
Table of Contents

List of Figures	xi
List of Tables	xvii
Preface	xxi

Chapter 1

MATLAB® Basics

1.1 Desktop Environment	1
1.2 Getting Help and Other Documentation	4
1.3 Data Import and Export	6
1.3.1 Data I/O via the Command Line	6
1.3.2 The Import Wizard	8
1.3.3 Examples of Data I/O in MATLAB®	8
1.3.4 Data I/O with the Statistics Toolbox	11
1.3.5 More Functions for Data I/O	13
1.4 Data in MATLAB®	14
1.4.1 Data Objects in Base MATLAB®	14
1.4.2 Accessing Data Elements	20
1.4.3 Examples of Joining Data Sets	22
1.4.4 Data Types in the Statistics Toolbox	24
1.4.5 Object-Oriented Programming	25
1.5 Miscellaneous Topics	27
1.5.1 File and Workspace Management	27
1.5.2 Punctuation in MATLAB®	27
1.5.3 Arithmetic Operators	29
1.5.4 Functions in MATLAB®	30
1.6 Summary and Further Reading	32

Chapter 2

Visualizing Data

2.1 Basic Plot Functions	35
2.1.1 Plotting 2-D Data	35
2.1.2 Plotting 3-D Data	39
2.1.3 Examples	40

2.2 Scatter Plots	42
2.2.1 Basic 2-D and 3-D Scatter Plots	43
2.2.2 Scatter Plot Matrix	44
2.2.3 Examples	44
2.3 GUIs for Graphics	45
2.3.1 Simple Plot Editing	47
2.3.2 Plotting Tools Interface	48
2.3.3 PLOTS Tab	49
2.4 Summary and Further Reading	51

Chapter 3

Descriptive Statistics

3.1 Measures of Location	53
3.1.1 Means, Medians, and Modes	54
3.1.2 Examples	55
3.2 Measures of Dispersion	56
3.2.1 Range	57
3.2.2 Variance and Standard Deviation	58
3.2.3 Covariance and Correlation	58
3.2.4 Examples	59
3.3 Describing the Distribution	62
3.3.1 Quantiles	62
3.3.2 Interquartile Range	63
3.3.3 Skewness	63
3.3.4 Examples	65
3.4 Visualizing the Data Distribution	66
3.4.1 Histograms	66
3.4.2 Probability Plots	67
3.4.3 Boxplots	68
3.4.4 Examples	69
3.5 Summary and Further Reading	72

Chapter 4

Probability Distributions

4.1 Distributions in MATLAB®	77
4.1.1 Continuous Distributions	78
4.1.2 Discrete Distributions	80
4.1.3 Probability Distribution Objects	81
4.1.4 Other Distributions	83
4.1.5 Examples of Probability Distributions in MATLAB®	87
4.1.6 disttool for Exploring Probability Distributions	91
4.2 Parameter Estimation	94
4.2.1 Command Line Functions	94
4.2.2 Examples of Parameter Estimation	95
4.2.3 dfittool for Interactive Fitting	100

4.3 Generating Random Numbers	105
4.3.1 Generating Random Variables in Base MATLAB®	105
4.3.2 Generating Random Variables with the Statistics Toolbox	106
4.3.3 Examples of Random Number Generation	107
4.3.4 randtool for Generating Random Variables	111
4.4 Summary and Further Reading	112

Chapter 5

Hypothesis Testing

5.1 Basic Concepts	115
5.1.1 Hypothesis Testing	116
5.1.2 Confidence Intervals	118
5.2 Common Hypothesis Tests	119
5.2.1 The z-Test and t-Test	119
5.2.2 Examples of Hypothesis Tests	122
5.3 Confidence Intervals Using Bootstrap Resampling	129
5.3.1 The Basic Bootstrap	129
5.3.2 Examples	130
5.4 Analysis of Variance	133
5.4.1 One-Way ANOVA	134
5.4.2 ANOVA Example	137
5.5 Summary and Further Reading	140

Chapter 6

Model-Building with Regression Analysis

6.1 Introduction to Linear Models	143
6.1.1 Specifying Models	144
6.1.2 The Least Squares Approach for Estimation	145
6.1.3 Assessing Model Estimates	147
6.2 Model-Building Functions in Base MATLAB®	148
6.2.1 Fitting Polynomials	149
6.2.2 Using the Division Operators	153
6.2.3 Ordinary Least Squares	155
6.3 Functions in the Statistics Toolbox	157
6.3.1 Using regress for Regression Analysis	159
6.3.2 Using regstats for Regression Analysis	160
6.3.3 The Linear Regression Model Class	164
6.3.4 Assessing Model Fit	168

6.4 Basic Fitting GUI	176
6.5 Summary and Further Reading	180

Chapter 7

Multivariate Analysis

7.1 Principal Component Analysis	183
7.1.1 Functions for PCA in Base MATLAB®	186
7.1.2 Functions for PCA in the Statistics Toolbox	190
7.1.3 Biplots	194
7.2 Multidimensional Scaling—MDS	194
7.2.1 Measuring Distance	196
7.2.2 Classical MDS	198
7.2.3 Metric MDS	200
7.2.4 Nonmetric MDS	203
7.3 Visualization in Higher Dimensions	209
7.3.1 Scatter Plot Matrix	210
7.3.2 Parallel Coordinate Plots	215
7.3.3 Andrews Curves	216
7.4 Summary and Further Reading	219

Chapter 8

Classification and Clustering

8.1 Supervised Learning or Classification	221
8.1.1 Bayes Decision Theory	222
8.1.2 Discriminant Analysis	224
8.1.3 Naive Bayes Classifiers	228
8.1.4 Nearest Neighbor Classifier	230
8.2 Unsupervised Learning or Cluster Analysis	233
8.2.1 Hierarchical Clustering	234
8.2.2 K-Means Clustering	241
8.3 Summary and Further Reading	249

References	253
------------------	-----

Index of MATLAB® Functions	257
----------------------------------	-----

Subject Index	261
---------------------	-----