Java

More Details

Array

Arrays

- A group of variables containing values that all have the same type
- Arrays are fixed-length entities
- In Java, arrays are objects, so they are considered reference types
- But the elements of an array can be either primitive types or reference types

Arrays

- We access the element of an array using the following syntax
  - name[index]
  - “index” must be a nonnegative integer
    - “index” can be int/byte/short/char but not long
- In Java, every array knows its own length
- The length information is maintained in a public final int member variable called length

Declaring and Creating Arrays

- int c[ ] = new int [12]
  - Here, “c” is a reference to an integer array
  - “c” is now pointing to an array object holding 12 integers
  - Like other objects arrays are created using “new” and are created in the heap
  - “int c[ ]” represents both the data type and the variable name. Placing number here is a syntax error
  - int c[12]; // compiler error

Declaring and Creating Arrays

- int[ ] c = new int [12]
  - Here, the data type is more evident i.e. “int[ ]”
  - But does the same work as
    - int c[ ] = new int [12]
- Is there any difference between the above two approaches?

Declaring and Creating Arrays

- int c[ ], x
  - Here, ‘c’ is a reference to an integer array
  - ‘x’ is just a normal integer variable
- int[ ] c, x;
  - Here, ‘c’ is a reference to an integer array (same as before)
  - But, now ‘x’ is also a reference to an integer array

Using an Array Initializer

- We can also use an array initializer to create an array
  - int n[ ] = {10, 20, 30, 40, 50}
- The length of the above array is 5
- n[0] is initialized to 10, n[1] is initialized to 20, and so on
- The compiler automatically performs a "new" operation taking the count information from the list and initializes the elements properly

Arrays of Primitive Types

- When created by "new", all the elements are initialized with default values
  - byte, short, char, int, long, float and double are initialized to zero
  - boolean is initialized to false
- This happens for both member arrays and local arrays

Arrays of Reference Types

- String [] str = new String[3]
  - Only 3 String references are created
  - Those references are initialized to “null” by default
  - Need to explicitly create and assign actual String objects in the above three positions.
    - str[0] = new String(“Hello”);
    - str[1] = “World”;
    - str[2] = “I” + “ Like” + “ Java”;

Passing Arrays to Methods

```
void modifyArray(double d[ ]) {…}
double [] temperature = new double[24];
modifyArray(temperature);
```

- Changes made to the elements of ‘d’ inside “modifyArray” is visible and reflected in the “temperature” array
- But inside “modifyArray” if we create a new array and assign it to ‘d’ then ‘d’ will point to the newly created array and changing its elements will have no effect on “temperature”

Passing Arrays to Methods

- Changing the elements is visible, but changing the array reference itself is not visible

```
void modifyArray(double d[ ]) {
    d[0] = 1.1; // visible to the caller
}
void modifyArray(double d[ ]) {
    d = new double [10];
    d[0] = 1.1; // not visible to the caller
}
```

Multidimensional Arrays

- Can be termed as array of arrays.
- int b[ ][ ] = new int[3][4];
  - Length of first dimension = 3
    - b.length equals 3
  - Length of second dimension = 4
    - b[0].length equals 4
- int[ ][ ] b = new int[3][4];
  - Here, the data type is more evident i.e. “int[ ][ ]”

Multidimensional Arrays

- int b[ ][ ] = { { 1, 2, 3 }, { 4, 5, 6 } };
  - b.length equals 2
  - b[0].length and b[1].length equals 3
- All these examples represent rectangular two dimensional arrays where every row has same number of columns
- Java also supports jagged array where rows can have different number of columns

Multidimensional Arrays

Example – 1

```
int b[ ][ ];
b = new int[2][ ];
b[0] = new int[2];
b[1] = new int[3];
b[0][2] = 7; //will throw an exception
```

Example – 2

```
int b[ ][ ] = { { 1, 2 }, { 3, 4, 5 } };
b[0][2] = 8; //will throw an exception
```

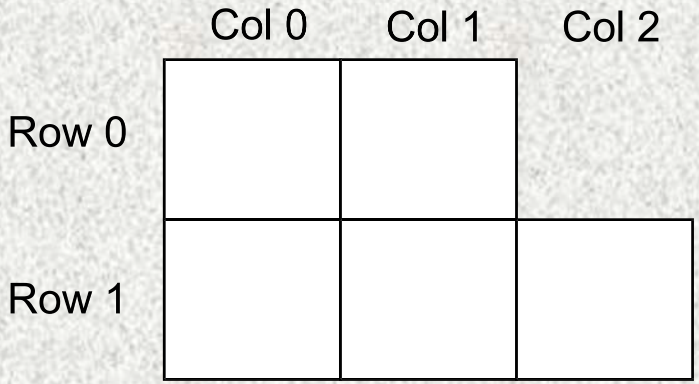
In both cases

b.length equals 2

b[0].length equals 2

b[1].length equals 3

Array ‘b’



