Understanding Methods & Variables Scope

- Create and Use Methods
- Pass Objects by Reference and Value
- Understand Variable Scope
- Create and Use Constructors
- Use the this and super Keywords
- Create Static Methods and Instance Variables
- Member modifiers
- Encapsulation

Variables

- Depending on type of contents

  a). Reference Variables : to hold object references

  Ex : String s = "Java";

  b). Primitive Variables: to hold primitive values

  Ex : int i=10;

- Depending on the position at which variable is declared

  a). Local Variables b). Instance Variables c). Static Variables

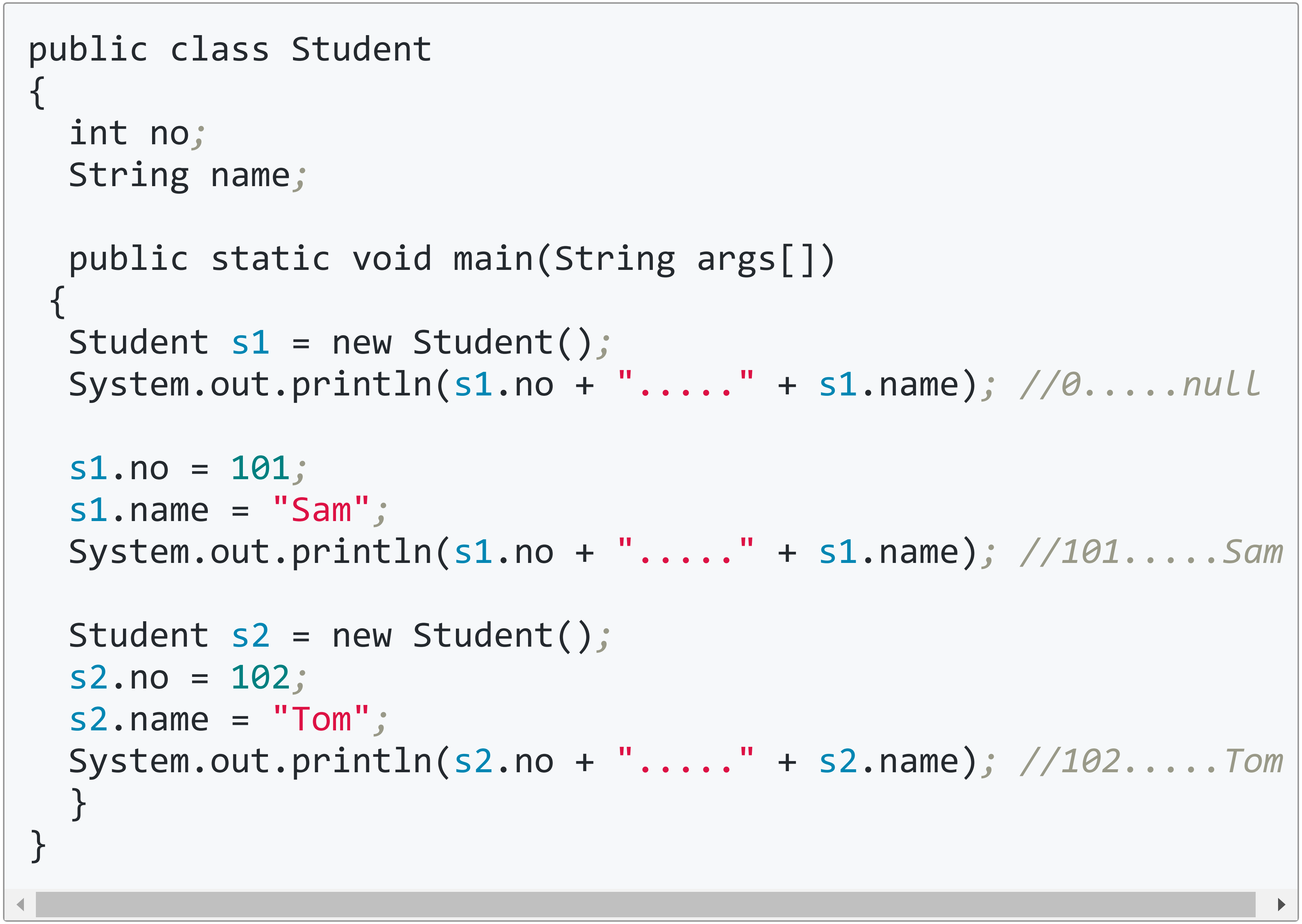
Local Variables (stack/temporary/automatic variables)

