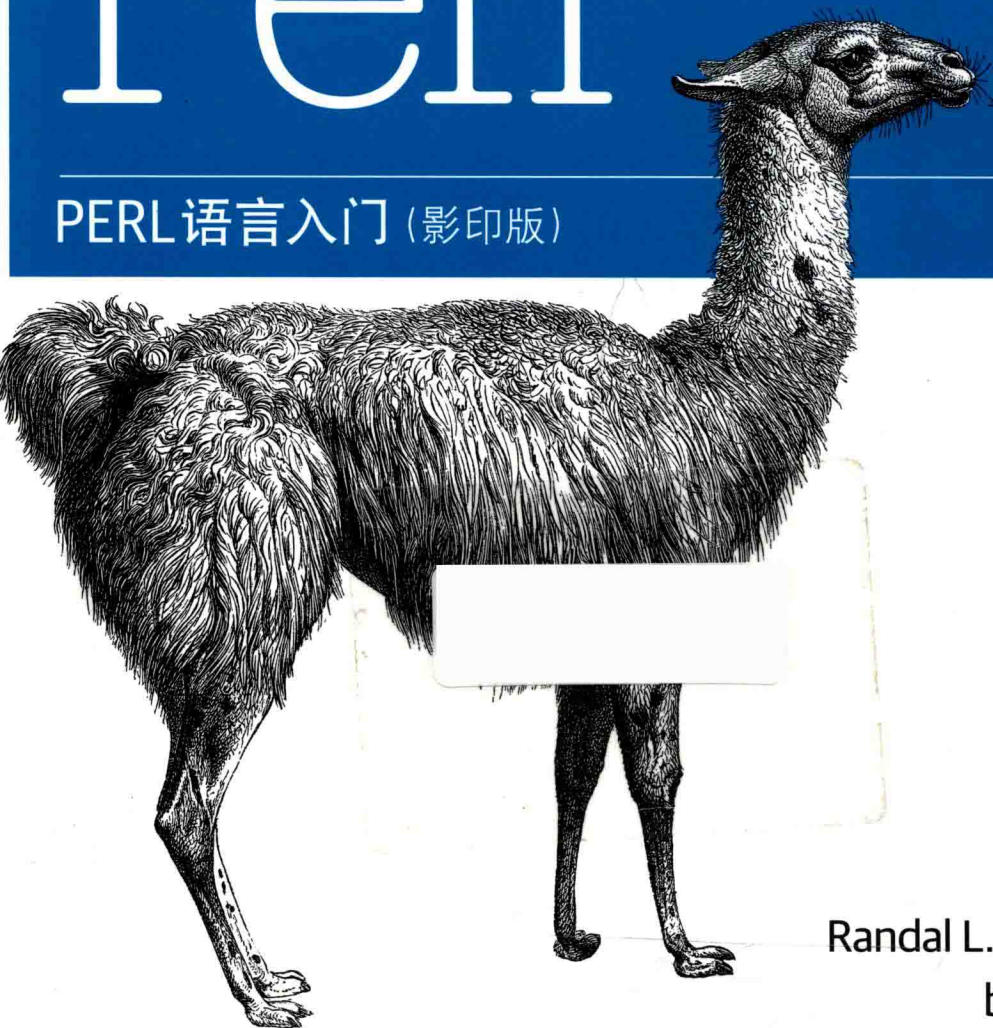


O'REILLY®

第7版

Learning Perl

PERL语言入门 (影印版)



Randal L. Schwartz,
brian d foy,
Tom Phoenix 著

東南大學出版社

第7版

Perl语言入门 (影印版)

Learning Perl

Randal L. Schwartz, brian d foy,
Tom Phoenix 著

Beijing • Boston • Farnham • Sebastopol • Tokyo

O'REILLY®

O'Reilly Media, Inc. 授权东南大学出版社出版

南京 东南大学出版社

图书在版编目(CIP)数据

Perl 语言入门:第 7 版:英文/(美)兰德尔·L·施瓦茨(Randal L. Schwartz),(美)布赖恩·d·福瓦(brian d foy),(美)汤姆·菲尼克斯(Tom Phoenix)著. —影印本.
南京:东南大学出版社,2017.10

书名原文:Learning Perl, 7E

ISBN 978-7-5641-7372-2

I. ①P… II. ①兰… ②布… ③汤… III. ①Perl
语言—程序设计—英文 IV. ①TP312.8

中国版本图书馆 CIP 数据核字(2017)第 195473 号

图字:10-2017-350 号

© 2016 by O'Reilly Media, Inc.

