



Learning SAS by Example

A Programmer's Guide

Ron Cody

The correct bibliographic citation for this manual is as follows: Cody, Ron. 2007. *Learning SAS® by Example: A Programmer's Guide*. Cary, NC: SAS Institute Inc.

Learning SAS® by Example: A Programmer's Guide

Copyright © 2007, SAS Institute Inc., Cary, NC, USA

ISBN 978-1-59994-165-3

All rights reserved. Produced in the United States of America.

Contents

List of Programs xv

Preface xxix

Acknowledgments xxxi

Part 1 Getting Started 1

Chapter 1 What Is SAS? 3

- 1.1 Introduction 3
- 1.2 Getting Data into SAS 4
- 1.3 A Sample SAS Program 4
- 1.4 SAS Names 7
- 1.5 SAS Data Sets and SAS Data Types 8
- 1.6 The SAS Display Manager and SAS Enterprise Guide 9
- 1.7 Problems 9

Chapter 2 Writing Your First SAS Program 11

- 2.1 A Simple Program to Read Raw Data and Produce a Report 11
- 2.2 Enhancing the Program 18
- 2.3 More on Comment Statements 20
- 2.4 How SAS Works (a Look Inside the “Black Box”) 22
- 2.5 Problems 25

Part 2 DATA Step Processing 27

Chapter 3 Reading Raw Data from External Files 29

- 3.1 Introduction 30
- 3.2 Reading Data Values Separated by Blanks 30
- 3.3 Specifying Missing Values with List Input 32
- 3.4 Reading Data Values Separated by Commas (CSV Files) 33
- 3.5 Using an Alternative Method to Specify an External File 34

- 3.6 Reading Data Values Separated by Delimiters Other Than Blanks or Commas 34
- 3.7 Placing Data Lines Directly in Your Program (the DATALINES Statement) 36
- 3.8 Specifying INFILE Options with the DATALINES Statement 37
- 3.9 Reading Raw Data from Fixed Columns—Method 1: Column Input 37
- 3.10 Reading Raw Data from Fixed Columns—Method 2: Formatted Input 39
- 3.11 Using a FORMAT Statement in a DATA Step versus in a Procedure 43
- 3.12 Using Informats with List Input 43
- 3.13 Supplying an INFORMAT Statement with List Input 45
- 3.14 Using List Input with Embedded Delimiters 46
- 3.15 Problems 47

Chapter 4 Creating Permanent SAS Data Sets 53

- 4.1 Introduction 54
- 4.2 SAS Libraries—The LIBNAME Statement 54
- 4.3 Why Create Permanent SAS Data Sets? 55
- 4.4 Examining the Descriptor Portion of a SAS Data Set Using PROC CONTENTS 56
- 4.5 Listing All the SAS Data Sets in a SAS Library Using PROC CONTENTS 59
- 4.6 Viewing the Descriptor Portion of a SAS Data Set Using the SAS Explorer 60
- 4.7 Viewing the Data Portion of a SAS Data Set Using PROC PRINT 63
- 4.8 Viewing the Data Portion of a SAS Data Set Using the SAS VIEWTABLE Window 64
- 4.9 Using a SAS Data Set as Input to a DATA Step 65
- 4.10 DATA_NULL_: A Data Set That Isn't 67
- 4.11 Problems 68

Chapter 5	Creating Formats and Labels	71
5.1	Adding Labels to Your Variables	71
5.2	Using Formats to Enhance Your Output	73
5.3	Regrouping Values Using Formats	76
5.4	More on Format Ranges	78
5.5	Storing Your Formats in a Format Library	79
5.6	Permanent Data Set Attributes	80
5.7	Accessing a Permanent SAS Data Set with User-Defined Formats	82
5.8	Displaying Your Format Definitions	83
5.9	Problems	84
Chapter 6	Reading and Writing Data from an Excel Spreadsheet	87
6.1	Introduction	87
6.2	Using the Import Wizard to Convert a Spreadsheet to a SAS Data Set	88
6.3	Creating an Excel Spreadsheet from a SAS Data Set	93
6.4	Using an Engine to Read an Excel Spreadsheet	95
6.5	Using the SAS Output Delivery System to Convert a SAS Data Set to an Excel Spreadsheet	96
6.6	Problems	98
Chapter 7	Performing Conditional Processing	101
7.1	Introduction	102
7.2	The IF and ELSE IF Statements	102
7.3	The Subsetting IF Statement	105
7.4	The IN Operator	107
7.5	Using a SELECT Statement for Logical Tests	108
7.6	Using Boolean Logic (AND, OR, and NOT Operators)	109
7.7	A Caution When Using Multiple OR Operators	111
7.8	The WHERE Statement	112
7.9	Some Useful WHERE Operators	113
7.10	Problems	114

