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Java语言导学

（英文版 · 第3版）

Mary Campione · Kathy Walrath · Alison Huml

The Java™ Tutorial, Third Edition

A Short Course on the Basics

The Java Series

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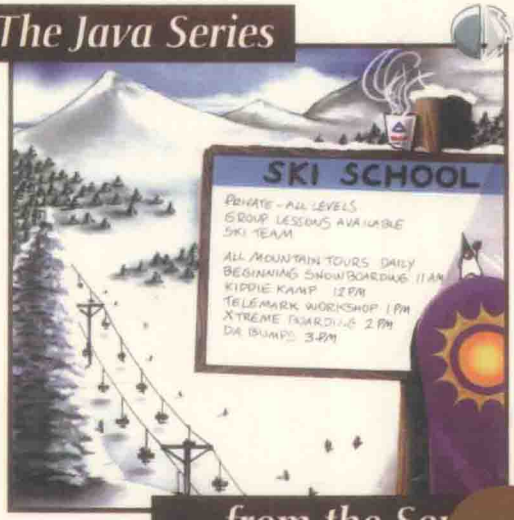

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（美）Mary Campione
Kathy Walrath
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机械工业出版社
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出版者的话

文艺复兴以降，源远流长的科学精神和逐步形成的学术规范，使西方国家在自然科学的各个领域取得了垄断性的优势；也正是这样的传统，使美国在信息技术发展的六十多年间名家辈出、独领风骚。在商业化的进程中，美国的产业界与教育界越来越紧密地结合，计算机学科中的许多泰山北斗同时身处科研和教学的最前线，由此而产生的经典科学著作，不仅擘划了研究的范畴，还揭橥了学术的源变，既遵循学术规范，又自有学者个性，其价值并不会因年月的流逝而减退。

近年，在全球信息化大潮的推动下，我国的计算机产业发展迅猛，对专业人才的需求日益迫切。这对计算机教育界和出版界都既是机遇，也是挑战；而专业教材的建设在教育战略上显得举足轻重。在我国信息技术发展时间较短、从业人员较少的现状下，美国等发达国家在其计算机科学发展的几十年间积淀的经典教材仍有许多值得借鉴之处。因此，引进一批国外优秀计算机教材将对我国计算机教育事业的发展起积极的推动作用，也是与世界接轨、建设真正的世界一流大学的必由之路。

机械工业出版社华章图文信息有限公司较早意识到“出版要为教育服务”。自1998年开始，华章公司就将工作重点放在了遴选、移译国外优秀教材上。经过几年的不懈努力，我们与Prentice Hall，Addison-Wesley，McGraw-Hill，Morgan Kaufmann等世界著名出版公司建立了良好的合作关系，从它们现有的数百种教材中甄选出Tanenbaum，Stroustrup，Kernighan，Jim Gray等大师名家的一批经典作品，以“计算机科学丛书”为总称出版，供读者学习、研究及庋藏。大理石纹理的封面，也正体现了这套丛书的品位和格调。

“计算机科学丛书”的出版工作得到了国内外学者的鼎力襄助，国内的专家不仅提供了中肯的选题指导，还不辞劳苦地担任了翻译和审校的工作；而原书的作者也相当关注其作品在中国的传播，有的还专诚为其书的中译本作序。迄今，“计算机科学丛书”已经出版了近百个品种，这些书籍在读者中树立了良好的口碑，并被许多高校采用为正式教材和参考书籍，为进一步推广与发展打下了坚实的基础。

随着学科建设的初步完善和教材改革的逐渐深化，教育界对国外计算机教材的需求和应用都步入一个新的阶段。为此，华章公司将加大引进教材的力度，在“华章教育”的总规划之下出版三个系列的计算机教材：除“计算机科学丛书”之外，对影印版的教材，则单独开辟出“经典原版书库”；同时，引进全美通行的教学辅导书“Schaum's Outlines”系列组成“全美经典学习指导系列”。为了保证这三套丛书的权威性，同时也为了更好地为学校和老师们服务，华章公司聘请了中国科学院、北京大学、清华大学、国防科技大学、复旦大学、上海交通大学、南京大学、浙江大学、中国科技大学、哈尔滨工业大学、西安交通大学、中国人民大学、北京航空航天大学、北京邮电大学、中山大学、解放军理工大学、郑州大学、湖北工学院、中国国

家信息安全测评认证中心等国内重点大学和科研机构在计算机的各个领域的著名学者组成“专家指导委员会”，为我们提供选题意见和出版监督。

这三套丛书是响应教育部提出的使用外版教材的号召，为国内高校的计算机及相关专业的教学度身订造的。其中许多教材均已为M. I. T.，Stanford，U.C. Berkeley，C. M. U. 等世界名牌大学所采用。不仅涵盖了程序设计、数据结构、操作系统、计算机体系结构、数据库、编译原理、软件工程、图形学、通信与网络、离散数学等国内大学计算机专业普遍开设的核心课程，而且各具特色——有的出自语言设计者之手、有的历经三十年而不衰、有的已被全世界的几百所高校采用。在这些圆熟通博的名师大作的指引之下，读者必将在计算机科学的宫殿中由登堂而入室。