Reprint of the English Edition, jointly published by O'Reilly Media, Inc. and Southeast University Press, 2017. Authorized reprint of the original English edition, 2017 O'Reilly Media, Inc., the owner of all rights to publish and sell the same.

All rights reserved including the rights of reproduction in whole or in part in any form.

英文原版由 O'Reilly Media, Inc. 出版 2016。

英文影印版由东南大学出版社出版 2017。此影印版的出版和销售得到出版权和销售权的所有者——O'Reilly Media, Inc. 的许可。

版权所有,未得书面许可,本书的任何部分和全部不得以任何形式重制。

Perl 语言入门 第 7 版(影印版)

出版发行:东南大学出版社

地 址:南京四牌楼 2 号 邮编:210096

出 版 人:江建中

网 址: <http://www.seupress.com>

电子邮件: press@seupress.com

印 刷:常州市武进第三印刷有限公司

开 本:787 毫米×980 毫米 16 开本

印 张:24.75

字 数:485 千字

版 次:2017 年 10 月第 1 版

印 次:2017 年 10 月第 1 次印刷

书 号:ISBN 978-7-5641-7372-2

定 价:82.00 元

Preface

Welcome to the seventh edition of *Learning Perl*, updated for Perl 5.24 and its latest features. This book is still mostly good even if you are still using Perl 5.8 (although, it's been a long time since it was released; have you thought about upgrading?).

We hope you're reading this preface before you buy the book because there's a historical hiccup that may cause some confusion. There's another language, Perl 6, that started off as a replacement for Perl 5 but then went out on its own without changing the name. As we write this, Perl 5 is probably the version you want. It's the widely installed and used language that people mean when they say simply "Perl." It's the one you want if you don't know why this paragraph is here.

If you're looking for the best way to spend your first 30 to 45 hours with the Perl programming language, you've found it. In the pages that follow, you'll find a carefully paced introduction to the language that is the workhorse of the Internet, as well as the language of choice for system administrators, web hackers, and casual programmers around the world. We've designed this book based on the in-person classes we teach, so we've timed the book for a week's worth of work.

We can't give you all of Perl in just a few hours. The books that promise that are probably fibbing a bit. Instead, we've carefully selected a useful subset of Perl for you to learn, good for programs from 1 to 128 lines long, which end up being about 90% of the programs in use out there. And when you're ready to go on, you can get *Intermediate Perl*, which picks up where this book leaves off. We've also included a number of pointers for further education.

Each chapter is small enough so you can read it in an hour or two. Each chapter ends with a series of exercises to help you practice what you've just learned, with the answers in Appendix A for your reference. Thus, this book is ideally suited for a classroom "Introduction to Perl" course. We know this directly because the material for this book was lifted almost word for word from our flagship "Learning Perl" course, delivered to thousands of students around the world. However, we've designed the book for self-study as well.

Perl lives as the “toolbox for Unix,” but you don’t have to be a Unix guru, or even a Unix user, to read this book. Unless otherwise noted, everything we’re saying applies equally well to Windows ActivePerl from ActiveState (<http://www.activestate.com/activeperl>) and Strawberry Perl (<http://www.strawberryperl.com/>) and pretty much every other modern implementation of Perl.

Although you don’t need to know a single thing about Perl to begin reading this book, we recommend that you already have familiarity with basic programming concepts such as variables, loops, subroutines, and arrays, and the all-important “editing a source code file with your favorite text editor.” We don’t spend any time trying to explain those concepts. Although we’re pleased that we’ve had many reports of people successfully picking up *Learning Perl* and grasping Perl as their first programming language, of course we can’t promise the same results for everyone.