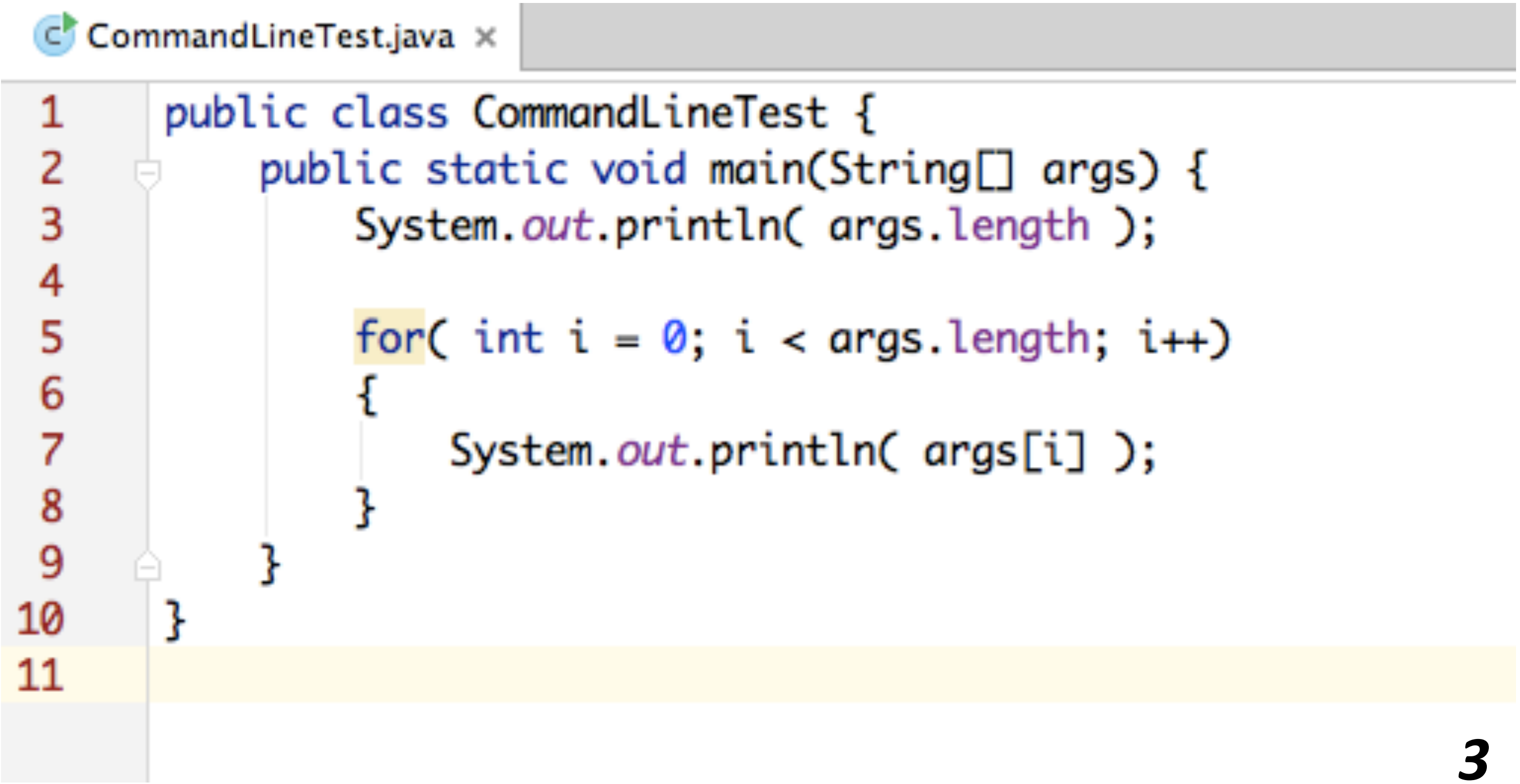
b[0][2] does not exist

Command Line Arguments

Using Command-Line Arguments

- java MyClass arg1 arg2 … argN
  - words after the class name are treated as command-line arguments by Java
  - Java creates a separate String object containing each command-line argument, places them in a String array and supplies that array to main
  - That’s why we have to have a String array parameter (String args[ ]) in main
  - We do not need a “argc” type parameter (for parameter counting) as we can easily use “args.length” to determine the number of parameters supplied.

Using Command-Line Arguments



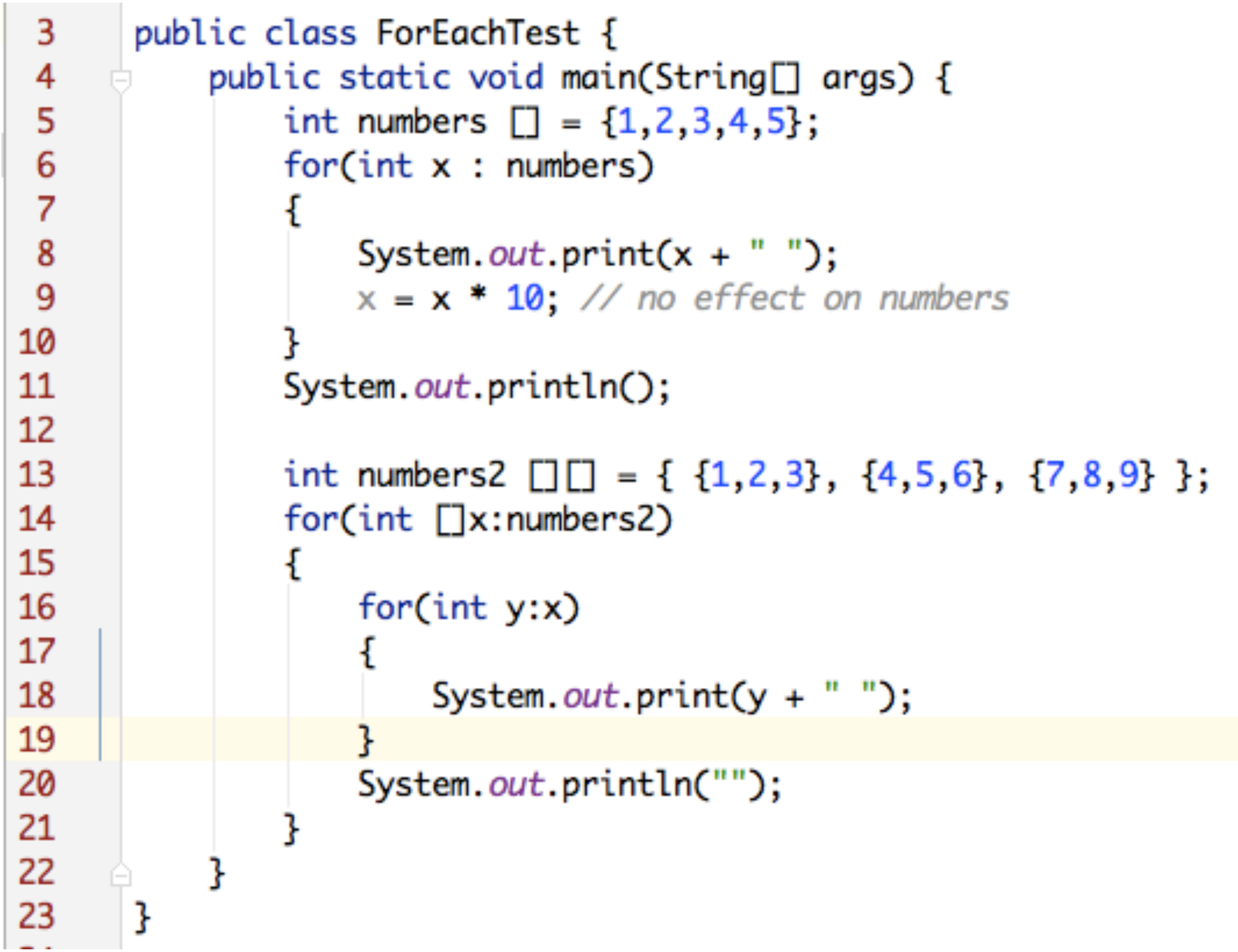
```java
public class CommandLineTest {
    public static void main(String[] args) {
        System.out.println( args.length );

        for( int i = 0; i < args.length; i++)
        {
            System.out.println( args[i] );
        }
    }
}

