

GNU Octave

A high-level interactive language for numerical computations
Octave version 2.0.17 (stable)

John W. Eaton

Table of Contents

Publisher's Preface	1
Author's Preface	3
Acknowledgements	3
How You Can Contribute to Octave	5
Distribution	6
1 A Brief Introduction to Octave	7
1.1 Running Octave	7
1.2 Simple Examples	7
Creating a Matrix	7
Matrix Arithmetic	8
Solving Linear Equations	8
Integrating Differential Equations	8
Producing Graphical Output	9
Editing What You Have Typed	10
Getting Help	11
1.3 Conventions	11
1.3.1 Fonts	11
1.3.2 Evaluation Notation	12
1.3.3 Printing Notation	12
1.3.4 Error Messages	12
1.3.5 Format of Descriptions	13
1.3.5.1 A Sample Function Description	13
1.3.5.2 A Sample Command Description ...	14
1.3.5.3 A Sample Variable Description	14
2 Getting Started	17
2.1 Invoking Octave	17
2.1.1 Command Line Options	17
2.1.2 Startup Files	20
2.2 Quitting Octave	21
2.3 Commands for Getting Help	22
2.4 Command Line Editing	23
2.4.1 Cursor Motion	23
2.4.2 Killing and Yanking	24
2.4.3 Commands For Changing Text	25
2.4.4 Letting Readline Type For You	25

2.4.5	Commands For Manipulating The History ...	26
2.4.6	Customizing the Prompt	28
2.4.7	Diary and Echo Commands	30
2.5	How Octave Reports Errors	31
2.6	Executable Octave Programs	32
2.7	Comments in Octave Programs	33
3	Data Types	35
3.1	Built-in Data Types	35
3.1.1	Numeric Objects	35
3.1.2	String Objects	35
3.1.3	Data Structure Objects	36
3.2	User-defined Data Types	36
3.3	Object Sizes	36
4	Numeric Data Types	39
4.1	Matrices	39
4.1.1	Empty Matrices	43
4.2	Ranges	45
4.3	Predicates for Numeric Objects	45
5	Strings	47
5.1	Creating Strings	48
5.2	Searching and Replacing	49
5.3	String Conversions	50
5.4	Character Class Functions	52
6	Data Structures	55
7	Variables	59
7.1	Global Variables	59
7.2	Status of Variables	61
7.3	Summary of Built-in Variables	63
7.4	Defaults from the Environment	68

8	Expressions	71
8.1	Index Expressions	71
8.2	Calling Functions	74
8.2.1	Call by Value	75
8.2.2	Recursion	76
8.3	Arithmetic Operators	76
8.4	Comparison Operators	78
8.5	Boolean Expressions	79
8.5.1	Element-by-element Boolean Operators	79
8.5.2	Short-circuit Boolean Operators	80
8.6	Assignment Expressions	81
8.7	Increment Operators	83
8.8	Operator Precedence	84
9	Evaluation	87
10	Statements	89
10.1	The if Statement	89
10.2	The switch Statement	92
10.3	The while Statement	93
10.4	The for Statement	94
10.4.1	Looping Over Structure Elements	95
10.5	The break Statement	96
10.6	The continue Statement	97
10.7	The unwind_protect Statement	98
10.8	The try Statement	99
10.9	Continuation Lines	99
11	Functions and Script Files	101
11.1	Defining Functions	101
11.2	Multiple Return Values	104
11.3	Variable-length Argument Lists	106
11.4	Variable-length Return Lists	107
11.5	Returning From a Function	108
11.6	Function Files	109
11.7	Script Files	111
11.8	Dynamically Linked Functions	113
11.9	Organization of Functions Distributed with Octave	117
12	Error Handling	119

