

WELCOME

TO THE INTERACTIVE GUIDE TO PROGRAMMING LANGUAGE PRAGMATICS



PROGRAMMING LANGUAGE PRAGMATICS

— THIRD EDITION —

Michael L. Scott



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WELCOME TO THE PROGRAMMING LANGUAGE PRAGMATICS, 3RD EDITION COMPANION CD. THIS PAGE CONTAINS SOME INFORMATION TO HELP YOU GET STARTED USING THE CD.

WHAT YOU WILL FIND ON THE CD

- *In More Depth* sections and sub-sections that are introduced in the book
- *In More Depth* Exercises and Explorations for students wanting additional challenges
- Links to Web-based language reference manuals, tutorials, compilers and interpreters
- Text files containing the code fragments featured as examples in the book

SYSTEM REQUIREMENTS

PDF VIEWER

The CD material is a PDF based application that you can read with a PDF viewer such as Adobe® Acrobat® or Adobe Reader®. The content is designed to be viewed in a browser window that is at least 720 pixels wide. You may find the content does not display well if your display is not set to at least 1024x768 pixel resolution.

Click here to visit the [Adobe Reader home page](#) for more information on this software.

OPERATING SYSTEM

This CD can be used under any operating system, including Windows, Mac OS, and Linux.

SEARCHING FOR CONTENT

The navigation sidebar contains buttons to access the content of this CD according to category. Since the content of this CD is delivered in Adobe PDF (Portable Document Format), you can search within the application using the search features of your PDF viewer. For more information on searching within a PDF file, see the help menu within your PDF viewer. You may also use the Ctrl+F feature as found in the edit drop down menu. To search within the entire content of the CD, use the full search feature located under Edit in the tool bar. Simply choose "Search All PDF Documents In", then choose your CD Drive as the location. You may also search this way using SHIFT+CTRL+F.

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PAGE, FIGURE AND EXERCISE NUMBERING

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CD-based pages are also numbered sequentially. However, they are distinguished from printed book page numbers by the inclusion of a CD icon that accompanies the page number. The CD page number sequence extends over all of the CD-only Sections, Exercises and Explorations material.

FIGURES AND EXAMPLES

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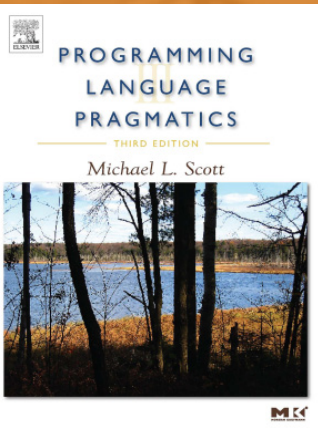
- Figure 1.1, Figure 1.2, Figure 1.3, etc.
- Example 1.1, Example 1.2, Example 1.3, etc.

The CD-based content continues the sequence from where it left off in the printed book chapter. So, for example, if the last figure in Chapter 2 of the printed book is Figure 2.32, the first figure in the CD-based material for Chapter 2 will be Figure 2.33. Examples are treated in the same way.

EXERCISES AND EXPLORATIONS

Exercises and Explorations are also numbered sequentially within each chapter of the printed book, with the sequence continuing on the CD, in a way similar to Figures and Examples.

