

contents

preface xix
preface to the first edition xxi
acknowledgments xxiii
about this book xxv
about the cover illustration xxx

PART 1 RUBY FOUNDATIONS.....1

1 *Bootstrapping your Ruby literacy* 3

1.1 Basic Ruby language literacy 4

A Ruby syntax survival kit 5 ■ *The variety of Ruby identifiers* 7
Method calls, messages, and Ruby objects 8 ■ *Writing and saving
a simple program* 10 ■ *Feeding the program to Ruby* 11
Keyboard and file I/O 13

1.2 Anatomy of the Ruby installation 15

*The Ruby standard library subdirectory
(RbConfig::CONFIG[rubylibdir])* 17 ■ *The C extensions
directory (RbConfig::CONFIG[archdir])* 17 ■ *The site_ruby
(RbConfig::CONFIG[sitedir]) and vendor_ruby
(RbConfig::CONFIG[vendordir]) directories* 17
The gems directory 18

- 1.3 Ruby extensions and programming libraries 18
 - Loading external files and extensions* 18
 - *“Load”-ing a file in the default load path* 19
 - *“Require”-ing a feature* 21
 - require_relative* 22
- 1.4 Out-of-the-box Ruby tools and applications 22
 - Interpreter command-line switches* 23
 - *A closer look at interactive Ruby interpretation with irb* 26
 - *ri and RDoc* 28
 - The rake task-management utility* 29
 - *Installing packages with the gem command* 31
- 1.5 Summary 33

2 **Objects, methods, and local variables** 34

- 2.1 Talking to objects 35
 - Ruby and object orientation* 35
 - *Creating a generic object* 36
 - Methods that take arguments* 38
 - *The return value of a method* 39
- 2.2 Crafting an object: The behavior of a ticket 40
 - The ticket object, behavior first* 40
 - *Querying the ticket object* 41
 - Shortening the ticket code via string interpolation* 42
 - Ticket availability: Expressing Boolean state in a method* 42
- 2.3 The innate behaviors of an object 44
 - Identifying objects uniquely with the object_id method* 45
 - Querying an object’s abilities with the respond_to? method* 46
 - Sending messages to objects with the send method* 47
- 2.4 A close look at method arguments 48
 - Required and optional arguments* 48
 - *Default values for arguments* 49
 - *Order of parameters and arguments* 50
 - What you can’t do in argument lists* 52
- 2.5 Local variables and variable assignment 54
 - Variables, objects, and references* 55
 - *References in variable assignment and reassignment* 57
 - *References and method arguments* 58
 - *Local variables and the things that look like them* 59
- 2.6 Summary 60

3 **Organizing objects with classes** 62

- 3.1 Classes and instances 63
 - Instance methods* 64
 - *Overriding methods* 64
 - Reopening classes* 65

- 3.2 Instance variables and object state 67
 - Initializing an object with state* 68
- 3.3 Setter methods 70
 - The equal sign (=) in method names* 70 ▪ *Syntactic sugar for assignment-like methods* 72 ▪ *Setter methods unleashed* 72
- 3.4 Attributes and the attr_* method family 74
 - Automating the creation of attributes* 75 ▪ *Summary of attr_* methods* 77
- 3.5 Inheritance and the Ruby class hierarchy 77
 - Single inheritance: One to a customer* 79 ▪ *Object ancestry and the not-so-missing link: The Object class* 79 ▪ *El Viejo's older brother: BasicObject* 80
- 3.6 Classes as objects and message receivers 81
 - Creating class objects* 81 ▪ *How class objects call methods* 82
 - A singleton method by any other name...* 83 ▪ *When, and why, to write a class method* 84 ▪ *Class methods vs. instance methods* 85
- 3.7 Constants up close 86
 - Basic use of constants* 87 ▪ *Reassigning vs. modifying constants* 88
- 3.8 Nature vs. nurture in Ruby objects 89
- 3.9 Summary 91

