

Core JAVA

- Fundamental Concepts
- Bootstrapping
- Basic Language Syntax
- Common Caveats
- Coding Conventions

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- Basic Language Syntax
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- Coding Conventions

General Purpose Computers

- Most computers that we encounter are application specific...
 - Light switches, microwave oven controller, VCR timer, DirecTV receiver
- GPCs are different...
 - GPCs are built as generic problem solving machines
 - Programming is the bridge from the generic tool to a useful “machine”

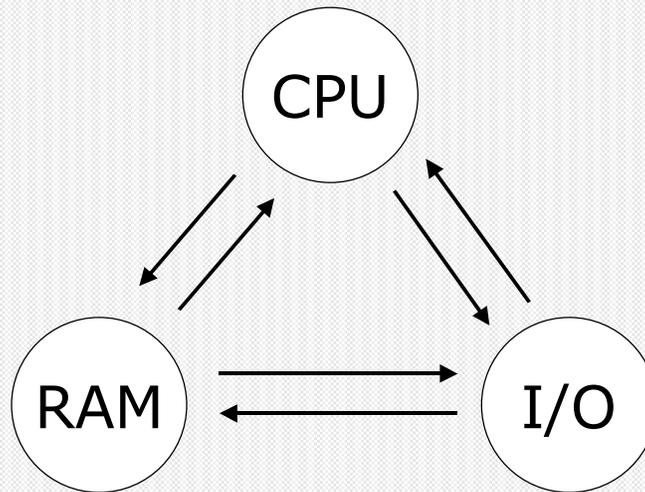
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GPC (Computer) Organization

- CPU – Central Processing Unit
 - Primary location for computations
- I/O – Input and Output Subsystem
 - Devices and communication bus for user interaction, import/export of data and permanent storage
- RAM – Random Access Memory
 - High speed, volatile, “scratchpad”

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Classic Computer Organization



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Programming a GPC

- The hardware can be controlled using “machine language”
 - 01001011001010010010010010101
- Assembly language is an attempt to make this more “friendly”
 - MOV AX, BX
 - ADD R3, #32, R9
 - PUSH EAX
 - JZ R25, [R12]

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High Level Languages

- Machine and Assembly Language are very hard to use...
 - Try computing a 3rd order integral in assembly...
 - How about writing a GUI?
- So we create high level languages and compilers for translating high level programs into assembly

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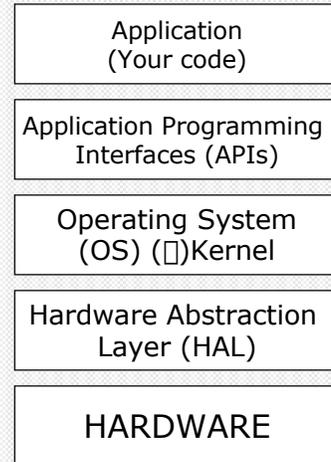
Multiuser/Multitasking

- GPCs are shared...
 - ... between multiple programs
 - ... between multiple users
- The operating system (OS) governs the computer's hardware resources
 - It allocates time for each program to run
 - It provides a unified interface for all of the hardware devices
 - It might also provide session support for multiple users

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Typical Topology

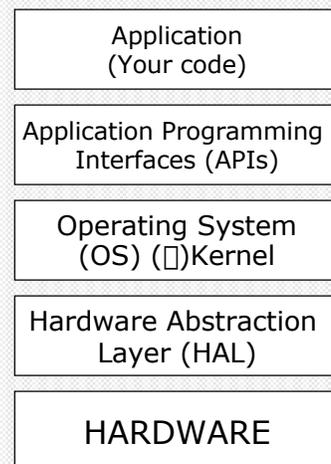
- Most applications talk to APIs implemented by the OS kernel.
- Most reasonable OS kernels talk to hardware through an HAL



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Why so many layers?

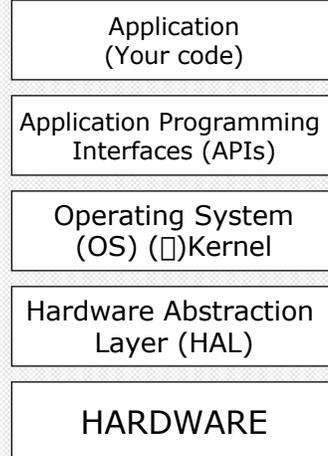
- HAL makes all hardware look the “same” to □kernel
- The same □kernel code that runs on an Intel x86 PC can run on a DEC 21x64 workstation



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The same for your code!

- Assume that all OS's agree on a common API
- You can write a single piece of code that can be recompiled onto many platforms



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“Recompiled?”

- Platforms will differ in many ways...
 - Static sizes for OS and device interfaces
 - Availability/coding of machine instructions
- Recompilation requires the source...
 - Your competitors will have access to code which took you a very long time to develop
 - Your users may not have a compiler... if they do, they may not know how to use it
 - Source code verification is critical!

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The JAVA Way

- Run a JAVA Virtual Machine as a regular application on the OS
- The JVM *simulates* a standard platform (GPC) that all JAVA programs can execute on
- Write once, run anywhere!



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Caveats of the JAVA Way

- Performance
 - Clearly, JAVA will always be slower than a natively coded application
 - JIT JVM technology brings most applications within 30% of native code
 - Latest HotSpot JVMs are within 5% of C++
- Touching the hardware
 - Not all local devices will have an interface through the JVM... your favorite USB scanner may simply not work (at least, for now...)

