

**LISP LORE: A GUIDE TO  
PROGRAMMING THE LISP MACHINE**

**SECOND EDITION**



# **LISP LORE: A GUIDE TO PROGRAMMING THE LISP MACHINE**

## **SECOND EDITION**

by

**Hank Bromley**  
AT&T Bell Laboratories

and

**Richard Lamson**  
Symbolics, Inc.



**KLUWER ACADEMIC PUBLISHERS**  
Boston/Dordrecht/Lancaster

**Distributors for North America:**

Kluwer Academic Publishers  
101 Philip Drive  
Assinippi Park  
Norwell, Massachusetts 02061, USA

**Distributors for the UK and Ireland:**

Kluwer Academic Publishers  
MTP Press Limited  
Falcon House, Queen Square  
Lancaster, LA1 1RN, UNITED KINGDOM

**Distributors for all other countries:**

Kluwer Academic Publishers Group  
Distribution Centre  
Post Office Box 322  
3300 AH Dordrecht, THE NETHERLANDS

*Consulting Editor: Tom M. Mitchell*

**Library of Congress Cataloging-in-Publication Data**

Bromley, Hank.  
Lisp lore.

Includes index.

1. LISP (Computer program language) I. Lamson,  
Richard. II. Title.  
QA76.73.L23B75 1987 005.13 '3 87-3639  
ISBN 0-89838-228-9

The Lexical Scoping example on page 52 is quoted from *Symbolics Common Lisp: Language Concepts*,  
Copyright © 1986 by Symbolics, Inc. Reprinted by permission.

Definitions from *The Hacker's Dictionary* Copyright © 1983 by Guy L. Steele. Reprinted by permission.

**Copyright © 1987 by Kluwer Academic Publishers**

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher, Kluwer Academic Publishers, 101 Philip Drive, Assinippi Park, Norwell, MA 02061.

Text masters produced on Symbolics 3600<sup>TM</sup>-family computers and printed on Symbolics LGP2 Laser Graphics Printers.

Printed in the United States of America.

# Table of Contents

	Page
<b>Preface to the First Edition</b>	<b>xiii</b>
<b>Preface to the Second Edition</b>	<b>xvii</b>
<b>1. Introduction</b>	<b>1</b>
<b>2. Getting Started on the Lisp Machine</b>	<b>7</b>
2.1 Why Use a Lisp Machine?	7
2.1.1 Why This Book?	8
2.1.2 Looking Ahead	9
2.2 The Keyboard	11
2.3 Typing to a Lisp Listener	13
2.4 Getting Around the Environment	15
2.5 The Mouse	17
2.5.1 The System Menu	18
2.6 The Monitor	19
2.7 The Editor	21
2.8 The Compiler and the Debugger	23
2.9 Getting Started	24
2.9.1 Bringing the Machine up	25
2.9.2 Logging in	27
2.10 A Word About Work Style	30
2.11 This and That	31
2.11.1 Problem Reporting	31
2.11.2 Backup	32
2.12 Problem Set #1	33
<b>3. Flow of Control</b>	<b>37</b>

---

3.1	Conditionals	37
3.2	Blocks and Exits	40
3.3	Nonlocal Exits	41
3.4	Iteration	42
3.4.1	Mapping	44
3.4.2	Do	45
3.4.3	Loop	47
3.4.4	Implicit Iteration	51
3.5	Lexical Scoping	52
3.6	Macros	53
3.7	Unwind-protect	55
3.8	Fun and Games	57
3.9	Problem Set	58
<b>4.</b>	<b>More on Navigating the Lisp Machine</b>	<b>67</b>
4.1	The Scheduler and Processes	67
4.2	Windows	73
4.3	Debugging	80
4.4	The Input Editor and Histories	83
4.5	Mouse Sensitivity	86
4.6	Poking Around	90
4.7	Fun and Games	92
4.8	Problem Set	94
<b>5.</b>	<b>What's a Flavor?</b>	<b>97</b>
5.1	Instance Variables	98
5.2	Methods	99
5.3	Making Instances	101
5.4	Initial Values for Instance Variables	102
5.5	Methods for <b>Make-instance</b>	105
5.6	Mixing Flavors	105
5.7	Combined Methods	108
5.8	Whoppers	111

