Minivan can carry " + v.passengers + " with a range of
    " + range); }
}
```

Reference variables and assignment

- Assigning one object reference variable to another.

```
Rectangle r1 =  new Rectangle( );
Rectangle r2 = r1; // assigning r1
```

- r1 is reference variable which contain the address of Actual Rectangle Object
- r2 is another reference variable
- r2 is initialized with r1 means – "**r1 and r2**" both are referring same object , thus it does not create duplicate object , nor does it allocate extra memory.


Rectangle r1 = new Rectangle( );
length
r1
breadth
Rectangle object
Rectangle r2 =r1
r2

```
class Rectangle {
  double length;
  double breadth;
}

class RectangleDemo {

  public static void main(String args[])  {

  Rectangle r1 = new Rectangle();
  Rectangle r2 = r1;

  r1.length = 10;
  r2.length = 20;

  System.out.println("Value of R1's Length : " + r1.length);
  System.out.println("Value of R2's Length : " + r2.length);

  }
}
```

Methods

- A method contains the statement that define its action.

  – Each method has a name
  – It is the same name used to call the method
  – General form

re-type name(parameter-list)

```
 {
    //body of method
}
```

Contd..

- ***return_type*** is nothing but the value to be returned to an calling method.
- ***method_name*** is an name of method that we are going to call through any method.
- ***arg1,arg2,arg3*** are the different parameters that we are going to pass to a method.

Contd..

- Return type of method

1. Method can return any type of value.
2. Method can return any Primitive data type.

```
int sum(int a, int b);
```

3. Method can return Object of Class Type.

```
Rectangle sum (int num1,int num2);
```

4. Method sometimes may not return value.

```
void sum (int num1,unt num2);
```

Contd..

- ***Method Name***

1. Method name must be valid identifier.
2. All Variable naming rules are applicable for writing Method Name.

Parameter List

1. Method can accept ***any*** number of parameters.
2. Method can accept any ***data type*** as parameter.
3. Method can accept ***Object*** as Parameter
4. Method can accept ***no*** Parameter.
5. Parameters are separated by ***Comma***.
6. Parameter must have ***Data Type***

Returning from a method

```
class Rectangle {
  double length;
  void setLength(int len)
     {
       length = len;
      }
}
class RectangleDemo {
  public static void main(String args[]) {

  Rectangle r1 = new Rectangle();
  r1.setLength(20);

  System.out.println("After Function Length : " + r1.length);

  }
}
```

Returning a value

- Return values are used for a variety of purposes in programming.
- In some cases, such as **sqrt(),** the return value contains the outcome of some calculation.
- In other cases, the return value simply indicate success or failure.
- In still others, it may contain a status code.
- Methods return a value to the calling routine using this form of **return:**

return value;

Contd…

```
class Rectangle {
    double lenght, breadth;
void setLength(double len){
    length= len;
}
int getLength()
{
    return lenght*length;
}
```