4 **Modules and program organization** 92

- 4.1 Basics of module creation and use 93
 - A module encapsulating "stacklikeness"* 94 ▪ *Mixing a module into a class* 96 ▪ *Using the module further* 98
- 4.2 Modules, classes, and method lookup 99
 - Illustrating the basics of method lookup* 100 ▪ *Defining the same method more than once* 103 ▪ *How prepend works* 105
 - The rules of method lookup summarized* 106 ▪ *Going up the method search path with super* 107
- 4.3 The method_missing method 109
 - Combining method_missing and super* 110
- 4.4 Class/module design and naming 114
 - Mix-ins and/or inheritance* 114 ▪ *Nesting modules and classes* 116
- 4.5 Summary 117

- 5 The default object (*self*), scope, and visibility 119**
- 5.1 Understanding self, the current/default object 120
 - Who gets to be self, and where* 120
 - *The top-level self object* 122
 - Self inside class, module, and method definitions* 123
 - *Self as the default receiver of messages* 126
 - *Resolving instance variables through self* 128
 - 5.2 Determining scope 129
 - Global scope and global variables* 130
 - *Local scope* 132
 - The interaction between local scope and self* 135
 - *Scope and resolution of constants* 136
 - *Class variable syntax, scope, and visibility* 138
 - 5.3 Deploying method-access rules 144
 - Private methods* 145
 - *Protected methods* 148
 - 5.4 Writing and using top-level methods 149
 - Defining a top-level method* 149
 - *Predefined (built-in) top-level methods* 150
 - 5.5 Summary 151
- 6 Control-flow techniques 152**
- 6.1 Conditional code execution 153
 - The if keyword and friends* 153
 - *Assignment syntax in condition bodies and tests* 157
 - *case statements* 160
 - 6.2 Repeating actions with loops 164
 - Unconditional looping with the loop method* 165
 - Conditional looping with the while and until keywords* 166
 - Looping based on a list of values* 168
 - 6.3 Iterators and code blocks 168
 - The ingredients of iteration* 168
 - *Iteration, home-style* 169
 - The anatomy of a method call* 170
 - *Curly braces vs. do/end in code block syntax* 170
 - *Implementing times* 171
 - The importance of being each* 173
 - *From each to map* 175
 - Block parameters and variable scope* 176
 - 6.4 Error handling and exceptions 179
 - Raising and rescuing exceptions* 180
 - *The rescue keyword to the rescue!* 181
 - *Raising exceptions explicitly* 182
 - Capturing an exception in a rescue clause* 183
 - *The ensure clause* 185
 - *Creating your own exception classes* 186
 - 6.5 Summary 187

PART 2 BUILT-IN CLASSES AND MODULES 189

7 Built-in essentials 191

- 7.1 Ruby's literal constructors 192
- 7.2 Recurrent syntactic sugar 193
 - Defining operators by defining methods* 194
 - Customizing unary operators* 196
- 7.3 Bang (!) methods and “danger” 197
 - Destructive (receiver-changing) effects as danger* 197
 - Destructiveness and “danger” vary independently* 198
- 7.4 Built-in and custom to_* (conversion) methods 200
 - String conversion: to_s* 200 ▪ *Array conversion with to_a and the * operator* 202 ▪ *Numerical conversion with to_i and to_f* 203
 - Role-playing to_* methods* 205
- 7.5 Boolean states, Boolean objects, and nil 207
 - True and false as states* 207 ▪ *true and false as objects* 209
 - The special object nil* 211
- 7.6 Comparing two objects 212
 - Equality tests* 212 ▪ *Comparisons and the Comparable module* 213
- 7.7 Inspecting object capabilities 215
 - Listing an object's methods* 215 ▪ *Querying class and module objects* 216 ▪ *Filtered and selected method lists* 217
- 7.8 Summary 217

8 Strings, symbols, and other scalar objects 219

- 8.1 Working with strings 220
 - String notation* 220 ▪ *Basic string manipulation* 224
 - Querying strings* 228 ▪ *String comparison and ordering* 230
 - String transformation* 231 ▪ *String conversions* 234
 - String encoding: A brief introduction* 235
- 8.2 Symbols and their uses 237
 - Chief characteristics of symbols* 237 ▪ *Symbols and identifiers* 238 ▪ *Symbols in practice* 240 ▪ *Strings and symbols in comparison* 242
- 8.3 Numerical objects 243
 - Numerical classes* 244 ▪ *Performing arithmetic operations* 244

- 8.4 Times and dates 246
 - Instantiating date/time objects* 246
 - *Date/time query methods* 249
 - *Date/time formatting methods* 249
 - Date/time conversion methods* 251
- 8.5 Summary 252

