

CONTENTS IN DETAIL

INTRODUCTION	1
On Programming	2
Why Language Matters	3
What Is JavaScript?	6
Code, and What to Do with It	7
Overview of This Book	7
Typographic Conventions	8

PART I: LANGUAGE

1 **VALUES, TYPES, AND OPERATORS** **11**

Values	12
Numbers	12
Arithmetic	13
Special Numbers	14
Strings	14
Unary Operators	15
Boolean Values	16
Comparisons	16
Logical Operators	17
Undefined Values	18
Automatic Type Conversion	18
Short-Circuiting of Logical Operators	19
Summary	20

2 **PROGRAM STRUCTURE** **23**

Expressions and Statements	23
Variables	24
Keywords and Reserved Words	26
The Environment	26
Functions	27
The console.log Function	27
Return Values	28
Prompt and Confirm	28
Control Flow	29

Conditional Execution	29
while and do Loops	31
Indenting Code	32
for Loops	33
Breaking Out of a Loop	33
Updating Variables Succinctly	34
Dispatching on a Value with switch	35
Capitalization	35
Comments	36
Summary	37
Exercises	37
Looping a Triangle	37
FizzBuzz	38
Chess Board	38

3

FUNCTIONS

41

Defining a Function	42
Parameters and Scopes	43
Nested Scopes	44
Functions as Values	45
Declaration Notation	45
The Call Stack	46
Optional Arguments	47
Closure	48
Recursion	50
Growing Functions	52
Functions and Side Effects	54
Summary	55
Exercises	56
Minimum	56
Recursion	56
Bean Counting	56

4

DATA STRUCTURES: OBJECTS AND ARRAYS

59

The Weresquirrel	60
Data Sets	60
Properties	61
Methods	62
Objects	63
Mutability	65
The Lycanthrope's Log	66
Computing Correlation	68
Objects as Maps	69

The Final Analysis	70
Further Arrayology	72
Strings and Their Properties	73
The arguments Object	74
The Math Object	75
The Global Object.....	77
Summary	77
Exercises	78
The Sum of a Range.....	78
Reversing an Array	78
A List	78
Deep Comparison	79

5 HIGHER-ORDER FUNCTIONS 81

Abstraction	82
Abstracting Array Traversal	83
Higher-Order Functions	84
Passing Along Arguments	86
JSON	87
Filtering an Array	88
Transforming with map.....	89
Summarizing with reduce	89
Composability	90
The Cost.....	91
Great-great-great-great.....	92
Binding.....	94
Summary	95
Exercises	95
Flattening	95
Mother-Child Age Difference	95
Historical Life Expectancy.....	96
Every and Then Some	96

6 THE SECRET LIFE OF OBJECTS 99

History	99
Methods.....	100
Prototypes	101
Constructors	103
Overriding Derived Properties	104
Prototype Interference.....	105
Prototype-less Objects.....	107
Polymorphism	107
Laying Out a Table	108

Getters and Setters	113
Inheritance	114
The instanceof Operator	115
Summary	116
Exercises	117
A Vector Type	117
Another Cell	117
Sequence Interface	117

7

PROJECT: ELECTRONIC LIFE **119**

Definition	119
Representing Space	120
A Critter's Programming Interface	122
The World Object	123
this and Its Scope	125
Animating Life	126
It Moves	128
More Life-forms	129
A More Lifelike Simulation	130
Action Handlers	131
Populating the New World	133
Bringing the World to Life	134
Exercises	135
Artificial Stupidity	135
Predators	136

8

BUGS AND ERROR HANDLING **139**

Programmer Mistakes	139
Strict Mode	140
Testing	141
Debugging	142
Error Propagation	144
Exceptions	145
Cleaning Up After Exceptions	146
Selective Catching	147
Assertions	149
Summary	150
Exercises	150
Retry	150
The Locked Box	151