Chapter 8 Performing Iterative Processing: Looping 117

- 8.1 Introduction 117
- 8.2 DO Groups 118
- 8.3 The Sum Statement 120
- 8.4 The Iterative DO Loop 125
- 8.5 Other Forms of an Iterative DO Loop 129
- 8.6 DO WHILE and DO UNTIL Statements 131
- 8.7 A Caution When Using DO UNTIL Statements 134
- 8.8 LEAVE and CONTINUE Statements 135
- 8.9 Problems 137

Chapter 9 Working with Dates 141

- 9.1 Introduction 142
- 9.2 How SAS Stores Dates 142
- 9.3 Reading Date Values from Raw Data 143
- 9.4 Computing the Number of Years between Two Dates 146
- 9.5 Demonstrating a Date Constant 147
- 9.6 Computing the Current Date 148
- 9.7 Extracting the Day of the Week, Day of the Month, Month, and Year from a SAS Date 149
- 9.8 Creating a SAS Date from Month, Day, and Year Values 150
- 9.9 Substituting the 15th of the Month when the Day Value Is Missing 151
- 9.10 Using Date Interval Functions 152
- 9.11 Problems 157

Chapter 10 Subsetting and Combining SAS Data Sets 161

- 10.1 Introduction 162
- 10.2 Subsetting a SAS Data Set 162
- 10.3 Creating More Than One Subset Data Set in One DATA Step 163
- 10.4 Adding Observations to a SAS Data Set 164
- 10.5 Interleaving Data Sets 167
- 10.6 Combining Detail and Summary Data 168

- 10.7 Merging Two Data Sets 170
- 10.8 Omitting the BY Statement in a Merge 172
- 10.9 Controlling Observations in a Merged Data Set 173
- 10.10 More Uses for IN= Variables 175
- 10.11 When Does a DATA Step End? 176
- 10.12 Merging Two Data Sets with Different BY Variable Names 177
- 10.13 Merging Two Data Sets with Different BY Variable Data Types 179
- 10.14 One-to-One, One-to-Many, and Many-to-Many Merges 181
- 10.15 Updating a Master File from a Transaction File 183
- 10.16 Problems 185

Chapter 11 Working with Numeric Functions 189

- 11.1 Introduction 190
- 11.2 Functions That Round and Truncate Numeric Values 190
- 11.3 Functions That Work with Missing Values 192
- 11.4 Setting Character and Numeric Values to Missing 193
- 11.5 Descriptive Statistics Functions 194
- 11.6 Computing Sums within an Observation 196
- 11.7 Mathematical Functions 197
- 11.8 Computing Some Useful Constants 198
- 11.9 Generating Random Numbers 199
- 11.10 Special Functions 201
- 11.11 Functions That Return Values from Previous Observations 204
- 11.12 Problems 207

Chapter 12 Working with Character Functions 211

- 12.1 Introduction 212
- 12.2 Determining the Length of a Character Value 212
- 12.3 Changing the Case of Characters 213
- 12.4 Removing Characters from Strings 214
- 12.5 Joining Two or More Strings Together 215
- 12.6 Removing Leading or Trailing Blanks 217

- 12.7 Using the COMPRESS Function to Remove Characters from a String 218
- 12.8 Searching for Characters 220
- 12.9 Searching for Individual Characters 223
- 12.10 Searching for Words in a String 223
- 12.11 Searching for Character Classes 225
- 12.12 Using the NOT Functions for Data Cleaning 226
- 12.13 Describing a Real Blockbuster Data Cleaning Function 227
- 12.14 Extracting Part of a String 228
- 12.15 Dividing Strings into Words 230
- 12.16 Comparing Strings 232
- 12.17 Performing a Fuzzy Match 234
- 12.18 Substituting Characters or Words 235
- 12.19 Problems 238