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Core JAVA

- Fundamental Concepts
- Bootstrapping
- Basic Language Syntax
- Common Caveats
- Coding Conventions

You need to “install JAVA”

- JAVA environment is like any other program (you need to install it)
- At home, download and install the proper JDK (J2SE SDK) for your platform
 - <http://java.sun.com/j2se>
- Also get the J2SE documentation
 - <http://java.sun.com/docs>
- This will have already been done for you in the computer lab

Add JAVA to your PATH

- Under both Windows and UNIX, the JAVA executables reside in the “bin” subdirectory of the installation site
- Add that directory to your PATH
 - Win95/98 – edit your AUTOEXEC.BAT
 - WinNT/2K/ME/XP – edit environment variables found under advanced system properties
 - Most UNIX – edit your .profile or .cshrc
 - MacOS 9 – upgrade to OS X
 - MacOS X – do nothing, it’s preinstalled!

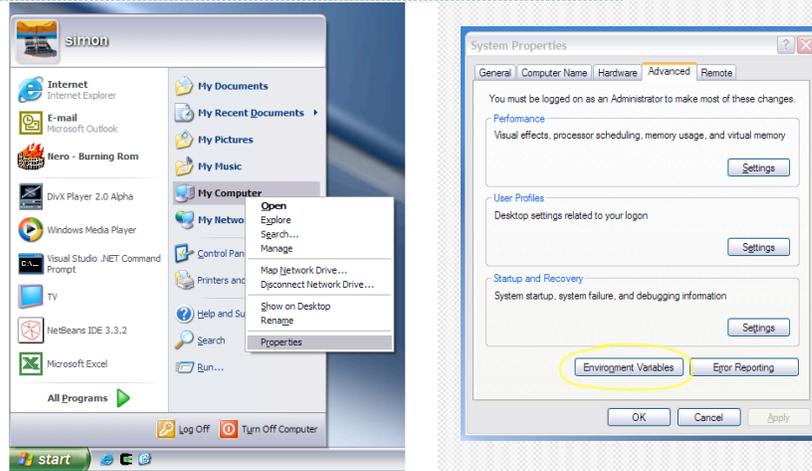
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Add JAVA to your PATH

- For example, under Win95/98, add the following statement to the end of your AUTOEXEC.BAT file:
 - SET PATH=C:\JDK1.4.0_01\BIN;%PATH%
- Under UNIX, edit your .profile and add the following statement:
 - EXPORT PATH=\$PATH:/opt/jdk1.3/bin
 - Substitute your install path for /opt

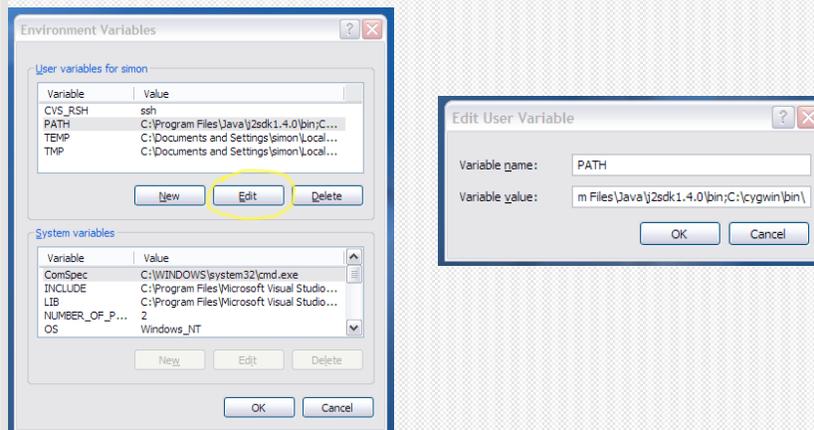
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WinNT/2K/ME/XP Path Addition



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WinNT/2K/ME/XP Path Addition



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Hello World - Our First Program

```
public class HelloWorld {  
    public static void main(String [] args) {  
        System.out.println("Hello, world");  
    }  
}
```

- All JAVA modules begin with a class definition ... classes are “objects”
- The POI (point-of-entry) of a class is the main method

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HelloWorld under Windows

- Start :: Accessories :: Notepad
- Type in HelloWorld as given
- Save as type “All Files” with name “HelloWorld.java”



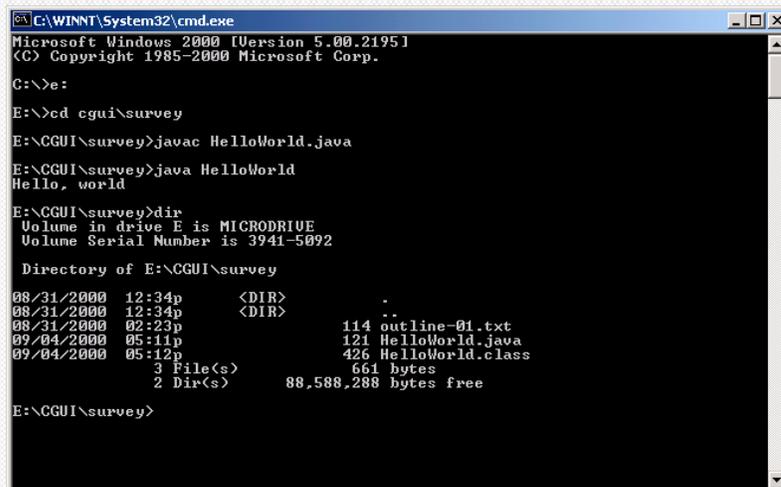
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HelloWorld under Windows

- Start a command prompt
 - Win98: Start :: Run :: DOSPRMPT
 - WinNT/2K: Start :: Run :: CMD
- Change to the proper directory
- Compile and Execute
 - JAVAC HelloWorld.java
 - JAVA HelloWorld
- Watch the case!

