

CONTENTS IN DETAIL

ACKNOWLEDGMENTS

xv

INTRODUCTION

xvii

Whom This Book Is For	xviii
A Note to the Reader	xviii
Features	xviii
Organization of This Text	xix
Conventions Used	xx
Online Resources	xx
Errata and Updates	xx

1

GETTING STARTED

1

What Is Scratch?	2
<i>Try It Out 1-1</i>	3
Scratch Programming Environment	3
The Stage	4
<i>Try It Out 1-2</i>	4
Sprite List	5
<i>Try It Out 1-3</i>	5
Blocks Tab	6
<i>Try It Out 1-4</i>	7
Scripts Area	7
<i>Try It Out 1-5</i>	8
<i>Try It Out 1-6</i>	9
Costumes Tab	9
<i>Try It Out 1-7</i>	10
Sounds Tab	10
<i>Try It Out 1-8</i>	10
Backdrops Tab	11
<i>Try It Out 1-9</i>	11
Sprite Info	11
Toolbar	12
Paint Editor	13
Setting the Center of an Image	13
<i>Try It Out 1-10</i>	14
Setting Transparent Color	14
Your First Scratch Game	15
Step 1: Prepare the Backdrop	16
Step 2: Add the Paddle and Ball	16
Step 3: Start the Game and Get Your Sprites Moving	17
<i>Try It Out 1-11</i>	18
Step 4: Spice It Up with Sound	19
Scratch Blocks: An Overview	20

Arithmetic Operators and Functions	21
Arithmetic Operators	21
Random Numbers	21
Mathematical Functions	22
Summary	22
Problems	23

2

MOTION AND DRAWING

25

Using Motion Commands	25
Absolute Motion	26
<i>Try It Out 2-1</i>	27
Relative Motion	27
<i>Try It Out 2-2</i>	30
Other Motion Commands	30
Pen Commands and Easy Draw	31
<i>Try It Out 2-3</i>	31
<i>Try It Out 2-4</i>	32
The Power of Repeat	33
<i>Try It Out 2-5</i>	34
Rotated Squares	34
<i>Try It Out 2-6</i>	35
Exploring with Stamp	35
<i>Try It Out 2-7</i>	35
Scratch Projects	36
Get the Money	36
Catching Apples	39
More on Cloned Sprites	42
Summary	43
Problems	44

3

LOOKS AND SOUND

47

The Looks Palette	48
Changing Costumes to Animate	48
<i>Try It Out 3-1</i>	49
Sprites That Speak and Think	50
<i>Try It Out 3-2</i>	50
Image Effects	50
Size and Visibility	51
<i>Try It Out 3-3</i>	52
Layers	52
<i>Try It Out 3-4</i>	53
The Sound Palette	53
Playing Audio Files	53
Playing Drums and Other Sounds	54
Composing Music	55

Controlling Sound Volume	55
<i>Try It Out 3-5</i>	56
Setting the Tempo	56
<i>Try It Out 3-6</i>	56
Scratch Projects	56
Dancing on Stage	57
Fireworks	60
Summary	62
Problems	63

4 PROCEDURES 67

Message Broadcasting and Receiving	68
Sending and Receiving Broadcasts	69
Message Broadcasting to Coordinate Multiple Sprites	70
Creating Large Programs in Small Steps	72
Creating Procedures with Message Broadcasting	73
Building Your Own Block	75
Passing Parameters to Custom Blocks	77
<i>Try It Out 4-1</i>	81
Using Nested Procedures	82
<i>Try It Out 4-2</i>	84
Working with Procedures	84
Breaking Programs Down into Procedures	84
<i>Try It Out 4-3</i>	86
Building Up with Procedures	87
Summary	89
Problems	89

5 VARIABLES 91

Data Types in Scratch	92
What's in the Shape?	92
Automatic Data Type Conversion	93
Introduction to Variables	94
What Is a Variable?	94
Creating and Using Variables	97
<i>Try It Out 5-1</i>	100
The Scope of Variables	100
Changing Variables	102
<i>Try It Out 5-2</i>	104
Variables in Clones	104
Displaying Variable Monitors	106
Using Variable Monitors in Applications	108
Simulating Ohm's Law	108
<i>Try It Out 5-3</i>	110
Demonstrating a Series Circuit	110
<i>Try It Out 5-4</i>	111