```

java CommandLineTest Hello 2 You

```
3
Hello
2
You
```

For-Each

For-Each version of the for loop



```java
public class ForEachTest {
    public static void main(String[] args) {
        int numbers [] = {1,2,3,4,5};
        for(int x : numbers)
        {
            System.out.print(x + " ");
            x = x * 10; // no effect on numbers
        }
        System.out.println();

        int numbers2 [][] = { {1,2,3}, {4,5,6}, {7,8,9} };
        for(int []x:numbers2)
        {
            for(int y:x)
            {
                System.out.print(y + " ");
            }
            System.out.println("");
        }
    }
}
```

Nested and Inner Classes

Nested Classes

- It is possible to define a class within another classes, such classes are known as nested classes
- The scope of nested class is bounded by the scope of its enclosing class. That means if class B is defined within class A, then B doesn’t exists without A
- The nested class has access to the members (including private!) of the class in which it is nested
- The enclosing class doesn’t have access to the members of the nested class

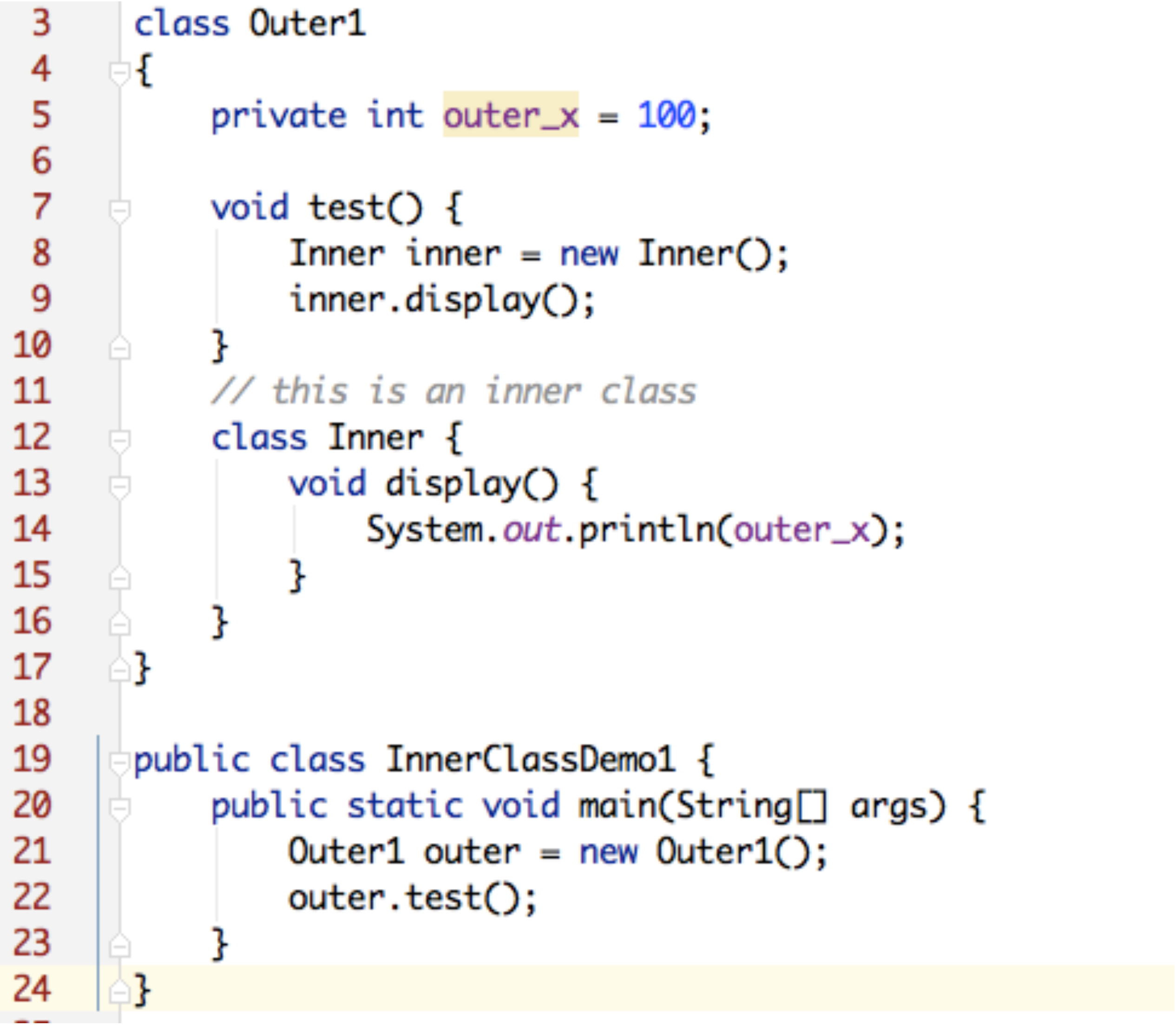
Static Nested Classes

- Two types of nested classes.
  - Static
  - Non-Static
- A static nested class is one which has the static modifier applied. Because it is static, it must access the members of its enclosing class through an object
- That is, it cannot refer to members of its enclosing class directly. Because of this restriction, static nested classes are seldom used