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HelloWorld under Windows



```
C:\WINNT\System32\cmd.exe
Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

C:\>e:
E:\>cd cgui\survey
E:\CGUI\survey>javac HelloWorld.java
E:\CGUI\survey>java HelloWorld
Hello, world

E:\CGUI\survey>dir
Volume in drive E is MICRODRIVE
Volume Serial Number is 3941-5092

Directory of E:\CGUI\survey

08/31/2000 12:34p <DIR>      .
08/31/2000 12:34p <DIR>      ..
08/31/2000 02:23p           114 outline-01.txt
09/04/2000 05:11p           121 HelloWorld.java
09/04/2000 05:12p           426 HelloWorld.class
                3 File(s)           661 bytes
                2 Dir(s)      88,588,288 bytes free

E:\CGUI\survey>
```

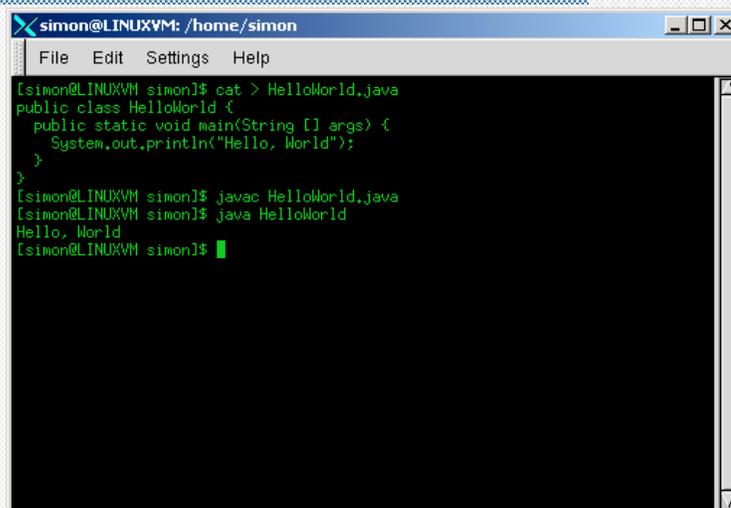
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HelloWorld under UNIX

- Start your favorite text editor
 - EMACS, PICO, VI or just use CAT
- Type in HelloWorld as given
- Save and exit the editor
 - Use filename "HelloWorld.java"
- Compile and Execute
 - JAVAC HelloWorld.java
 - JAVA HelloWorld

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HelloWorld under UNIX



```
simon@LINUXVM: /home/simon
File Edit Settings Help
[simon@LINUXVM simon]$ cat > HelloWorld.java
public class HelloWorld {
    public static void main(String [] args) {
        System.out.println("Hello, World");
    }
}
[simon@LINUXVM simon]$ javac HelloWorld.java
[simon@LINUXVM simon]$ java HelloWorld
Hello, World
[simon@LINUXVM simon]$
```

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The “Real World”

- Text editors with command line compilation are “stone age” tools for program development
- Contemporary software engineering is accomplished using RAD (rapid application development) tools and IDEs (integrated development environments) with inline debuggers

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JAVA RAD Tools and IDEs

- Many are available...
 - Symantec Visual Cafe
 - Borland J-Builder
 - Microsoft Visual J++ (EOL), J#
 - Sun Forte / NetBeans
- Recommendation: Sun Forte / NetBeans
 - It's free
 - It's the official Sun IDE
 - It produces “clean code”
 - It's got modules for RMI and other cool stuff

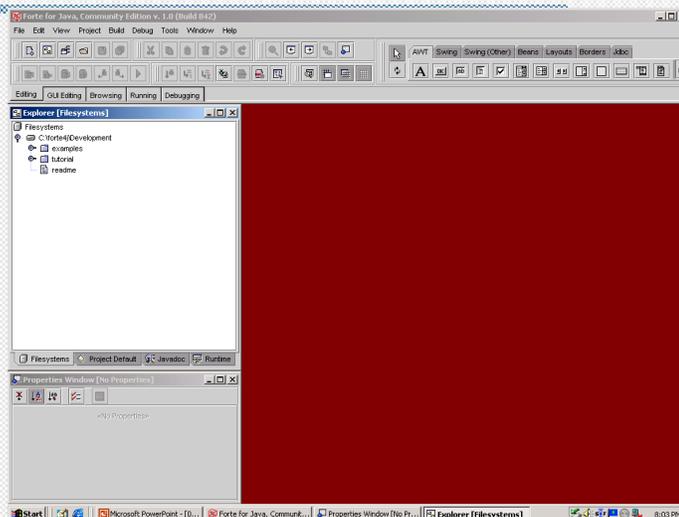
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The NetBeans / Forte IDE

