Introduction

What this book will tell you

This book explains how to write Java programs that run either as independent applications or as applets (part of a web page).

This book is for novices

If you have never done any programming before – if you are a complete novice – this book is for you. This book assumes no prior knowledge of programming. It starts from scratch. It is written in a simple, direct style for maximum clarity. It is aimed primarily at first-year undergraduates at universities and colleges, but it is also suitable for novices studying alone.

Why Java?

Java is probably one of the best programming languages to learn and use because of the following features.

Java is small and beautiful

The designers of Java have deliberately left out all the superfluous features of programming languages; they cut the design to the bone. The result is a language that has all the necessary features, combined in an elegant and logical way. The design is lean and mean. It is easy to learn, but powerful.

Java is object oriented

Object-oriented languages are the latest and most successful approach to programming. Object-oriented programming is the most popular approach to programming. Java is

completely object oriented from the ground up. It is not a language that has had object-orientedness grafted onto it as an afterthought.

Java supports the Internet

A major motivation for Java is to enable people to develop programs that use the Internet and the World Wide Web. Java applets can easily be invoked from web browsers to provide valuable and spectacular facilities. In addition, Java programs can be easily transmitted around the Internet and run on any computer.

Java is general purpose

Java is a truly general-purpose language. Anything that C++, Visual Basic, etc., can do, so can Java.

Java is platform independent

Java programs will run on almost all computers and mobile phones and with nearly all operating systems – unchanged! Try that with any other programming language. (You almost certainly can't!) This is summed up in the slogan 'write once – run anywhere'.

Java has libraries

Because Java is a small language, most of its functionality is provided by pieces of program held in libraries. A whole host of library software is available to do graphics, access the Internet, provide graphical user interfaces (GUIs) and many other things.

You will need

To learn to program you need a computer and some software. A typical system is a PC (personal computer) with the Java Software Development Kit (JDK). This is also available for Unix, GNU/Linux and Apple systems. This kit allows you to prepare and run Java programs. There are also more convenient development environments. See Chapter 2.

Exercises are good for you

If you were to read this book time and again until you could recite it backwards, you still wouldn't be able to write programs. The practical work of writing programs and program fragments is vital to becoming fluent and confident at programming.

There are exercises for the reader at the end of each chapter. Please do some of them to enhance your ability to program.

There are also short self-test questions throughout the text with answers at the end of the chapter, so that you can check you have understood things properly.

What's included?

This book explains the fundamentals of programming:

- variables;
- assignment;
- input and output;
- calculation;
- graphics and windows programming;
- selection using `if`;
- repetition using `while`.

It also covers integer numbers, floating-point numbers and character strings. Arrays are also described. All these are topics that are fundamental, whatever kind of programming you go on to do.

This book also thoroughly addresses the object-oriented aspects of programming:

- using library classes;
- writing classes;
- using objects;
- using methods.

We also look at some of the more sophisticated aspects of object-oriented programming, like:

- inheritance;
- polymorphism;
- interfaces.

What's not included

This book describes the essentials of Java. It does not explain the bits and pieces, the bells and whistles. Thus the reader is freed from unnecessary detail and can concentrate on mastering Java and programming in general.

Applications or applets?

There are two distinct types of Java program:

- a distinct free-standing program (this is called an application);
- a program invoked from a web browser (this is called an applet).

In this book we concentrate on applications, because we believe that this is the main way in which Java is being used. (We explain how to run applets in Appendix C.)

Graphics or text?

Throughout the text we have emphasized programs that use graphical images rather than text input and output. We think they are more fun, more interesting and clearly demonstrate all the important principles of programming. We haven't ignored programs that input and output text – they are included, but they come second best.

Graphical user interfaces (GUIs)

The programs we present use many of the features of a GUI, such as windows, buttons, scrollbars and using the mouse in lots of different ways.

AWT or Swing?

There are two Java mechanisms for creating and using GUIs – AWT and Swing. The Swing set of user-interface components is more complete and powerful than the AWT set. This book adopts the Swing approach because it is being used more widely.