Chapter 13 Working with Arrays 243

- 13.1 Introduction 244
- 13.2 Setting Values of 999 to a SAS Missing Value for Several Numeric Variables 244
- 13.3 Setting Values of NA and ? to a Missing Character Value 247
- 13.4 Converting All Character Values to Lowercase 248
- 13.5 Using an Array to Create New Variables 249
- 13.6 Changing the Array Bounds 250
- 13.7 Temporary Arrays 251
- 13.8 Loading the Initial Values of a Temporary Array from a Raw Data File 253
- 13.9 Using a Multidimensional Array for Table Lookup 254
- 13.10 Problems 257

Part 3 Presenting and Summarizing Your Data 259

Chapter 14 Displaying Your Data 261

- 14.1 Introduction 262
- 14.2 The Basics 262
- 14.3 Changing the Appearance of Your Listing 263
- 14.4 Changing the Appearance of Values 265
- 14.5 Controlling the Observations That Appear in Your Listing 266
- 14.6 Adding Additional Titles and Footnotes to Your Listing 268
- 14.7 Changing the Order of Your Listing 270
- 14.8 Sorting by More Than One Variable 272
- 14.9 Labeling Your Column Headings 273
- 14.10 Adding Subtotals and Totals to Your Listing 274
- 14.11 Making Your Listing Easier to Read 277
- 14.12 Adding the Number of Observations to Your Listing 279
- 14.13 Double-Spacing Your Listing 280
- 14.14 Listing the First n Observations of Your Data Set 281
- 14.15 Problems 283

Chapter 15 Creating Customized Reports 287

- 15.1 Introduction 288
- 15.2 Using PROC REPORT 289
- 15.3 Selecting Variables to Include in Your Report 291
- 15.4 Comparing Detail and Summary Reports 291
- 15.5 Producing a Summary Report 293
- 15.6 Demonstrating the FLOW Option of PROC REPORT 294
- 15.7 Using Two Grouping Variables 296
- 15.8 Changing the Order of Variables in the COLUMN Statement 297
- 15.9 Changing the Order of Rows in a Report 299
- 15.10 Applying the ORDER Usage to Two Variables 300
- 15.11 Creating a Multi-Column Report 301
- 15.12 Producing Report Breaks 303
- 15.13 Using a Nonprinting Variable to Order a Report 306
- 15.14 Computing a New Variable with PROC REPORT 307
- 15.15 Computing a Character Variable in a COMPUTE Block 308

- 15.16 Creating an ACROSS Variable with PROC REPORT 310
- 15.17 Modifying the Column Label for an ACROSS Variable 311
- 15.18 Using an ACROSS Usage to Display Statistics 311
- 15.19 Problems 313

Chapter 16 Summarizing Your Data 319

- 16.1 Introduction 320
- 16.2 PROC MEANS—Starting from the Beginning 320
- 16.3 Adding a BY Statement to PROC MEANS 323
- 16.4 Using a CLASS Statement with PROC MEANS 324
- 16.5 Applying a Format to a CLASS Variable 325
- 16.6 Deciding between a BY Statement and a CLASS Statement 327
- 16.7 Creating Summary Data Sets Using PROC MEANS 327
- 16.8 Outputting Other Descriptive Statistics with PROC MEANS 328
- 16.9 Asking SAS to Name the Variables in the Output Data Set 329
- 16.10 Outputting a Summary Data Set: Including a BY Statement 330
- 16.11 Outputting a Summary Data Set: Including a CLASS Statement 331
- 16.12 Using Two CLASS Variables with PROC MEANS 333
- 16.13 Selecting Different Statistics for Each Variable 337
- 16.14 Problems 338