- You must download and install Netbeans / Forte as a separate package:
 - <http://www.netbeans.org>
 - <http://www.sun.com/forte/ffj/ce/>
- Prerequisites
 - J2SE SDK
 - J2SE Documentation (recommended)
 - Installer automatically detects the location of your JDK and documentation during the installation process

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The Main IDE Screen

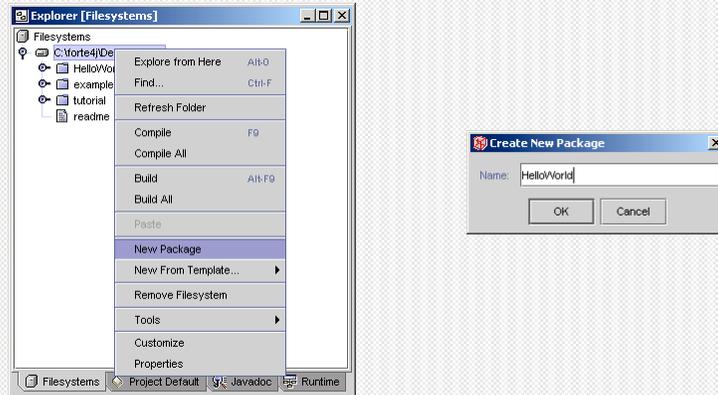


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Hello World in Forte/NetBeans

■ Create a new package

- Right click on the explorer window...

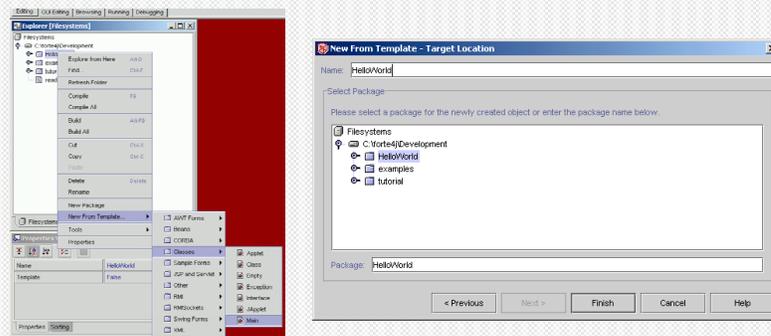


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Hello World in Forte/NetBeans

■ Create a new class

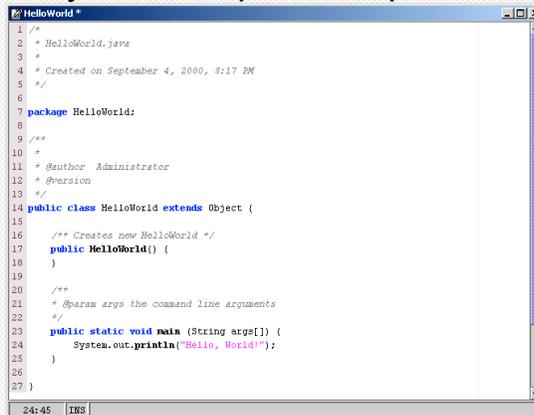
- Right click on the name of the new project that you just created...



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Hello World in Forte/NetBeans

- The template does most of the work, just add the `System.out.println` imperative

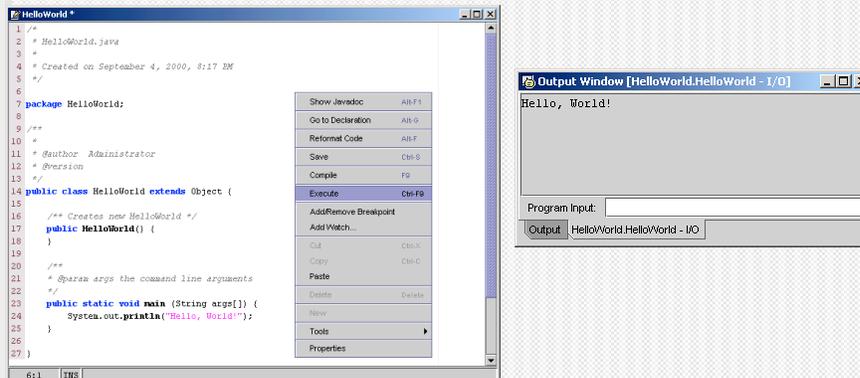


```
1 /*
2  * HelloWorld.java
3  *
4  * Created on September 4, 2000, 8:17 PM
5  */
6
7 package HelloWorld;
8
9 /**
10  *
11  * @author Administrator
12  * @version
13  */
14 public class HelloWorld extends Object {
15
16     /** Creates new HelloWorld */
17     public HelloWorld() {
18     }
19
20     /**
21     * @param args the command line arguments
22     */
23     public static void main (String args[]) {
24         System.out.println("Hello, World!");
25     }
26
27 }
```

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Hello World in Forte/NetBeans

- Compile and run
 - Right click on the name of the class...



```
1 /*
2  * HelloWorld.java
3  *
4  * Created on September 4, 2000, 8:17 PM
5  */
6
7 package HelloWorld;
8
9 /**
10  *
11  * @author Administrator
12  * @version
13  */
14 public class HelloWorld extends Object {
15
16     /** Creates new HelloWorld */
17     public HelloWorld() {
18     }
19
20     /**
21     * @param args the command line arguments
22     */
23     public static void main (String args[]) {
24         System.out.println("Hello, World!");
25     }
26
27 }
```

Context Menu:

