Learning the Java Language

(http://docs.oracle.com/javase/tutorial/java/index.html)

Objectives

- Study some fundamentals of Java languages: Data types, variables, arrays, operators, logic constructs.
- Pass arguments to the main method
- Input/output variables

Keywords and Identifiers

- Keywords: Almost of them are similar to those in C language
- Naming Convention:

Letter	Letters
$	Digits, $
_	_

- Java is a case-sensitive language
- Identifiers must be different to keywords

Primitive Data Types - Variables

- A *primitive* is a simple non-object data type that represents a single value.
- Java's primitive data types are:

Type	Bytes	Minimum	Maximum
char	2	\u0000	\uFFFF
byte	1	-2^7	$2^7 - 1$
short	2	-2^{15}	$2^{15} – 1$
int	4	-2^{31}	$2^{31} – 1$
long	8	-2^{63}	$2^{63} - 1$
float	4		
double	8		
boolean	true/false		

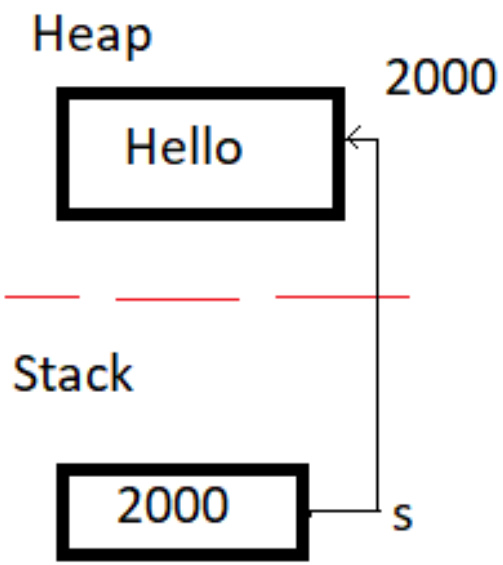
Type var [=Initial value] ;

Reference Data Types - Variables

- A reference data type contains reference/address of dynamically created objects.
- reference types in Java:

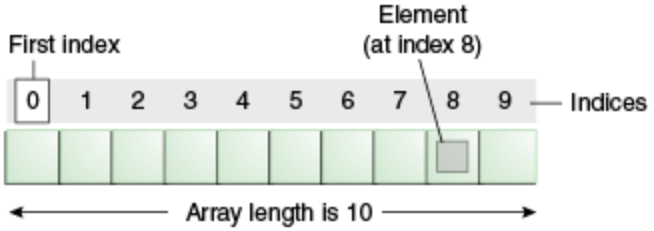
  Class types.
  Array types
  Interface types
- Default value of any reference variable is null

for example:
String s=new String("Hello");



One Dimensional Arrays (1)

- An *array* is a container object that holds a fixed number of values of a single type.
- The length of an array is established when the array is created.
- Each item in an array is called an *element*, and each element is accessed by its numerical *index.*



One Dimensional Arrays (2)

- Declaring a Variable to Refer to an Array

```
int[] anArray;
```

or `float anArrayOfFloats[];`

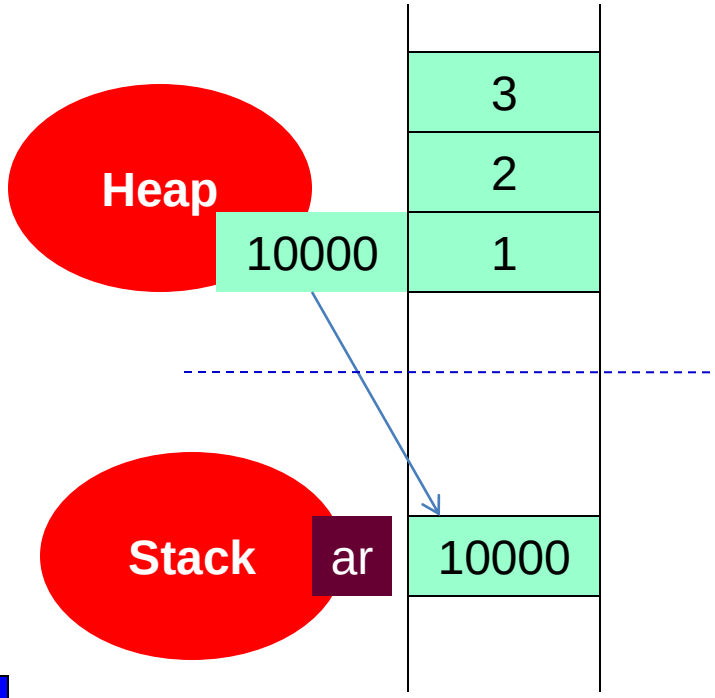
- Creating, Initializing, and Accessing an Array

```
anArray = new int[10];
```

- Copying Arrays
  - Use arraycopy method from System class.