Chapter 17 Counting Frequencies 341

- 17.1 Introduction 342
- 17.2 Counting Frequencies 342
- 17.3 Selecting Variables for PROC FREQ 345
- 17.4 Using Formats to Label the Output 346
- 17.5 Using Formats to Group Values 347
- 17.6 Problems Grouping Values with PROC FREQ 349
- 17.7 Displaying Missing Values in the Frequency Table 351
- 17.8 Changing the Order of Values in PROC FREQ 353
- 17.9 Producing Two-Way Tables 356

17.10 Requesting Multiple Two-Way Tables 358

17.11 Producing Three-Way Tables 358

17.12 Problems 360

Chapter 18 Creating Tabular Reports 363

18.1 Introduction 364

18.2 A Simple PROC TABULATE Table 364

18.3 Describing the Three PROC TABULATE Operators 366

18.4 Using the Keyword ALL 369

18.5 Producing Descriptive Statistics 370

18.6 Combining CLASS and Analysis Variables in a Table 372

18.7 Customizing Your Table 374

18.8 Demonstrating a More Complex Table 377

18.9 Computing Row and Column Percentages 379

18.10 Displaying Percentages in a Two-Dimensional Table 381

18.11 Computing Column Percentages 382

18.12 Computing Percentages on Numeric Variables 384

18.13 Understanding How Missing Values Affect PROC TABULATE Output 385

18.14 Problems 390

Chapter 19 Introducing the Output Delivery System 397

19.1 Introduction 397

19.2 Sending SAS Output to an HTML File 398

19.3 Creating a Table of Contents 400

19.4 Selecting a Different HTML Style 401

19.5 Choosing Other ODS Destinations 402

19.6 Selecting or Excluding Portions of SAS Output 403

19.7 Sending Output to a SAS Data Set 407

19.8 Problems 409

Chapter 20 Generating High-Quality Graphics 411

20.1 Introduction 412

20.2 Some Basic Concepts 412

20.3 Producing Simple Bar Charts Using PROC GCHART 413

20.4 Creating Pie Charts 415

20.5 Creating Bar Charts for a Continuous Variable 416

- 20.6 Creating Charts with Values Representing Categories 418
- 20.7 Creating Bar Charts Representing Sums 420
- 20.8 Creating Bar Charts Representing Means 422
- 20.9 Adding Another Variable to the Chart 423
- 20.10 Producing Scatter Plots 425
- 20.11 Connecting Points 427
- 20.12 Connecting Points with a Smooth Line 430
- 20.13 Problems 431

Part 4 Advanced Topics 435

Chapter 21 Using Advanced INPUT Techniques 437

- 21.1 Introduction 438
- 21.2 Handling Missing Values at the End of a Line 438
- 21.3 Reading Short Data Lines 440
- 21.4 Reading External Files with Lines Longer Than 256 Characters 443
- 21.5 Detecting the End of the File 443
- 21.6 Reading a Portion of a Raw Data File 445
- 21.7 Reading Data from Multiple Files 446
- 21.8 Reading Data from Multiple Files Using a FILENAME Statement 447
- 21.9 Reading External Filenames from a Data File 447
- 21.10 Reading Multiple Lines of Data to Form One Observation 448
- 21.11 Reading Data Conditionally (the Single Trailing @ Sign) 451
- 21.12 More Examples of the Single Trailing @ Sign 453
- 21.13 Creating Multiple Observations from One Line of Input 454
- 21.14 Using Variable and Informat Lists 455
- 21.15 Using Relative Column Pointers to Read a Complex Data Structure Efficiently 456
- 21.16 Problems 458

Chapter 22 Using Advanced Features of User-Defined Formats and Informats 462

- 22.1 Introduction 462
- 22.2 Using Formats to Recode Variables 462
- 22.3 Using Formats with a PUT Function to Create New Variables 463
- 22.4 Creating User-Defined Informats 464
- 22.5 Reading Character and Numeric Data in One Step 467
- 22.6 Using Formats (and Informats) to Perform Table Lookup 470
- 22.7 Using a SAS Data Set to Create a Format 471
- 22.8 Updating and Maintaining Your Formats 477
- 22.9 Using Formats within Formats 479
- 22.10 Using Multilabel Formats 482
- 22.11 Using the INPUTN Function to Perform a More Complicated Table Lookup 485
- 22.12 Problems 490