Typographical Conventions

The following font conventions are used in this book:

Constant width

Used for method names, function names, variables, and attributes. It is also used for code examples.

Constant width bold

Used to indicate user input.

Constant width italic

Used to indicate a replaceable item in code (e.g., filename, where you are supposed to substitute an actual filename).

Italic

Used for filenames, URLs, hostnames, commands in text, important words on first mention, and emphasis.

[37]

At the start of an exercise’s text, we provide a (very rough) estimate of how many minutes you can expect to spend on that particular exercise.

Code Examples

This book is here to help you get your job done. You are invited to copy the code in the book and adapt it for your own needs. Rather than copying by hand, however, we encourage you to download the code from the book’s companion website (<http://www.learning-perl.com>).

In general, you may use the code in this book in your programs and documentation. You do not need to contact us for permission unless you're reproducing a significant portion of the code. For example, writing a program that uses several chunks of code from this book does not require permission. Selling or distributing a CD-ROM of examples from O'Reilly books does require permission. Answering a question by citing this book and quoting example code does not require permission. Incorporating a significant amount of example code from this book into your product's documentation does require permission.

We appreciate, but do not require, attribution. An attribution usually includes the title, authors, publisher, and ISBN. For example: "*Learning Perl*, 7th edition, by Randal Schwartz, brian foy, and Tom Phoenix (O'Reilly). Copyright 2017 Randal Schwartz, brian foy, and Tom Phoenix, 978-1-491-95432-4." If you feel your use of code examples falls outside fair use or the permission given above, feel free to contact us at permissions@oreilly.com.

Safari® Books Online



Safari Books Online (<http://safaribooksonline.com>) is an on-demand digital library that delivers expert content in both book and video form from the world's leading authors in technology and business.

Technology professionals, software developers, web designers, and business and creative professionals use Safari Books Online as their primary resource for research, problem solving, learning, and certification training.

Safari Books Online offers a range of plans and pricing for enterprise, government, and education, and individuals.

Members have access to thousands of books, training videos, and prepublication manuscripts in one fully searchable database from publishers like O'Reilly Media, Prentice Hall Professional, Addison-Wesley Professional, Microsoft Press, Sams, Que, Peachpit Press, Focal Press, Cisco Press, John Wiley & Sons, Syngress, Morgan Kaufmann, IBM Redbooks, Packt, Adobe Press, FT Press, Apress, Manning, New Riders, McGraw-Hill, Jones & Bartlett, Course Technology, and hundreds more. For more information about Safari Books Online, please visit us online.

How to Contact Us

We have tested and verified all the information in this book to the best of our abilities, but you may find that features have changed or that we have inadvertently let

errors slip through the production of the book. Please let us know of any errors that you find, as well as suggestions for future editions, by writing to:

O'Reilly Media, Inc.
1005 Gravenstein Highway North
Sebastopol, CA 95472
1-800-998-9938 (in the U.S. or Canada)
1-707-829-7000 (international/local)
1-707-829-0104 (fax)

We have a web page for the book, where we'll list examples, errata, and any additional information. It also offers a downloadable set of text files (and a couple of Perl programs) that are useful, but not required, when doing some of the exercises. You can access this page at <http://www.learning-perl.com> or go to the O'Reilly page (<http://bit.ly/learning-perl-7e>).

To comment or ask technical questions about this book, send email to info@oreilly.com.

For more information about our books, courses, conferences, and news, see our website at <http://www.oreilly.com>.

Find us on Facebook: <http://facebook.com/oreilly>

Follow us on Twitter: <http://twitter.com/oreillymedia>

Watch us on YouTube: <http://www.youtube.com/oreillymedia>

History of This Book

For the curious, here's how Randal tells the story of how this book came about:

After I had finished the first *Programming perl* book with Larry Wall (in 1991), I was approached by Taos Mountain Software in Silicon Valley to produce a training course. This included having me deliver the first dozen or so courses and train their staff to continue offering the course. I wrote the course for them¹ and delivered it for them as promised.

