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UNIX教程

新版

(英文版·第2版)

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UNIX[®]
the textbook

second edition

(美) Syed Mansoor Sarwar 著
Robert Koretsky
Syed Aqeel Sarwar



机械工业出版社
China Machine Press

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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中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，不仅肇划了研究的范畴，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、研究及度藏。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，有的还专程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，我们的联系方式如下：

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为了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。

随着学科建设的深入，教育界对国外计算机教材的需求和应用越来越大。为此，华研公司将加大引进教材的力度，(详情请见下列)

Dedications

- To my teachers
- To my family
- To my parents

- S.M.S.
- R.M.K.
- S.A.S.

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Preface

The Matured Subject

Since the first edition of this book, very little has been introduced in the world of business, scientific, or engineering computing and computer science that was either patently expected or blatantly announced in advance, and perhaps this is a mark of just how developed these disciplines have become. Still, the disciplines remain pervasive, and are notoriously segregated into the “open source” and proprietary camps. But the entrenched powers—whether legitimate or licentious—that dominate the business of computing continue to grow, and now reach an incredible level of influence on the distribution, consumption, and assimilation of information in the transnational marketplace. Commensurate with this growth, UNIX and its clones now almost exclusively control the service of information globally, and from all indications, this control will not be relinquished in the near future.

Changes in the Second Edition of This Book

Because UNIX has some important functional additions to the application user's interface since the first edition came out, and because UNIX is an even more widely dispersed system in the marketplace than it previously was, the authors felt that the book needed new instructional material to cover these additions, to include:

- Implementations of UNIX in a broader context rather than just demonstrating the surviving variants of the system
- A complete tutorial section on the XFree86 KDE GUI
- A description of Mac UNIX as seen in the Aqua GUI
- A “Quick Start Guide to UNIX” as Chapter Zero, to allow new users to get hands-on experience
- Many new diagrams, tables, interactive shell sessions, in-chapter tutorials, in-chapter exercises, and end-of-chapter problems
- Enhanced coverage in the chapter on networking by adding a section on RFCs, revising the coverage of domain name hierarchy, and describing the various organizations that set Internet standards and plan for its growth
- Coverage of new commands such as `ssh`, `scp`, `sftp`, `host`, and `dig`, and enhanced coverage of existing commands such as `telnet` and `finger`
- URLs of important Web resources about the history of UNIX and various commands and programming tools
- Supplemental materials, including an online Lab Manual with additional problem sets, and a test bank for each chapter
- A redesign of the text layout to provide a more usable reference to programmers

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When you look at these additions, the sequence and presentation of all the material in the book, keep in mind that the authors have a cumulative total of almost 40 years in practical teaching experience at the college level. As educators, the authors retain an unwillingness to use either the large, intractable UNIX reference sources, or the short, "nutshell" guides in order to teach meaningful, complete, and relevant introductory classes on the subject. The authors still feel very strongly that a textbook approach, with pedagogy incorporating in-chapter tutorials and exercises, as well as useful problem sets at the end of each chapter, allows a presentation of all the important UNIX topics for a classroom lecture-laboratory-homework presentation. The fine-tuned second edition of this textbook achieves a consistent manner of optimal learning outcomes (i.e., a well thought-out sequence of old and new topics, well-developed and timely lessons, online laboratory problems, and homework exercises/problems synchronized with the progression of the chapters in the book). As in the earlier edition, the in-depth coverage of the topics presented in this textbook will provide anyone interested in furthering their professional knowledge of the subject matter with useful information.

The Purposes of the Second Edition

The primary purpose remains a didactic description of the UNIX application user's interface (AUI), and the authors try to provide this in a way that gives the reader insight into the inner workings of the system, along with explanations of some important UNIX concepts, data structures, and algorithms. Notable examples of the inner workings of the system as revealed in this edition are the in-depth descriptions of the UNIX file, process, and I/O redirection concepts. The secondary purpose of this textbook is to describe some of the most important UNIX software engineering tools for developers of C/C++ software and shell scripts. As in the first edition, the authors do not describe the UNIX application's programmer's interface (API) in terms of C/C++ libraries and UNIX system calls. In writing this second edition, the authors assumed no previous knowledge of UNIX or programming on the part of the reader.