9 **Collection and container objects** 254

- 9.1 Arrays and hashes in comparison 255
- 9.2 Collection handling with arrays 256
 - Creating a new array* 257
 - *Inserting, retrieving, and removing array elements* 261
 - *Combining arrays with other arrays* 264
 - Array transformations* 265
 - *Array querying* 266
- 9.3 Hashes 267
 - Creating a new hash* 268
 - *Inserting, retrieving, and removing hash pairs* 269
 - *Specifying default hash values and behavior* 271
 - *Combining hashes with other hashes* 272
 - Hash transformations* 273
 - *Hash querying* 274
 - Hashes as final method arguments* 275
 - *A detour back to argument syntax: Named (keyword) arguments* 276
- 9.4 Ranges 277
 - Creating a range* 278
 - *Range-inclusion logic* 279
- 9.5 Sets 281
 - Set creation* 281
 - *Manipulating set elements* 282
 - Subsets and supersets* 284
- 9.6 Summary 285

10 **Collections central: Enumerable and Enumerator** 286

- 10.1 Gaining enumerability through each 287
- 10.2 Enumerable Boolean queries 289
- 10.3 Enumerable searching and selecting 291
 - Getting the first match with find* 292
 - *Getting all matches with find_all (a.k.a. select) and reject* 293
 - *Selecting on three equal matches with grep* 294
 - *Organizing selection results with group_by and partition* 295
- 10.4 Element-wise enumerable operations 297
 - The first method* 297
 - *The take and drop methods* 298
 - The min and max methods* 299

- 10.5 Relatives of each 300
 - reverse_each* 300
 - *The each_with_index method (and each.with_index)* 301
 - *The each_slice and each_cons methods* 302
 - *The cycle method* 303
 - *Enumerable reduction with inject* 303
 - 10.6 The map method 304
 - The return value of map* 305
 - *In-place mapping with map!* 306
 - 10.7 Strings as quasi-enumerables 306
 - 10.8 Sorting enumerables 308
 - Where the Comparable module fits into enumerable sorting (or doesn't)* 310
 - *Defining sort-order logic with a block* 310
 - Concise sorting with sort_by* 311
 - 10.9 Enumerators and the next dimension of enumerability 311
 - Creating enumerators with a code block* 312
 - *Attaching enumerators to other objects* 314
 - *Implicit creation of enumerators by blockless iterator calls* 316
 - 10.10 Enumerator semantics and uses 316
 - How to use an enumerator's each method* 316
 - *Protecting objects with enumerators* 318
 - *Fine-grained iteration with enumerators* 320
 - *Adding enumerability with an enumerator* 320
 - 10.11 Enumerator method chaining 322
 - Economizing on intermediate objects* 322
 - *Indexing enumerables with with_index* 324
 - *Exclusive-or operations on strings with enumerators* 324
 - 10.12 Lazy enumerators 326
 - FizzBuzz with a lazy enumerator* 327
 - 10.13 Summary 328
- 11 Regular expressions and regexp-based string operations 330**
- 11.1 What are regular expressions? 331
 - 11.2 Writing regular expressions 331
 - Seeing patterns* 331
 - *Simple matching with literal regular expressions* 332

- 11.3 Building a pattern in a regular expression 333
 - Literal characters in patterns* 334 ▪ *The dot wildcard character (.)* 334 ▪ *Character classes* 334
- 11.4 Matching, substring captures, and MatchData 336
 - Capturing submatches with parentheses* 336 ▪ *Match success and failure* 338 ▪ *Two ways of getting the captures* 339
 - Other MatchData information* 341
- 11.5 Fine-tuning regular expressions with quantifiers, anchors, and modifiers 342
 - Constraining matches with quantifiers* 342 ▪ *Greedy (and non-greedy) quantifiers* 344 ▪ *Regular expression anchors and assertions* 346 ▪ *Modifiers* 349
- 11.6 Converting strings and regular expressions to each other 350
 - String-to-regexp idioms* 351 ▪ *Going from a regular expression to a string* 352
- 11.7 Common methods that use regular expressions 353
 - String#scan* 353 ▪ *String#split* 355 ▪ *sub/sub! and gsub/gsub!* 356 ▪ *Case equality and grep* 357
- 11.8 Summary 359