Chapter 23 Restructuring SAS Data Sets 493

- 23.1 Introduction 494
- 23.2 Converting a Data Set with One Observation per Subject to a Data Set with Several Observations per Subject: Using a DATA Step 494
- 23.3 Converting a Data Set with Several Observations per Subject to a Data Set with One Observation per Subject: Using a DATA Step 496
- 23.4 Converting a Data Set with One Observation per Subject to a Data Set with Several Observations per Subject: Using PROC TRANSPOSE 498
- 23.5 Converting a Data Set with Several Observations per Subject to a Data Set with One Observation per Subject: Using PROC TRANSPOSE 500
- 23.6 Problems 501

Chapter 24 Working with Multiple Observations per Subject 505

- 24.1 Introduction 506
- 24.2 Identifying the First or Last Observation in a Group 506
- 24.3 Counting the Number of Visits Using PROC FREQ 509

- 24.4 Counting the Number of Visits Using PROC MEANS 511
- 24.5 Computing Differences between Observations 512
- 24.6 Computing Differences between the First and Last Observation in a BY Group Using the LAG Function 514
- 24.7 Computing Differences between the First and Last Observation in a BY Group Using a RETAIN Statement 515
- 24.8 Using a Retained Variable to “Remember” a Previous Value 517
- 24.9 Problems 518

Chapter 25 Introducing the SAS Macro Language 521

- 25.1 Introduction 522
- 25.2 Macro Variables: What Are They? 522
- 25.3 Some Built-In Macro Variables 523
- 25.4 Assigning Values to Macro Variables with a %LET Statement 524
- 25.5 Demonstrating a Simple Macro 525
- 25.6 A Word about Tokens 527
- 25.7 Another Example of Using a Macro Variable as a Prefix 529
- 25.8 Using a Macro Variable to Transfer a Value between DATA Steps 530
- 25.9 Problems 532

Chapter 26 Introducing the Structured Query Language 535

- 26.1 Introduction 536
- 26.2 Some Basics 536
- 26.3 Joining Two Tables (Merge) 539
- 26.4 Left, Right, and Full Joins 543
- 26.5 Concatenating Data Sets 546
- 26.6 Using Summary Functions 549
- 26.7 Demonstrating an ORDER Clause 551
- 26.8 An Example of Fuzzy Matching 551
- 26.9 Problems 553

Solutions to Odd-Numbered Problems 557

Index 601

List of Programs

Programs in Chapter 1

- 1-1 A sample SAS program 5
- 1-2 An alternative version of Program 1-1 7

Programs in Chapter 2

- 2-1 Your first SAS program 12
- 2-2 Enhancing the program 18
- 2-3 Example of a fancy comment using the asterisk style 21
- 2-4 Example of a fancy comment using the /* */ style 21
- 2-5 Incorrect nesting of /* */ style comments 21

Programs in Chapter 3

- 3-1 Demonstrating list input with blanks as delimiters 31
- 3-2 Adding PROC PRINT to list the observations in the data set 31
- 3-3 Reading data from a comma-separated values (CSV) file 33
- 3-4 Using a FILENAME statement to identify an external file 34
- 3-5 Demonstrating the DATALINES statement 36
- 3-6 Using INFILE options with DATALINES 37
- 3-7 Demonstrating column input 38
- 3-8 Demonstrating formatted input 40
- 3-9 Demonstrating a FORMAT statement 42
- 3-10 Rerunning Program 3-9 with a different format 42
- 3-11 Using informats with list input 44
- 3-12 Supplying an INFORMAT statement with list input 45
- 3-13 Demonstrating the ampersand modifier for list input 46

Programs in Chapter 4

- 4-1 Creating a permanent SAS data set 55
- 4-2 Using PROC CONTENTS to examine the descriptor portion of a SAS data set 56
- 4-3 Demonstrating the VARNUM option of PROC CONTENTS 58
- 4-4 Using a LIBNAME in a new SAS session 58

- 4-5 Using PROC CONTENTS to list the names of all the SAS data sets in a SAS library 59
- 4-6 Using PROC PRINT to list the data portion of a SAS data set 63
- 4-7 Using observations from a SAS data set as input to a new SAS data set 66
- 4-8 Demonstrating a DATA _NULL_ step 67