One Dimensional Arrays (3)

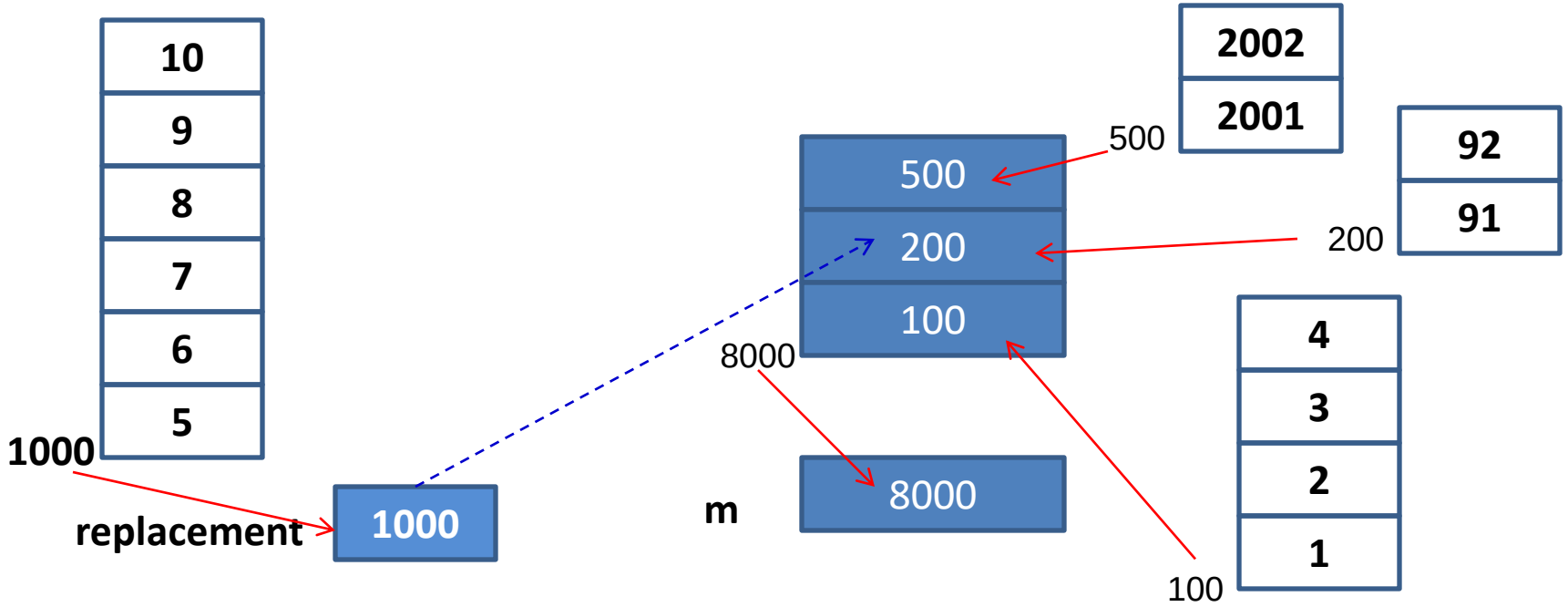
```
int[] ar;
ar= new int[3];
ar[0]=1; ar[1]=2; ar[2]=3;
int a2[];
int[] a3 = {1,2,3,4,5};
int a4[] = {1,2,3,4,5};
```



Array is a reference variable

int n=10;

Multiple Dimensional Arrays




```
int m[][]= { {1,2,3,4}, {91,92}, {2001,2002}};
int[] replacement = {5,6,7,8,9,10};
m[1]= replacement;
```

m[i][j]

```
int[][] m; // declare a matrix
int r=10, c=5; // number of rows, columns
m= new int[r][c]; // memory allocate
```