12 *File and I/O operations* 360

- 12.1 How Ruby's I/O system is put together 361
 - The IO class* 361 ▪ *IO objects as enumerables* 362
 - STDIN, STDOUT, STDERR* 363 ▪ *A little more about keyboard input* 364
- 12.2 Basic file operations 364
 - The basics of reading from files* 365 ▪ *Line-based file reading* 365 ▪ *Byte- and character-based file reading* 366
 - Seeking and querying file position* 367 ▪ *Reading files with File class methods* 368 ▪ *Writing to files* 369 ▪ *Using blocks to scope file operations* 370 ▪ *File enumerability* 371 ▪ *File I/O exceptions and errors* 372
- 12.3 Querying IO and File objects 373
 - Getting information from the File class and the FileTest module* 373
 - Deriving file information with File::Stat* 374
- 12.4 Directory manipulation with the Dir class 375
 - Reading a directory's entries* 375 ▪ *Directory manipulation and querying* 378

- 12.5 File tools from the standard library 379
 - The FileUtils module* 379
 - *The Pathname class* 381
 - The StringIO class* 382
 - *The open-uri library* 384
- 12.6 Summary 384

PART 3 RUBY DYNAMICS387

13 *Object individuation* 389

- 13.1 Where the singleton methods are:
 - The singleton class 390
 - Dual determination through singleton classes* 391
 - *Examining and modifying a singleton class directly* 392
 - *Singleton classes on the method-lookup path* 394
 - *The singleton_class method* 398
 - Class methods in (even more) depth* 399
- 13.2 Modifying Ruby's core classes and modules 400
 - The risks of changing core functionality* 401
 - *Additive changes* 405
 - *Pass-through overrides* 406
 - *Per-object changes with extend* 408
 - *Using refinements to affect core behavior* 411
- 13.3 BasicObject as ancestor and class 412
 - Using BasicObject* 413
 - *Implementing a subclass of BasicObject* 414
- 13.4 Summary 416

14 *Callable and runnable objects* 418

- 14.1 Basic anonymous functions: The Proc class 419
 - Proc objects* 419
 - *Procs and blocks and how they differ* 420
 - Block-proc conversions* 422
 - *Using Symbol#to_proc for conciseness* 424
 - *Procs as closures* 426
 - *Proc parameters and arguments* 428
- 14.2 Creating functions with lambda and -> 428
- 14.3 Methods as objects 430
 - Capturing Method objects* 430
 - *The rationale for methods as objects* 431
- 14.4 The eval family of methods 433
 - Executing arbitrary strings as code with eval* 433
 - *The dangers of eval* 435
 - *The instance_eval method* 435
 - *Using class_eval (a.k.a. module_eval)* 437

- 14.5 Parallel execution with threads 438
 - Killing, stopping, and starting threads* 440
 - *A threaded date server* 441
 - *Writing a chat server using sockets and threads* 443
 - Threads and variables* 445
 - *Manipulating thread keys* 446
- 14.6 Issuing system commands from inside
 - Ruby programs 449
 - The system method and backticks* 449
 - *Communicating with programs via open and popen3* 451
- 14.7 Summary 454

15 **Callbacks, hooks, and runtime introspection** 456

- 15.1 Callbacks and hooks 457
 - Intercepting unrecognized messages with method_missing* 457
 - Trapping include and prepend operations* 461
 - *Intercepting extend* 462
 - *Intercepting inheritance with Class#inherited* 464
 - The Module#const_missing method* 465
 - *The method_added and singleton_method_added methods* 465
- 15.2 Interpreting object capability queries 467
 - Listing an object's non-private methods* 468
 - *Listing private and protected methods* 470
 - *Getting class and module instance methods* 471
 - *Listing objects' singleton methods* 473
- 15.3 Introspection of variables and constants 474
 - Listing local and global variables* 475
 - Listing instance variables* 475
- 15.4 Tracing execution 476
 - Examining the stack trace with caller* 476
 - *Writing a tool for parsing stack traces* 477
- 15.5 Callbacks and method inspection in practice 480
 - MicroTest background: MiniTest* 480
 - *Specifying and implementing MicroTest* 482
- 15.6 Summary 485
 - index* 487