Programs in Chapter 5

- 5-1 Adding labels to variables in a SAS data set 72
- 5-2 Using PROC FORMAT to create user-defined formats 74
- 5-3 Adding a FORMAT statement in PROC PRINT 75
- 5-4 Regrouping values using a format 77
- 5-5 Applying the new format to several variables with PROC FREQ 77
- 5-6 Creating a permanent format library 79
- 5-7 Adding LABEL and FORMAT statements in the DATA step 81
- 5-8 Running PROC CONTENTS on a data set with labels and formats 81
- 5-9 Using a user-defined format 82
- 5-10 Displaying format definitions in a user-created library 83
- 5-11 Demonstrating a SELECT statement with PROC FORMAT 84

Programs in Chapter 6

- 6-1 Using PROC PRINT to list the first four observations in a data set 91
- 6-2 Using the FIRSTOBS= and OBS= options together 92
- 6-3 Reading a spreadsheet using an XLS engine 96
- 6-4 Using ODS to convert a SAS data set into a CSV file (to be read by Excel) 97

Programs in Chapter 7

- 7-1 First attempt to group ages into age groups (incorrect) 102
- 7-2 Corrected program to group ages into age groups 104
- 7-3 An alternative to Program 7-2 105
- 7-4 Demonstrating a subsetting IF statement 106
- 7-5 Demonstrating a SELECT statement when a select-expression is missing 109
- 7-6 Combining various Boolean operators 110

- 7-7 A caution on the use of multiple OR operators 111
- 7-8 Using a WHERE statement to subset a SAS data set 112

Programs in Chapter 8

- 8-1 Example of a program that does not use a DO group 118
- 8-2 Demonstrating a DO group 119
- 8-3 Attempt to create a cumulative total 121
- 8-4 Adding a RETAIN statement to Program 8-3 122
- 8-5 Third attempt to create cumulative total 123
- 8-6 Using a sum statement to create a cumulative total 124
- 8-7 Using a sum statement to create a counter 124
- 8-8 Program without iterative loops 125
- 8-9 Demonstrating an iterative DO loop 126
- 8-10 Using an iterative DO loop to make a table of squares and square roots 127
- 8-11 Using an iterative DO loop to graph an equation 128
- 8-12 Using character values for DO loop index values 130
- 8-13 Demonstrating a DO UNTIL loop 131
- 8-14 Demonstrating that a DO UNTIL loop always executes at least once 133
- 8-15 Demonstrating a DO WHILE statement 133
- 8-16 Demonstrating that DO WHILE loops are evaluated at the top 134
- 8-17 Combining a DO UNTIL and iterative DO loop 135
- 8-18 Demonstrating the LEAVE statement 135
- 8-19 Demonstrating a CONTINUE statement 136

Programs in Chapter 9

- 9-1 Program to read dates from raw data 143
- 9-2 Adding a FORMAT statement to format each of the date values 144
- 9-3 Compute a person's age in years 146
- 9-4 Demonstrating a date constant 148
- 9-5 Using the TODAY function to return the current date 148
- 9-6 Extracting the day of the week, day of the month, month, and year from a SAS date 149
- 9-7 Using the MDY function to create a SAS date from month, day, and year values 150

- 9-8 Substituting the 15th of the month when a day value is missing 151
- 9-9 Demonstrating the INTCK function 154
- 9-10 Using the INTNX function to compute dates 6 months after discharge 156
- 9-11 Demonstrating the SAMEDAY alignment with the INTNX function 156

Programs in Chapter 10

- 10-1 Subsetting a SAS data set using a WHERE statement 162
- 10-2 Demonstrating a DROP= data set option 163
- 10-3 Creating two data sets in one DATA step 164
- 10-4 Using a SET statement to combine observations from two data sets 165
- 10-5 Using a SET statement on two data sets containing different variables 166
- 10-6 Interleaving data sets 167
- 10-7 Combining detail and summary data: using a conditional SET statement 168
- 10-8 Merging two SAS data sets 171
- 10-9 Demonstrating the IN= data set option 173
- 10-10 Using IN= variables to select IDs that are in both data sets 174
- 10-11 More examples of using IN= variables 175
- 10-12 Demonstrating when a DATA step ends 176
- 10-13 Merging two data sets by renaming a variable in one data set 178
- 10-14 Merging two data sets when the BY variables are different data types 179
- 10-15 An alternative to Program 10-14 180
- 10-16 Updating a master file from a transaction file 184