Operators

Category (Descending Precedence)	Operators
Unary	`++ -- + - ! ~ (type)`
Arithmetic	`* / %` `+ -`
Shift	`<< >> >>>`
Comparison	`< <= > >= instanceof` `== !=`
Bitwise	`& ^ |`
Short-circuit	`&& ||`
Conditional	`?:`
Assignment	`= op=`

They are the same with those in C language

Using Operators Demonstration

UseOps.java

```java
public class UseOps {
  public static void main(String[] args)
  {  int x=-1;
     System.out.println("-1<<1: " + (x<<1) );
     System.out.println("-1>>1: " + (x>>1) );
     System.out.println("-1>>>1: " + (x>>>1));
     System.out.println("3|4: " + (3|4));
     System.out.println("3&4: " + (3&4));
     System.out.println("3^4: " + (3^4));
     String S="Hello";
     boolean result= S instanceof String;
     System.out.println("Hello is an instance of String: " + result);
  }
}
```

Output - Chapter01 (run)

```
run:
-1<<1: -2
-1>>1: -1
-1>>>1: 2147483647
3|4: 7
3&4: 0
3^4: 7
Hello is an instance of String: true
BUILD SUCCESSFUL (total time: 0 seconds)
```

Using Operators Demonstration

Use 2 bytes to store value

```
Output - Chapter01 (run)
run:
-1<<1: -2
-1>>1: -1
-1>>>1: 2147483647
3|4: 7
3&4: 0
3^4: 7
Hello is an instance of String: true
BUILD SUCCESSFUL (total time: 0 seconds)
```

1: → 0000 0000 0000 0001
1111 1111 1111 1110 (1-complement)
-1 → 1111 1111 1111 1111 (2-complement)
-1 <<1 → 1111 1111 1111 1110 (-2)

-1 → 1111 1111 1111 1111
-1 >>1 → 1111 1111 1111 1111

-1 → 1111 1111 1111 1111
-1 >>>1 → 0111 1111 1111 1111 (2147483647)

3 → 0000 0000 0000 0011
4 → 0000 0000 0000 0100
3|4 → 0000 0000 0000 0111 (7)

3 → 0000 0000 0000 0011
4 → 0000 0000 0000 0100
3&4 → 0000 0000 0000 0000 (0)

3 → 0000 0000 0000 0011
4 → 0000 0000 0000 0100
3^4 → 0000 0000 0000 0111 (7): XOR BIT

Literals and Value Variables

- Character: ‘a’
- String: String S=“Hello”;
- Escape sequences: see the page 10
- Integral literals:

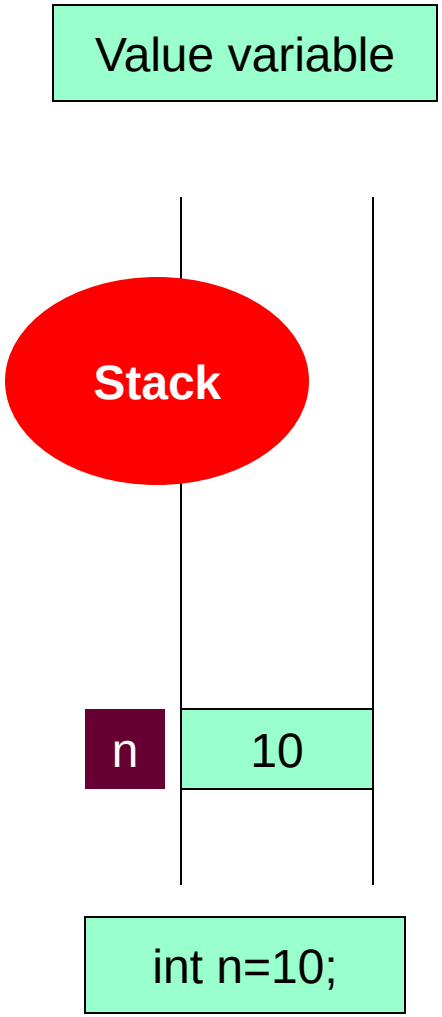
  28, 0x1c, 0X1A (default: int).
  123l, 123L (long)
- Floating point:

  1.234 (default: double)