On the third or fourth delivery of that course (in late 1991), someone came up to me and said, "You know, I really like *Programming perl*, but the way the material is presented in this course is so much easier to follow—you oughta write a book like this course." It sounded like an opportunity to me, so I started thinking about it.

¹ In the contract, I retained the rights to the exercises, hoping someday to reuse them in some other way, like in the magazine columns I was writing at the time. The exercises are the only things that leapt from the Taos course to the book.

I wrote to Tim O'Reilly with a proposal based on an outline that was similar to the course I was presenting for Taos—although I had rearranged and modified a few of the chapters based on observations in the classroom. I think that was my fastest proposal acceptance in history—I got a message from Tim within 15 minutes, saying “We’ve been waiting for you to pitch a second book—*Programming perl* is selling like gangbusters.” That started the effort over the next 18 months to finish the first edition of *Learning Perl*.

During that time, I was starting to see an opportunity to teach Perl classes outside Silicon Valley,² so I created a class based on the text I was writing for *Learning Perl*. I gave a dozen classes for various clients (including my primary contractor, Intel Oregon), and used the feedback to fine-tune the book draft even further.

The first edition hit the streets on the first day of November 1993,³ and became a smashing success, frequently even outpacing *Programming perl* book sales.

The back-cover jacket of the first book said “written by a leading Perl trainer.” Well, that became a self-fulfilling prophecy. Within a few months, I was starting to get email from all over the United States asking me to teach at their site. In the following seven years, my company became the leading worldwide on-site Perl training company, and I had personally racked up (literally) a million frequent-flier miles. It didn’t hurt that the Web started taking off about then, and the webmasters and webmistresses picked Perl as the language of choice for content management, interaction through CGI, and maintenance.

For two years, I worked closely with Tom Phoenix in his role as lead trainer and content manager for Stonehenge, giving him charter to experiment with the “Llama” course by moving things around and breaking things up. When we had come up with what we thought was the best major revision of the course, I contacted O'Reilly and said, “It’s time for a new book!” And that became the third edition.

Two years after writing the third edition of the Llama, Tom and I decided it was time to push our follow-on “advanced” course out into the world as a book, for people writing programs that are “100 to 10,000 lines of code.” And together we created the first Alpaca book (*Learning Perl Objects, References, and Modules*), released in 2003.

But fellow instructor brian d foy had noticed that we could use some rewriting in both books, because our courseware still needed to track the changing needs of the typical student. So, he pitched the idea to O'Reilly to take on rewriting both the Llama and the Alpaca. This edition of the Llama reflects those changes. brian has really been

2 My Taos contract had a non-compete clause, so I had to stay out of Silicon Valley with any similar courses, which I respected for many years.

3 I remember that date very well, because it was also the day I was arrested at my home for computer-related activities around my Intel contract, a series of felony charges for which I was later convicted.

the lead writer here, working with my occasional guidance, and has done a brilliant job of the usual “herding cats” that a multiple-writer team generally feels like.

On December 18, 2007, the Perl 5 Porters released Perl 5.10, a significant new version of Perl with several new features. The previous version, 5.8, had focused on the underpinnings of Perl and its Unicode support. The latest version, starting from the stable 5.8 foundation, was able to add completely new features, some of which it borrowed from the development of Perl 6. Some of these features, such as named captures in regular expressions, are much better than the old ways of doing things, thus perfect for Perl beginners. We hadn’t thought about a fifth edition of this book, but Perl 5.10 was so much better that we couldn’t resist.

Since then, Perl has been under constant improvement and is keeping a regular release cycle. Each new Perl release has brought exciting new features, many of which programmers have wanted for years. As long as Perl keeps doing that, we’ll keep updating this book.

Changes from the Previous Edition

The text is updated for the latest version, Perl 5.24, and some of the code only works with that version. We note in the text when we are writing about a Perl 5.24 feature, and we mark those code sections with a special use statement that ensures you’re using the right version:

```
use v5.24; # this script requires Perl 5.24 or greater
```

If you don’t see that `use v5.24` in a code example (or a similar statement with a different version), it should work all the way back to Perl 5.8. To see which version of Perl you have, try the `-v` command-line switch:

```
$ perl -v
```

In some examples, we’ll show a lower minimum Perl version because that’s all the program needs. For instance, `say` was introduced in Perl v5.10:

```
use v5.10;

say "Howdy, Fred!";
```

In most cases, we’ll probably forgo a new feature to make the examples work on as many versions of Perl as possible. That doesn’t mean you shouldn’t use the new features or that we don’t endorse them. We simply have a wide audience for this book.

