Chapter 1 Introduction to Java

Why Java?

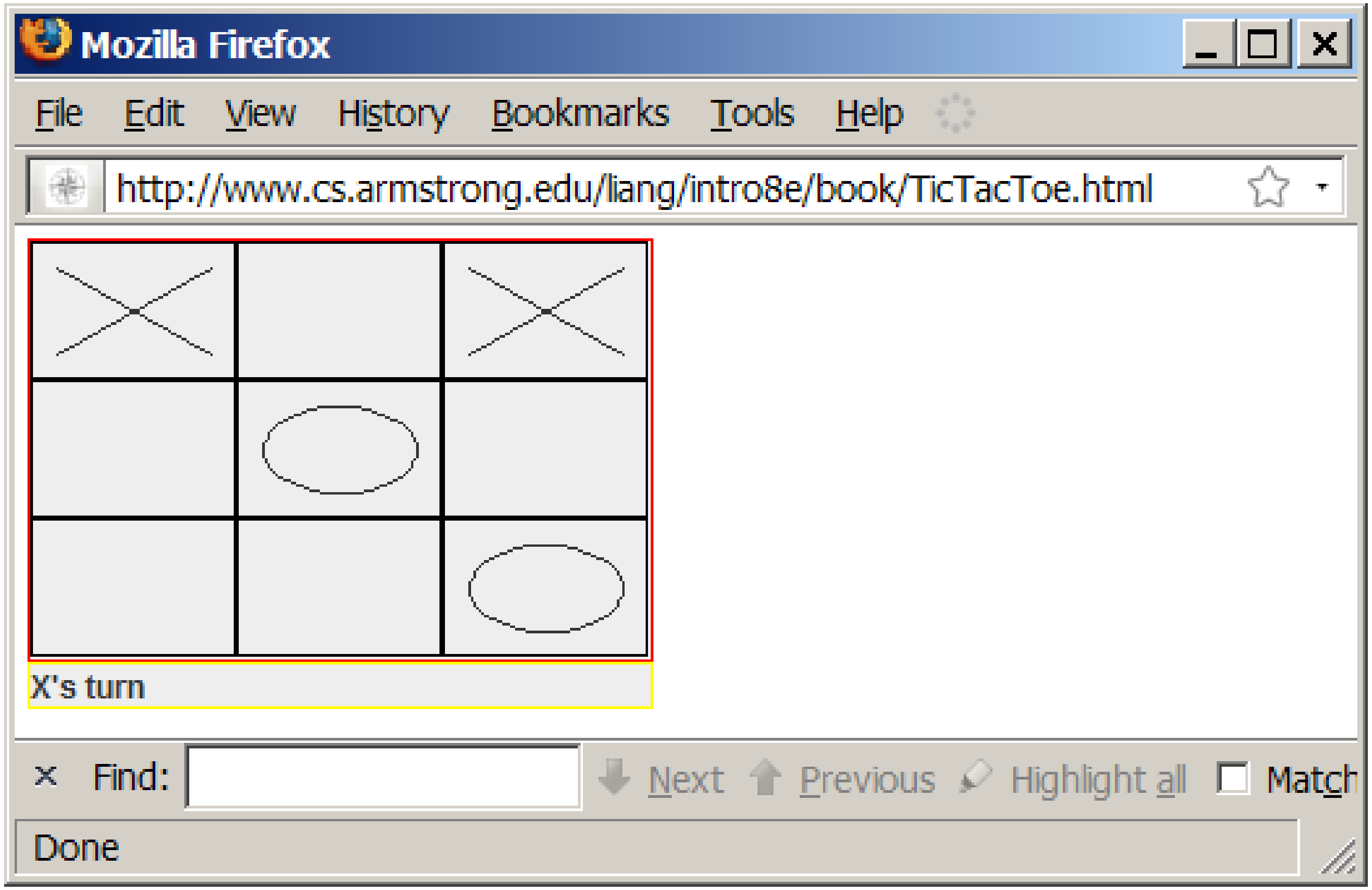
The answer is that Java enables users to develop and deploy applications on the Internet for servers, desktop computers, and small hand-held devices. The future of computing is being profoundly influenced by the Internet, and Java promises to remain a big part of that future. Java is the Internet programming language.