The Presentation Format

The didactic structure of each chapter in this new edition follows one of two similar formats: the shell session format, or the tutorial format. In the shell session format, (used in all chapters except 5, 6, and 21), the following outline is employed:

1. Learning objectives
2. Introduction
3. Topic discussion and background organized in sections and sub-sections
4. Illustrative commands or topic illustrations presented as actual shell sessions, where the user types in commands shown and results are displayed
5. In-Chapter Exercises that reinforce what was discussed on a topic or done interactively in a shell session
6. Summary
7. End-of-Chapter Problems keyed to topics presented

In the Tutorial Format, (used in Chapters 5, 6, and 21), the following outline is used:

1. Learning objectives
2. Introduction
3. Topic discussions and background organized in sections and sub-sections
4. One Example Session and several Practice Session tutorials that illustrate the commands and topics of interest in any particular section or sub-section
5. Illustrative commands or topic illustrations presented as shell sessions, where the user types in commands shown and results are displayed
6. In-Chapter Exercises that reinforce what was discussed on a topic or done interactively in a shell session
7. Summary
8. End-of-Chapter Problems keyed to topics presented

This edition adds new diagrams and tables, and includes many in-chapter tutorials, interactive shell sessions, in-chapter exercises, and end-of-chapter problems. More syntax boxes appear whenever the authors introduce a new command or utility. These syntax boxes provide exact usage of the command (and any other pertinent variants of the basic syntax), its purpose, the output produced by the command, and its useful options and features. In addition, every chapter contains a summary of the material covered in the chapter.

Pathways through the Text

If this book is to be used as the main text for an introductory course in UNIX, all the chapters should be covered, with the possible exception of Chapter 20. If the book is to be used as a companion to another, main text on operating systems concepts and principles course, the coverage of chapters would be dictated by the order in which the main topics of the course are covered but should include Chapters 7, 12, and 13. For use in a C/C++ or Shell programming course, Chapters 0, 7–20 and relevant sections of Chapters 3–6 would be a great help to students. The extent of coverage of Chapter 20 would depend on the nature of the course—partial coverage in an introductory and full coverage in an advanced course.

The Design of Fonts

The following typefaces have been used in the book for various types of text items.

Typeface	Text Type
Boldface Roman	Keywords
Boldface Monospace	Any character or string typed at the keyboard (commands, shell variables, and user input)
Monospace	Commands, tools, applications, and their options in the text
<i>Italic</i>	A word being used as a word and text being emphasized
Roman	Everything else, including file pathnames

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The keyboard presses are enclosed in angle brackets (e.g., <Enter> and <Ctrl-D>). The instruction “press <Ctrl-D>” means to hold the <Ctrl> key down while pressing the <D> key. This instruction is also denoted <Ctrl-D>.

Supplements

A variety of supplemental materials are available to support this textbook.

Materials Available to All Users of This Textbook

To access these materials, go to <http://www.aw.com/cssupport>

- **Online Lab Workbook** that includes a variety of keystroke-oriented, structured, and open-ended problems for use in a two- to three-hour lab environment
- **Answers to In-Chapter Exercises**
- **Source Code** for C programs and long shell scripts
- **Links to other UNIX resources on the Web**

Resources Available to Qualified Instructors Only

Please contact your Addison-Wesley representative, or send an e-mail to aw.cse@aw.com, for information on how to access these resources.

- **Test Bank**
- **Powerpoint slides**
- **Solutions** to the problems at the end of each chapter
- **Solutions** to Online Lab Manual Workbook problems

The authors take full responsibility for any errors in this book. Please send error reports and comments to msarwar@lums.edu.pk and bobk@egr.up.edu (or koretsky@up.edu). The authors will incorporate your feedback and fix any errors in subsequent printings.

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