- Declared inside a method or block or constructor or in the method arguments
- Gets created as part of method execution and gets destroyed as soon as the method execution completes
- Must be initialized before using a local variable

```
public void print() {
    int i=10;
    System.out.println(i);
}  //Error : variable i might not have been initialized
```

Instance Variables (properties/attributes/member variables)

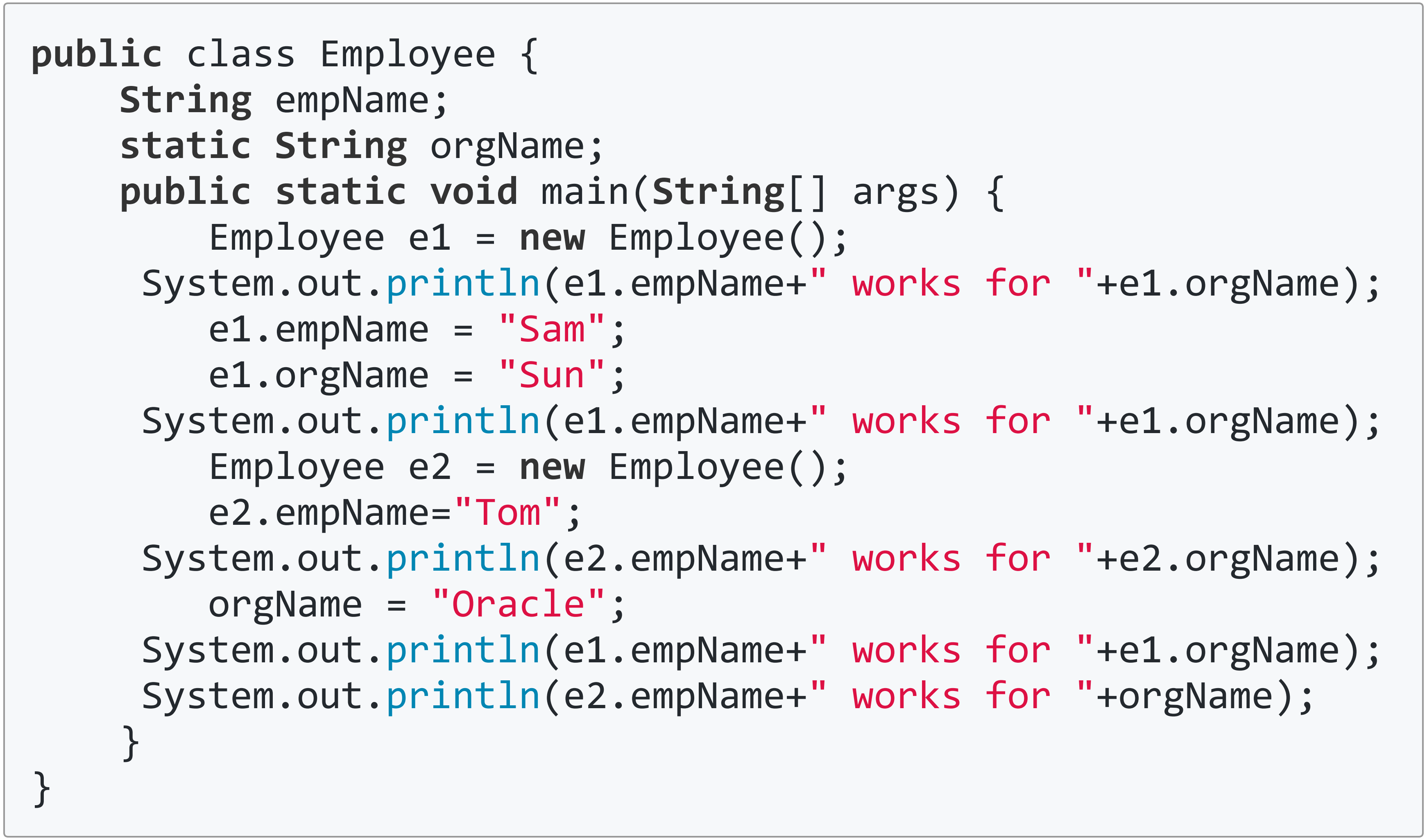
- If the values of the variables are varied from instance to instance such type of variables are called as instance variables
- Can be declared within a class, outside of any method or block
- Gets created as soon as new object is created and destroyed whenever garbage collector destroys that object
- Gets default values, no need to perform explicit initialization



```
public class Student
{
  int no;
  String name;

  public static void main(String args[])
 {
  Student s1 = new Student();
  System.out.println(s1.no + "....." + s1.name); //0.....null

  s1.no = 101;
  s1.name = "Sam";
  System.out.println(s1.no + "....." + s1.name); //101.....Sam

  Student s2 = new Student();
  s2.no = 102;
  s2.name = "Tom";
  System.out.println(s2.no + "....." + s2.name); //102.....Tom
  }
}
```