- ☞Java is a general purpose programming language.
- ☞Java is the Internet programming language.

Java, Web, and Beyond

- Java can be used to develop Web applications.
- Java Applets
- Java Web Applications
- Java can also be used to develop applications for hand-held devices such as cell phones

Examples of Java's Versatility (Applets)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http://www.cs.armstrong.edu/liang/intro8e/book/TicTacToe.html
X's turn
Find:
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Characteristics of Java

- Java Is Simple
- Java Is Object-Oriented
- Java Is Distributed
- Java Is Interpreted
- Java Is Robust
- Java Is Secure
- Java Is Architecture-Neutral
- Java Is Portable
- Java's Performance
- Java Is Multithreaded
- Java Is Dynamic

www.cs.armstrong.edu/liang/intro8e/JavaCharacteristics.pdf

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Java is partially modeled on C++, but greatly simplified and improved. Some people refer to Java as "C++--" because it is like C++ but with more functionality and fewer negative aspects.

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Java is inherently object-oriented. Although many object-oriented languages began strictly as procedural languages, Java was designed from the start to be object-oriented. Object-oriented programming (OOP) is a popular programming approach that is replacing traditional procedural programming techniques.

One of the central issues in software development is how to reuse code. Object-oriented programming provides great flexibility, modularity, clarity, and reusability through encapsulation, inheritance, and polymorphism.

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Distributed computing involves several computers working together on a network. Java is designed to make distributed computing easy. Since networking capability is inherently integrated into Java, writing network programs is like sending and receiving data to and from a file.

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You need an interpreter to run Java programs. The programs are compiled into the Java Virtual Machine code called bytecode. The bytecode is machine-independent and can run on any machine that has a Java interpreter, which is part of the Java Virtual Machine (JVM).

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Java compilers can detect many problems that would first show up at execution time in other languages.

Java has eliminated certain types of error-prone programming constructs found in other languages.

Java has a runtime exception-handling feature to provide programming support for robustness.

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Java implements several security mechanisms to protect your system against harm caused by stray programs.

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Write once, run anywhere

With a Java Virtual Machine (JVM), you can write one program that will run on any platform.

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Because Java is architecture neutral, Java programs are portable. They can be run on any platform without being recompiled.

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Java's performance Because Java is architecture neutral, Java programs are portable. They can be run on any platform without being recompiled.

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Multithread programming is smoothly integrated in Java, whereas in other languages you have to call procedures specific to the operating system to enable multithreading.

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Java was designed to adapt to an evolving environment. New code can be loaded on the fly without recompilation. There is no need for developers to create, and for users to install, major new software versions. New features can be incorporated transparently as needed.

JDK Versions

- 1 JDK Alpha and Beta (1995)
- 2 JDK 1.0 (January 23, 1996)
- 3 JDK 1.1 (February 19, 1997)
- 4 J2SE 1.2 (December 8, 1998)
- 5 J2SE 1.3 (May 8, 2000)
- 6 J2SE 1.4 (February 6, 2002)
- 7 J2SE 5.0 (September 30, 2004)
- 8 Java SE 6 (December 11, 2006)
- 9 Java SE 7 (July 28, 2011)
- 10 Java SE 8 (March 18, 2014)

JDK Editions

- Java Standard Edition (J2SE)
  - J2SE can be used to develop client-side standalone applications or applets.
- Java Enterprise Edition (J2EE)
  - J2EE can be used to develop server-side applications such as Java servlets and Java ServerPages.
- Java Micro Edition (J2ME).
  - J2ME can be used to develop applications for mobile devices such as cell phones.

This book uses J2SE to introduce Java programming.