```
class RectDemo {
 public static void main(String [] args)
{
      Rectangle r1 = new Rectangle();
      r1. setlength(10);
      int sum = r1.getLenght();
      System.out.println("length"+sum
);
      }
}
```

Using Parameters

- It is possible to pass one or more values to a method when the method is called.
- A value passed to a method is called an ***argument*.**
- Inside the method, the variable that receives the argument is called a ***parameter*.**
- Parameters are declared inside the parentheses that follow the method's name.
- The parameter declaration syntax is the same as that used for variables.

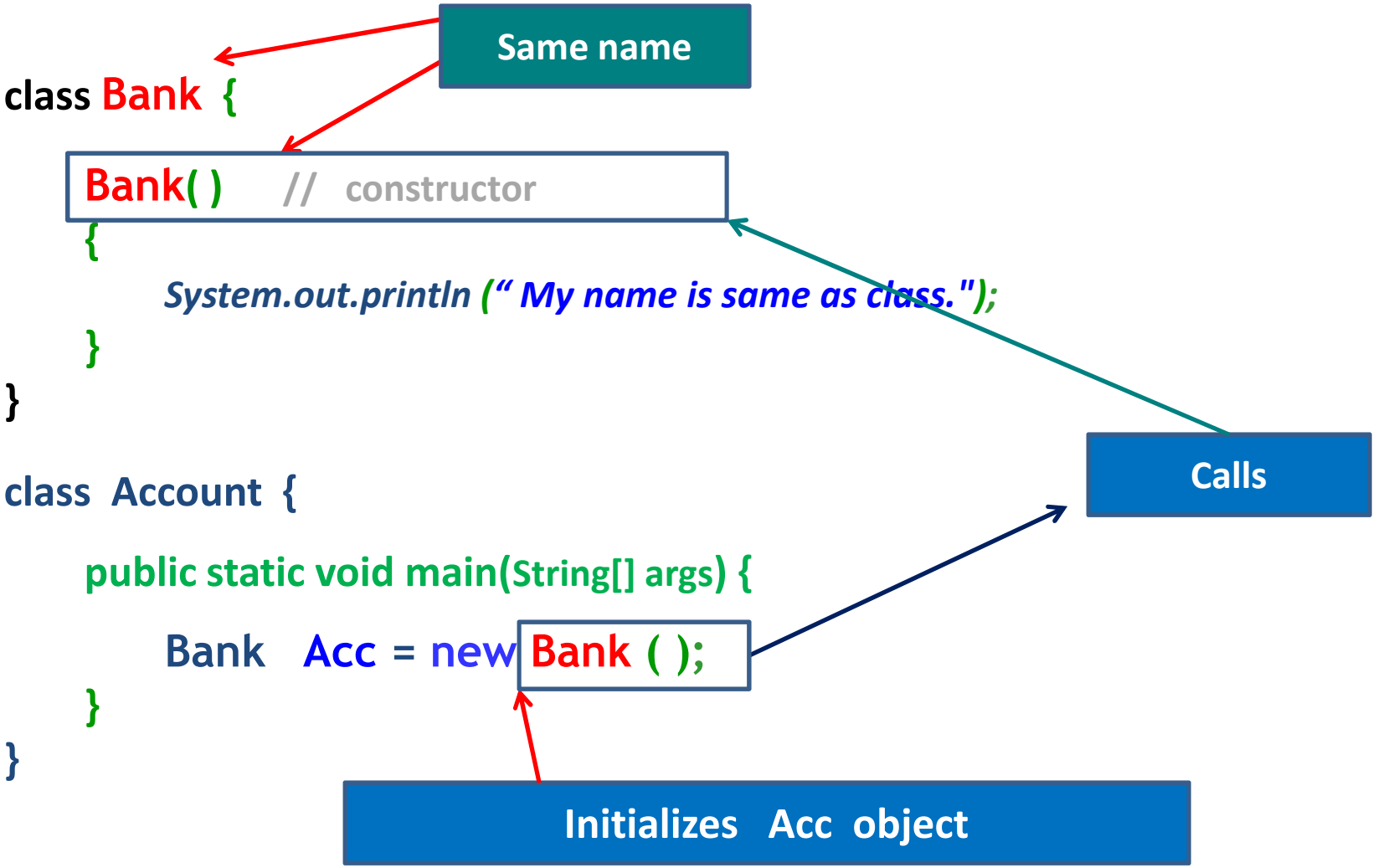
What is a constructor?

- a member function which initializes a class.
- A constructor has:

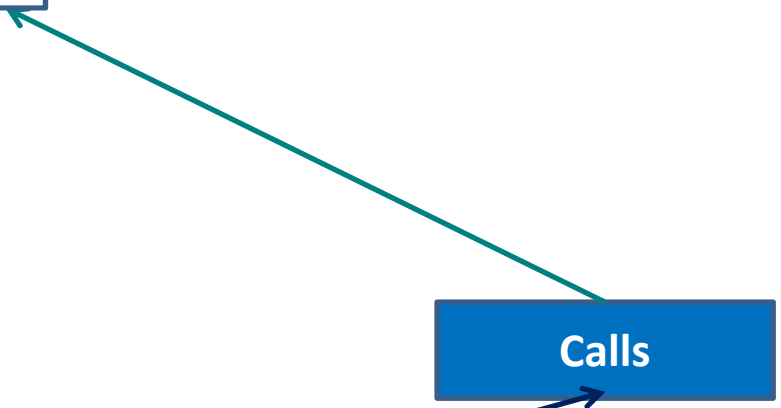
  (i) the same name as the class itself

  (ii) no return type

What is the name of the file