13	Input and Output	123
13.1	Basic Input and Output	124
13.1.1	Terminal Output	124
13.1.2	Terminal Input	126
13.1.3	Simple File I/O	128
13.2	C-Style I/O Functions	130
13.2.1	Opening and Closing Files	131
13.2.2	Simple Output	132
13.2.3	Line-Oriented Input	132
13.2.4	Formatted Output	133
13.2.5	Output Conversion for Matrices	134
13.2.6	Output Conversion Syntax	134
13.2.7	Table of Output Conversions	136
13.2.8	Integer Conversions	137
13.2.9	Floating-Point Conversions	137
13.2.10	Other Output Conversions	138
13.2.11	Formatted Input	139
13.2.12	Input Conversion Syntax	140
13.2.13	Table of Input Conversions	141
13.2.14	Numeric Input Conversions	142
13.2.15	String Input Conversions	143
13.2.16	Binary I/O	143
13.2.17	Temporary Files	145
13.2.18	End of File and Errors	145
13.2.19	File Positioning	146
14	Plotting	149
14.1	Two-Dimensional Plotting	149
14.2	Specialized Two-Dimensional Plots	155
14.3	Three-Dimensional Plotting	157
14.4	Plot Annotations	159
14.5	Multiple Plots on One Page	159
15	Matrix Manipulation	163
15.1	Finding Elements and Checking Conditions	163
15.2	Rearranging Matrices	165
15.3	Special Utility Matrices	168
15.4	Famous Matrices	171

16	Arithmetic	173
	16.1 Utility Functions	173
	16.2 Complex Arithmetic	175
	16.3 Trigonometry	176
	16.4 Sums and Products	177
	16.5 Special Functions	178
	16.6 Mathematical Constants	180
17	Linear Algebra	183
	17.1 Basic Matrix Functions	183
	17.2 Matrix Factorizations	186
	17.3 Functions of a Matrix	189
18	Nonlinear Equations	191
19	Quadrature	193
	19.1 Functions of One Variable	193
	19.2 Orthogonal Collocation	194
20	Differential Equations	195
	20.1 Ordinary Differential Equations	195
	20.2 Differential-Algebraic Equations	196
21	Optimization	199
	21.1 Quadratic Programming	199
	21.2 Nonlinear Programming	199
	21.3 Linear Least Squares	199
22	Statistics	201
23	Sets	203
24	Polynomial Manipulations	205
25	Control Theory	209
26	Signal Processing	215

27	Image Processing	219
28	Audio Processing	223
29	System Utilities	225
	29.1 Timing Utilities	225
	29.2 Filesystem Utilities	231
	29.3 Controlling Subprocesses	234
	29.4 Process, Group, and User IDs	238
	29.5 Environment Variables	239
	29.6 Current Working Directory	239
	29.7 Password Database Functions	240
	29.8 Group Database Functions	241
	29.9 System Information	241
	Appendix A Tips and Standards	245
	A.1 Writing Clean Octave Programs	245
	A.2 Tips for Making Code Run Faster	245
	A.3 Tips for Documentation Strings	246
	A.4 Tips on Writing Comments	247
	A.5 Conventional Headers for Octave Functions	248
	Appendix B Known Causes of Trouble	
	251
	B.1 Actual Bugs We Haven't Fixed Yet	251
	B.2 Reporting Bugs	252
	B.3 Have You Found a Bug?	252
	B.4 Where to Report Bugs	253
	B.5 How to Report Bugs	253
	B.6 Sending Patches for Octave	256
	B.7 How To Get Help with Octave	257
	Appendix C Installing Octave	259
	C.1 Notes	262
	C.2 Installation Problems	262
	C.3 Binary Distributions	266
	C.3.1 Installing Octave from a Binary Distribution	
	266
	C.3.2 Creating a Binary Distribution	267

Appendix D	Emacs Octave Support . . .	269
D.1	Installing EOS	269
D.2	Using Octave Mode	269
D.3	Running Octave From Within Emacs	274
D.4	Using the Emacs Info Reader for Octave	276
30	Grammar	279
30.1	Keywords	279
Appendix E	GNU GENERAL PUBLIC	
	LICENSE	281
E.1	Preamble	281
E.2	TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION	282
E.3	Appendix: How to Apply These Terms to Your New Programs	288
	Other books from the publisher	291
	Variable Index	295
	Operator Index	299
	Function Index	301
	Concept Index	307