---

5.9	Internal Interfaces	115
5.10	Vanilla Flavor	115
5.11	The Flavor Examiner Tools	116
5.12	Message Passing	117
5.13	The Window System	120
5.14	Fun and Games	121
5.15	Problem Set	122
<b>6.</b>	<b>User Interface</b>	<b>131</b>
6.1	Program Frameworks: an Overview	132
6.2	Defining Commands	135
6.3	The Redisplay	137
6.4	Presentation Types	138
6.5	Mouse Sensitivity	141
6.5.1	Mouse Sensitivity – the Easy Part	142
6.5.2	Mouse Gesture Translations	144
6.6	Fun and Games	147
<b>7.</b>	<b>The Graph Example</b>	<b>149</b>
7.1	The Nodes and Arcs	150
7.2	The Presentation Types	154
7.3	The Display	155
7.4	The Commands	157
7.5	The Mouse Gesture Translators	157
7.6	The Program	159
7.7	Problem Set	169
<b>8.</b>	<b>Streams and Files</b>	<b>173</b>
8.1	Streams	174
8.1.1	Standard Stream Operations	175
8.1.2	Special-purpose Operations	177
8.1.3	Standard Streams	179
8.2	Accessing Files and Directories	180

---

8.2.1	Open and Other Functions for Operating on Files	181
8.2.2	Directories	184
8.3	Pathnames	184
8.3.1	Component Values	187
8.3.2	Case in Pathnames	189
8.3.3	Defaults and Merging	190
8.3.4	Pathname Functions and Methods	191
8.3.5	Logical Pathnames	195
8.4	Making Other I/O Streams	198
8.5	Fun and Games	199
8.6	Problem Set	201
<b>9.</b>	<b>The Calculator Example</b>	<b>205</b>
9.1	The Program Frame	205
9.2	The Redisplay	207
9.3	The Command-definition Macrology	209
9.4	The Program	210
9.5	Fun and Games	214
<b>10.</b>	<b>Systems, Storage and Errors</b>	<b>217</b>
10.1	Systems	217
10.1.1	Defining a System	218
10.1.2	Compiling and Loading Systems	221
10.1.3	Patching a System	222
10.2	Storage Allocation	224
10.2.1	Allocation and the Garbage Collector	224
10.2.2	Areas	226
10.2.3	Resources	227
10.2.4	Stack Allocation	231
10.3	Condition Handling	233
10.3.1	Signalling Conditions	234
10.3.2	Handling Conditions	235



---

10.3.3	Creating New Condition Flavors	236
10.3.4	Restart Handlers	237
10.3.5	Proceeding	238
10.3.6	A Few Examples	239
10.4	Fun and Games	243
<b>11.</b>	<b>The Card Game Example</b>	<b>245</b>
11.1	Card Definitions	246
11.2	Presentation Types	248
11.3	Card Places	249
11.3.1	Basic Places	249
11.3.2	Presentation	250
11.3.3	Caching	251
11.3.4	Stacked Places	251
11.4	The Interactive Program	252
11.4.1	Games	253
11.4.2	Place Display	255
11.5	The Program	256
11.6	Problem Set	278
11.7	Fun and Games	278
<b>12.</b>	<b>More Advanced Use of the Editor</b>	<b>279</b>
12.1	Keyboard Macros	280
12.2	Writing New Commands	282
12.2.1	Zwei Data Structure	282
12.2.2	Command Tables and Command Definition	286
12.2.3	Reading From the Mini-buffer	289
12.2.4	A Real Example	290
12.3	Learning More About the Editor	290
12.4	Fun and Games	291
12.5	Problem Set	292