Static Variables (fields/class variables)

- static keyword can be applied for methods, variables and inner classes , but not for calsses
- If a single copy of the variable needs to be maintained & shared by all instances, such variables are called as static
- Value of static variable is same for all instances
- Gets created when the class is loaded into the memory and destroyed when the class is unloaded from memory
- Gets default values, no need to perform explicit initialization
- Can be accessed by using class name (highly recommended) or object reference from static and non-static contexts



```
public class Employee {
    String empName;
    static String orgName;
    public static void main(String[] args) {
        Employee e1 = new Employee();
     System.out.println(e1.empName+" works for "+e1.orgName);
        e1.empName = "Sam";
        e1.orgName = "Sun";
     System.out.println(e1.empName+" works for "+e1.orgName);
        Employee e2 = new Employee();
        e2.empName="Tom";
     System.out.println(e2.empName+" works for "+e2.orgName);
        orgName = "Oracle";
     System.out.println(e1.empName+" works for "+e1.orgName);
     System.out.println(e2.empName+" works for "+orgName);
    }
}
```

- Instance variables can not be accessed from static context directly.

```
public class Employee1 {
     String empName ="Sam";
    public static void main(String[] args) {
        System.out.println(empName);
//Error: non-static variable empName cannot be referenced
// from a static context
    } }
```

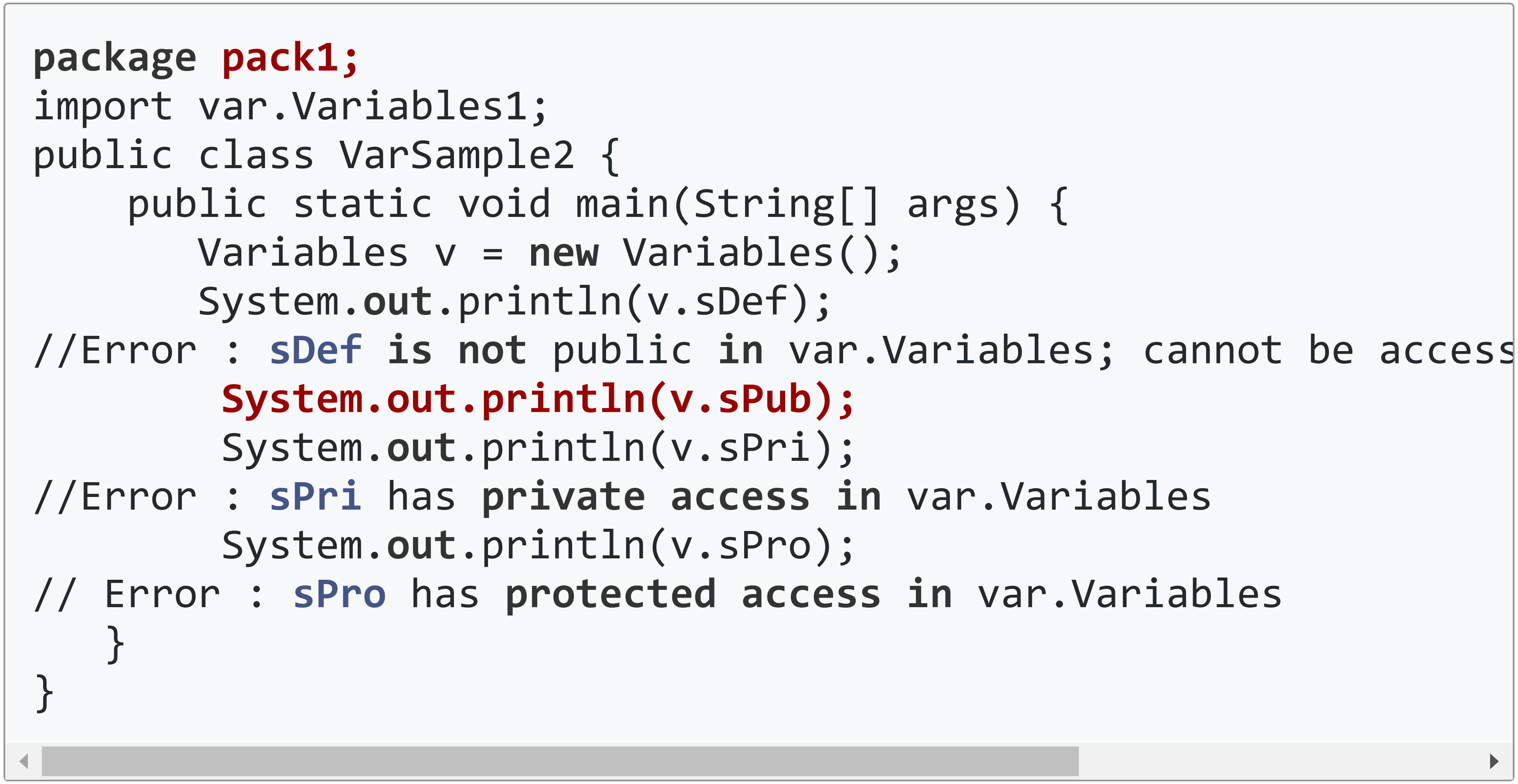
- static variables are used to define class level CONSTANTS(final)

```
public class Employee2 {
    public static final String ORGANIZATION_NAME ="Oracle";
    public static void main(String[] args) {
        System.out.println(ORGANIZATION_NAME);
    }
}
```