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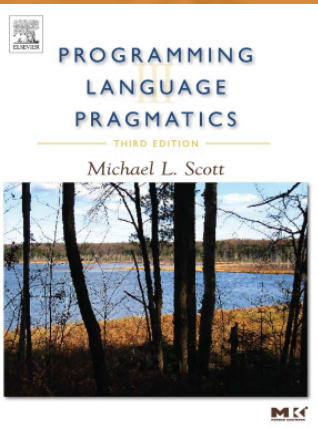
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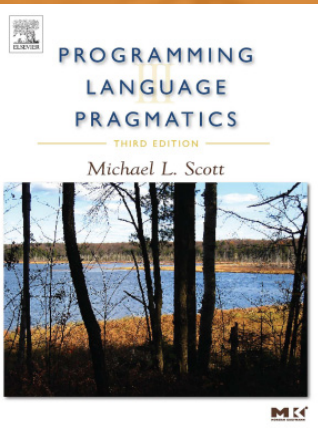
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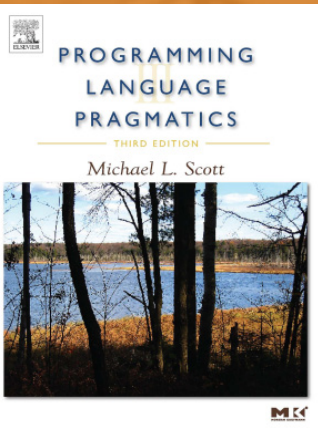
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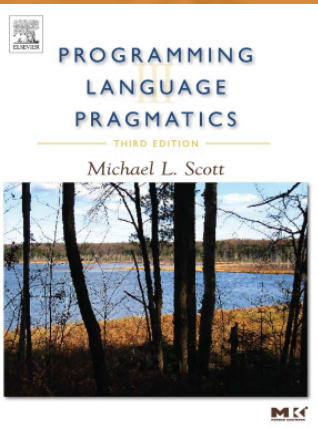
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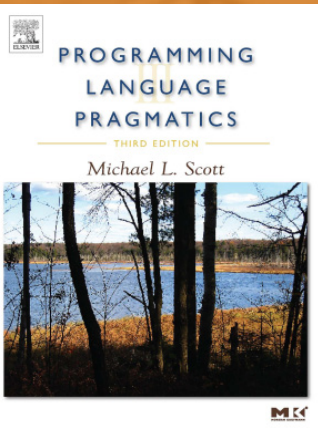
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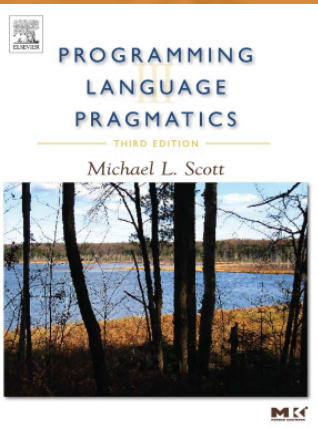
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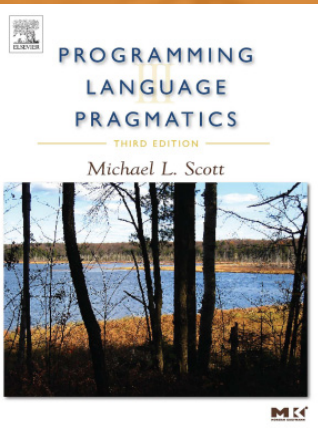
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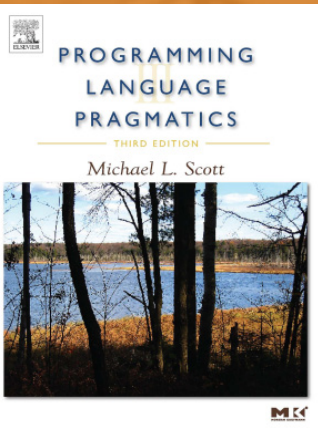
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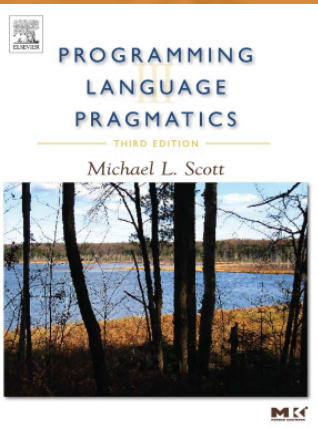
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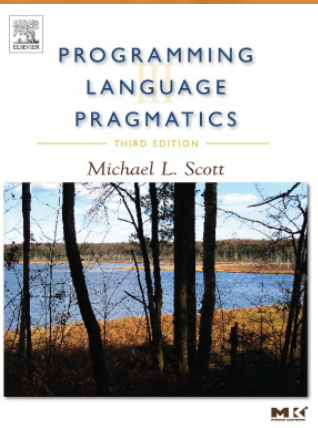
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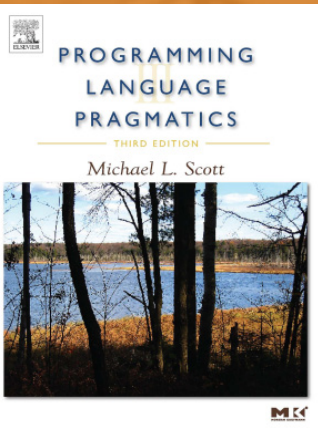
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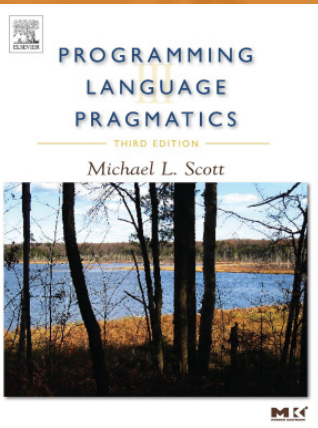
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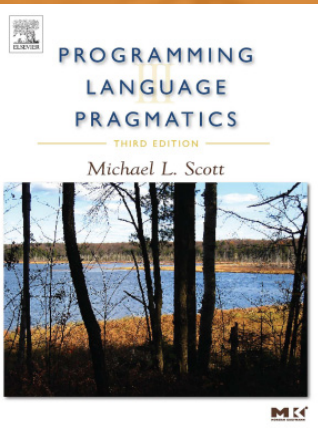
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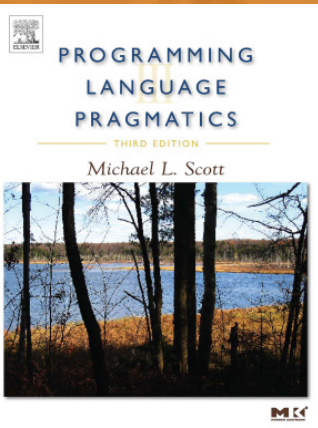
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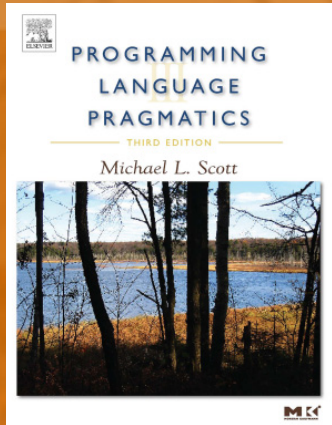
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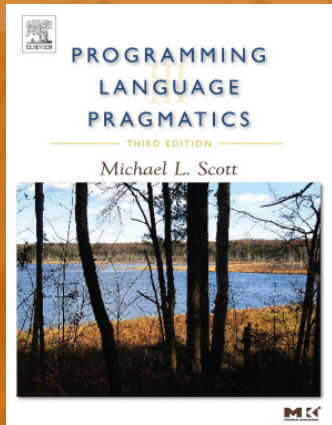
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The World Wide Web is, for practical purposes, an endless source on technical subjects. However, it can sometimes be difficult to figure out where to start.