- Show Javadoc Alt-F1
- Go to Declaration Alt-G
- Reformat Code Alt-F
- Save Ctrl-S
- Compile F9
- Execute Ctrl-F8
- Add/Remove Breakpoint
- Add Watch...
- Cut Ctrl-X
- Copy Ctrl-C
- Paste
- Delete Delete
- New
- Tools
- Properties

Output Window [HelloWorld.HelloWorld - 1/0]:

```
Hello, World!
```

Program Input:

Output: HelloWorld.HelloWorld - I/O

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Features of Forte/NetBeans

- RAD (rapid application development)
 - “Drag-and-drop” programming of GUIs
 - Clean (pure JAVA) code generation
- Integrated debugger
 - Real time variable watches
 - Single click breakpoints
- Powerful templates
 - You only need to write the “core” code
- ... and much much more.

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Inline Comments

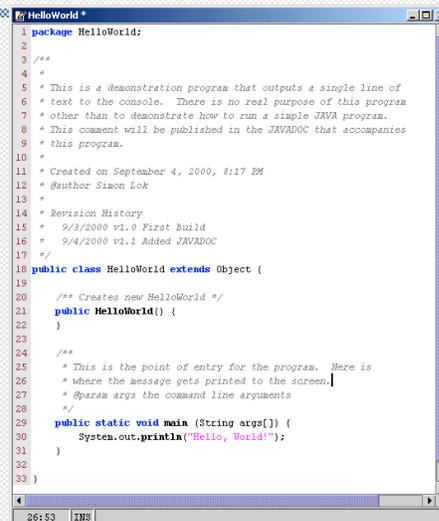
```
public class HelloWorld {
    public static void main(String [] args) {
        // Next line prints out a message to the console
        System.out.println("Hello, world");
    }
}
```

- Denoted by // (same as C++)
- Everything between // and EOL is not compiled
- Write short notes about what this particular piece of code is doing

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JAVADOC Comments

- JAVADOC comments are begun by the sequence `/**`, continued with a `*` at the beginning of each line and terminated by the `*/` sequence
- JAVADOC comments are “official” documentation of your code

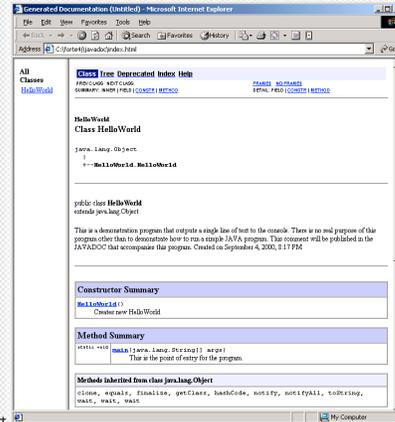
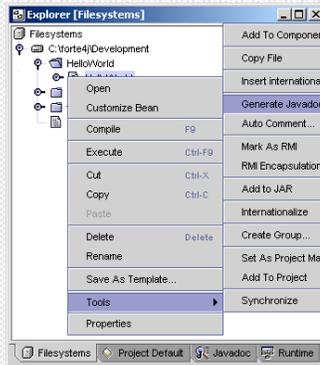


```
1 package HelloWorld;
2
3 /**
4  *
5  * This is a demonstration program that outputs a single line of
6  * text to the console. There is no real purpose of this program
7  * other than to demonstrate how to run a simple JAVA program.
8  * This comment will be published in the JAVADOC that accompanies
9  * this program.
10 *
11 * Created on September 4, 2000, 8:17 PM
12 * @author Simon Lok
13 *
14 * Revision History
15 * 9/3/2000 v1.0 First Build
16 * 9/4/2000 v1.1 Added JAVADOC
17 */
18 public class HelloWorld extends Object {
19
20     /** Creates new HelloWorld */
21     public HelloWorld() {
22     }
23
24     /**
25     * This is the point of entry for the program. Here is
26     * where the message gets printed to the screen.
27     * @param args the command line arguments
28     */
29     public static void main (String args[]) {
30         System.out.println("Hello, World!");
31     }
32
33 }
```

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JAVADOC Comments

- JAVADOC comments can be compiled into HTML files via Forte or via the JAVADOC command line tool



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Primitive Variables

- A *variable* is an item of data named by an identifier
 - Variable declaration is manipulation of the computer's scratchpad (RAM)
 - We are reserving a space in the scratchpad and giving that space an easy-to-use name
- Examples:
 - `int x = 0;`
 - `float f = 3.14159265;`

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Fixed Point Data Types

- **Byte** - byte b = 16;
 - 8-bits, -127 to 127
- **Short** - short s = -1543;
 - 16-bits, -32767 to 32767
- **Int** - int i = 100340;
 - 32-bits, -2 billion to 2 billion
- **Long** - long l = -123456789123;
 - 64-bits, absurdly large numbers

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Fixed Point Data Types

- Used when representing integral numeric data (like 4 or 5)
- Common misconception:
 - Fixed point types can/is not used to represent fractional values
- Used to represent data where the decimal point position stays constant
 - Example: money ... \$18.45

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Floating Point Data Types

- Used when data may take on wildly different values or when scientific precision must be preserved
- Float
 - `float f = 3.14159265;`
 - 32-bits (max value $\sim 10^{38}$)
- Double
 - `double d = 5.6243*Math.pow(10,250);`
 - 64-bits (max value $\sim 10^{308}$)

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Why use fixed point?