Popular Java IDEs

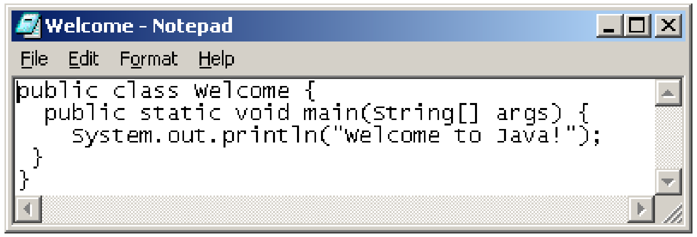
- NetBeans Open Source by Sun
- Eclipse Open Source by IBM

A Simple Java Program

Listing 1.1

```
//This program prints Welcome to Java!
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java!");
  }
}
```

Creating, Compiling, and Running Programs



```
public class Welcome {
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}
```
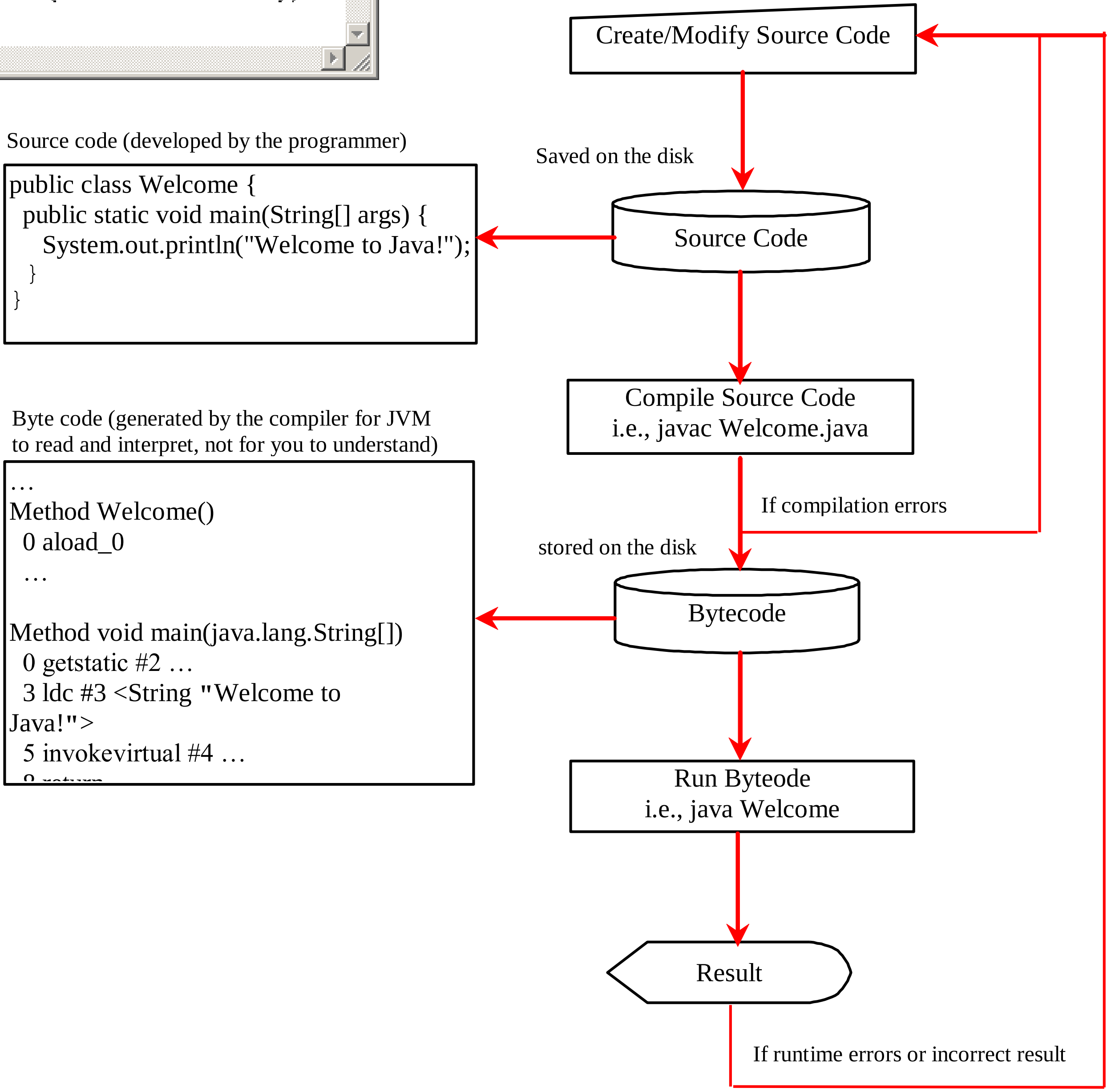