The list provided here consists of high- quality sources for programming language tutorials, reference manuals, and other resources. All URLs are current as of February 2009.

<u>Ada</u>	<u>C and C++</u>	<u>C#</u>	<u>Common Lisp</u>	<u>Erlang</u>	<u>F#</u>	<u>Fortran</u>
<u>Haskell</u>	<u>Java</u>	<u>JavaScript</u>	<u>ML</u>	<u>OCaml</u>	<u>Pascal</u>	<u>Perl</u>
<u>PHP</u>	<u>Prolog</u>	<u>Python</u>	<u>Ruby</u>	<u>Scheme</u>	<u>Tcl</u>	<u>XSLT</u>
<u>Architecture Resources</u>						

PLP HOME PAGES

[Companion Web site for PLP](#)

[Elsevier Web Site](#)

[Morgan Kaufmann Web site](#)

[The author's Web site for PLP](#)

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DIRECTORIES AND LISTS OF LINKS

The Language List

Maintained by Bill Kinnersley, this list includes basic information and links to additional resources for some 2,500 different programming languages.

Free Programming Resources

Maintained by Richard Barry. Where Kinnersley's list aims to be encyclopedic, this site aims to be useful. Includes tutorials, books, compilers, tools, source code, libraries, and resources for gaming, graphics, and security.

Open Directory Project

The Open Source Web directory programming languages page.

Yahoo Computer Programming Languages

The human-maintained languages index at Yahoo.