9

REGULAR EXPRESSIONS

153

Creating a Regular Expression	153
Testing for Matches	154
Matching a Set of Characters	154
Repeating Parts of a Pattern	156
Grouping Subexpressions	157
Matches and Groups	157
The Date Type	158
Word and String Boundaries	160
Choice Patterns	160
The Mechanics of Matching	161
Backtracking	162
The replace Method	163
Greed	165
Dynamically Creating RegExp Objects	166
The search Method	167
The lastIndex Property	167
Looping over Matches	168
Parsing an INI File	168
International Characters	170
Summary	171
Exercises	172
Regex Golf	172
Quoting Style	173
Numbers Again	173

10

MODULES

175

Why Modules Help	175
Namespacing	176
Reuse	176
Decoupling	177
Using Functions as Namespaces	177
Objects as Interfaces	179
Detaching from the Global Scope	180
Evaluating Data as Code	180
The require Function	181
Slow-Loading Modules	183
Interface Design	185
Predictability	186
Composability	186
Layered Interfaces	186

Summary	187
Exercises	187
Month Names	187
A Return to Electronic Life	187
Circular Dependencies	188

11

PROJECT: A PROGRAMMING LANGUAGE 191

Parsing	191
The Evaluator	195
Special Forms	196
The Environment	198
Functions	199
Compilation	200
Cheating	201
Exercises	202
Arrays	202
Closure	202
Comments	202
Fixing Scope	202

PART II: BROWSER

12

JAVASCRIPT AND THE BROWSER 207

Networks and the Internet	207
The Web	209
HTML	209
HTML and JavaScript	211
In the Sandbox	212
Compatibility and the Browser Wars	213

13

THE DOCUMENT OBJECT MODEL 215

Document Structure	215
Trees	216
The Standard	217
Moving Through the Tree	218
Finding Elements	219
Changing the Document	220
Creating Nodes	221
Attributes	222
Layout	224

Styling	226
Cascading Styles	227
Query Selectors	229
Positioning and Animating	229
Summary	231
Exercises	232
Build a Table	232
Elements by Tag Name	232
The Cat's Hat	233

14 HANDLING EVENTS 235

Event Handlers	235
Events and DOM Nodes	236
Event Objects	237
Propagation	237
Default Actions	239
Key Events	239
Mouse Clicks	241
Mouse Motion	242
Scroll Events	244
Focus Events	245
Load Event	246
Script Execution Timeline	246
Setting Timers	247
Debouncing	248
Summary	250
Exercises	250
Censored Keyboard	250
Mouse Trail	250
Tabs	251

15 PROJECT: A PLATFORM GAME 253

The Game	254
The Technology	254
Levels	255
Reading a Level	256
Actors	257
Encapsulation as a Burden	259
Drawing	260
Motion and Collision	264
Actors and Actions	266
Tracking Keys	270
Running the Game	271

Exercises	273
Game Over	273
Pausing the Game	273

16

DRAWING ON CANVAS **275**

SVG	276
The Canvas Element	277
Filling and Stroking	278
Paths	278
Curves	280
Drawing a Pie Chart	283
Text	284
Images	284
Transformation	286
Storing and Clearing Transformations	288
Back to the Game	290
Choosing a Graphics Interface	295
Summary	295
Exercises	296
Shapes	296
The Pie Chart	297
A Bouncing Ball	297
Precomputed Mirroring	297

17

HTTP **299**

The Protocol	299
Browsers and HTTP	301
XMLHttpRequest	302
Sending a Request	303
Asynchronous Requests	304
Fetching XML Data	304
HTTP Sandboxing	305
Abstracting Requests	306
Promises	308
Appreciating HTTP	310
Security and HTTPS	311
Summary	311
Exercises	312
Content Negotiation	312
Waiting for Multiple Promises	313