<b>13. A Quick Look At the Network</b>	<b>299</b>
13.1 The Gee-whiz Look	299
13.1.1 What is a Network?	300
13.1.2 Levels of Abstraction	302
13.2 The Generic Network System	305
13.2.1 How Does Path-finding Work?	306
13.2.2 How Does Service Invocation Work?	307
13.2.3 Other GNS Functions	307
13.3 The Namespace System	308
13.4 Examples of the Use of the Generic Network System	310
13.4.1 Time of Day	310
13.4.2 Who's Logged in	311
13.4.3 Mail Delivery	311
13.5 Writing Your Own Network Software	314
13.5.1 Writing Your Own User End	317
13.5.2 Writing Your Own Server End	317
13.5.3 Sample User and Server Definition	318
<b>APPENDIX A. Basic Zmacs Commands</b>	<b>325</b>
<b>Index</b>	<b>331</b>

## List of Figures

Figure 1.	Transitions among window states	76
Figure 2.	Flavor inheritance hierarchy for <b>si:indirect-escape-input-stream</b> .	107
Figure 3.	Structure of combined method	114
Figure 4.	Grapher program display window	151
Figure 5.	A Sample SYS:SITE;SYS.TRANSLATIONS	197
Figure 6.	Calculator program display window	206
Figure 7.	Card game program display window	247
Figure 8.	Standard medium and protocol for <i>Alert Farmers</i> .	302
Figure 9.	All possible implementations of <i>Alert Farmers</i> .	303



## Preface to the First Edition

This book had its genesis in the following piece of computer mail:

From allegra!joan-b Tue Dec 18 09:15:54 1984  
To: sola!hjb  
Subject: lisp

Hank, I've been talking with Mark Plotnik and Bill Gale about asking you to conduct a basic course on using the lisp machine. Mark, for instance, would really like to cover basics like the flavor system, etc., so he could start doing his own programming without a lot of trial and error, and Bill and I would be interested in this, too. I'm quite sure that Mark Jones, Bruce, Eric and Van would also be really interested. Would you like to do it? Bill has let me know that if you'd care to set something up, he's free to meet with us anytime this week or next (although I'll only be here on Wed. next week) so we can come up with a plan. What do you think?

Joan.

(All the people and computers mentioned above work at AT&T Bell Laboratories, in Murray Hill, New Jersey.) I agreed, with some trepidation, to try teaching such a course. It wasn't clear how I was going to explain the Lisp Machine environment to a few dozen beginners when at the time I felt I was scarcely able to keep *myself* afloat. Particularly since many of the "beginners" had PhD's in computer science and a decade or two of programming experience. But the need was apparent, and it sounded like fun to try, so we had a few planning sessions and began class the next month.

From early January through late March we met once a week, about a dozen times in all, generally choosing the topic for each session at the conclusion of the previous one. I spent the last few days before each meeting throwing together lecture notes and a problem set (typically finishing shortly *after* the announced class time). By the end of the course, the students had attained varying levels of expertise. In all likelihood, the person who learned the most was the instructor; nothing provides motivation to figure something out like having committed oneself to talking about it.

After it was over, another co-worker saw the sizable pile of handouts I had generated and proposed that it would make a good book. He offered to contact a publisher he had recently dealt with. I was at first skeptical that the informal notes I had hurriedly concocted would interest a reputable academic publisher, but after taking another look at the materials that had sprouted, and discussing the matter, we agreed that quite a few people would find them valuable. I've spent the last few months filling out and cleaning up the pile, and Presto, change-o. My "set of handouts" is "a book."

---

There are a number of people who have, in one way or another, consciously or otherwise, helped create this book. Ken Church was instrumental in arranging my first experience using the Lisp Machine, and later was responsible for bringing me to Bell Labs. He also taught a course here, before I came, which laid some of the groundwork for my own course. Eva Ejerhed, in a rare act of faith, hired me to work on a Lisp Machine thousands of miles from the nearest expert assistance, without my having ever touched one. Joan Bachenko and Bill Gale first suggested I teach a course at the Labs. Many of my colleagues who served as experimental subjects by participating in one of the three trials of the course provided useful comments on the class handouts; among those whose contributions I particularly recall are Mark Liberman, Jeff Gelbard and Doug Stumberger. Ted Kowalski first broached the idea of making a book from the handouts, and also – with Sharon Murrel – supplied lots of assistance with the use of their *Monk* text formatting system. Wayne Wolf suggested improvements to my coverage of managing multiple processes. Jon Balgley, of Symbolics, Inc.,<sup>1</sup> wrote a helpful review of one version of the manuscript. Valerie Barr introduced herself to the Lisp Machine by actually working through an entire draft, making a great many valuable observations along the way. Mitch Marcus and Osamu Fujimura, my supervision at the Labs, were most understanding about the amount of time I put into this project. Carl Harris was an obliging and patient Publisher. Finally, Symbolics, Inc. graciously allowed me to quote extensively from their copyrighted materials, and Sheryl Avruch of Symbolics made possible the distribution of a tape to accompany this book.

