SAS/STAT® 9.3 User's Guide
Introduction
(Chapter)

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Chapter 2
Introduction

Contents

Overview of SAS/STAT Software

SAS/STAT software provides comprehensive statistical tools for a wide range of statistical analyses, including analysis of variance, categorical data analysis, cluster analysis, multiple imputation, multivariate analysis, nonparametric analysis, power and sample size computations, psychometric analysis, regression, survey data analysis, and survival analysis. A few examples include nonlinear mixed models, generalized linear models, correspondence analysis, and robust regression. The software is constantly being updated to reflect new methodology.

In addition to over sixty procedures for statistical analysis, SAS/STAT software also includes the Market Research Application (MRA), a point-and-click interface to commonly used techniques in market research. The Analyst Application provides convenient access to some of the more commonly used statistical analyses in SAS/STAT software including analysis of variance, regression, logistic regression, mixed models, survival analysis, and some multivariate techniques. Also, the Power and Sample Size Application (PSS) is an interface to power and sample size computations. The Analyst Application and MRA are documented separately.

Experimental Software

Experimental software is sometimes included as part of a production-release product. It is provided to (sometimes targeted) customers in order to obtain feedback. All experimental uses are marked Experimental in this document. Whenever an experimental procedure, statement, or option is used, a message is printed to the SAS log to indicate that it is experimental.

The design and syntax of experimental software might change before any production release. Experimental software has been tested prior to release, but it has not necessarily been tested to production-quality standards, and so should be used with care.

About This Book

Since SAS/STAT software is a part of the SAS System, this book assumes that you are familiar with Base SAS software and with the books *SAS Language Reference: Concepts* and the *Base SAS Procedures Guide*. It also assumes that you are familiar with basic SAS System concepts such as creating SAS data sets with the DATA step and manipulating SAS data sets with the procedures in Base SAS software (for example, the PRINT and SORT procedures).

Chapter Organization

This book is organized as follows.

Chapter 1, "What's New in SAS/STAT 9.3," provides information about the changes and enhancements to SAS/STAT software in SAS 9.3.

Chapter 2, this chapter, provides an overview of SAS/STAT software and summarizes related information, products, and services. The remaining introductory chapters (Chapter 3, "Introduction to Statistical Modeling with SAS/STAT Software," through Chapter 17, "Introduction to Structural Equation Modeling with Latent Variables,") provide an introduction to the broad areas covered by SAS/STAT software.

Chapter 18, "Introduction to Power and Sample Size Analysis," provides documentation for the Power and Sample Size Application (PSS).

Chapter 19, "Shared Concepts and Topics," provides information about topics that are common to multiple procedures. Topics include parameterization of model effects, the EFFECT statement, and the NLOPTIONS statement. Starting in SAS/STAT 9.22, this chapter also documents the following statements that are used for postfitting analysis and are common across many modeling procedures: EFFECTPLOT, ESTIMATE, LSMEANS, LSMESTIMATE, SLICE, STORE, and TEST.

Chapter 20, "Using the Output Delivery System," explains the fundamentals of using the Output Delivery System (ODS) to manage your SAS output.

Chapter 21, "Statistical Graphics Using ODS," describes the extension to ODS that enables many statistical procedures to create statistical graphics as easily as they create tables.

Subsequent chapters describe the SAS procedures that make up SAS/STAT software. These chapters appear in alphabetical order by procedure name and are organized as follows:

- The "Overview" section provides a brief description of the analysis provided by the procedure.

- The "Getting Started" section provides a quick introduction to the procedure through a simple example.

- The "Syntax" section describes the SAS statements and options that control the procedure.

- The "Details" section discusses methodology and miscellaneous details, such as ODS tables and ODS graphics.

- The "Examples" section contains examples that use the procedure.

- The "References" section contains references for the methodology and for examples of the procedure.

Following the chapters on the SAS/STAT procedures, Chapter A, "Special SAS Data Sets," documents the special SAS data sets that are associated with SAS/STAT procedures.

Typographical Conventions

This book uses several type styles for presenting information. The following list explains the meaning of the typographical conventions used in this book:

roman	is the standard type style used for most text.
UPPERCASE ROMAN	is used for SAS statements, options, and other SAS language elements when they appear in the text. However, you can enter these elements in your own SAS programs in lowercase, uppercase, or a mixture of the two.
UPPERCASE BOLD	is used in the "Syntax" sections' initial lists of SAS statements and options.
oblique	is used for user-supplied values for options in the syntax definitions. In the text, these values are written in *italic*.