Google Computers > Programming > Languages

The corresponding index at Google.

Wikipedia Programming Languages List

The corresponding index at Wikipedia, available alphabetically and sorted by categories or time.

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LANGUAGE-SPECIFIC RESOURCES

Remember also to look under the appropriate language in the directory entries above.

ADA

[Ada Home](#)

Principal Web repository for everything Ada, including documentation, tutorials, compilers, and tools.

[Ada 95 Reference Manual](#)

[Ada 95 Design Rationale](#)

C AND C++

[accu C/C++ Resources](#)

Resources page of the Association of C and C++ Users, based in Great Britain. Incredibly rich set of links to resources of every kind.

[GCC Home Page](#)

Home page for the Free Software GNU Compiler Collection, with implementations for almost every known computer system. Includes front ends not only for C and C++, but also for Objective C, Fortran, Java, and Ada as well.

[Programming in C: UNIX System Calls and Subroutines Using C](#)

by A. D. Marshall, One of many good books on C. This one has the advantage of being available online.

[Standard Template Library Programmer's Guide](#)

Official on-line reference for the C++ Standard Template Library.

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The C++ Programming Language

Bjarne Stroustrup's C++ home page.

The C99 Language Standard

International Standard.

Rationale for the C99 Language Standard

Working Draft for the Emerging C++ Standard

C#

C# Programming

There isn't a single canonical site for C#, but this one is pretty good.

Standard ECMA-334 C# Language Specification

The international language standard. Covers C# 2.0.

Mono Main Page

The open source development platform based on the .NET framework, this site allows developers to build Linux and cross-platform applications with improved developer productivity with a particular emphasis on high-quality compilation of C# and support for the x86, PowerPC, x86-64, Sparc, and S390 architectures. Mono is primarily sponsored by Novell Inc.

DotGNU Project

A Free Software alternative to Microsoft's .NET (including C#), developed under GNU auspices.

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[Microsoft's C# Documentation](#)

[The Common Language Infrastructure Standard](#)

COMMON LISP

[Association of Lisp Users](#)

Home page for the Association of Lisp Users. Includes resources not only for Common Lisp, but also for Scheme and other dialects.

[Common Lisp HyperSpec](#)

Online hypertext version of the ANSI Common Lisp standard.

[Common Lisp the Language, 2nd Edition](#)

Online hypertext copy of Common Lisp the Language, 2nd Edition, by Guy L. Steele, 1990. Once the standard language reference.

[An Introduction and Tutorial for Common Lisp](#)

Extensive list of Common Lisp links, including tutorials, standards, implementations, and papers. Some of the links have gone stale.

[The CMU Common Lisp Project](#)

CMUCL is a high-performance, free Common Lisp implementation for Unix platforms. Its CVS repository is hosted here at common-lisp.net, but its Web presence is at:

<http://www.cons.org/cmucl/>.

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ERLANG

Open Source Erlang

Official site.

Trapexit.org

News and weblogs related to Erlang/OTP.

Jungerl

The Jungle of Erlang code. This sourceforge project contains miscellaneous utilities for Erlang programmers.

F#

F# at Microsoft Research

Official Microsoft Research site. These pages document F# as a research project.

hubFS

The primary gathering point of the F# community.

Planet F#

An RSS feed.

FORTRAN

Fortran Library Directory

Contains links to tutorials, articles, compilers, and other resources.

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ANSIX3J3

The Fortran 77 standard.

Home page for the Fortran standards group.

HASKELL

The Haskell Home Page

Principal Web site for Haskell, with documentation, tutorials, compilers, and tools.

JAVA

Java Technology

Java home page at Sun.

The Java Virtual Machine

The Java Virtual Machine Specification.

The Java Community Process Program

Home page for the Java Community Process, charting the future evolution of the language.

Java Programming FAQs and Tutorials

Extensive list of Java tutorials.

JAVASCRIPT

The JavaScript Source

A good collection of resources, albeit with a lot of ads.

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JavaScript Made Easy

A good tutorial, plus lots of free scripts.

ECMAScript Language Specification

The international language standard.

JScript Language Reference

Manual for JScript, Microsoft's version of JavaScript.

ML

Standard ML of New Jersey

The most widely used ML implementation. Open Source. Includes documentation and an extensive list of pointers to other resources.