  1.3f 1.3F

  1.3E+21

  1.3d 1.3D



Java Expressions

- Java is an expression-oriented language. A simple expression in Java is either:
  - A constant: 7, false
  - A char - literal enclosed in single quotes: 'A', '3‘
  - A String - literal enclosed in double quotes: "foo“
  - The name of any properly declared variables: x
  - Any two|one of the preceding types of expression that are combined with one of the Java binary operators: i++, x + 2, (x + 2)

Evaluating Expressions and Operator Precedence

- The compiler generally evaluates such expressions from the innermost to outermost parentheses, left to right.

```
int x = 1; int y = 2; int z = 3;
int answer = ((8 * (y + z)) + y) * x;
would be evaluated piece by piece as follows:
((8 * (y + z) ) + y) * x
((8 * 5) + y) * x
(40 + y) * x
42 * x
42
```

Operator Precedence- Evaluation Order

Projects

- Chapter01
  - Source Packages
    - <default package>
      - UseOps.java
      - UseOps_2.java
    - myPackage
  - Test Packages
  - Libraries
  - Test Libraries

UseOps_2.java

```
1  public class UseOps_2 {
2    public static void main(String[] args)
3    {   int[] a= {4,4};
4        int b=1;
5        a[b]=b=0;
6        System.out.println("a: " + a[0] + "," + a[1]);
7    }
8  }
```

Output - Chapter01 (run)

```
run:
a: 4,0
BUILD SUCCESSFUL (total time: 0 seconds)
```

Order:

(1) [ ] ➔ a[b] ➔ a[1]

(2) = (from the right) ➔ b=0 ➔ return 0 ➔ a[1] = 0

Basic Constructs

- They are taken from C-language
- Selection

  if, if … else

  switch (char/int exp)… case … default…
- Loops

  for

  do… while

  while

Basic Logic Constructs

- They are the same with those in C-statements

```
2   package com;
    import java.lang.*;
4   public class Chao {
5     public static void main(String args[]){
6         System.out.println("Hello");
7         int a[] = { 1,2,3,4,5};
8         for (int i=0;i<a.length;i++)System.out.print(a[i] + ",");
9         System.out.println();
10        for (int x : a) System.out.print(x + ",");
11        System.out.println();
12        for (int x : a) x+=10;
13        for (int i=0;i<a.length;i++)System.out.print(a[i] + ",");
14        System.out.println();
15    }
16  }
```

An enhanced for loop

Read only

a

1	2	3	4	5

x

1

Output - P1 (run)

```
run:
Hello
1,2,3,4,5,
1,2,3,4,5,
1,2,3,4,5,
```

The String type

- A String represents a sequence of zero or more Unicode characters.
  - String name = "Steve";
  - String s = “”;
  - String s = null;
- String concatenation.
  - String x = "foo“ + "bar“ + "!";
- Java is a case-sensitive language.

Type Conversions and Explicit Casting

Casting_Convert_1.java *

```java
public class Casting_Convert_1 {
    public static void main (String[] args)
    {   short x, y = 256;
        byte m,n = 6;
        x = n ; // Systematic Conversion
        n = y;  // narrow conversion
        n = (byte) y; // narrow casting, possible loss of precision
        System.out.println(n);
    }
}
```

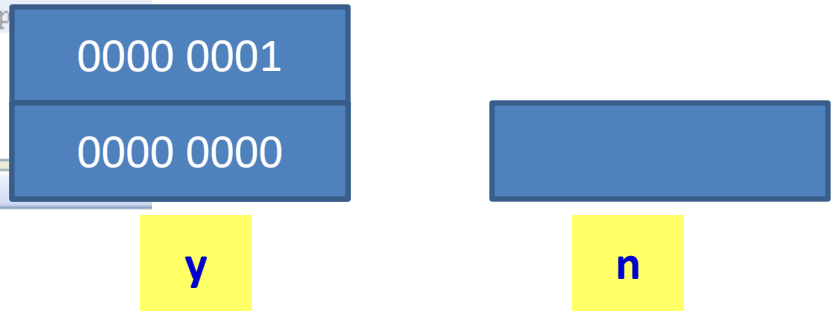
Casting_Convert_1.java *

```java
public class Casting_Convert_1 {
    public static void main (String[] args)
    {   short x, y = 256;
        byte m,n = 6;
        x = n ; // Systematic Conversion
        n = (byte) y; // narrow casting, possible loss of p
        System.out.println(n);
    }
}
```

Output - Chapter04 (run)

```
run:
0
BUILD SUCCESSFUL (total time: 0 seconds)
```

* Widening Conversion: OK
- Narrowing conversion: Not allowed. We must use explicit casting.
- A boolean can not be converted to any other type.
- A non-boolean can be converted to another non-boolean type.