VariableName	is used for the names of variables and data sets when they appear in the text.
bold	is used to refer to matrices and vectors.
italic	is used for terms that are defined in the text, for emphasis, and for references to publications.
`monospace`	is used for example code. In most cases, this book uses lowercase type for SAS code.

Options Used in Examples

Output of Examples

Most of the output shown in this book is produced with the following SAS System options:

```
options linesize=80 pagesize=500 nonumber nodate;
```

The HTMLBLUE style is used to create the HTML output and graphs that appear in the online documentation. A style template controls stylistic elements such as colors, fonts, and presentation attributes. The style template is specified in the ODS HTML statement as follows:

```
ods html style=HTMLBlue;
```

See Chapter 21, "Statistical Graphics Using ODS," for more information about styles.

If you run the examples, you might get slightly different output. This is a function of the SAS System options used and the precision used by your computer for floating-point calculations.

Where to Turn for More Information

This section describes other sources of information about SAS/STAT software.

Accessing the SAS/STAT Sample Library

The SAS/STAT sample library includes many examples that illustrate the use of SAS/STAT software, including the examples used in this documentation. To access these sample programs from the SAS windowing environment, select **Help** from the main menu and then select **Getting Started with SAS Software**. On the **Contents** tab, expand the **Learning to Use SAS**, **Sample SAS Programs**, and **SAS/STAT** items. Then click **Samples**.

Sashelp Data Sets

SAS provides over 200 data sets in the Sashelp library. These data sets are available for you to use for examples and for testing code. For example, the following step uses the Sashelp.Class data set:

```
proc reg data=sashelp.class;
   model weight = height;
run; quit;
```

You do not need to provide a DATA step to use Sashelp data sets.

The following steps list all of the data sets that are available in Sashelp:

```
ods listing close;
proc contents data=sashelp._all_;
   ods output members=m;
run;
ods listing;

proc print;
   where memtype = 'DATA';
run;
```

The results of these steps (over 200 data set names) are not displayed.

The following steps provide detailed information about the Sashelp data sets:

```
proc contents data=sashelp._all_;
run;
```

The results of this step (hundreds of pages of PROC CONTENTS information) are not displayed. See Chapter B, "Sashelp Data Sets," for more information about Sashelp data sets.

Online Documentation

This documentation is available online with the SAS System. To access SAS/STAT documentation from the SAS windowing environment, select **Help** from the main menu and then select **SAS Help and Documentation**. (Alternatively, you can type **help STAT** in the command line.) On the **Contents** tab, expand the **SAS Products**, **SAS/STAT**, and **SAS/STAT User's Guide** items. Then expand chapters and click on sections. You can search the documentation by using the **Search** tab.

You can also access the documentation by going to `http://support.sas.com/documentation`.

SAS Technical Support Services

As with all SAS products, the SAS Technical Support staff is available to respond to problems and answer technical questions regarding the use of SAS/STAT software. Go to `http://support.sas.com/techsup` for more information.

Related SAS Software

Many features not found in SAS/STAT software are available in other parts of the SAS System. If you do not find something you need in SAS/STAT software, try looking for the feature in the following SAS software products.

SAS/IML Software

SAS/IML software gives you access to a powerful and flexible programming language (Interactive Matrix Language) in a dynamic, interactive environment. The fundamental object of the language is a data matrix. You can use SAS/IML software interactively (at the statement level) to see results immediately, or you can store statements in a module and execute them later. The programming is dynamic because necessary activities such as memory allocation and dimensioning of matrices are done automatically. SAS/IML software is of interest to users of SAS/STAT software because it enables you to program your methods in the SAS System.

Base SAS Software

The features provided by SAS/STAT software are in addition to the features provided by Base SAS software. Many data management and reporting capabilities you will need are part of Base SAS software. Refer to *SAS Language Reference: Concepts*, *SAS Language Reference: Dictionary*, and the *Base SAS Procedures Guide* for documentation of Base SAS software.

ODS Graphics

Base SAS software provides the following:

- The SG family of procedures provides a simple syntax for creating stand-alone statistical graphics. These procedures include SGPLOT, SGSCATTER, and SGPANEL, which provide a simple and con-

venient syntax for producing many types of displays. They are particularly convenient for exploring and presenting data. See the *SAS ODS Graphics: Procedures Guide* for more information.