Source code (developed by the programmer)

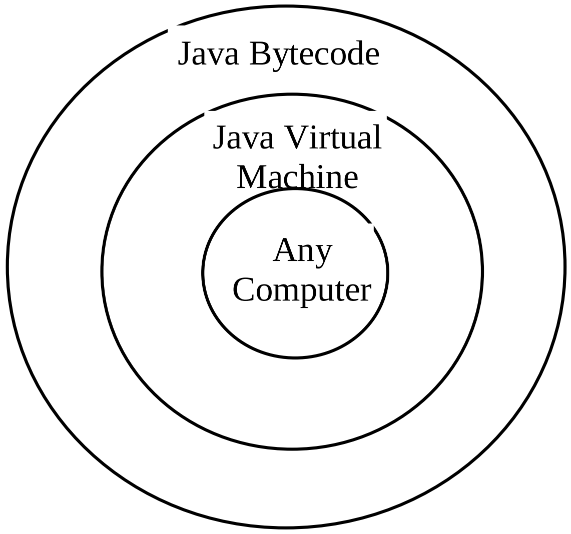
```
public class Welcome {
  public static void main(String[] args) {
     System.out.println("Welcome to Java!");
  }
}
```

Byte code (generated by the compiler for JVM to read and interpret, not for you to understand)

```
…
Method Welcome()
  0 aload_0
  …

Method void main(java.lang.String[])
  0 getstatic #2 …
  3 ldc #3 <String "Welcome to
Java!">
  5 invokevirtual #4 …
```

Compiling Java Source Code

You can port a source program to any machine with appropriate compilers. The source program must be recompiled, however, because the object program can only run on a specific machine. Nowadays computers are networked to work together. Java was designed to run object programs on any platform. With Java, you write the program once, and compile the source program into a special type of object code, known as *bytecode*. The bytecode can then run on any computer with a Java Virtual Machine, as shown below. Java Virtual Machine is a software that interprets Java bytecode.



animation

Trace a Program Execution

Enter main method

```
//This program prints Welcome to Java!
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java!");
  }
}
```

animation

Trace a Program Execution

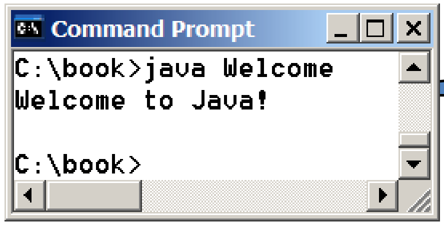
Execute statement

```
//This program prints Welcome to Java!
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java!");
  }
}
```

animation

Trace a Program Execution

```
//This program prints Welcome to Java!
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java!");
  }
}
```



```
C:\book>java Welcome
Welcome to Java!

C:\book>
```

