

Contents

1	Discovering Lisp	1
1.1	Introduction	1
1.2	Why Lisp?	1
1.3	A Short History on Lisp	4
1.4	The NewLisp Implementation	7
1.5	A Quick Start Using NewLisp	8
1.6	Using Variables	13
1.7	As a Summary	17
	References	17
2	Lists Everywhere	19
2.1	Introduction	19
2.2	Atoms and Lists	20
2.3	First and Rest	24
2.4	Building Lists	26
2.5	Some Geometry and then Some Art, Too	30
2.6	A World Full of Queues	38
2.7	Rotate, Extend and Flat	42
2.8	As a Summary	45
	References	48
3	Functions in Lisp	49
3.1	Introduction	49
3.2	Starting Functions with Three Simple Examples and then Came Map	50
3.3	Managing Lists with User Defined Functions	55
3.4	The Discovery of Conditional Structures	58
3.4.1	From Predicates to If-Then-Else Structures	58
3.4.2	A Note About Functional Programming	62

- 3.4.3 Robust Functions from the Use of Conditional Programming 64
- 3.4.4 Solving Multiple Conditions Without Using If 67
- 3.5 The Discovery of Loop Structures. 71
 - 3.5.1 While Computing 71
 - 3.5.2 Other Looping Structures 77
- 3.6 Recursion Is Based on Recursion 81
- 3.7 A Note on Lambda Expressions 87
- 3.8 As a Summary 89
- References 91
- 4 Lisp Programming.** 93
 - 4.1 Introduction 93
 - 4.2 From Montecarlo with Love 94
 - 4.2.1 Declaring Global Variables. 95
 - 4.2.2 Throwing the Ball and Checking Results 96
 - 4.2.3 Betting and Playing. 99
 - 4.2.4 Building a Simple User Interface 102
 - 4.2.5 Putting It All Together. 105
 - 4.3 Messier Was a French Astronomer 109
 - 4.3.1 Opening and Loading Databases in CSV Format. 111
 - 4.3.2 Querying the Database. 113
 - 4.3.3 Updating the Database. 115
 - 4.3.4 Modifying the Database. 116
 - 4.3.5 Filtering the Database 120
 - 4.3.6 Performing Simple Statistics. 122
 - 4.3.7 Saving the Database 123
 - 4.4 A Word on Function Design for This Chapter 125
 - 4.5 As a Summary 125
 - References 127
- 5 From Crisp Sets to Fuzzy Sets** 129
 - 5.1 Introduction 129
 - 5.2 A Review of Crisp (Classical) Sets 129
 - 5.2.1 Definition of Sets and the Concept of Belonging. 130
 - 5.2.2 Subsets 131
 - 5.2.3 Union, Intersection, Complement and Difference. 134
 - 5.2.4 Set Properties 139
 - 5.2.5 Cartesian Product and Relations 140
 - 5.3 Moving Towards Fuzzy Sets 143
 - 5.3.1 The “Fuzzy Sets” Paper. 144
 - 5.3.2 Union, Intersection and Complement of Fuzzy Sets. 149
 - 5.3.3 Fuzzy Sets Properties. 155
 - 5.3.4 Fuzzy Relations 158

5.4	Membership Degrees: An Example Application in Medicine.	161
5.5	As a Summary	166
	References	167
6	From Fuzzy Sets to Linguistic Variables.	169
6.1	Introduction	169
6.2	Towards Geometrical Characteristic Functions	170
6.3	From Geometry to FuzzyLisp	174
6.4	Support, Nucleus and Alpha-Cuts	180
6.5	Fuzzy Sets with Discrete Characteristic Functions	186
6.6	Revisiting Complement, Union and Intersection of Fuzzy Sets . . .	193
6.7	Fuzzy Numbers.	197
	6.7.1 Fuzzy Numbers Arithmetic.	198
	6.7.2 More Numerical Operations on Fuzzy Sets.	206
	6.7.3 Fuzzy Averaging.	209
6.8	Linguistic Variables.	212
6.9	Fuzzy Databases	220
6.10	As a Summary	225
	References	227
7	Fuzzy Logic.	229
7.1	Introduction	229
7.2	The Beginning of Logic.	230
7.3	Modern Bivalent Logic	231
7.4	Fuzzy Logic	234
7.5	Logical Connectives in Fuzzy Propositions.	236
7.6	Fuzzy Hedges.	242
7.7	Fuzzy Systems from Fuzzy Propositions	248
	7.7.1 Fuzzy Rule-Based Systems.	251
	7.7.2 Defuzzification	252
7.8	Modeling FRBS with FuzzyLisp.	258
7.9	Fuzzy Logic in Motor Racing: Scoring in Regularity Rallies	270
7.10	FRBS Using Fuzzy Sets with Discrete Membership Functions . . .	279
7.11	As a Summary	283
	References	287
8	Practical Projects Using FuzzyLisp.	289
8.1	Introduction	289
8.2	Landing the Eagle: Simulation and Fuzzy Control in Engineering	290
	8.2.1 Fuzzy Control.	294
	8.2.2 Controlling the Eagle.	296
	8.2.3 Interpreting Results	303
8.3	Double Stars in Astronomy: Speech Synthesis	306
	8.3.1 Generating Suitable Linguistic Variables	310
	8.3.2 Managing Linguistic Expressions	323

- 8.4 Spirometry Analysis in Medicine: Floating Singletons 330
 - 8.4.1 Introducing Floating Singletons. 332
 - 8.4.2 Modeling Pulmonary Obstruction with FuzzyLISP 334
- 8.5 As a Summary 344
- References 346

- Appendix A: NewLisp Versus Common Lisp 347**

- Appendix B: Glossary of FuzzyLisp Functions 353**



<http://www.springer.com/978-3-319-23185-3>

A Practical Introduction to Fuzzy Logic using LISP

Argüelles Méndez, L.

2016, XV, 370 p. 109 illus., 1 illus. in color., Hardcover

ISBN: 978-3-319-23185-3