```
class  Animal  {
      String  name;
      boolean  goodDog;
      Animal ( String Dname, boolean  val )  {  // Parameterized constructor
      {
            name = Dname;
            goodDog = val;
      }
}

class  Demo {
    public static void main ( String [] args)    {
      Animal   dog =  new  Animal ( "Dobberman" , false ) ;
      // ..
    }
}
```



Destructor..

- A destructor is a special method typically used to perform cleanup after an object is no longer needed
- No destructors in java.
- Alternative in JAVA : garbage collection

About garbage collection..

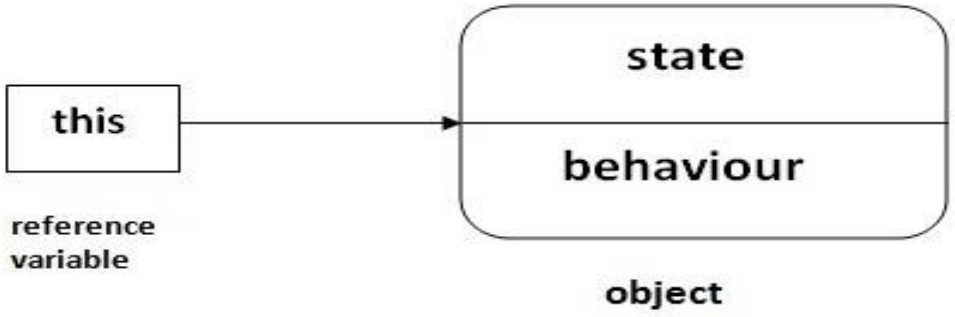
- **Garbage Collection** is carried by a ***daemon thread*** called ***Garbage Collector***.
- **Destroying object by garbage collector**
  - ✓ Before Destroy **invokes finalize () method.**
- **User can't force Garbage collection**; **JVM triggers it** if needed.
- **Requesting garbage collection**
  - ✓ `System.gc()` and `Runtime.gc()`
  - ✓ **send request to JVM** but **Garbage collection** is *not guaranteed.*

```
protected void finalize ( )
{
    //finalize code
}
```

- *A finalizer* in Java is the opposite of a constructor.
- a finalizer method performs finalization for the object.
- Garbage collector can't free resources, such as open files and network connections.
- you need to write a finalize() method for any object that needs to perform such tasks.

this – keyword

- *this* is a reference variable that refers to the *current object*.



- 5 usage of this keyword.
  1. *this.variable* :- access instance variable.
  2. *this.method()* :- calls method of current class.
  3. *this()* :- calls constructor of current class .
  4. *method(this)* :- passes current object as an argument.
  5. *return this* :- returns instance of current class.

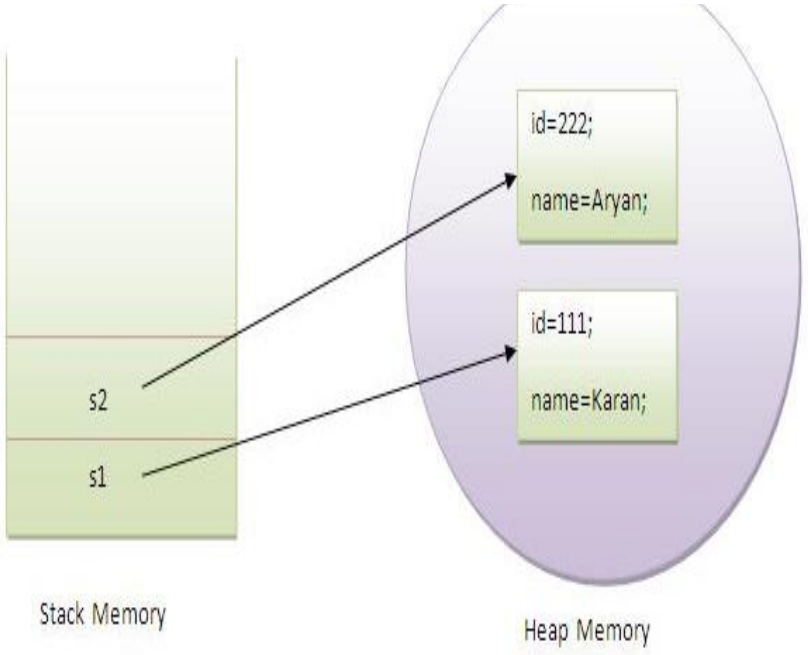
this – 5 uses

1. *this.variable* : to refer current class instance

```
//example of this keyword
class Student:  {
    int id;
    String name;

    Student:  (int id,String name){
    this.id = id;
    this.name = name;
    }
    void display(){System.out.println(id+" "+name);}
    public static void main(String args[]){
    Student:  s1 = new Student:  (111,"Karan");
    Student:  s2 = new Student:  (222,"Aryan");
    s1.display();
    s2.display();
}
}
```

Test it Now

```
Output111 Karan
          222 Aryan
```



this – – 5 uses

2. this() :- invokes current class constructor.