Scope

- The scope of a declaration is the portion of a program over which that declaration is visible. Scopes include
  - global scope
  - file scope
  - function scope
  - Class scope
  - block scope
- The scope of a non-global declaration begins at the declaration and ends at the closing brace for that declaration.
- A non-global declaration is called a local declaration.

Scope of a Variable

ScopeDemo.java

Source History

```
2    public static void main (String[]args){
3        int x=2, k=2;
4        if(x<2){
5            int y=3;
6            int z=4;
7        }
         y=6;
9        for (int i=1; i<3; i++) x+=i;
         k+=i;
11   }
12 }
```

Scope of the variable y

Scope of the variable i

Input/Output Data

InputOutputDemo.java

```java
/* Write a program that will accept an array of intergers then
   print out entered value and the sum of values
 */
import java.util.Scanner;
public class InputOutputDemo {
   public static void main (String args[])
   {  int a[]; // array of integers
      int n ;  // number of elements of the array
      int i;   // variable for traversing the array
      Scanner sc= new Scanner(System.in); // object for the keyboard
      System.out.print("Enter number of elements: ");
      n = Integer.parseInt(sc.nextLine());
      a = new int[n]; // mem. allocating for elements of the array
      for (i=0;i<n;i++)
      {  System.out.print("Enter the " + (i+1) + "/" + n + " element: ");
         a[i]=Integer.parseInt(sc.nextLine());
      }
      System.out.print("Entered values: ");
      for (i=0;i<n;i++) System.out.format("%5d", a[i]);
      int S=0;
      for (int x: a) S+=x;
      System.out.println("\nSum of values: " + S);
   }
}
```

- Class java.lang.System
- Class java.util.Scanner

Refer to Java documentation:
java.lang.String class,
- the **format** method,
  - format string

for more details

n= sc.nextInt();

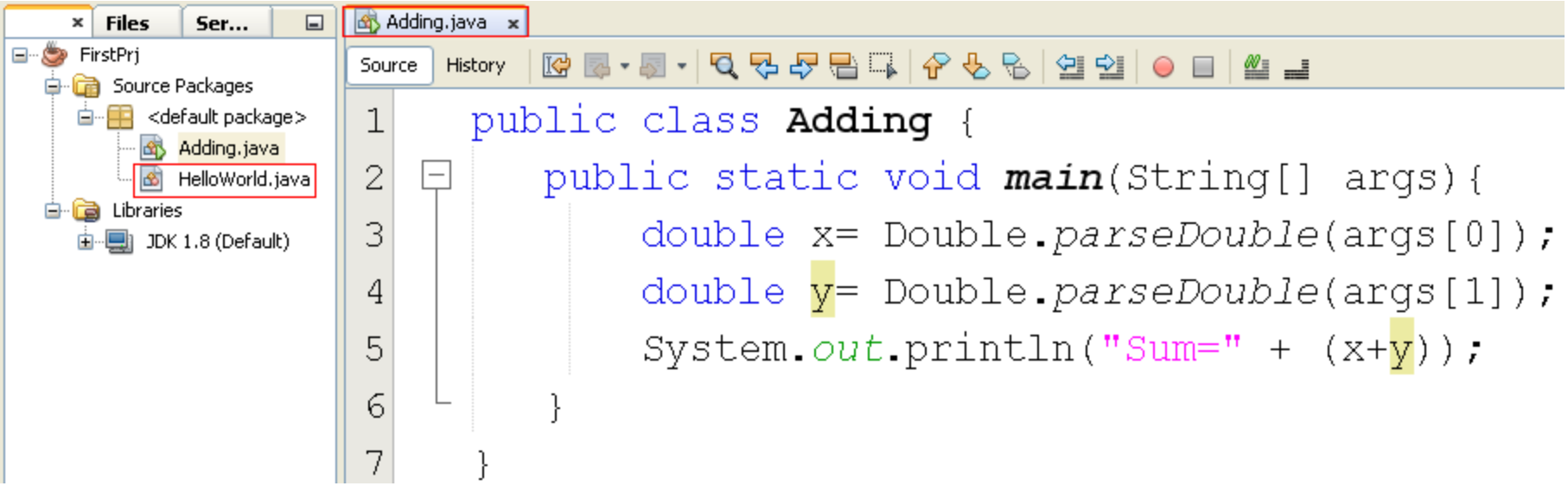
Output - Chapter01 (run) #2

```
run:
Enter number of elements: 5
Enter the 1/5 element: 1
Enter the 2/5 element: 4
Enter the 3/5 element: 2
Enter the 4/5 element: 0
Enter the 5/5 element: 7
Entered values:     1    4    2    0    7
Sum of values: 14
BUILD SUCCESSFUL (total time: 11 seconds)
```