Inner Classes

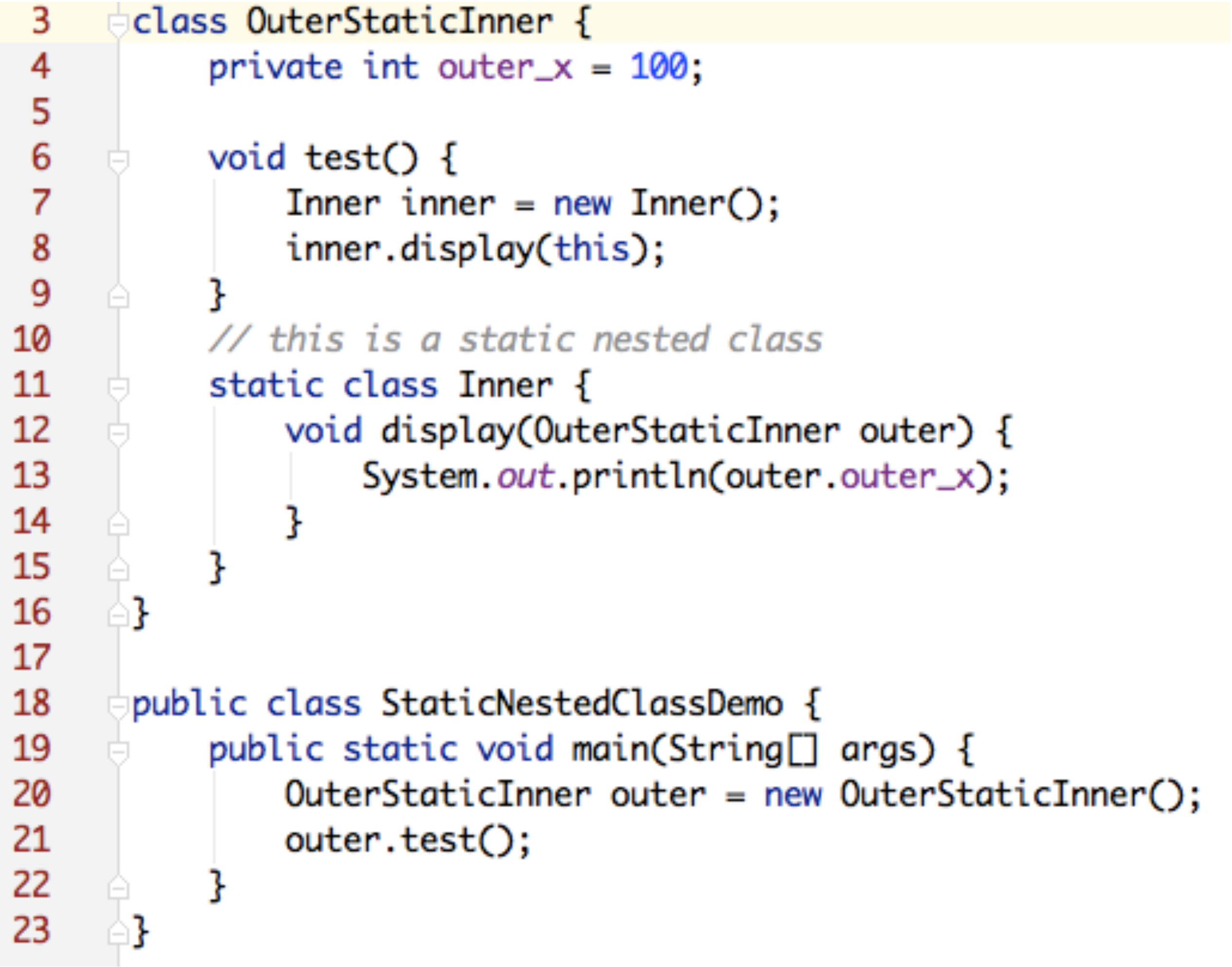
- The most important type of nested class is the inner class
- An inner class is a non-static nested class
- It has access to all of the variables and methods of its outer class and may refer to them directly in the same way that other non-static members of the outer class do
- Thus, an inner class is fully within the scope of its enclosing class

Inner Classes



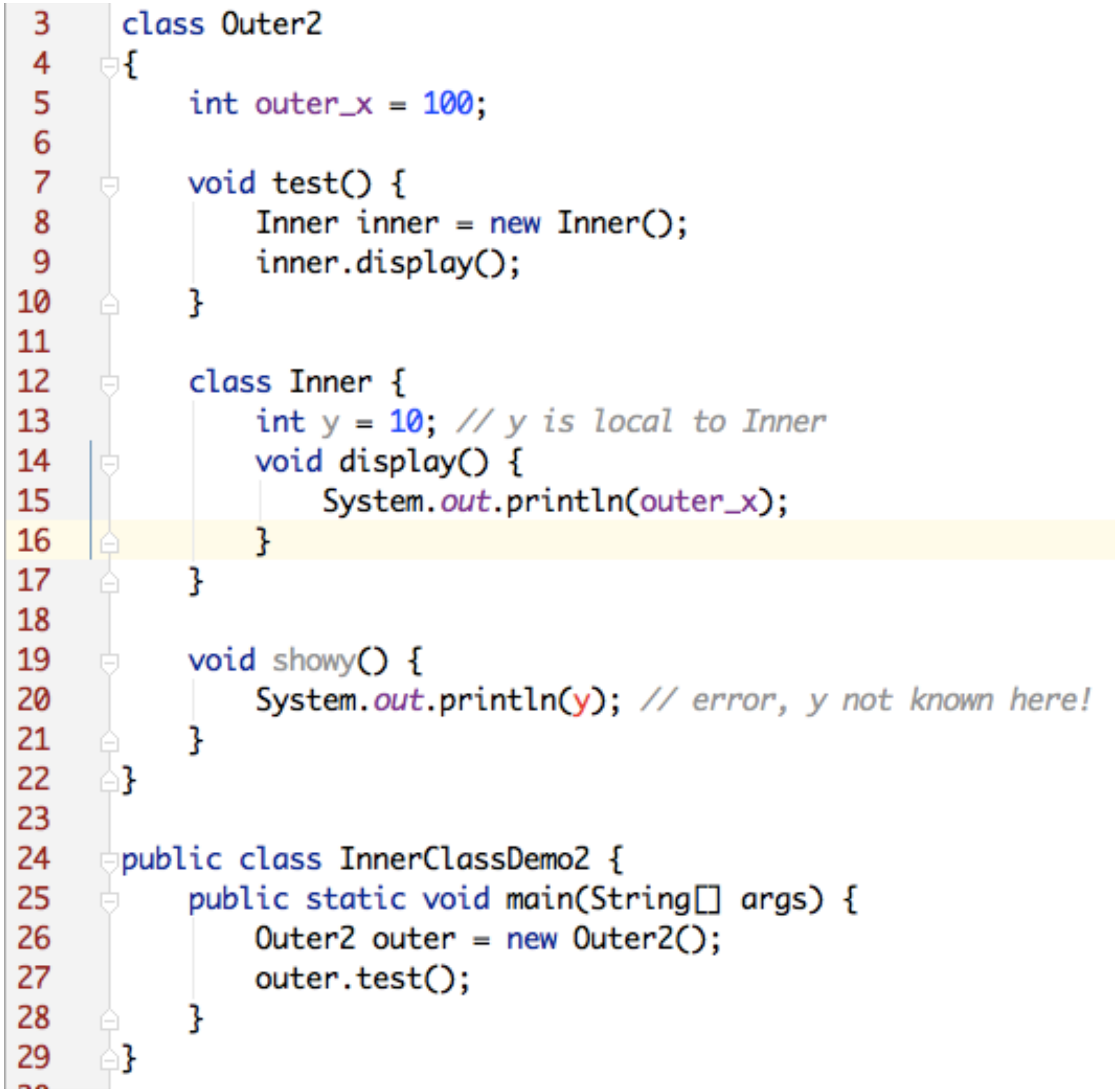
```java
class Outer1
{
    private int outer_x = 100;

    void test() {
        Inner inner = new Inner();
        inner.display();
    }
    // this is an inner class
    class Inner {
        void display() {
            System.out.println(outer_x);
        }
    }
}

public class InnerClassDemo1 {
    public static void main(String[] args) {
        Outer1 outer = new Outer1();
        outer.test();
    }
}
```