We include Unicode examples and features where appropriate. If you haven’t started playing with Unicode, you may want to read our primer in Appendix C. You have to bite the bullet sometime, so it might as well be now. You’ll see Unicode throughout the book, most notably in the chapters on scalars (Chapter 2), input/output (Chapter 5), and sorting (Chapter 14).

Here's a quick summary of the updated or new things in this edition:

- An appendix on experimental features (Appendix D)
- More Windows examples where appropriate
- Hexadecimal floating-point literals (v5.22) in Chapter 2
- The experimental but very exciting subroutine signatures (v5.20) in Chapter 4
- The more-secure double diamond line input operator (v5.22) in Chapter 5
- Many updates to regular expressions and match operator flags in Chapters 7 through 9
- Use `Time::Moment` over `DateTime` as an example in Chapter 11
- The experimental bitwise string operators in Chapter 12
- Key-value slices (v5.20) in Chapter 16

Acknowledgments

From Randal

I want to thank the Stonehenge trainers past and present (Joseph Hall, Tom Phoenix, Chip Salzenberg, brian d foy, and Tad McClellan) for their willingness to go out and teach in front of classrooms week after week and to come back with their notes about what's working (and what's not), so we could fine-tune the material for this book. I especially want to single out my coauthor and business associate, Tom Phoenix, for having spent many, many hours working to improve Stonehenge's Llama course and to provide the wonderful core text for most of this book. And brian d foy for being the lead writer beginning with the fourth edition, and taking that eternal to-do item out of my inbox so that it would finally happen.

I also want to thank everyone at O'Reilly, especially our very patient editor and overseer for previous editions, Allison Randal (no relation, but she has a nicely spelled last name), current editor Simon St. Laurent, and Tim O'Reilly himself for taking a chance on me in the first place with the Camel and Llama books.

I am also absolutely indebted to the thousands of people who have purchased the past editions of the Llama so that I could use the money to stay "off the streets and out of jail," and to those students in my classrooms who have trained me to be a better trainer, and to the stunning array of Fortune 1000 clients who have purchased our classes in the past and will continue to do so into the future.

As always, a special thanks to Lyle and Jack, for teaching me nearly everything I know about writing. I won't ever forget you guys.

From brian

I have to thank Randal first, since I learned Perl from the first edition of this book, and then had to learn it again when he asked me to start teaching for Stonehenge in 1998. Teaching is often the best way to learn. Since then, Randal has mentored me not only in Perl but several other things he thought I needed to learn—like the time he decided that we could use Smalltalk instead of Perl for a demonstration at a web conference. I'm always amazed at the breadth of his knowledge. He's the one who told me to start writing about Perl. Now I'm helping out on the book where I started. I'm honored, Randal.

I probably only actually saw Tom Phoenix for less than two weeks in the entire time I worked for Stonehenge, but I had been teaching his version of Stonehenge's *Learning Perl* course for years. That version turned into the third edition of this book. By teaching Tom's new version, I found new ways to explain almost everything, and learned even more corners of Perl.

When I convinced Randal that I should help out on the Llama update, I was anointed as the maker of the proposal to the publisher, the keeper of the outline, and the version control wrangler. Our editor, Allison Randal, helped me get all of those set up and endured my frequent emails without complaining. After Allison went on to other things, Simon St. Laurent has been extremely helpful in the role of editor and inside guy at O'Reilly, patiently waiting for the right phase of the moon to suggest another update.