Member Modifiers

- default : (package level modifier)
  default member is visible with in the current package only
- public : can be acessed from anywhere within the package or outside the package
- private : can be accessed within the class only and can not be accessed it from outside the class
- protected : can be accessed in every class within the package, and accessible only in child classes from outside the package
  protected = default (current package) + child classes

```java
package var;
public class Variables {
    String sDef ="default";
    public String sPub = "public";
    private String sPri = "private";
    protected String sPro = "protected";
}

package var;
public class VarSample1 {
    public static void main(String[] args) {
        Variables v = new Variables();
        System.out.println(v.sDef);
        System.out.println(v.sPub);
        System.out.println(v.sPri);
      // Error : sPri has private access in var.Variables
        System.out.println(v.sPro);
   } }
```



```
package pack1;
import var.Variables1;
public class VarSample2 {
    public static void main(String[] args) {
       Variables v = new Variables();
       System.out.println(v.sDef);
//Error : sDef is not public in var.Variables; cannot be access
        System.out.println(v.sPub);
        System.out.println(v.sPri);
//Error : sPri has private access in var.Variables
        System.out.println(v.sPro);
// Error : sPro has protected access in var.Variables
   }
}
```

- protected members in child class must be accessed with child class refererence only

```java
package pack1;
import var.Variables;
public class VarSample3 extends Variables{
    public static void main(String[] args) {
        Variables v = new Variables();
        System.out.println(v.sPro);
  // Error : sPro has protected access in var.Variables

        VarSample3 v1= new VarSample3();
        System.out.println(v1.sPro);

        Variables v2= new VarSample3();
        System.out.println(v2.sPro);
  // Error : sPro has protected access in var.Variables
    }
}
```

Variable Argument (var-arg) Methods

- Allow us to specify that a method can take multiple arguments of the same types and allows no. of variables to be variable

```
public class VarArgSample1
{   static int add(int... x) {
    int sum = 0;
    System.out.println("Number of arguments: " + x.length);

    // using for loop to show array representation
    // for (int i = 0; i < x.length; i++) sum = sum + x[i];

    for (int a : x)  sum = sum + a; // using for each loop
        return sum;
    }

public static void main(String[] args) {
 System.out.println("Result="+add()); // no parameter
 System.out.println("Result="+add(1,2)); // 2 params
 System.out.println("Result="+add(1, 2, 3, 4)); // 4 params
   }  }
```