- Why bother with implicit decimal points?
 - You might forget about the point...
 - Somebody else might modify your code...
- First guess: it's the size
 - 8 bits versus 32 or 64 bits...
 - No... because of alignment issues
- The real reason... SPEED!

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Fixed vs. Floating Point

- On a MIPS R4000 class processor (found in 1990 SGI Indy's and Y2000 PDAs like the Casio Cassiopeia)...
 - Floating point division takes ~ 70 cycles
 - Fixed point division takes ~ 13 cycles
- This is even more apparent with SIMD instruction sets...
 - MMX/SSE/3DNow, etc. can improve fixed point performance by 4 to 16 times!

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Other Data Types

- Boolean
 - 1-bit fixed point type
 - Use the words "true" and "false" to assign and compare values
- Char
 - Holds a single unicode character
 - 16-bits (unlike the "usual" 8-bit ASCII)
- Reference
 - Called pointer in C/C++... this holds an address in memory

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Literal Data

- How can you tell if 12 is a byte, short, int or long?
- By default, literals w/o a decimal point are int and with a decimal point are double
 - You can use 12345L to make a long
 - 12.3456F can be used for float
 - Byte/Short don't have equivalents

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Something to Try...

```
public class Test {
    public static void main(String args[]) {

        float f = 3.14159265; // this is okay.
        int x = 3.14159265; // is this valid?

        byte b = 32; // this is also okay.
        byte b2 = 130; // ... how about this?

    }
}
```

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Another Thing to Try...

```
public class Test {
    public static void main(String args[]) {
        boolean firstGuy = true; // works.
        boolean secondGuy = 1;    // this?
        boolean thirdGuy = -1;    // this?
    }
}
```

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Aggregate Types - Arrays

■ Easily access groups of variables

- All variables share the same prefix
- Variables must be of the same type

■ Syntax:

```
int[] myArray = new int[64];
myArray[15] = 9226;
System.out.println(myArray[15]);
```

■ Arrays start counting from ZERO!

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Something to Try:

```
public class ArrayTest {
    public static void main(String [] args) {
        int [] myArray = new int[5];
        for (int j = 0; j <= 5; j++) { // ???
            myArray[j] = j*100;
            System.out.println(myArray[j]);
        }
    }
}
```

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Type Casting

- If you want to “force” one type into another, you have to “cast” it
- This code will not compile:

```
int x = 123;
byte b = x;
```

- This is the correct code:

```
int x = 123;
byte b = (byte)x;
```

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Something to Try:

```
public class Test {
    public static void main(String [] args) {
        int x = 5000;
        byte smallFry = 64;
        long bigGuy = 1234567890;
        x = smallFry;        // will this work?
        x = bigGuy;         // how about this?
        x = (int)bigGuy;    // or this?
    }
}
```

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Scope

- Variables live within the nearest set of curly braces...

```
public class myStuff {
    int x = 327; // this is visible classwide
    public static void main(String[] args) {
        int y = -33; // visible inside main
    }
}
```

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Something to Try:

```
public class Test {
    public static void main(String [] args) {
        int x = 32;
        System.out.println(x);
        {
            int x = 64; // this won't work
            int y = 74;
            System.out.println(x);
            System.out.println(y);
        }
        System.out.println(x);
        System.out.println(y); // won't work
    }
}
```

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Constants

- If you want to reserve a space in memory as being “immutable”, use the “final” keyword:

```
final int x = 327;
final double PI = 3.14159265;
```

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Something to Try:

```
public class Test {
    public static void main(String [] args) {
        final int x = 32;
        int y = 64;
        System.out.println(x);
        System.out.println(y);
        x = 24; // this won't work
        y = 32;
    }
}
```

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Infix Arithmetic

- The + - / * operators work as you think that they would:

```
int z = y + x;
```

```
double fz = fx * fy + fw;
```

- In addition there is the % operator which is called modulo, it divides and takes the remainder

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Something to Try:

```
public class Test {  
    public static void main(String [] args) {  
        int ix = 9;  
        double fx = 9.0;  
        int iy = 5;  
        double fy = 5.0;  
        System.out.println(ix/iy);  
        System.out.println(fx/fy);  
    }  
}
```

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Prefix/Postfix Arithmetic

- The `-` operator negates a value:
`int y = -z;`
- The `+` operator promotes:
`byte x = 32;`
`int y = +x;`
- The `++` and `--` operators increment and decrement by 1
`int z = x++;`
`int y = ++x;`

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++X versus X++?

- Consider the following piece of code:

```
int x = 1;
System.out.println(x);      1
System.out.println(x++);   1
System.out.println(x);      2
System.out.println(++x);   3
System.out.println(x);      3
```

- What's the output?