print a message to the console

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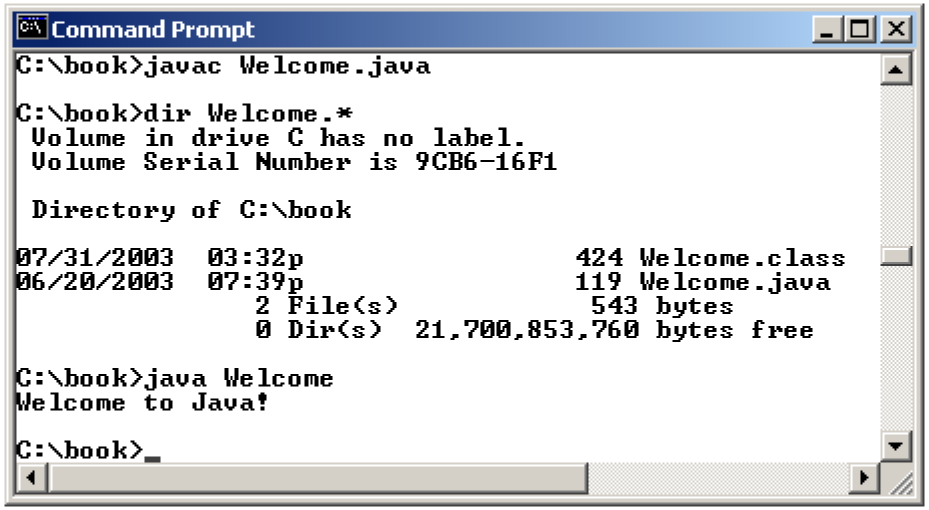
Compiling and Running Java from the Command Window

- Set path to JDK bin directory
  - set path=c:\Program Files\java\jdk1.6.0\bin
- Set classpath to include the current directory
  - set classpath=.
- Compile
  - javac Welcome.java
- Run
  - java Welcome



```
C:\book>javac Welcome.java

C:\book>dir Welcome.*
 Volume in drive C has no label.
 Volume Serial Number is 9CB6-16F1

 Directory of C:\book

07/31/2003  03:32p                 424 Welcome.class
06/20/2003  07:39p                 119 Welcome.java
               2 File(s)            543 bytes
               0 Dir(s)  21,700,853,760 bytes free

C:\book>java Welcome
Welcome to Java!

C:\book>_
```

Anatomy of a Java Program

- Comments
- Reserved words
- Modifiers
- Statements
- Blocks
- Classes
- Methods
- The main method

Comments

Three types of comments in Java.

Line comment: A line comment is preceded by two slashes (//) in a line.

Paragraph comment: A paragraph comment is enclosed between /* and */ in one or multiple lines.

javadoc comment: javadoc comments begin with /** and end with */. They are used for documenting classes, data, and methods. They can be extracted into an HTML file using JDK's javadoc command.

Reserved Words

Reserved words or keywords are words that have a specific meaning to the compiler and cannot be used for other purposes in the program. For example, when the compiler sees the word class, it understands that the word after class is the name for the class. Other reserved words in Listing 1.1 are public, static, and void. Their use will be introduced later in the book.

Modifiers

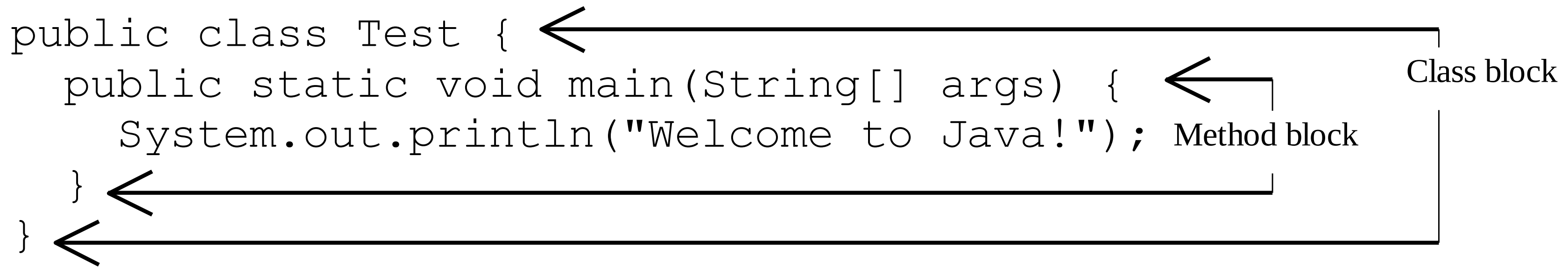
Java uses certain reserved words called modifiers that specify the properties of the data, methods, and classes and how they can be used. Examples of modifiers are public and static. Other modifiers are private, final, abstract, and protected. A public datum, method, or class can be accessed by other programs. A private datum or method cannot be accessed by other programs. Modifiers are discussed in Chapter 6, “Objects and Classes.”