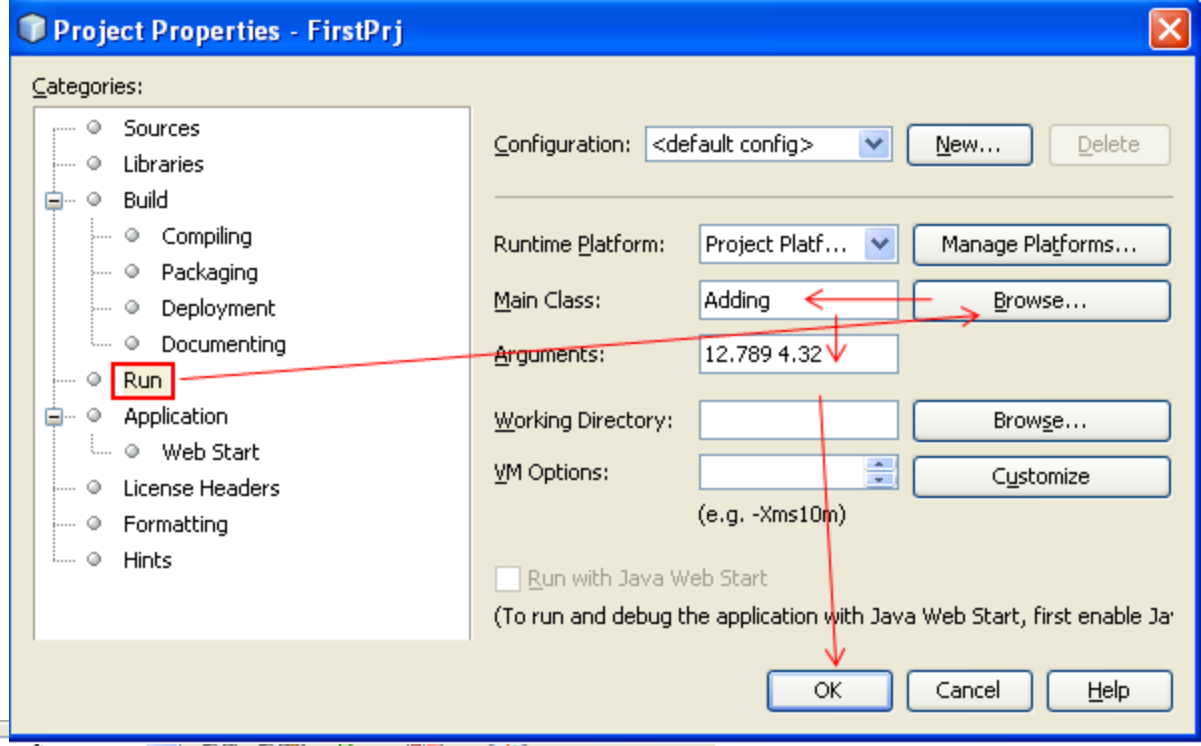
Elements of Java Style

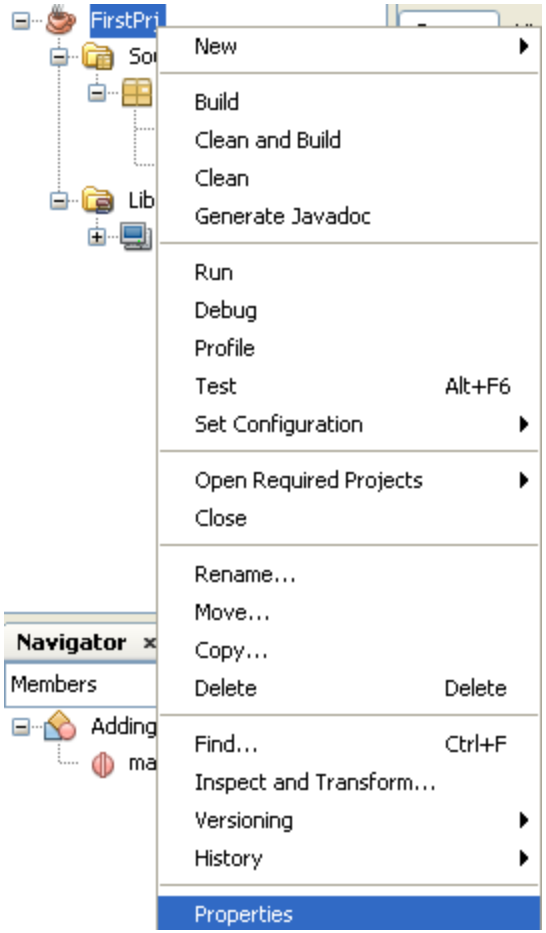
- Proper Use of Indentation
  - Statements within a block of code should be indented relative to the starting/ending line of the enclosing block.
- Use Comments Wisely
- Placement of Braces
  - Opening brace at the end of the line of code that starts a given block. Each closing brace goes on its own line, aligned with the first character of the line con.