Visualizing a Sphere's Volume and Surface Area	111
<i>Try It Out 5-5</i>	113
Drawing an n-Leaved Rose	114
<i>Try It Out 5-6</i>	115
Modeling Sunflower Seed Distribution	116
<i>Try It Out 5-7</i>	117
Getting Input from Users	117
Reading a Number	118
Reading Characters	118
Performing Arithmetic Operations	119
Summary	120
Problems	120

6

MAKING DECISIONS

123

Comparison Operators	124
Evaluating Boolean Expressions	125
Comparing Letters and Strings	126
Decision Structures	128
The if Block	128
Using Variables as Flags	129
The if/else Block	130
Nested if and if/else Blocks	132
Menu-Driven Programs	132
Logical Operators	134
The and Operator	135
The or Operator	135
The not Operator	136
Using Logical Operators to Check Numeric Ranges	137
Scratch Projects	140
Guess My Coordinates	140
<i>Try It Out 6-1</i>	142
Triangle Classification Game	142
<i>Try It Out 6-2</i>	145
Line Follower	146
<i>Try It Out 6-3</i>	147
Equation of a Line	147
<i>Try It Out 6-4</i>	151
Other Applications	151
Summary	151
Problems	152

7

REPETITION: A DEEPER EXPLORATION OF LOOPS

155

More Loop Blocks in Scratch	156
The repeat until Block	157
<i>Try It Out 7-1</i>	158
Building a forever if Block	158
<i>Try It Out 7-2</i>	159

Stop Commands	160
<i>Try It Out 7-3</i>	161
Ending a Computational Loop	162
Validating User Input	162
Counters	164
Check a Password	164
<i>Try It Out 7-4</i>	165
Counting by a Constant Amount	165
Revisiting Nested Loops	167
<i>Try It Out 7-5</i>	169
Recursion: Procedures That Call Themselves	169
<i>Try It Out 7-6</i>	171
Scratch Projects	171
Analog Clock	171
<i>Try It Out 7-7</i>	173
Bird Shooter Game	173
<i>Try It Out 7-8</i>	176
Free-Fall Simulation	177
<i>Try It Out 7-9</i>	178
Projectile Motion Simulator	179
<i>Try It Out 7-10</i>	182
Other Applications	182
Summary	182
Problems	183

8 STRING PROCESSING 185

Revisiting the String Data Type	186
Counting Special Characters in a String	186
Comparing String Characters	187
<i>Try It Out 8-1</i>	188
String Manipulation Examples	189
Igpay Atinlay	189
<i>Try It Out 8-2</i>	190
Fix My Spelling	190
<i>Try It Out 8-3</i>	192
Unscramble	193
Scratch Projects	195
Shoot	195
<i>Try It Out 8-4</i>	197
Binary to Decimal Converter	198
<i>Try It Out 8-5</i>	199
<i>Try It Out 8-6</i>	201
Hangman	201
<i>Try It Out 8-7</i>	205
Fraction Tutor	206
<i>Try It Out 8-8</i>	210
Summary	210
Problems	211

Lists in Scratch	214
Creating Lists	214
<i>Try It Out 9-1</i>	216
List Commands	216
<i>Try It Out 9-2</i>	218
Bounds Checking	219
Dynamic Lists	220
Filling Lists with User Input	220
Creating a Bar Chart	221
<i>Try It Out 9-3</i>	224
Numerical Lists	224
Finding Min and Max	224
<i>Try It Out 9-4</i>	225
Finding the Average	225
<i>Try It Out 9-5</i>	226
Searching and Sorting Lists	226
Linear Search	226
Frequency of Occurrence	227
<i>Try It Out 9-6</i>	228
Bubble Sort	229
<i>Try It Out 9-7</i>	231
Finding the Median	231
Scratch Projects	232
The Poet	232
<i>Try It Out 9-8</i>	233
Quadrilateral Classification Game	234
<i>Try It Out 9-9</i>	235
Math Wizard	236
<i>Try It Out 9-10</i>	239
Flower Anatomy Quiz	239
Other Applications	240
<i>Try It Out 9-11</i>	241
Summary	241
Problems	242

APPENDIX**SHARING AND COLLABORATION**

Creating a Scratch Account	243
Using the Backpack	246
Creating Your Own Project	247
Starting a New Project	247
Remixing a Project	249
The Project Page	249
Sharing Your Project	250

INDEX