From Tom

I've got to echo Randal's thanks to everyone at O'Reilly. For the third edition of this book, Linda Mui was our editor, and I still thank her, for her patience in pointing out which jokes and footnotes were most excessive, while pointing out that she is in no way to blame for the ones that remain. Both she and Randal have guided me through the process of writing, and I am grateful. In a previous edition, Allison Randal took charge; now Simon St. Laurent has become the editor. My thanks go to each of them in recognition of their unique contributions.

And another echo with regard to Randal and the other Stonehenge trainers, who hardly ever complained when I unexpectedly updated the course materials to try out a new teaching technique. You folks have contributed many different viewpoints on teaching methods that I would never have seen.

For many years, I worked at the Oregon Museum of Science and Industry (OMSI), and I'd like to thank the folks there for letting me hone my teaching skills as I learned to build a joke or two into every activity, explosion, or dissection.

To the many folks on Usenet who have given me your appreciation and encouragement for my contributions there, thanks. As always, I hope this helps.

Also to my many students, who have shown me with their questions (and befuddled looks) when I needed to try a new way of expressing a concept. I hope that the present edition helps to relieve any remaining puzzlement.

Of course, deep thanks are due especially to my coauthor, Randal, for giving me the freedom to try various ways of presenting the material both in the classroom and here in the book, as well as for the push to make this material into a book in the first place. And without fail, I must say that I am indeed inspired by your ongoing work to ensure that no one else becomes ensnared by the legal troubles that have stolen so much of your time and energy; you're a fine example.

To my wife, Jenna, thanks for being a cat person, and everything thereafter.

From All of Us

We also thank our “correcters.” The O'Reilly Media system is one of continuous publishing. As people find mistakes, we fix them immediately. When it's time to print more books, or release a new ebook, you get the benefit of those post-publication corrections. For those, we thank Egon Choroba, Cody Czesler, Kieren Diment, Charles Evans, Keith Howanitz, Susan Malter, Peter O'Neill, Enrique Nell, Povl Ole Haarlev Olsen, Flavio Poletti, Rob Reed, Alan Rucker, Dylan Scott, Peter Scott, Shaun Smiley, John Trammel, Emma Urquhart, John Wiersba, Danny Woods, and Zhenyo Zhou. Additionally, David Farrell, Grzegorz Szpetkowski, and Ali Sinan Ünür carefully read through the entire book to find all (we hope) mistakes and lies. We learned from each of them.

Thanks also to our many students who have let us know what parts of the course material have needed improvement over the years. It's because of you that we're all so proud of it today.

Thanks to the many Perl Mongers who have made us feel at home as we've visited your cities. Let's do it again sometime.

And finally, our sincerest thanks to our friend Larry Wall, for having the wisdom to share his really cool and powerful toys with the rest of the world so that we can all get our work done just a little bit faster, easier, and with more fun.

Table of Contents

Preface.....	xi
1. Introduction.....	1
Questions and Answers	1
Is This the Right Book for You?	1
What About the Exercises and Their Answers?	2
What If I'm a Perl Course Instructor?	3
What Does "Perl" Stand For?	4
Why Did Larry Create Perl?	4
Why Didn't Larry Just Use Some Other Language?	4
Is Perl Easy or Hard?	5
How Did Perl Get to Be So Popular?	7
What's Happening with Perl Now?	7
What's Perl Really Good For?	7
What Is Perl Not Good For?	8
How Can I Get Perl?	8
What Is CPAN?	9
Is There Any Kind of Support?	9
What If I Find a Bug in Perl?	10
How Do I Make a Perl Program?	11
A Simple Program	11
What's Inside That Program?	13
How Do I Compile My Perl Program?	15
A Whirlwind Tour of Perl	16
Exercises	17
2. Scalar Data.....	19
Numbers	19