权威的作者、经典的教材、一流的译者、严格的审校、精细的编辑，这些因素使我们的图书有了质量的保证，但我们的目标是尽善尽美，而反馈的意见正是我们达到这一终极目标的重要帮助。教材的出版只是我们的后续服务的起点。华章公司欢迎老师和读者对我们的工作提出建议或给予指正，我们的联系方法如下：

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Preface

SINCE the release of the original Java Development Kit in May of 1995, the engineering team at Sun Microsystems has been hard at work improving and enhancing the Java platform. We have been similarly laboring to update *The Java Tutorial* to reflect the work of the engineers.

This edition documents the APIs in the Java 2 Software Development Kit (SDK), v. 1.3. Because you might have to write or update code used with earlier releases of the Java platform, this book is also valid for versions 1.2 and 1.1.

Besides integrating v. 1.3 information into the text, we've added questions and exercises to help you practice what you learn. To help beginners avoid many common mistakes, an appendix is devoted to programming problems and their solutions. Convenient summaries at the end of each section are also new to this edition.

Like the first and second editions, this book is based on the online tutorial hosted at Sun Microsystems's Web site for the Java platform.

```
http://java.sun.com/docs/books/tutorial/index.html
```

Like the online version, this book reflects the latest advances in Java technology. Unlike the online version, this book solely focuses on the APIs needed by most beginning to intermediate programmers. Once you've mastered the material in this book, you can explore the rest of the Java platform on the Web site.

Our intent has always been to create a fun, easy-to-read, task-oriented programmer's guide with lots of practical examples to help people learn to program.

Who Should Read This Book?

The book is geared towards both novice and experienced programmers.

- *New programmers* can benefit most by reading the book from beginning to end, including the step by step instructions for compiling and running your first program in Getting Started (page 1).
- *Programmers experienced with procedural languages* such as C may wish start with the material on object-oriented concepts and features of the Java programming language.
- *Experienced object-oriented programmers* may want to jump feet first into more advanced trails, such as those on applets, essential classes, or user interfaces.

No matter what type of programmer you are, you can find a path through this book that fits your learning requirements.

How to Use This Book

This book is designed so that you can either read it straight through or skip around from topic to topic. Whenever a topic is discussed in another place, you'll see a link to that place in the tutorial. Links are underlined and are followed by page numbers, like this: What Can Java Technology Do? (page 5).

All the sample code used in this book is available online and on the accompanying CD. The CD icon in the margin indicates that the code is available. At the end of each chapter there is also a "Code Sample" section with a table that specifies the locations of the examples on the CD and online.

We're dedicated to keeping this book up-to-date with the most current information. To learn what's new since this book went to press, visit the following URL:

```
http://java.sun.com/docs/books/tutorial/books/3e/index.html
```

Answers to Questions and Exercises

You can test your comprehension of each chapter by trying problems in the "Questions and Exercises" sections. The answers are all available online; here's a handy link to all the solution pages for this book:

```
http://java.sun.com/docs/books/tutorial/books/3e/toc.html
```

Acknowledgments

Many Internet readers have helped us maintain and improve the quality of the tutorial by sending us email and cheerfully pointing out our numerous typos, broken links, and more importantly, areas of the tutorial that caused confusion or could benefit from rewriting.

Many members of the Java Software engineering and documentation team have given us counsel, answered our many questions, reviewed our material, and even made contributions to it. They also make Sun Microsystems a fun place to work. The list is long but we'd particularly like to note the contributions of Jennifer Ball, Brian Beck, Joshua Bloch, David Connelly, Chris Darke, Lisa Fenwick, Bill Foote, Carol Hayes, Herb Jellinek, Doug Kramer, Tim Lindholm, Marianne Mueller, Marla Parker, Mark Reinhold, John Rose, and Sharon Zakhour. We are also especially grateful for the talented writers at Sun who have contributed to the online tutorial as guest authors.

The Java programming language wouldn't exist without its creator, James Gosling. We'd like to thank James, not only for creating the language but also for staying involved as the Java platform develops.

Lisa Friendly, our manager and series editor, gave us the freedom and support necessary to do our work—and enjoy it.

Mike Hendrickson, our editorial advisor at Addison-Wesley, is always a calming influence and keeps us on schedule. Sarah Weaver was the superb and patient production manager on the book and Evelyn Pyle was our copy editor and grammar queen. The always cheerful and supportive Julie DiNicola and the whole team at Addison-Wesley have been a pleasure to work with.

Those who graciously helped with the first and second editions are thanked online at: `http://java.sun.com/docs/books/tutorial/2e/book.html`

Dedication

Mary: This book is dedicated to my husband, Richard Campione, for being my greatest friend. It's also dedicated to Sophia, a delightful child and a constant reminder of what's truly important.