- The GTL (Graph Template Language) and the SGRENDER procedure provide a powerful syntax for creating customized graphs. See the *SAS Graph Template Language: User's Guide* and the *SAS Graph Template Language: Reference Guide* for more information. You can also use the GTL to modify the SAS templates that are provided for use with SAS/STAT procedures. See Chapter 22, "ODS Graphics Template Modification," for more information about template modification.

- The ODS Graphics Editor enables you to make immediate changes to ODS Graphics by using a point-and-click interface. See the *SAS ODS Graphics Editor: User's Guide* for more information.

See Chapter 21, "Statistical Graphics Using ODS," for more information about ODS Graphics.

SAS DATA Step

The DATA step is your primary tool for reading and processing data in the SAS System. The DATA step provides a powerful general purpose programming language that enables you to perform all kinds of data processing tasks. The DATA step is documented in *SAS Language Reference: Concepts*.

Base SAS Procedures

Base SAS software includes many useful SAS procedures. Base SAS procedures are documented in the *Base SAS Procedures Guide*. The following is a list of Base SAS procedures you might find useful:

CORR   computes correlations.

RANK   computes rankings or order statistics.

STANDARD   standardizes variables to a fixed mean and variance.

MEANS   computes descriptive statistics and summarizes or collapses data over cross sections.

TABULATE   prints descriptive statistics in tabular format.

UNIVARIATE   computes descriptive statistics.

SAS/ETS Software

SAS/ETS software provides SAS procedures for econometrics and time series analysis. It includes capabilities for forecasting, systems modeling and simulation, seasonal adjustment, and financial analysis and reporting. In addition, SAS/ETS software includes an interactive time series forecasting system.

SAS/GRAPH Software

SAS/GRAPH software includes procedures that create two- and three-dimensional plots and charts.

SAS/INSIGHT Software

SAS/INSIGHT software is a highly interactive tool for data analysis. You can explore data through a variety of interactive graphs including bar charts, scatter plots, box plots, and three-dimensional rotating plots. You can examine distributions and perform parametric and nonparametric regression, analyze general linear models and generalized linear models, examine correlation matrices, and perform principal component analyses. Any changes you make to your data show immediately in all graphs and analyses. You can also configure SAS/INSIGHT software to produce graphs and analyses tailored to the way you work.

SAS/INSIGHT software might be of interest to users of SAS/STAT software for interactive graphical viewing of data, editing data, exploratory data analysis, and checking distributional assumptions.

SAS/OR Software

SAS/OR software provides SAS procedures for operations research and project planning and includes a point-and-click interface to project management. Its capabilities include the following:

- solving transportation problems

- linear, integer, and mixed-integer programming

- nonlinear programming

- scheduling projects

- plotting Gantt charts

- drawing network diagrams

- solving optimal assignment problems

- network flow programming

SAS/OR software might be of interest to users of SAS/STAT software for its mathematical programming features. In particular, the NLP procedure in SAS/OR software solves nonlinear programming problems, and it can be used for constrained and unconstrained maximization of user-defined likelihood functions.

SAS/QC Software

SAS/QC software provides a variety of procedures for statistical quality control and quality improvement. SAS/QC software includes procedures for the following:

- Shewhart control charts

- cumulative sum control charts

- moving average control charts

- process capability analysis

- Ishikawa diagrams

- Pareto charts

- experimental design

SAS/QC software also includes the ADX interface for experimental design.

SAS/IML Studio

Many users of SAS/STAT software will be interested in SAS/IML Studio, which is new in SAS 9.2 software. Formerly known as SAS Stat Studio, SAS/IML Studio is a tool for data exploration and analysis; it provides a highly flexible programming environment in which you can run SAS/STAT or SAS/IML analyses and display the results with dynamically linked graphics and data tables. You can also move seamlessly between interactive analysis and programatically driven analysis. SAS/IML Studio is intended for data analysts who write SAS programs to solve statistical problems but need more versatility for data exploration and model building.

The programming language in SAS/IML Studio, which is called *IMLPlus*, is an enhanced version of the SAS/IML programming language. IMLPlus extends SAS/IML by providing features such as the ability to create and manipulate dynamically linked graphs and the ability to call SAS procedures.

SAS/IML Studio also includes an interface to the R language. The IMLPlus language provides functions that transfer data between SAS data sets and R data frames, and between SAS/IML matrices and R matrices.

SAS/IML Studio runs on a PC in the Microsoft Windows operating environment. For more information about SAS/IML Studio, see the *SAS/IML Studio: User's Guide* and *SAS/IML Studio for SAS/STAT Users*.

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Your Turn

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