All Numbers Have the Same Format Internally	20
Integer Literals	20
Nondecimal Integer Literals	21
Floating-Point Literals	21
Numeric Operators	22
Strings	23
Single-Quoted String Literals	24
Double-Quoted String Literals	24
String Operators	25
Automatic Conversion Between Numbers and Strings	26
Perl's Built-In Warnings	27
Interpreting Nondecimal Numerals	28
Scalar Variables	29
Choosing Good Variable Names	30
Scalar Assignment	31
Compound Assignment Operators	31
Output with print	32
Interpolation of Scalar Variables into Strings	32
Creating Characters by Code Point	33
Operator Precedence and Associativity	34
Comparison Operators	36
The if Control Structure	37
Boolean Values	37
Getting User Input	38
The chomp Operator	39
The while Control Structure	40
The undef Value	40
The defined Function	41
Exercises	41
3. Lists and Arrays.....	43
Accessing Elements of an Array	44
Special Array Indices	45
List Literals	45
The qw Shortcut	46
List Assignment	47
The pop and push Operators	49
The shift and unshift Operators	49
The splice Operator	50
Interpolating Arrays into Strings	51
The foreach Control Structure	52
Perl's Favorite Default: \$_	53

The reverse Operator	53
The sort Operator	54
The each Operator	54
Scalar and List Context	55
Using List-Producing Expressions in Scalar Context	56
Using Scalar-Producing Expressions in List Context	58
Forcing Scalar Context	58
<STDIN> in List Context	58
Exercises	59
4. Subroutines.....	61
Defining a Subroutine	61
Invoking a Subroutine	62
Return Values	62
Arguments	64
Private Variables in Subroutines	66
Variable-Length Parameter Lists	67
A Better &max Routine	67
Empty Parameter Lists	68
Notes on Lexical (my) Variables	69
The use strict Pragma	70
The return Operator	71
Omitting the Ampersand	72
Nonscalar Return Values	74
Persistent, Private Variables	74
Subroutine Signatures	76
Exercises	78
5. Input and Output.....	81
Input from Standard Input	81
Input from the Diamond Operator	83
The Double Diamond	85
The Invocation Arguments	85
Output to Standard Output	86
Formatted Output with printf	89
Arrays and printf	91
Filehandles	91
Opening a Filehandle	93
Binmoding Filehandles	96
Bad Filehandles	96
Closing a Filehandle	97
Fatal Errors with die	97

Warning Messages with warn	99
Automatically die-ing	99
Using Filehandles	100
Changing the Default Output Filehandle	100
Reopening a Standard Filehandle	101
Output with say	102
Filehandles in a Scalar	102
Exercises	104
6. Hashes.....	107
What Is a Hash?	107
Why Use a Hash?	109
Hash Element Access	110
The Hash as a Whole	111
Hash Assignment	112
The Big Arrow	113
Hash Functions	114
The keys and values Functions	114
The each Function	115
Typical Use of a Hash	116
The exists Function	117
The delete Function	117
Hash Element Interpolation	118
The %ENV hash	118
Exercises	119
7. Regular Expressions.....	121
Sequences	121
Practice Some Patterns	123
The Wildcard	125
Quantifiers	126
Grouping in Patterns	130
Alternatives	133
Character Classes	134
Character Class Shortcuts	135
Negating the Shortcuts	137
Unicode Properties	137
Anchors	138
Word Anchors	139
Exercises	141

8. Matching with Regular Expressions.....	143
Matches with m//	143
Match Modifiers	144
Case-Insensitive Matching with /i	144
Matching Any Character with /s	144
Adding Whitespace with /x	145
Combining Option Modifiers	146
Choosing a Character Interpretation	146
Beginning and End-of-Line Anchors	148
Other Options	149
The Binding Operator =~	149
The Match Variables	150
The Persistence of Captures	151
Noncapturing Parentheses	152
Named Captures	153
The Automatic Match Variables	155
Precedence	157
Examples of Precedence	158
And There's More	158
A Pattern Test Program	159
Exercises	159
9. Processing Text with Regular Expressions.....	161
Substitutions with s//	161
Global Replacements with /g	162
Different Delimiters	163
Substitution Modifiers	163
The Binding Operator	163
Nondestructive Substitutions	163
Case Shifting	164
Metaquoting	166
The split Operator	166
The join Function	168
m// in List Context	168
More Powerful Regular Expressions	169
Nongreedy Quantifiers	169
Fancier Word Boundaries	170
Matching Multiple-Line Text	172
Updating Many Files	172
In-Place Editing from the Command Line	174
Exercises	176