Kathy: This book is dedicated to my husband, Nathan Walrath, and to our children, Laine and Cosmo. Nathan has done whatever it takes to help me get my work done, from distracting kids to dispensing advice and art criticism. Laine and Cosmo are not old enough to help but like their dad, they sure are fun.

Alison: This book is dedicated to everyone who put up with me during the book production. Highest honors go to my husband, Aron Hall, who helped to review chapters and lured me away from my computer for hikes in the mountains and down to Peet's Coffee and Tea.

Contents

http://java.sun.com/docs/books/tutorial/getStarted/index.html

1 Getting Started

THIS chapter gives a quick introduction to the Java™ technology. First, we explain what the Java platform is and what it can do. Next are step-by-step instructions on how to compile and run two simple programs on the Win32, the UNIX/Linux or the MacOS platforms.[1] After that, we take a look at the code for the two programs, so you can see how they work. The chapter ends with questions and exercises to test and expand your knowledge, followed by a table of download instructions for the code used in this chapter.

The software development kits (SDKs) that Sun Microsystems provides include a minimal set of tools to let you run and compile your programs. Serious developers are advised to use a professional Integrated Development Environment (IDE).[2] See Integrated Development Environments (page 540) for a list of IDEs.

[1] So, you're using a platform not listed here? Sun Microsystems maintains this list of third-party ports to other platforms: http://java.sun.com/cgi-bin/java-ports.cgi

[2] In fact, Java 2 SDK, Standard Edition v. 1.3, is available bundled with an IDE, the Forte™ for Java™, Community Edition. This version is included on this book's CD.

About the Java Technology

Talk about Java technology seems to be everywhere, but what exactly is it? The next two sections explain how it is both a programming language and a platform.

The Java Programming Language

The Java programming language is a high-level language that can be characterized by all the following buzzwords:[1]

- Simple
- Object oriented
- Distributed
- Interpreted
- Robust
- Secure
- Architecture neutral
- Portable
- High performance
- Multithreaded
- Dynamic

With most programming languages, you either compile or interpret a program so that you can run it on your computer. The Java programming language is unusual in that a program is both compiled and interpreted. With the compiler, first you translate a program into an inter-

[1] Each of these terms is explained in "The Java Language Environment," a white paper by James Gosling and Henry McGilton. You can find this white paper at http://java.sun.com/docs/white/langenv/index.html

mediate language called *Java bytecodes*—the platform-independent codes interpreted by the interpreter on the Java platform. The interpreter parses and runs each Java bytecode instruction on the computer. Compilation happens just once; interpretation occurs each time the program is executed. Figure 1 illustrates how this works.

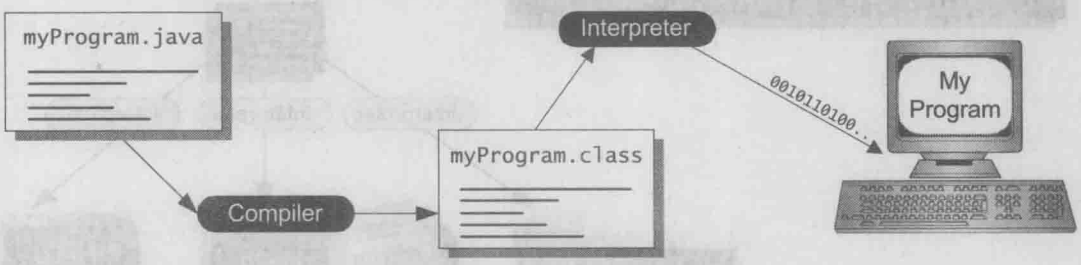

Figure 1 Programs written in the Java programming language are first compiled and then interpreted.

You can think of Java bytecodes as the machine code instructions for the *Java Virtual Machine* (Java VM). Every Java interpreter, whether it's a development tool or a Web browser that can run applets, is an implementation of the Java VM.

Java bytecodes help make "write once, run anywhere" possible. You can compile your program into bytecodes on any platform that has a Java compiler. The bytecodes can then be run on any implementation of the Java VM. That means that as long as a computer has a Java VM, the same program written in the Java programming language can run on Windows 2000, a Solaris workstation, or on an iMac, as shown in Figure 2.

The Java Platform

A *platform* is the hardware or software environment in which a program runs. We've already mentioned some of the most popular platforms, such as Windows 2000, Linux, Solaris, and MacOS. Most platforms can be described as a combination of the operating system and hardware. The Java platform differs from most other platforms in that it's a software-only platform that runs on top of other, hardware-based platforms.

The Java platform has two components:

- The *Java Virtual Machine* (Java VM)
- The *Java Application Programming Interface* (Java API)

You've already been introduced to the Java VM. It's the base for the Java platform and is ported onto various hardware-based platforms.