Static Nested Classes



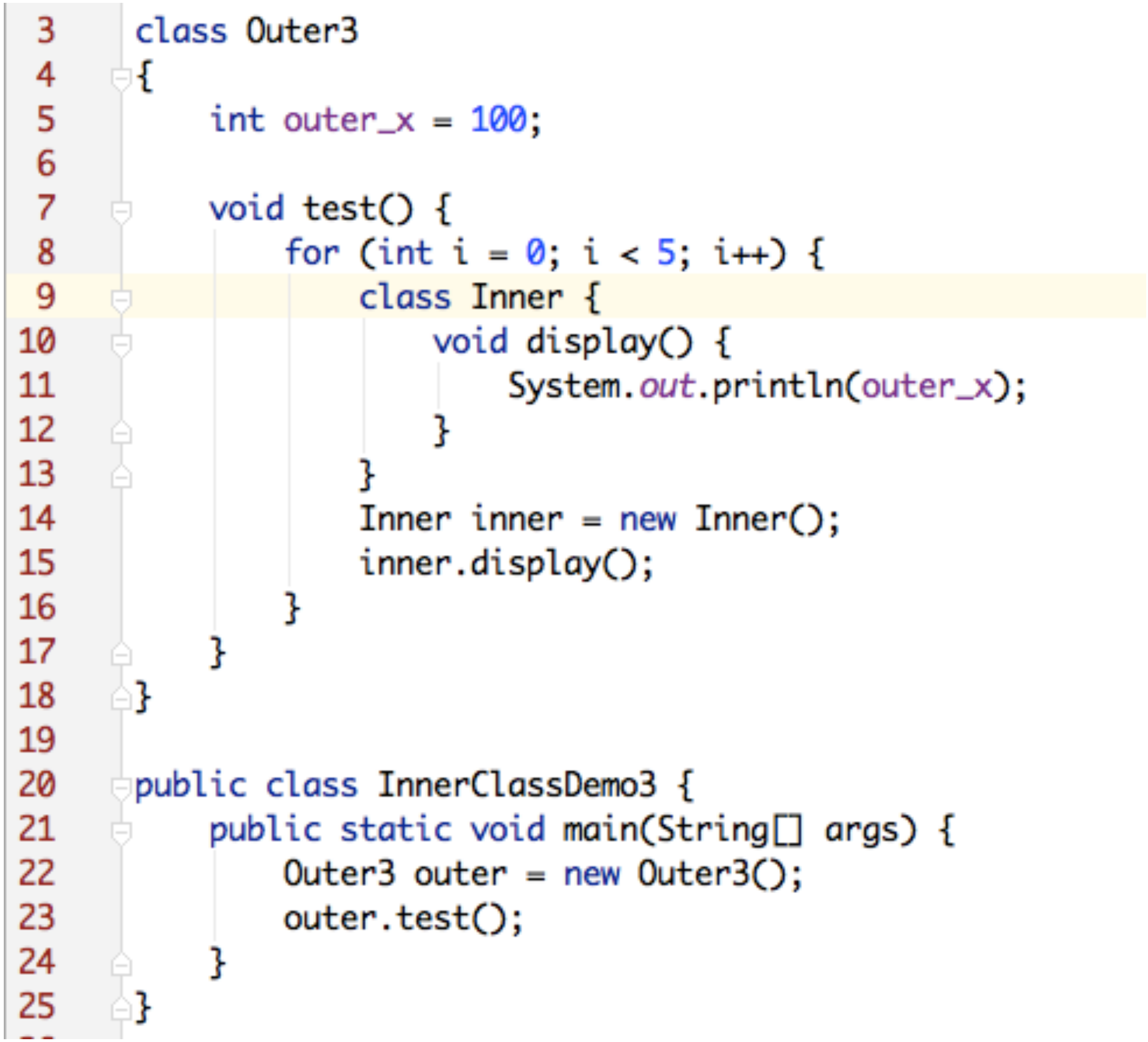
```java
class OuterStaticInner {
    private int outer_x = 100;

    void test() {
        Inner inner = new Inner();
        inner.display(this);
    }
    // this is a static nested class
    static class Inner {
        void display(OuterStaticInner outer) {
            System.out.println(outer.outer_x);
        }
    }
}

public class StaticNestedClassDemo {
    public static void main(String[] args) {
        OuterStaticInner outer = new OuterStaticInner();
        outer.test();
    }
}
```

Inner Classes



```
class Outer2
{
    int outer_x = 100;

    void test() {
        Inner inner = new Inner();
        inner.display();
    }

    class Inner {
        int y = 10; // y is local to Inner
        void display() {
            System.out.println(outer_x);
        }
    }

    void showy() {
        System.out.println(y); // error, y not known here!
    }
}

public class InnerClassDemo2 {
    public static void main(String[] args) {
        Outer2 outer = new Outer2();
        outer.test();
    }
}
```

