## **Table of Contents**

Foreword		
Preface	xiii	
Part I. Basic Concepts		
1. How to Write a Simple Makefile		
Targets and Prerequisites	4	
Dependency Checking	6	
Minimizing Rebuilds	7	
Invoking make	7	
Basic Makefile Syntax	8	
2. Rules		
Explicit Rules	10	
Variables	16	
Finding Files with VPATH and vpath	17	
Pattern Rules	21	
The Implicit Rules Database	25	
Special Targets	30	
Automatic Dependency Generation	31	
Managing Libraries	34	
3. Variables and Macros	41	
What Variables Are Used For	42	
Variable Types	43	
Macros	45	

	When Variables Are Expanded	4/
	Target- and Pattern-Specific Variables	50
	Where Variables Come From	51
	Conditional and include Processing	54
	Standard make Variables	57
4.	Functions	61
	User-Defined Functions	61
	Built-in Functions	64
	Advanced User-Defined Functions	80
5.	Commands	88
	Parsing Commands	88
	Which Shell to Use	96
	Empty Commands	97
	Command Environment	98
	Evaluating Commands	99
	Command-Line Limits	100
Dart	HI Advanced and Specialized Topics	
Part	·	107
Part 6.	Managing Large Projects	107
	Managing Large Projects	108
	Managing Large Projects  Recursive make  Nonrecursive make	108 117
	Managing Large Projects  Recursive make  Nonrecursive make  Components of Large Systems	108 117 124
	Managing Large Projects  Recursive make  Nonrecursive make  Components of Large Systems  Filesystem Layout	108 117 124 126
	Managing Large Projects  Recursive make  Nonrecursive make  Components of Large Systems  Filesystem Layout  Automating Builds and Testing	108 117 124
	Managing Large Projects  Recursive make  Nonrecursive make  Components of Large Systems  Filesystem Layout  Automating Builds and Testing  Portable Makefiles	108 117 124 126 128
6.	Managing Large Projects  Recursive make  Nonrecursive make  Components of Large Systems  Filesystem Layout  Automating Builds and Testing  Portable Makefiles  Portability Issues	108 117 124 126 128 <b>129</b>
6.	Managing Large Projects  Recursive make  Nonrecursive make  Components of Large Systems  Filesystem Layout  Automating Builds and Testing  Portable Makefiles  Portability Issues  Cygwin	108 117 124 126 128 <b>129</b> 130 131
6.	Managing Large Projects Recursive make Nonrecursive make Components of Large Systems Filesystem Layout Automating Builds and Testing  Portable Makefiles Portability Issues Cygwin Managing Programs and Files	108 117 124 126 128 <b>129</b> 130 131 134
6.	Managing Large Projects  Recursive make  Nonrecursive make  Components of Large Systems  Filesystem Layout  Automating Builds and Testing  Portable Makefiles  Portability Issues  Cygwin  Managing Programs and Files  Working with Nonportable Tools	108 117 124 126 128 <b>129</b> 130 131 134 137
6.	Managing Large Projects Recursive make Nonrecursive make Components of Large Systems Filesystem Layout Automating Builds and Testing  Portable Makefiles Portability Issues Cygwin Managing Programs and Files	108 117 124 126 128 <b>129</b> 130 131 134
6.	Managing Large Projects Recursive make Nonrecursive make Components of Large Systems Filesystem Layout Automating Builds and Testing  Portable Makefiles Portability Issues Cygwin Managing Programs and Files Working with Nonportable Tools Automake  C and C++	108 117 124 126 128 129 130 131 134 137 139
7.	Managing Large Projects  Recursive make  Nonrecursive make  Components of Large Systems  Filesystem Layout  Automating Builds and Testing  Portable Makefiles  Portability Issues  Cygwin  Managing Programs and Files  Working with Nonportable Tools  Automake  C and C++  Separating Source and Binary	108 117 124 126 128 129 130 131 134 137 139 141
7.	Managing Large Projects Recursive make Nonrecursive make Components of Large Systems Filesystem Layout Automating Builds and Testing  Portable Makefiles Portability Issues Cygwin Managing Programs and Files Working with Nonportable Tools Automake  C and C++	108 117 124 126 128 129 130 131 134 137 139

	Supporting Multiple Binary Trees	154
	Partial Source Trees	156
	Reference Builds, Libraries, and Installers	157
9.	Java	159
	Alternatives to make	160
	A Generic Java Makefile	164
	Compiling Java	168
	Managing Jars	175
	Reference Trees and Third-Party Jars	177
	Enterprise JavaBeans	178
10.	Improving the Performance of make	182
	Benchmarking	182
	Identifying and Handling Bottlenecks	186
	Parallel make	190
	Distributed make	194
11.	Example Makefiles	196
	The Book Makefile	196
	The Linux Kernel Makefile	218
12.	Debugging Makefiles	229
	Debugging Features of make	229
	Writing Code for Debugging	236
	Common Error Messages	241
Part	III. Appendixes	
A.	Running make	249
В.	The Outer Limits	252
C.	GNU Free Documentation License—GNU Project—Free Software	
	Foundation (FSF)	263
Inde	•	271