```
class Demo{
    Demo()
    {
        System.out.println("In first constructor");

    }
    Demo(String name){
        this(); //should be first line
        System.out.println("In Second constructor "+name);
    }

    public static void main(String args[]){

        Demo d= new Demo("John");
    }
}
```

this — 5 uses

3. this.method ():invoke current class method

```
class Student {

    void one(){
        System.out.println("one" );
        this.two();
    }

    void two(){

        System.out.println("Wellcome to Wase" );
    }

    public static void main(String args[]){
        Student s = new Student();
        s.one();
    }
}
```

this – 5 uses

4. Method(this): to pass as an argument in the method call.

```
class Student {

    void two( Student stud){
        System.out.println("two" );
        stud.three();
    }
    void three()
    {
        System.out.println("three");
    }
    void one()
    {
        System.out.println("one" );
        two(this);
    }

    public static void main(String args[]){
        Student s = new Student();
        s.one();
    }
}
```

this – keyword

5. return this : to return the current class instance.

Example: Rectangle .java

Syntax of class declaration

```
[ public ] [ ( abstract | final ) ]  class  ClassName

 {
        // variables

        // methods

 }
```

- **Modifiers** and **meaning**

Class type	Purpose
Public	can be seen by class of other package.

- A class can be
  - public class or
  - default (no modifier) class