Inner Classes within blocks



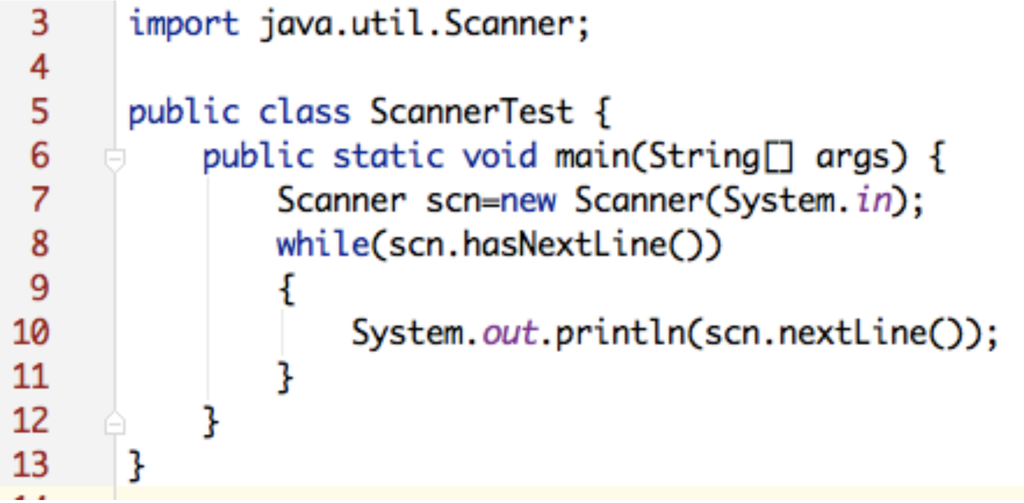
```java
class Outer3
{
    int outer_x = 100;

    void test() {
        for (int i = 0; i < 5; i++) {
            class Inner {
                void display() {
                    System.out.println(outer_x);
                }
            }
            Inner inner = new Inner();
            inner.display();
        }
    }
}

public class InnerClassDemo3 {
    public static void main(String[] args) {
        Outer3 outer = new Outer3();
        outer.test();
    }
}
```

Scanner

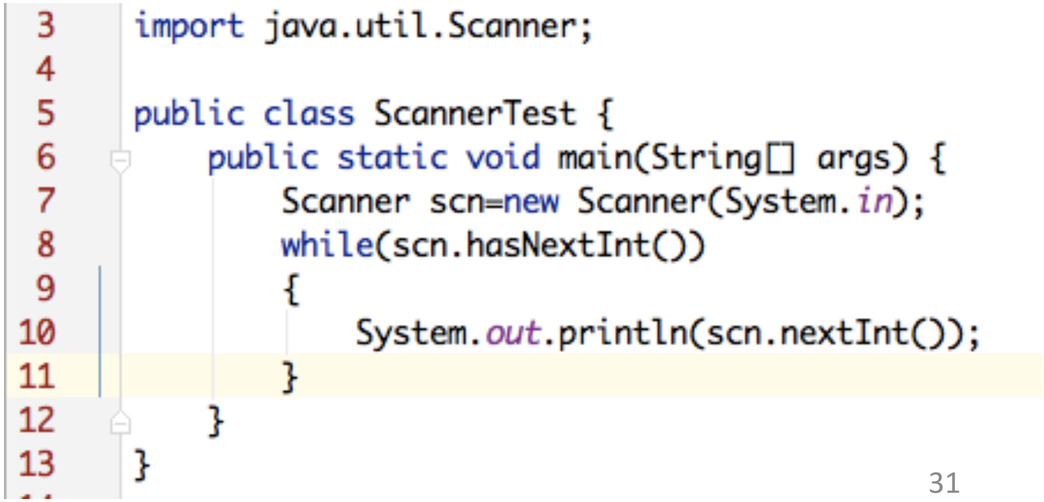
Scanner

- It is one of the utility class located in the java.util package
- Using Scanner class, we can take inputs from the keyboard
- Provides methods for scanning
    - Int
    - float
    - Double
    - Line etc.

Scanner

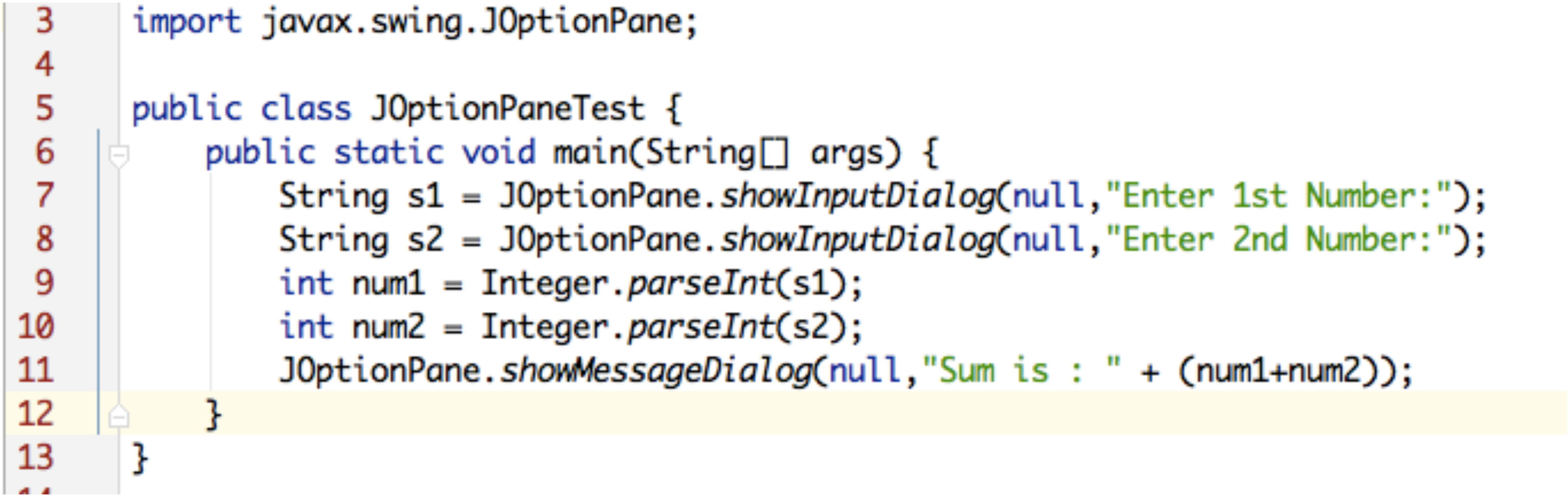


```java
import java.util.Scanner;

public class ScannerTest {
    public static void main(String[] args) {
        Scanner scn=new Scanner(System.in);
        while(scn.hasNextLine())
        {
            System.out.println(scn.nextLine());
        }
    }
}
```