Programming in Standard ML '97

Excellent online tutorial.

OCAML

The Caml Language

Official site.

The Objective-Caml System

Documentation and user's manual.

PASCAL

Pascal Central

Good central repository for Pascal resources.

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Pascal Standards

The ISO language standards.

GNU Pascal

The GNU Pascal compiler. Open Source. Based on gcc.

Free Pascal

An alternative Open Source implementation. Self-hosting (written in Pascal).

PERL

The Perl Directory

Principal Web site for Perl, with documentation, tutorials, implementations, tools, and news from the user community.

The Source for Perl

Alternative Web site, maintained by O'Reilly publishers.

Larry Wall's Very Own Perl Page

Larry Wall's Perl home page.

PHP

PHP: Hypertext Preprocessor

Principal Web site for PHP, with documentation, tutorials, implementations, tools, and news from the user community.

Practical PHP Programming

Paul Hudson's PHP Wiki. Based on his book, PHP in a Nutshell.

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PROLOG

The WWW Virtual Library: Logic Programming

Good central repository for resources on logic programming in general and Prolog in particular.

SWI-Prolog's Home

A widely used Open Source Prolog implementation.

PYTHON

Python Programming Language

Principal Web site for Python, with documentation, tutorials, implementations, tools, and news from the user community.

RUBY

Ruby: Programmers' Best Friend

English language home page for Ruby, with documentation, tutorials, implementations, tools, and news from the user community.

Ruby Central

Additional Ruby resources.

SCHEME

'(schemers.org)

Good central repository for Scheme resources.

The Scheme Programming Language

The MIT Scheme Web site. Source for MIT GNU Scheme.

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(CHEZ [CHEZ SCHEME])

Source for the Chez Scheme implementation. Also hosts complete on-line version of Kent Dybvig's excellent Scheme textbook.

PLT Scheme

Source of the PLT Scheme implementation. Widely used for teaching.

Revised5 Report on the Algorithmic Language Scheme

The Revised5 Scheme language standard, in several different formats.

Revised6 Report on the Algorithmic Language Scheme

The new 6th revision of the language standard.

TCL

Tcl Developer Xchange

Principal Web site for Tcl, with documentation, tutorials, implementations, tools, and news from the user community.

Practical Programming in Tcl and Tk

Online version of (previous editions of) the excellent text by Welch and Jones.

XSLT

The Extensible Stylesheet Language Family (XSL)

World Wide Web Consortium official Web site for XSLT, XPath, XSL-FO, and related technologies.

XSLT Tutorial

A good online tutorial. Site also has tutorials for a wide range of other Web technologies.

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[Learn XSL & XPath Tutorial](#)

A more extensive and detailed XSLT tutorial.

ARCHITECTURE RESOURCES

[x86 Assembly Language Reference Manual](#)

x86 Assembly Language Reference Manual (Sun). Follows the GNU convention of listing the destination register last.

[MIPSpro Assembly Language Programmer's Guide](#)

[AMD64 Architecture Tech Docs](#)

The first 64-bit extension detailed for the x86 architecture was the AMD64 architecture. Intel's EM64T 64-bit extensions for the x86 architecture copied the AMD64 extensions, though some non-substantive changes may emerge between the two over time.

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The directories below contain source code for most of the nontrivial code fragments in Programming Language Pragmatics, 3rd edition.

In most cases the code in the book does not constitute a complete and runnable program, so these have been extended. In general the goal has been to create as small a program as possible that illustrates the feature in question. The result is not always good programming style.

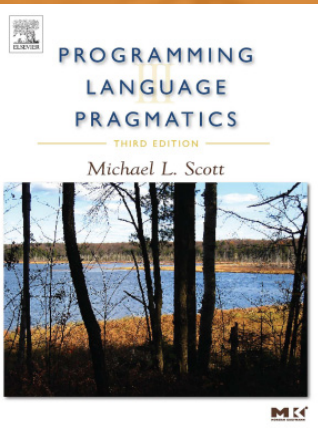
In a few cases (generally when the point is to observe the behavior of the compiler itself), the example is just a single module, and will not produce runnable code. These must typically be compiled with a "-c" command-line switch.