```
public class Employee {

        … …

}
```

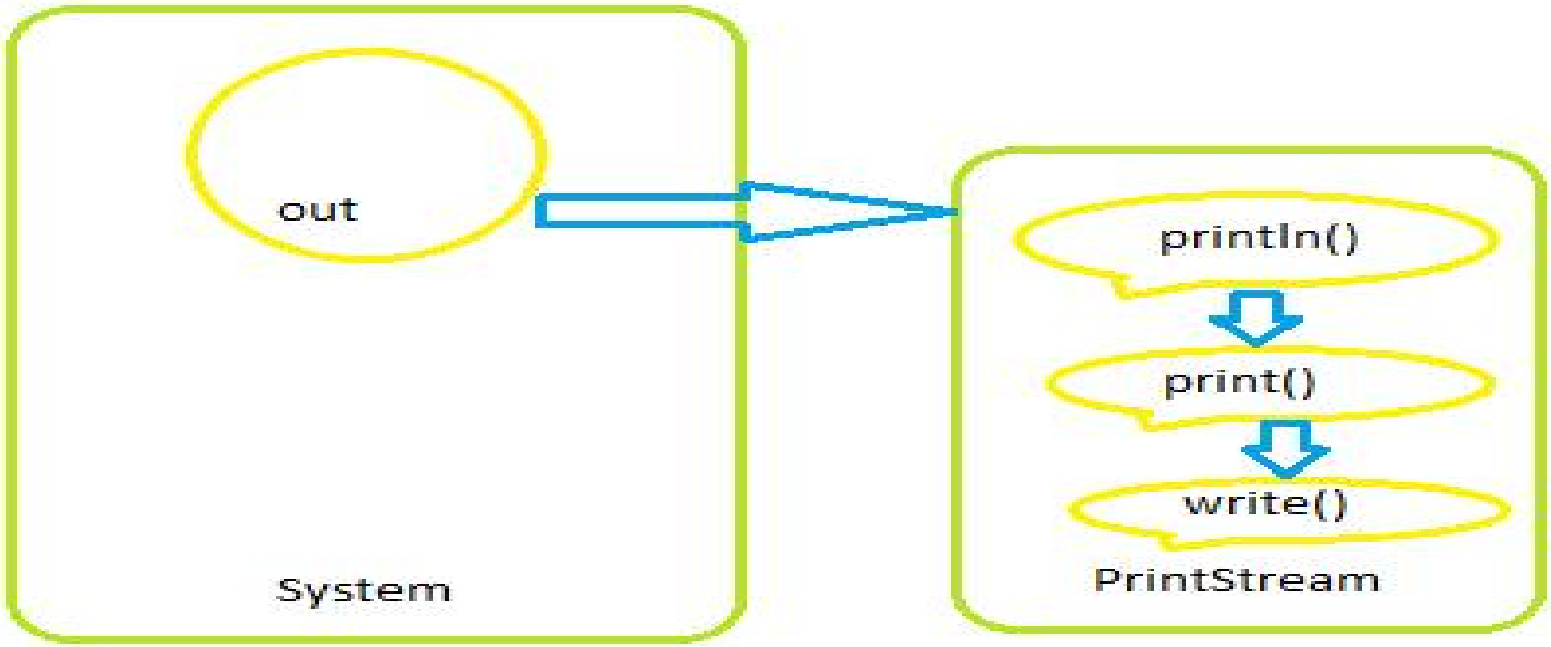
public class

```
class Employee {

        … …

}
```

default class

- There can be only one public class per source file.
- If there is a public class in a file,
  - the name of the file must match the name of the public class.
- A file can have more than one nonpublic class.

- **What is**
  - ***System.out.println ( ).***



- **What is**
  - ***System.out.println ( ).***

- ***System***
  - *is a final class and cannot be inherited.*

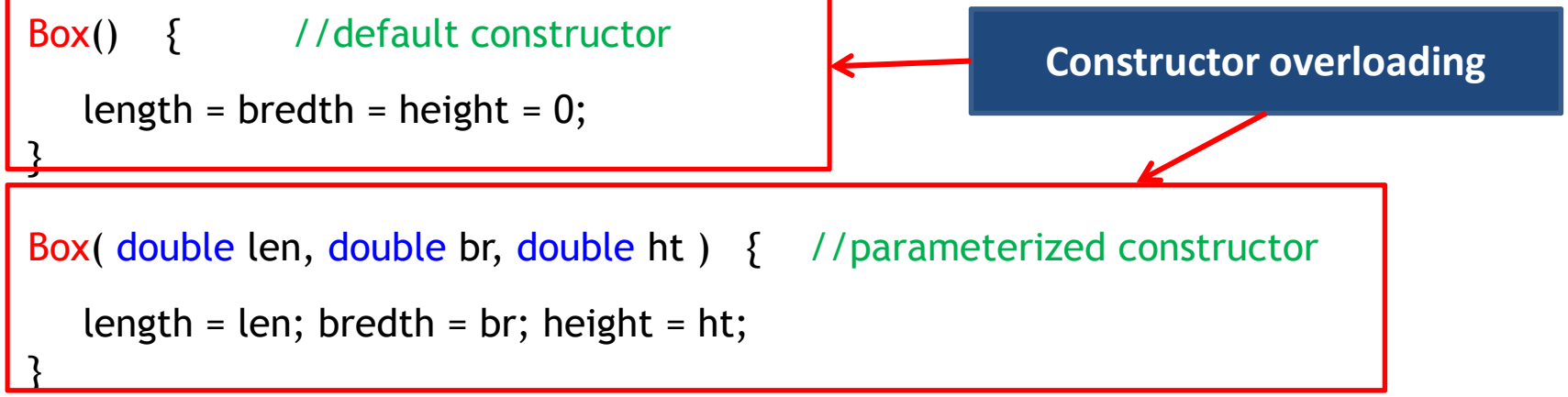
- ***out***
  - *is a static member field.*
  - *is public static object of PrintStream class.*
  - *gets mapped with standard output and is ready to accept data.*

- ***println()***
  - *is a method of PrintStream class.*

- **Method overloading**
- ***Constructor overloading***

Constructor and Method overloading

```
class Box {

    double length, bredth, height;

    Box()   {        //default constructor
        length = bredth = height = 0;
    }

    Box( double len, double br, double ht )  {   //parameterized constructor
        length = len; bredth = br; height = ht;
    }

    void volume( double side )  {
        System.out.print ( " Volume is = " + side * side * side);
    }

    void volume()   {
        System.out.print ( "volume is = "+ length * bredth * height);
    }
}
```



Constructor and Method overloading

```
class Box {

    double length, breadth, height;

    Box()   {        //default constructor
        length = breadth = height = 0;
    }

    Box( double len, double br, double ht )  {    //parameterized constructor
        length = len; breadth = br; height = ht;
    }

    void volume( double side )  {
        System.out.println ( " Volume is = " + side * side * side);
    }

    void volume()   {
        System.out.println ( "volume is = "+ length * breadth * height);
    }
}
```

Method Overloading

Constructor and Method overloading

```
class  Box Demo  {

      public static void main (String args []) {

          Box    b1 = new  Box (10, 20, 30);

          Box    b2 = new  Box ();

          b1.volume();

          b2.volume(30);
      }
}
```