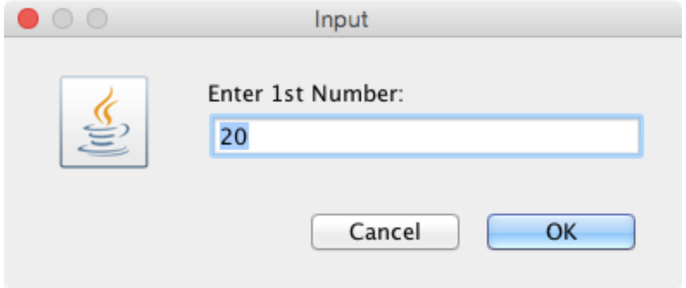


```java
import java.util.Scanner;

public class ScannerTest {
    public static void main(String[] args) {
        Scanner scn=new Scanner(System.in);
        while(scn.hasNextInt())
        {
            System.out.println(scn.nextInt());
        }
    }
}
```

JOptionPane

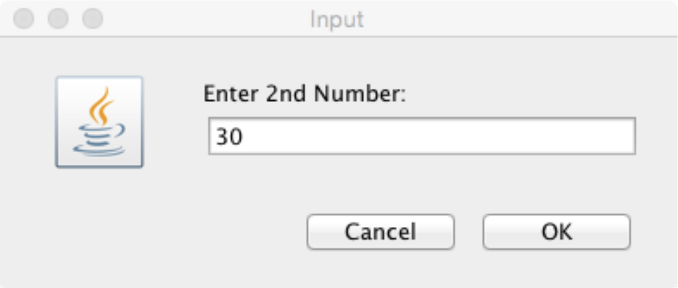


```java
import javax.swing.JOptionPane;

public class JOptionPaneTest {
    public static void main(String[] args) {
        String s1 = JOptionPane.showInputDialog(null,"Enter 1st Number:");
        String s2 = JOptionPane.showInputDialog(null,"Enter 2nd Number:");
        int num1 = Integer.parseInt(s1);
        int num2 = Integer.parseInt(s2);
        JOptionPane.showMessageDialog(null,"Sum is : " + (num1+num2));
    }
}
```



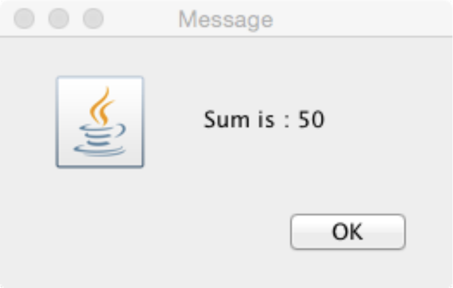
Enter 1st Number:

20



Enter 2nd Number:

30



Sum is : 50

Static

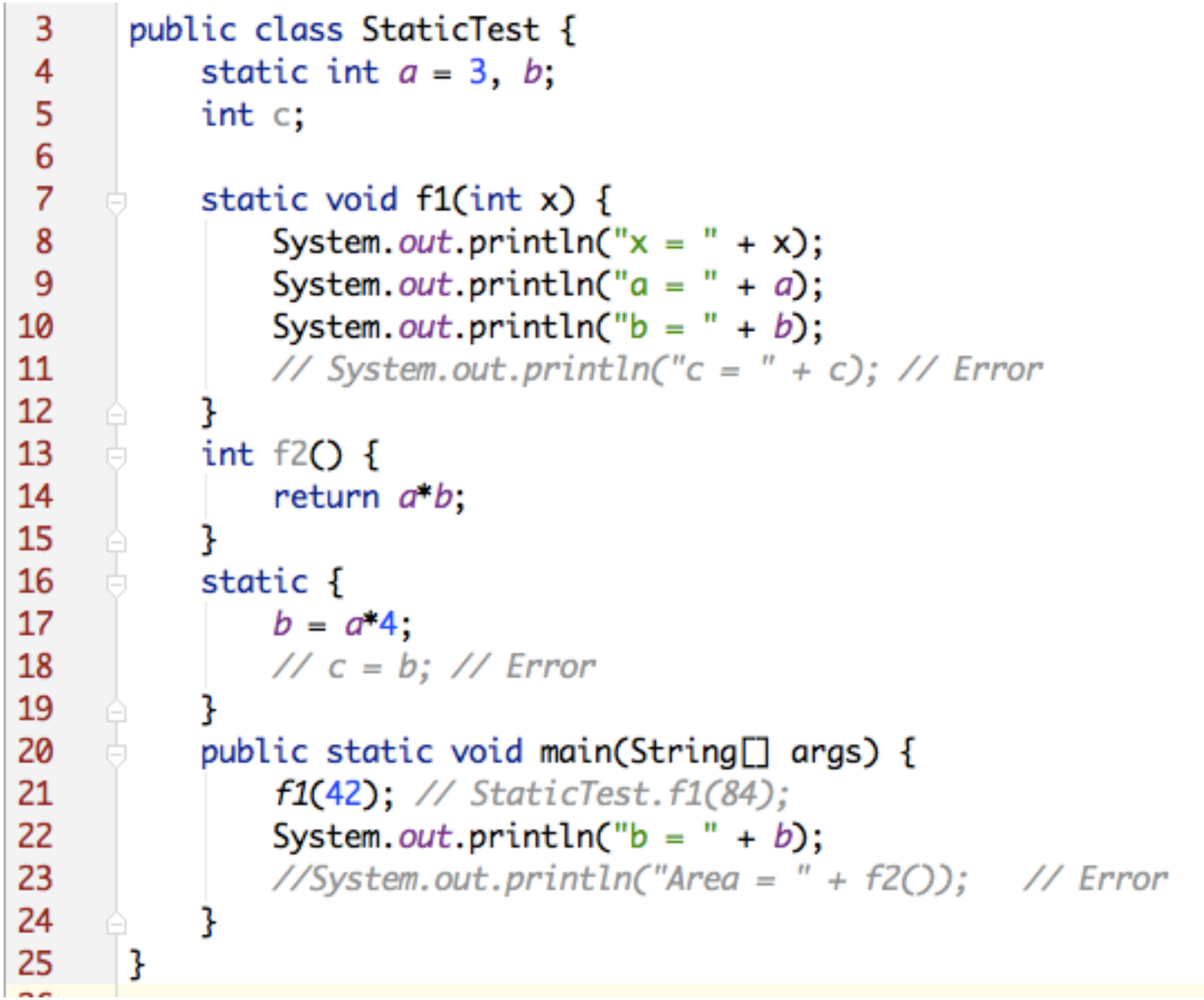
Static Variables

- When a member (both methods and variables) is declared static, it can be accessed before any objects of its class are created, and without reference to any object
- Static variable
  - Instance variables declared as static are like global variables
  - When objects of its class are declared, no copy of a static variable is made

