contents in detail

foreword: why LEGO matters, by Chris Anderson xv

introduction xvii
the NXT STEP blog xvii
who is this book for? xvii
about this book xviii
how to use this book xviii

PART I BEYOND THE BASICS

chapter 1 the LEGO MINDSTORMS NXT system 3
differences between the RIS and the NXT 3
the electronics 4
the building pieces 6
the programming language 6
conclusion 7

chapter 2 the grammar of NXT-G 9
is NXT-G a toy programming language? 9
where's the guidebook? 10
help is built in 10
help index 10
the basics: starting out 10
sequence beams 12
branching and sequences 12
blocks and structures 13
blocks 13
cloning blocks 13
loop and switch structures 13
tabbed view 14
keeping things neat 14
wires 14
comment tool 15
my blocks save time and simplify your programs 16
going with the flow: data dependency 17
matching wires and plugs 17
a deeper look at dependency 18
solutions using variables 19
using data dependency to your advantage 19
wiring into a wait: my blocks in action 19
a better way 20
cautions 20

chapter 3 NXT-G problems and solutions 21
the dreaded "mystery" broken wire 21
remove bad wires 21
running out of memory 22
stretching the memory 22
mini blocks 23
when to use a crowbar in programming 24
the crowbar 24
a bigger crowbar: the switch 24
removing the crowbar 24
variables: the scoop on scoping 25
local variables 25
global variables 25
all variables are global 25
the problem with global variables 25
solving the problem 25
the remarkable untouchable variable 26
an invitation to continue 26

chapter 4 debugging—when the unexpected occurs 27
care to comment? 27
waiting as a debugging tool 29
listen as you troubleshoot 31
look before you leap 32
summary 34

chapter 5 making sense of sensors 35
light sensor 35
block types 35
sound sensor 36
block types 36
what the sound sensor is not 38
touch sensor 38
block types 38
ultrasonic sensor 39
potential drawbacks 39
accessing the ultrasonic sensor 40
wait block 40
switch conditions 40
built-in sensors 41
data plug reference chart 42

chapter 6 design 45
taking inventory of available resources 45
taking inventory of smart parts 45
taking inventory of LEGO building parts 48
taking inventory of chassis types 49

design concept ... 50
brainstorming robotic tasks ... 50
design feasibility ... 50
hardware feasibility check ... 51
software feasibility check ... 51
prototyping and building techniques ... 51
testing and improvements ... 52
maintenance and repairs ... 52
the design cycle ... 52
worksheets ... 52
smart parts worksheet ... 53
smart part groups worksheet ... 54
building parts and assemblies worksheet ... 55
chassis types worksheet ... 56
task worksheet ... 57

chapter 7 bluetooth on the NXT ... 59
problems with the RCX IR connection ... 59
bluetooth as problem solver ... 60
making a connection: wireless introductions ... 60
time for a connection ... 60
connecting with a mac ... 61
connecting with a windows PC ... 62
after your device is paired ... 64
breaking the BT barrier: troubleshooting ... 64
networking with your peers: NXT-to-NXT communication ... 65
setting up an inter-NXT connection ... 66
communicating between NXTs ... 67
BT messaging under program control ... 67
receiving messages ... 67

chapter 8 NXT-to-NXT remote control ... 69
choosing a robot platform ... 69
defining a common language ... 70
defining a control system ... 70
programming the remote control ... 70
programming refinements ... 72
mailing out the result ... 73
the receiver ... 75
control issues ... 76
tuning the program ... 77
where do we go from here? ... 77
giving control back to the robot ... 78
adding brains to the vehicle ... 78
future directions: going beyond the book ... 79

PART II THE ROBOTS

chapter 9 RaSPy: a rock, scissors, paper–playing robot 83
building RaSPy 84
programming RaSPy 93

chapter 10 beach buggy chair: a ramblin' robot 101
building the beach buggy chair 102
seat back 103
front wheel hub 105
front 107
robot back 108
final assembly (including sensors) 110
programming the beach buggy chair 115
my blocks 115
putting the pieces together 120
troubleshooting tips 121
hints for further exploration 121
a final thought 121

chapter 11 3D PhotoBot: a 3D photo assistant robot 123
the art of three-dimensional photography 124
producing three-dimensional images 125
viewing your three-dimensional image 126
notes on using your 3D PhotoBot 126
building the 3D PhotoBot 127
subassembly 1 127
subassembly 2 128
subassembly 3 130
main assembly 132
programming the 3D PhotoBot 140

chapter 12 CraneBot: a grabber robot 143
grippers 143
the robotic arm 144
building CraneBot 145
building the gripper 145
building the arm 151
building the crane body 155
programming CraneBot 168
part 1 169
part 2 170
part 3 170
part 4 170

chapter 13 slot machine: a one-armed robot 171
what is a slot machine? 172
hardware challenges 172
the reels 172
the lever 172
the slot 172
the pay-off mechanism 173
the complete robot 173
building the slot machine 175
finishing up 222
adding symbols 222
connecting the motors and sensors 222
general program flow 223
the game controller 223
the game's result controller 224
programming the slot machine 224
the game controller 224
the game's result controller 229
running the programs 231
ideas for enhancing your robot 232

chapter 14 BenderBot: an anti-theory music robot 233
building BenderBot 234
wiring BenderBot 244
programming BenderBot 244
a program to start you off 244
additional programs to explore 246
learning more 248

chapter 15 ScanBot: an image-scanning robot 249
building ScanBot 250
NXT module 256
light sensor carriage 260
final model 265
programming ScanBot 267
defining the variables 267
the my blocks 268
increasing the threshold 273
displaying the updated threshold 274
deciding whether to scan the next row 282
using ScanBot 289
troubleshooting tips 289
above and beyond 289

chapter 16 marty: a performance art robot 291
design challenges 291
holding the pen 291
wheels 292

building marty ... 293
left motor subassembly ... 293
right motor subassembly ... 295
the two-wheeled chassis ... 298
pen grip ... 300
left rail ... 304
right rail ... 305
pen housing ... 307
putting it all together ... 311
programming marty ... 312
marty's first drawing ... 312
tweaking the program ... 313
marty's basic my block toolkit ... 313
marty gets into shape ... 319
mbPolygon ... 319
RandomPolygon ... 321
mbStar ... 322
RandomStar ... 323
mbZigzag ... 323
MegaRandom ... 325
SpiralStraight ... 327
SpiralCurve ... 328
where to next? ... 329
troubleshooting ... 329

appendix A differences between sets ... 331
why two? ... 331
what do they cost? ... 331
advantages of the retail version ... 331
advantages of the education version ... 332
which one? ... 333

appendix B trouble-free CAD installation guide ... 335
why use the CAD programs? ... 335
just how good could this freeware be? ... 335
what's the use? ... 336
step 1: download and install LDraw ... 336
step 2: download andinstall MLCad ... 336
step 3: download andinstall LdView ... 337
adding parts to the LDraw parts library ... 337
official parts ... 337
unofficial parts ... 337
parts library structure ... 337
conclusion ... 338

index ... 339