The sequence of material

Programming involves many challenging ideas, and one of the problems of writing a book about programming is deciding how and when to introduce new ideas. We introduce simple ideas early and more sophisticated ideas later on. We use objects from an early stage. Then later we see how to write new objects. Our approach is to start with ideas like variables and assignment, then introduce selection and looping, and then go on to objects and classes (the object-oriented features). We also wanted to make sure that the fun element of programming is paramount, so we use graphics right from the start.

Bit by bit

In this book we introduce new ideas carefully one at a time, rather than all at once. So there is a single chapter on writing methods, for example.

Computer applications

Computers are used in many different applications and this book uses examples from all these areas:

- information processing;
- games;
- scientific calculations.

The reader can choose to concentrate on those application areas of interest and spend less time on the other areas.

Different kinds of programming

There are many different kinds of programming – examples are procedural, logic, functional, spreadsheet, visual and object-oriented programming. This book is about the dominant type of programming – object-oriented programming (OOP) – as practised in languages like Visual Basic, C++, C#, Eiffel and Smalltalk.

Which version of Java?

This book uses Java 6.

Have fun

Programming is creative and interesting, particularly in Java. Please have fun!

Visit our website

All the programs presented in this book are available on our website, which can be reached via: **www.pearsoned.co.uk/bell**

Changes to this edition

If you have used earlier editions of this book, you might like to know what is different about this edition.

The latest version of Java is version 6. This book accords with version 6. There are no changes to the Java language or to the library classes that we use. All the programs in the book work with version 6. This has actually meant no changes to the programs from the last edition.

The main changes for this 6th edition are:

- Chapter 2, 'First programs', and Appendix I. We have enhanced the explanation to include some treatment of integrated development environments (IDEs).
- The CD. In an era of broadband, we have eliminated the CD. Everything, and more, is on the website.
- Chapter 26 on the role of Java in the world is thoroughly updated.
- There are light-touch improvements throughout to enhance readability

We hope you like the changes.

around 1970. C was tremendously popular. It was used to write the Unix operating system, and, much later, Linus Torvalds used it to write a major part of Unix – named Linux – for PCs.

The next step came when C++ ('C plus plus') was created around 1980 by Bjarne Stroustrup, also at Bell Labs. This made possible the creation and reuse of separate sections of code, in a style known as 'object-oriented programming'. (In C, you could use ++ to add one to an item – hence C++ is one up from C.) C++ is still popular, but hard to use – it takes a lot of study.

Now we move to Sun Microsystems in the USA. In the early 1990s, James Gosling was designing a new language named Oak, intended to be used in consumer electronics products. This project never came to fruition, but the Oak language became renamed Java (after the coffee).

In parallel, the Internet was becoming more popular, and a small company called Netscape had created a web browser.

After discussions with Microsoft, Netscape agreed to provide support for Java in its web browser, with the result that Java programs could be downloaded alongside web pages. This provided a programming capability to enhance static pages. These programs were known as 'applets'. Netscape decided to allow users to download its browser for free, and this also spread the word about Java.

The main features of Java

When James Gosling designed Java, he didn't create something from nothing. Rather, he took existing concepts, and integrated them to form a new language. Here are its main features:

- Java programs look similar to C++ programs. This meant that the C++ community would take it seriously, and also meant that C++ programmers can be productive quickly.
- Java was designed with the Internet in mind. As well as creating conventional programs, applets can be created which run 'inside' a web page. Java also had facilities for transferring data over the Internet in a variety of ways.
- Java programs are portable: they can run on any type of computer. In order for this to happen, a Java 'run-time system' has to be written for every type of computer, and this has been done for virtually all types of computer in use today. Java is also available for cell or mobile phones, so, in a sense, the abandoned Oak project has come to fruition.
- Java applets are secure. Computer viruses are widespread, and downloading and running programs over the Internet can be risky. However, the design of Java applets means that they are secure, and will not infect your computer with a virus.