18
FORMS AND FORM FIELDS **315**

Fields	315
Focus	317
Disabled Fields	318
The Form as a Whole	318
Text Fields	319
Checkboxes and Radio Buttons	321
Select Fields	322
File Fields	323
Storing Data Client-Side	325
Summary	327
Exercises	327
A JavaScript Workbench	327
Autocompletion	328
Conway's Game of Life	328

19
PROJECT: A PAINT PROGRAM **331**

Implementation	332
Building the DOM	332
The Foundation	333
Tool Selection	334
Color and Brush Size	336
Saving	337
Loading Image Files	339
Finishing Up	340
Exercises	341
Rectangles	342
Color Picker	342
Flood Fill	343

PART III: BEYOND

20
NODE.JS **347**

Background	347
Asynchronicity	348
The node Command	349
Modules	350
Installing with NPM	351

The Filesystem Module	353
The HTTP Module	354
Streams	356
A Simple File Server	357
Error Handling	361
Summary	363
Exercises	363
Content Negotiation, Again	363
Fixing a Leak	364
Creating Directories	364
A Public Space on the Web	364

21

PROJECT: SKILL-SHARING WEBSITE 367

Design	368
Long Polling	369
HTTP Interface	369
The Server	372
Routing	372
Serving Files	373
Talks as Resources	374
Long-Polling Support	376
The Client	379
HTML	379
Starting up	380
Displaying Talks	382
Updating the Server	384
Noticing Changes	385
Exercises	386
Disk Persistence	386
Comment Field Resets	386
Better Templates	387
The Unscriptables	387

22

JAVASCRIPT AND PERFORMANCE 389

Staged Compilation	390
Graph Layout	390
Defining a Graph	392
A First Force-Directed Layout Function	393
Profiling	395
Function Inlining	396
Going Back to Old-school Loops	397
Avoiding Work	398

Creating Less Garbage	399
Garbage Collection	400
Writing to Objects.....	401
Dynamic Types.....	402
Summary	403
Exercises	404
Pathfinding	404
Timing	404
Optimizing	405

EXERCISE HINTS 407

Program Structure	407
Looping a Triangle	407
FizzBuzz	408
Chess Board	408
Functions	408
Minimum.....	408
Recursion	408
Bean Counting	409
Data Structures: Objects and Arrays	409
The Sum of a Range.....	409
Reversing an Array	409
A List	410
Deep Comparison	410
Higher-Order Functions	411
Mother-Child Age Difference.....	411
Historical Life Expectancy.....	411
Every and Then Some	411
The Secret Life of Objects	411
A Vector Type	411
Another Cell.....	412
Sequence Interface	412
Project: Electronic Life	412
Artificial Stupidity	412
Predators	413
Bugs and Error Handling	413
Retry.....	413
The Locked Box	413
Regular Expressions	414
Quoting Style.....	414
Numbers Again	414
Modules.....	414
Month Names	414
A Return to Electronic Life.....	414
Circular Dependencies	415

Project: A Programming Language	415
Arrays	415
Closure	416
Comments	416
Fixing Scope	416
The Document Object Model	416
Build a Table	416
Elements by Tag Name	417
Handling Events	417
Censored Keyboard	417
Mouse Trail	417
Tabs	418
Project: A Platform Game	418
Game Over	418
Pausing the Game	418
Drawing on Canvas	419
Shapes	419
The Pie Chart	419
A Bouncing Ball	420
Precomputed Mirroring	420
HTTP	420
Content Negotiation	420
Waiting for Multiple Promises	421
Forms and Form Fields	421
A JavaScript Workbench	421
Autocompletion	421
Conway's Game of Life	422
Project: A Paint Program	422
Rectangles	422
Color Picker	423
Flood Fill	423
Node.js	424
Content Negotiation, Again	424
Fixing a Leak	424
Creating Directories	424
A Public Space on the Web	425
Project: Skill-Sharing Website	425
Disk Persistence	425
Comment Field Resets	425
Better Templates	426
The Unscriptables	426
JavaScript and Performance	426
Pathfinding	426
Optimizing	427