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Relational Operators

- Unlike arithmetic, these process numeric data into a boolean result
- The common ones are:
 - >, >=, <, <=, == and !=
- They work as you would expect

```
int y = 8; int x = 3;
boolean myGuy = (y < x);
System.out.println(myGuy);
```

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Combining Relational Ops

■ Conditional Combinations

- &&, ||, ^ - implement the logical AND, OR and XOR functions
- boolean result = ((x > y) && (x < y));

■ Negation

- The ! operator can prefix any boolean variable or expression
- It inverts the logical value of the variable or expression that it prefixes

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Something To Try:

```
public class Test {
    int x = 32, y = 32, z = 64;
    boolean a = (x > y);
    System.out.println(a);        // output?
    boolean b = (x == y);
    System.out.println(b);        // output?
    boolean c = ((y == x) && (z > y));
    System.out.println(c);        // output?
}
```

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Bitwise Operations

■ Bitwise Conditional Operations

- `&`, `|` and `^` perform bitwise AND/OR/XOR on numeric data...

```
• int x = 6 & 3;  
  int y = 6 | 3;  
  System.out.println(x + ", " + y);
```

■ Remember that 6 is 0110 and 3 is 0011 in binary...

| | | |
|-------------------------|---------------------|---------------------|
| 0110 | 0110 | 0110 |
| <code>&</code> 0011 | <code> </code> 0011 | <code>^</code> 0011 |
| 0010 | 0111 | 0101 |

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Bit Shifting

■ The `>>`, `>>>` and `<<` operators move the bits around...

```
• int x = 16 >> 2;  
  System.out.println(x);
```

■ Shifting can be used for quickly multiplying and dividing by two

■ `>>>` differs from `>>` in that `>>>` is unsigned... `>>` simply pads zero

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Why bitwise ops?

- Hardware interaction...
 - Most hardware provides a stream of data in the form of bytes that need to be sliced, shifted and otherwise massaged into usable form
- Flags...
 - Rather than having many boolean variables, you can have a fixed point “flag” variable with up to 64 flags

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Assignment Operations

- You can assign with the = operator, but you can also combine most other operations...
 - `int x = 0;`
`x += 5; // same as x = x + 5;`
- +=, -=, *=, /=, &=, >>=, etc. are all valid assignment operations
- `y += 6` is faster than `y = y + 6;`

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String Manipulation

- The + infix operator does something slightly different with Strings...

```
String firstGuy = "Hello";  
String secGuy = "World";  
String sum = firstGuy + " " + secGuy;  
System.out.println(sum);
```

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String Comparison

- You cannot use == to compare Strings directly!
- Call "compareTo"
 - Returns the lexicographic difference
 - Zero means they're the same
- Syntax:

```
if (myString.compareTo("hello") == 0) {  
    // executes if myString == "hello"  
}
```

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Conditional Execution

- Execute a statement block if a certain condition is met...

```
if (x > 0) {
    System.out.println("x is good!");
} else if (x < 0) {
    System.out.println("problem!");
} else {
    System.out.println("borderline!");
}
```

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Something to Try:

```
public class Test {
    public static void main(String [] args) {
        double x = 32;
        if(x < 0) {
            System.out.println("x less than zero");
        } else if (x > 0) {
            System.out.println("x greater than zero");
            boolean positiveNumberFlag = true;
        } else {
            System.out.println("x is zero");
        }
        System.out.println(positiveNumberFlag); // ???
    }
}
```

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Conditional Execution

■ Another alternative:

```
switch(x) {
    case 0: System.out.println("border!");
            break;
    case 1: System.out.println("good");
            break;
    default: System.out.println("BAD!");
}
```

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Something to Try:

```
public class test {
    public static void main(String [] args) {
        int x = 2;
        switch(x) {
            case 1: System.out.println("one");
                    break;
            case 2: System.out.println("two");
                    // whoops, forgot the break!
            case 3: System.out.println("three");
                    break;
            default: System.out.println("unknown");
        }
    }
}
```

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Iteration

- To repeat a task a specified number of times, use the “for” construct:

```
for(int i = 0; i < 10; i++) {  
    System.out.println(i);  
}
```

- To repeat until a condition is met:

```
while(i < 10) {  
    System.out.println(i);  
    i++;  
}
```

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More Iteration

- Another variation on the while loop:

```
int i = 0;  
do {  
    System.out.println(i);  
    i++;  
} (while (i < 10));
```

- The do/while loop will always run the loop at least once
- This is often used for user input

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Something to Try:

```
public class Test {
    public static void main(String [] args) {
        int j = 0;
        // print out all even numbers up to 100
        while (j != 99) {
            System.out.println(j);
            j += 2;
        }
    }
}
```

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Changing the flow

- Break and continue can be used to stop/jump iteration blocks
- OUT:

```
for (int j = 0; j < 100; j++)
{
    for (k = 0; k < 100; k++) {
        if ((j % k)==0) continue OUT;
        System.out.println(j);
    }
}
```

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Something to Try:

```
public class Test {
    public static void main(String [] args) {
        for (int w = 0; w < 4; w++) {
            MID: for (int y = 0; y < 5; y+= 2) {
                for (int k = 3; k > 0; k++) {
                    if ((w + y + k) == 4) break;
                    if ((w * y) > 6) continue MID;
                }
            }
        }
    }
}
```

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Basic I/O using a CLI

- Soon, we will be building all of our applications with GUIs, but for now, we can take user input from the command line interface
- There are two basic ways to get user input from the CLI
 - The command line arguments
 - Reading from the console

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Command Line Arguments

- When you run a program, you often supply it with arguments
 - `dir myfile* /a`
 - `ls -la myfile*`
- You can supply a JAVA program command line arguments as well
 - `java myProgram myFirstArg anotherArg`

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Retrieving Arguments

- Recall the declaration of main:
`public static void main(String [] args)`
- The array “args” can be used to access the parameters
- The scope of the “args” array is inside main
- `args.length` gives us how many parameters were passed

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Something to Try:

```
public class EchoArgs {
    public static void main(String [] args) {

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

    }
}
```

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Arguments are Strings!