Programs in Chapter 11

- 11-1 Demonstrating the ROUND and INT truncation functions 191
- 11-2 Testing for missing numeric and character values (without the MISSING function) 192
- 11-3 Demonstrating the MISSING function 192
- 11-4 Demonstrating the N, MEAN, MIN, and MAX functions 194

- 11-5 Finding the sum of the three largest values in a list of variables 195
- 11-6 Using the SUM function to compute totals 197
- 11-7 Demonstrating the ABS, SQRT, EXP, and LOG functions 197
- 11-8 Computing some useful constants with the CONSTANT function 198
- 11-9 Using the RANUNI function to randomly select observations 200
- 11-10 Using PROC SURVEYSELECT to obtain a random sample 200
- 11-11 Using the INPUT function to perform a character-to-numeric conversion 202
- 11-12 Demonstrating the PUT function 203
- 11-13 Demonstrating the LAG and LAGn functions 204
- 11-14 Demonstrating what happens when you execute a LAG function conditionally 205
- 11-15 Using the LAG function to compute interobservation differences 206
- 11-16 Demonstrating the DIF function 207

Programs in Chapter 12

- 12-1 Determining the length of a character value 213
- 12-2 Changing values to uppercase 214
- 12-3 Converting multiple blanks to a single blank and demonstrating the PROPCASE function 215
- 12-4 Demonstrating the concatenation functions 216
- 12-5 Demonstrating the TRIM, LEFT, and STRIP functions 217
- 12-6 Using the COMPRESS function to remove characters from a string 219
- 12-7 Demonstrating the COMPRESS modifiers 220
- 12-8 Demonstrating the FIND and COMPRESS functions 221
- 12-9 Demonstrating the FINDW function 224
- 12-10 Demonstrating the ANYDIGIT function
- 12-11 Demonstrating the NOT functions for data cleaning 227
- 12-12 Using the VERIFY function for data cleaning 228
- 12-13 Using the SUBSTR function to extract substrings 229
- 12-14 Demonstrating the SCAN function 230
- 12-15 Using the SCAN function to extract the last name 231
- 12-16 Demonstrating the COMPARE function 232

- 12-17 Clarifying the use of the colon modifier with the COMPARE function 233
- 12-18 Using the SPEDIS function to perform a fuzzy match 234
- 12-19 Demonstrating the TRANSLATE function 236
- 12-20 Using the TRANWRD function to standardize an address 237

Programs in Chapter 13

- 13-1 Converting values of 999 to a SAS missing value—without using arrays 244
- 13-2 Converting values of 999 to a SAS missing value—using arrays 245
- 13-3 Rewriting Program 13-2 using the CALL MISSING routine 246
- 13-4 Converting values of NA and ? to missing character values 247
- 13-5 Converting all character values in a SAS data set to lowercase 249
- 13-6 Using an array to create new variables 250
- 13-7 Changing the array bounds 251
- 13-8 Using a temporary array to score a test 252
- 13-9 Loading the initial values of a temporary array from a raw data file 253
- 13-10 Loading a two-dimensional, temporary array with data values 255

Programs in Chapter 14

- 14-1 PROC PRINT using all the defaults 262
- 14-2 Controlling which variables appear in the listing 264
- 14-3 Using an ID statement to omit the Obs column 264
- 14-4 Adding a FORMAT statement to PROC PRINT 266
- 14-5 Controlling which observations appear in the listing (WHERE statement) 267
- 14-6 Using the IN operator in a WHERE statement 267
- 14-7 Adding titles and footnotes to your listing 268
- 14-8 Using PROC SORT to change the order of your observations 270
- 14-9 Demonstrating the DESCENDING option of PROC SORT 271
- 14-10 Sorting by more than one variable 272
- 14-11 Using labels as column headings with PROC PRINT 273
- 14-12 Using a BY statement in PROC PRINT 275