Static Methods & Blocks

- Static method
  - They can only call other static methods
  - They must only access static data
  - They cannot refer to ***this*** or ***super*** in any way
- Static block
  - Initialize static variables.
  - Get executed exactly once, when the class is first loaded

Static



```java
public class StaticTest {
    static int a = 3, b;
    int c;

    static void f1(int x) {
        System.out.println("x = " + x);
        System.out.println("a = " + a);
        System.out.println("b = " + b);
        // System.out.println("c = " + c); // Error
    }
    int f2() {
        return a*b;
    }
    static {
        b = a*4;
        // c = b; // Error
    }
    public static void main(String[] args) {
        f1(42); // StaticTest.f1(84);
        System.out.println("b = " + b);
        //System.out.println("Area = " + f2());    // Error
    }
}
```

Final

- Declare a final variable, prevents its contents from being modified
- final variable must initialize when it is declared
- It is common coding convention to choose all uppercase identifiers for final variables

final int FILE_NEW = 1;

final int FILE_OPEN = 2;

final int FILE_SAVE = 3;

final int FILE_SAVEAS = 4;

final int FILE_QUIT = 5;

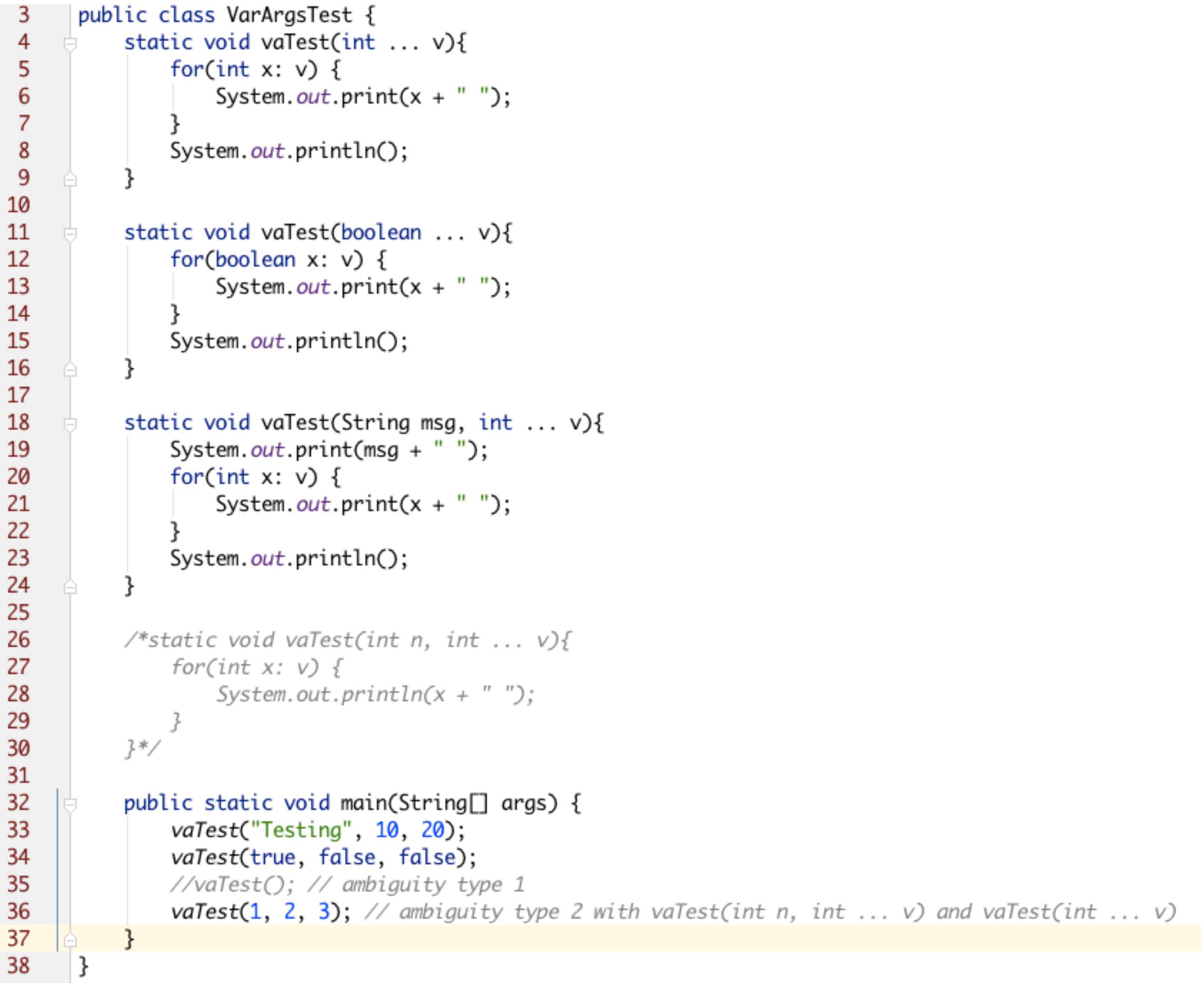
Unsigned right shift operator

- The >> operator automatically fills the high-order bit with its previous contents each time a shift occurs
- This preserves the sign of the value
- But if you want to shift something that doesn't represent a numeric value, you may not want the sign extension
- Java's >>> shifts zeros into the high-order bit

int a= -1; a = a >>> 24;

```
11111111  11111111  11111111   11111111  [-1]
00000000  00000000  00000000   11111111  [255]
```

Variable Arguments



```java
public class VarArgsTest {
    static void vaTest(int ... v){
        for(int x: v) {
            System.out.print(x + " ");
        }
        System.out.println();
    }

    static void vaTest(boolean ... v){
        for(boolean x: v) {
            System.out.print(x + " ");
        }
        System.out.println();
    }

    static void vaTest(String msg, int ... v){
        System.out.print(msg + " ");
        for(int x: v) {
            System.out.print(x + " ");
        }
        System.out.println();
    }

    /*static void vaTest(int n, int ... v){
        for(int x: v) {
            System.out.println(x + " ");
        }
    }*/

    public static void main(String[] args) {
        vaTest("Testing", 10, 20);
        vaTest(true, false, false);
        //vaTest(); // ambiguity type 1
        vaTest(1, 2, 3); // ambiguity type 2 with vaTest(int n, int ... v) and vaTest(int ... v)
    }
}
```