- Be careful... the command line arguments in the args array is of type String
- You must convert it to a numeric type if you plan on doing arithmetic

```
• int myArg =
    Integer.parseInt(args[2]);
• float gimme =
    Float.parseFloat(args[1]);
```

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Something to Try:

```
public class Test {
    public static void main(String [] args) {
        if (args.length < 2) {
            System.out.println("Must have two args");
            System.exit(-1);
        }
        double a0 = Double.parseDouble(args[0]);
        double a1 = Double.parseDouble(args[1]);
        System.out.println(args[0] + args[1]);
        System.out.println(a0 + a1);
    }
}
```

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Reading from the Console

- Unfortunately, this is pretty complicated... the reason is because Sun wants JAVA to be very “clean”
- Refer to the NumberInput.java sample program...
 - Basically you have to open System.in
 - Then you have to readLine and parse
 - You also have to make sure the user types in something that’s valid using a loop

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One more thing...

- You must import `java.io.*`;
 - This loads a package, we'll revisit this later
- The try-catch construct is required when doing any kind of I/O
 - ```
try {
 String input = console.readLine();
} catch (Exception e) {
 System.out.println("An error occurred.");
}
```
  - This is called an exception handler, we will revisit this later

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## Something to Try:

```
import java.io.*;
public class Test {
 public static void main(String [] args) {
 InputStreamReader in = new InputStreamReader(System.in);
 BufferedReader con = new BufferedReader(in);
 boolean isGood = false;
 while(isGood != true) {
 try {
 System.out.print("Enter a number: ");
 double input = Double.parseDouble(con.readLine());
 isGood = true;
 } catch (Exception e) {
 System.out.println("That was not a number!");
 }
 }
 if (input > 0) { System.out.println("positive"); }
 else { System.out.println("not positive"); }
 }
}
```

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# Core JAVA

---

- Fundamental Concepts
- Bootstrapping
- Basic Language Syntax
- Common Caveats
- Coding Conventions

## javac: Command not found

---

- You have not put the jdk/bin directory into your executable path...
  - Under Win9X/ME, edit autoexec.bat
  - Under WinNT/2K, modify system properties
  - Under UNIX variants, edit .profile/.cshrc
- Better yet, use Forte (or some other IDE) that has a built in compiler

## Blah.java:14: ';' expected

- You forgot to end the line with the semicolon character
- You forgot to match your curly braces... for every { you need a }

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## Can't find class MyStuff.class

- You attempted to run a JAVA program incorrectly:
  - java MyStuff.class
- You should run JAVA programs w/o the trailing .class:
  - java MyStuff

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## It's a Jungle Out There

- Keep your variables to the absolute minimum scope that they need
- This helps prevent namespace collisions...
  - Namespace collisions are usually quite painful to debug, especially if it's some obscure control flow variable

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## Infinite Loops

- Loops terminate upon a condition...
  - If you make a blunder on the condition, the loop may never terminate.
- The while loop is prone to this particular problem
- If you know how many times you are going to run a loop at compile time, use a for loop

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## Comments, who needs those?

- Properly documenting a software engineering project is 100000 times more important than creating the project itself...
- In JAVA, this means proper JAVADOC and inline comments

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## Test as you write code!

- Design your approach on “paper” first... make a flowchart, etc.
- Write small test programs with code fragments to test your ideas
- Test integrated code as you go along... don't wait for the last step and hope things will just work

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# Core JAVA

---

- Fundamental Concepts
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- Coding Conventions

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## Why bother? It's arbitrary!

---

- 80% of the lifetime cost of a piece of software goes to maintenance.
- Hardly any software is maintained for its whole life by the original author.
- Code conventions improve the readability of the software, allowing engineers to understand new code easily.
- If you publish your source code, you need to make sure it is as well packaged and clean as any other product you create.

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## Comments

- We have already talked about this
- JAVADOC comments at the beginning of every class, method and field
- Inline comments every other line to describe what the following line of code does

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## Line Length

- No line of code should be > 80 characters in length
- Line breaks should make sense...

```
longName1 = longName2 * (longName3 + longName4 - longName5)
 + 4 * longname6; // PREFER
```

```
longName1 = longName2 * (longName3 + longName4
 - longName5) + 4 * longname6; // AVOID
```

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## Variables

---

- Initialize all variables all of the time
- Only declare one variable per line
- For local variables, use an inline comment immediately after the variable declaration to describe what the variable is for
- For fields, use a JAVADOC comment

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## Indentation

---

- All open curly braces imply that the next line should be indented
- Indentation should be uniform across all files
- Large indentations are a bad idea because you run out of room to nest blocks of code

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## Parentheses

---

- Be explicit everywhere
- Order of operations applies, but you should be explicit to make sure that anyone reading your code can easily understand what is going on

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## Identifiers

---

- Class names should start with a capital letter and have an additional capital letter for each word in the noun phrase (MyClassName)
- Methods and Variables names do not have a leading capital letter (myVar)
- Constants all all caps with \_ breaking the words (MY\_CONSTANT)

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## Clean code is good code

---

- The vast majority of software defects can be avoided through a combination of:
  - Thorough paper designs
  - Writing clean, standardized code
  - Proper unit testing while coding
  - Meticulous documentation