- var-arg parameter must be last in the parameter declarations, when we have other regular parameters.

```
public class VarArgSample2
{
//public void show( int... a, String name) { //Error : ')' expe
   public void show(String name, int... a){
        System.out.println(name+" scores :");
        for (int i:a)     System.out.println(i);
    }

  public static void main(String[] args) {
        VarArgSample2 x = new VarArgSample2();
        x.show("Sam", 90,80);
        x.show("Tom", 56, 90, 80, 50 );
    }
}
```

- In var-arg method, we are restricted to have only one var-arg param and it must be last parameter.

```
public class VarArgSample3 {
   public static void main(String[] args) {
       VarArgSample3 x = new VarArgSample3();
       x.print(1,2,3,'a','b','c','d');
   }

//public void print(int... a, char... c)//Error : ')' expected
  public void print(int... a)
   {
       for(int i:a)  System.out.println(i);
     /*   for (char ch : c) System.out.println(ch); */
   }
}
```

- Var-arg method will get last priority when there is method exists with exact no.of parameteres match.

```
public class VarArgSample4 {

  public void print(int... a) {
      System.out.println("Var-Arg Method");  }

  public void print(int a) {
      System.out.println("Regular Method");  }

  public static void main(String[] args) {
      VarArgSample4 x = new VarArgSample4();
      x.print(2);
      x.print(1,2);
  }
}
```

Method Signature

- Composed of method name and argument list (the order of arguments is also important)
- Return type is not part of signature
- Used by Compiler to resolve method calls within a class
- A class cannot have 2 methods with same signature

```
class SignatureSample {
public int m1(int i) {}
public void m1(int i) {}
}
//Error : method m1(int) is already defined in class SignatureS
```

Method Overloading

- 2 methods are said be overloaded if and only if they have same method name but different parameter list (atleast in order)
- return type, access modifier and throws clause are not considered in overloading

```
public class OLSample1 {
public void m1(){System.out.println("No-Arg");}
public int m1(int i){System.out.println("Int-Arg"); return i;}
public void m1(double d){System.out.println("Double-Arg");}
  public static void main(String[] args) {
       OLSample1 s = new OLSample1();
       s.m1(); // No-Arg
       s.m1(5); // Int-Arg
       s.m1(5.5); // Double-Arg
   } }
```

- Automatic promotion of parameteres in overloading

  byte -> short/char -> int -> long -> float -> double

```
public class OLSample2 {
   public void m1(int i, float f)
          { System.out.println("Int-Float"); }
   public void m1(float f, int i)
          { System.out.println("Float-Int"); }

   public static void main(String[] args){
       OLSample2 s= new OLSample2();
       s.m1(10,10.5f); //Int-Float
       s.m1(10.5f,10); //Float-Int
       s.m1(10,10);  //Error: reference to m1 is ambiguous;
   }
}
```

- In the case of overloading the method resolution can be performed by compiler based on the object reference type. It never bothers about run time object.

Pass Objects by Reference and Value

Main Method

- Running such class without main method , will give the error : " NoSuchMethodError : main "
- Any of below changes
  static -> non-static
  void -> some other return type
  main -> any other name
  will give the error : " NoSuchMethodError : main " while running the class
- Order of public & static can be interchanged
- Main method can be declared as final & synchronized => No CE & No RE

Constructors

- Purpose: perform initialization of all data members of an object
- Gets called automatically to initialize data members when a object is created
- Applicable for every class including abstract class, but not interfaces
- Name of the constructor must be same as class name
- Allowed modifiers are public, default, protected and private
- Applying any other modifier to constructor will give compilation error : " Modifier xxx is not allowed here."
- Though it is legal, not a good practice to give return type, even void also. If we give it compiler / jvm treats it as a normal method, not as constructor

Default Constructor

- Suppose programmer is not writing any constructor then compiler will generate a default constructor.
- Either programmer written constructor or compiler generated constructor must present in a class. But not both at the same time.
- The default constructor is always no-arg constructor
- The access modifier of the default constructor is same as class modifier (public & default)
- The default constructor contains only one statement which is no-arg call to super class constructor.

Encapsulation

- Data Hiding : Restricting direct data access from outside of the class by declaring all the data memebers as private
- Abstraction : Hiding internal implementation
- Encapsulation = Data Hiding + Abstraction
- Hiding data behind methods is the key concept of Encapsulation
- Benefits : security, easy to inhance, maintainability, modularity
- A class is said to be tightly encapsulated if and only if all the data memebers declared as private.