- Descriptive Variable Names

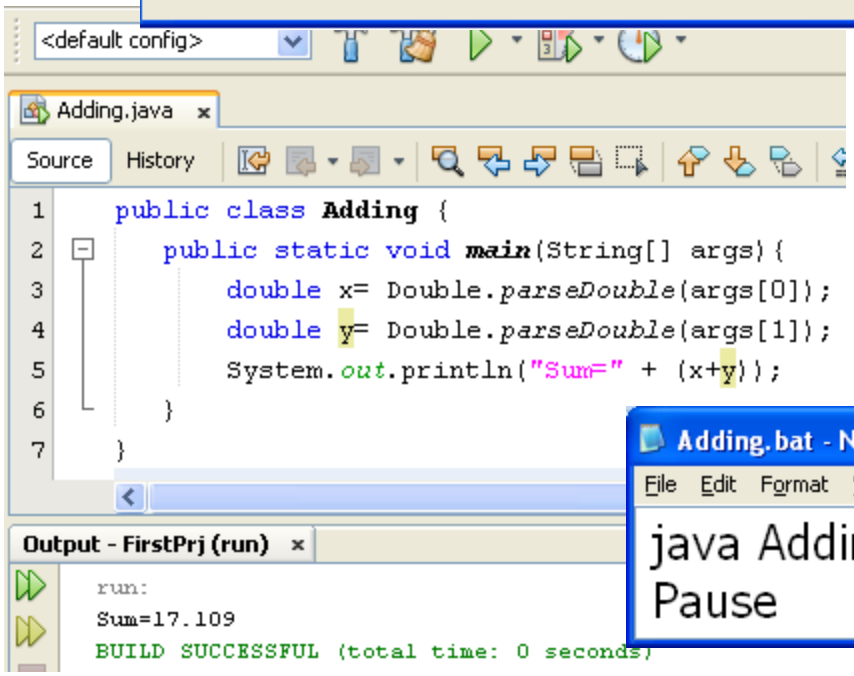
Pass Arguments to the method main

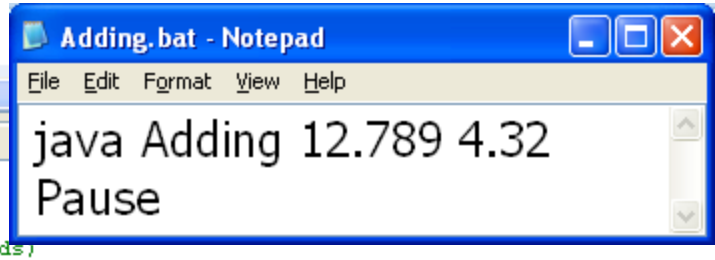


Pass Arguments to the method main









Summary

- The traditional features of the language, including variables, data types, operators, and control flow.
- There are two categories : primitive types and reference types
- the scope of a declaration is that part of the program throughout which the declaration is visible