Statements

A statement represents an action or a sequence of actions. The statement System.out.println("Welcome to Java!") in the program in Listing 1.1 is a statement to display the greeting "Welcome to Java!" Every statement in Java ends with a semicolon (;).

Blocks

A pair of braces in a program forms a block that groups components of a program.



```
public class Test {
  public static void main(String[] args) {
    System.out.println("Welcome to Java!");
  }
}
```

Classes

The class is the essential Java construct. A class is a template or blueprint for objects. To program in Java, you must understand classes and be able to write and use them. The mystery of the class will continue to be unveiled throughout this book. For now, though, understand that a program is defined by using one or more classes.

Methods

What is System.out.println? It is a method: a collection of statements that performs a sequence of operations to display a message on the console. It can be used even without fully understanding the details of how it works. It is used by invoking a statement with a string argument. The string argument is enclosed within parentheses. In this case, the argument is "Welcome to Java!" You can call the same println method with a different argument to print a different message.

main Method

The main method provides the control of program flow. The Java interpreter executes the application by invoking the main method.

The main method looks like this:

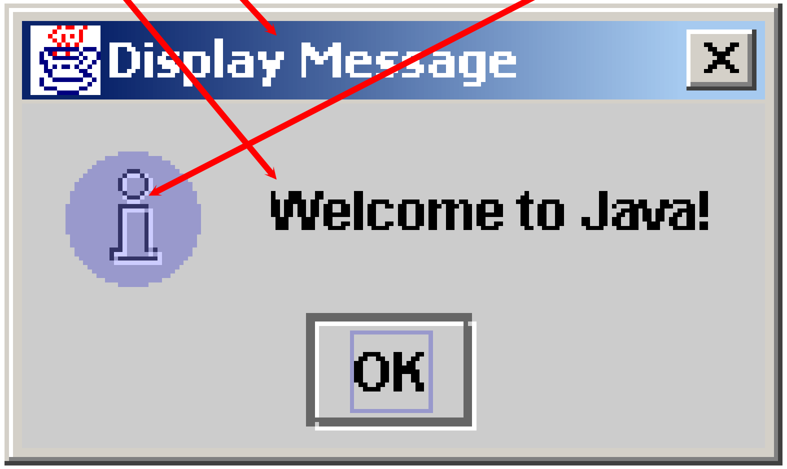
```
public static void main(String[] args) {
  // Statements;
}
```

Displaying Text in a Message Dialog Box

you can use the showMessageDialog method in the JOptionPane class. JOptionPane is one of the many predefined classes in the Java system, which can be reused rather than “reinventing the wheel.”

The showMessageDialog Method

```
JOptionPane.showMessageDialog(null,
  "Welcome to Java!",
  "Display Message",
  JOptionPane.INFORMATION_MESSAGE);
```



Two Ways to Invoke the Method

There are several ways to use the showMessageDialog method. For the time being, all you need to know are two ways to invoke it.

One is to use a statement as shown in the example:

```
JOptionPane.showMessageDialog(null, x,
  y, JOptionPane.INFORMATION_MESSAGE);
```

where x is a string for the text to be displayed, and y is a string for the title of the message dialog box.

The other is to use a statement like this:

```
JOptionPane.showMessageDialog(null, x);
```

where x is a string for the text to be displayed.