---

<sup>1</sup>Symbolics, Symbolics 3600, Symbolics 3640, Symbolics 3670, and Document Examiner are trademarks of Symbolics, Inc. Zetalisp(r) is a registered trademark of Symbolics, Inc.

I would like to hear about any problems readers have while working their way through the text. Please don't hesitate to mail me any of your comments or suggestions.

Hank Bromley

December, 1985

computer mail:

US mail:<sup>2</sup>

hjb@mit-mc (arpa)  
alice  
research } !sola!hjb (uucp)  
allegra

AT&T Bell Laboratories  
room 2D-410  
600 Mountain Avenue  
Murray Hill, NJ 07974

---

<sup>2</sup>As of September, 1986, Hank is no longer working for AT&T. His new address is:

Hank Bromley  
Martha's Coop  
225 Lake Lawn Place  
Madison, WI 53703



## Preface to the Second Edition

I received my copy of *Lisp Lore* back in July directly from Hank; we had met at a course taught by Symbolics in Cambridge and he had mentioned it to me. Immediately, I recognized its value. Unfortunately, much of it was soon to be made obsolete by the issuance of Release 7.0, which was scheduled for a little over two months after its publication. I wished I had had time to review it before publication.

Two days later, I received a copy of the following piece of computer mail:

```
From: hjb.sola%bt1.csnet@CSNET-RELAY.ARPA
Date: Mon 21 Jul EDT 1986 18:51
To: SLUG@R20.UTEXAS.EDU
Subject: masochist, I mean writer, needed
```

The publisher of my book ("Lisp Lore: A Guide to Programming the Lisp Machine") would like to do a revised-for-Release-7 version. I don't have the time to do the revision. If you or anyone you know might be interested, have them call me (201/582-4377), or send me mail, or call Carl Harris at Kluwer Academic Publishers (617/871-6300).

Well, here it is, months later, and I'm getting my "wish." I hope this edition is as valuable as I found the first. I've certainly had fun writing it.

An enormous number of people have contributed to my ability to get this work done. First, of course, Hank Bromley, who turned his manuscript over to me, both emotionally and electronically. A number of my colleagues at Symbolics have read the various drafts and commented quite helpfully: Muffy Barkocy (who also drew the card font for the solitaire program), Lois Wolf, Carmen Silva, Debbie Ward, Robert ("BigBob") Westcott, Jon Balgley and Allan Wechsler. Thom Whitaker greatly aided my efforts to make Scribe make the book printable. My managers during this project, Larry Rostetter and Jim O'Donnell, were extraordinarily supportive. And my family and loved ones, especially Joan Freedman, have given me encouragement and massages when all else failed.

I would certainly like to hear about problems you have while reading this book and its accompanying examples. Please don't hesitate to send me comments or suggestions. I imagine there will be later editions as this one becomes obsolete.

By the way, you might be slightly confused by the fact that both Hank and I wrote sections of this book in first person. I've adapted as much of Hank's text as possible, including all his "I"'s. However, I did write the following chapters from scratch: 6, 9, 10, 11 and 13. Most of the other chapters have had a pretty substantial updating.

Richard Lamson

November, 1986

computer mail:

US mail:

rsl@Symbolics.ARPA  
rsl@E.SCRC.Symbolics.COM

Symbolics, Inc.  
25 Van Ness Blvd.  
San Francisco, Calif 94102