File names and comments at the top of the source indicate the corresponding Example, Figure, or Exercise in the book. Code that appears both as an Example or Exercise and as a Figure is provided in a file named after the Example.

The code samples are grouped by chapter. Chapters that do not contain samples are listed in blue.

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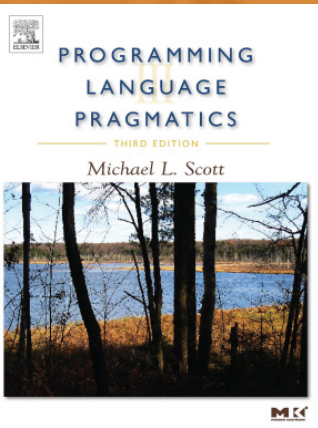
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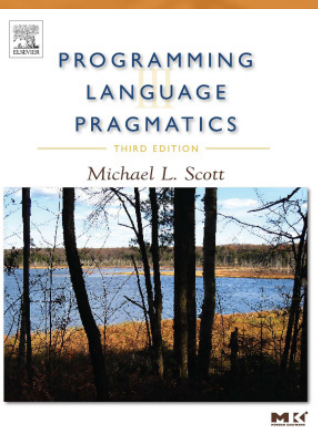
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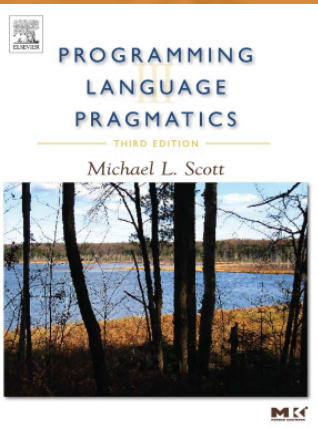
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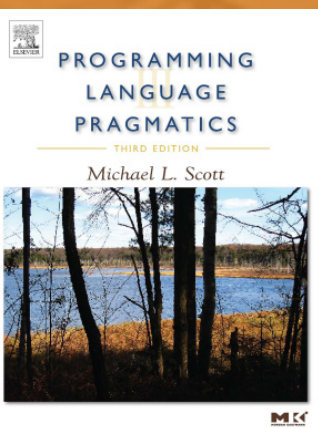
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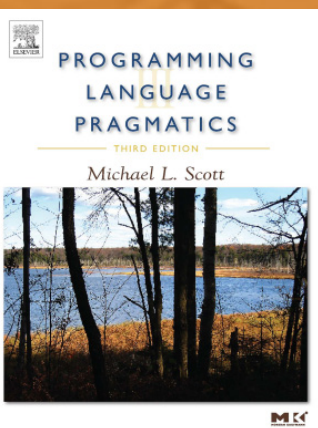
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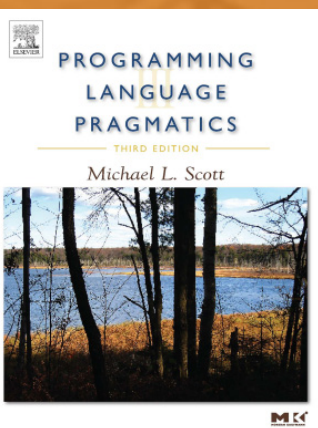
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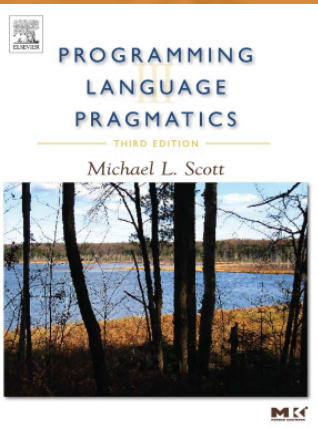
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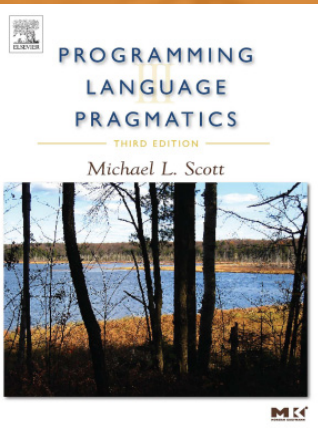
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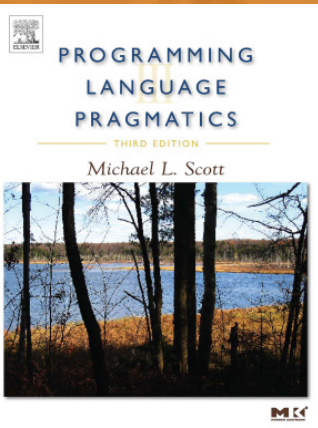
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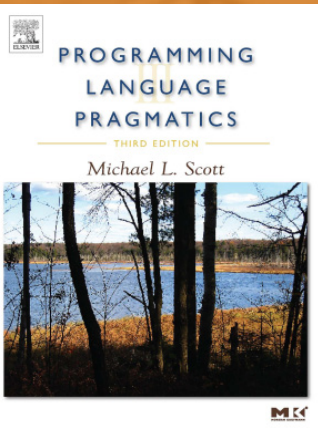
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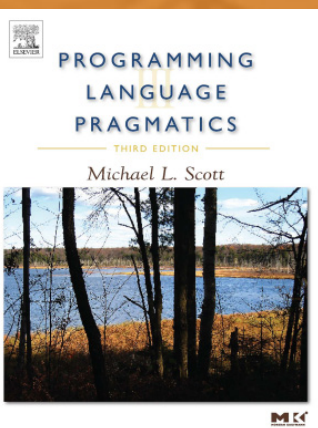
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All fragments have been tested using the following compilers and interpreters:

Ada

gnat version 3.13p on x86 Red Hat Linux 2.4 available from www.gnat.com

awk

BSD version shipped with MacOS X.4 (Darwin 8.2.0)

bash

version 2.05b.0(1) on MacOS X.4 (Darwin 8.2.0)

C, C++, and Objective C

gcc version 3.3 or 4.0 on MacOS X.4

C#

mono version 1.1.7 or 1.1.8 on MacOS X.4 available from www.mono-project.com/Main_Page
(note that programs with generics must be compiled with gmcs, not mcs)

or

Portable.net csc version 0.6.12 on MacOS X.4 available from www.dotgnu.org/pnet.html

Clu

pclu version 7.0 on Red Hat Linux 2.4 available from <ftp://ftp.lcs.mit.edu/pub/pclu>

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elisp

emacs version 22.0.50.1 for MacOS X (Darwin 7.9.0)

Fortran

g77 version 3.2.2 on x86 Red Hat Linux 2.4

or

Sun f90 version 5.0 on Solaris 8

Haskell

hugs November 2003 version on x86 Red Hat Linux 2.4

or

March 2005 version on MacOS X.4 available from www.haskell.org/hugs/

Icon

version 9.4.2 on MacOS X.4 available from www.cs.arizona.edu/icon

Java

Sun JDK 1.5.0 on Solaris 8 or MacOS X.4

JavaScript

version embedded in Apple Safari 2.0 browser

ML

Standard ML of New Jersey version 110.55 on MacOS X.4

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Modula-2

Mocka version 9905 on x86 Red Hat Linux 2.4 available from www.info.uni-karlsruhe.de/~modula/

Pascal

gpc version 3.3.2 on MacOS X.4 available from gnu-pascal.de/

Perl

perl version 5.8.1 or 5.8.6 on MacOS X.4

PHP

PHP version 4.3.10 or 4.3.11 under Apache 1.3.33 on MacOS X.4

Prolog

Open Prolog version 1.1b10 on MacOS 9.2.2 (Classic) available from www.cs.tcd.ie/open-prolog/

or

gprolog version 1.2.16 on MacOS X.4 available from pauillac.inria.fr/~diaz/gnu-prolog/

Python

python version 2.3.3 or 2.3.5 on MacOS X.4

Scheme

DrScheme version 207 or 299 on MacOS X.4 available from download.plt-scheme.org/drscheme/

sed

BSD version shipped with MacOS X.4 (Darwin 8.2.0)

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SR

version 2.3.3 on Red Hat Linux 2.6 available from www.cs.arizona.edu/sr

Ruby

ruby 1.6.8 or 1.8.2 on macOS X.4

Tcl

tclsh version 8.4 on MacOS X.4

XSLT

TestXSLT version 3.0 on MacOS X.4 available from www.entropy.ch/software/macosx/

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