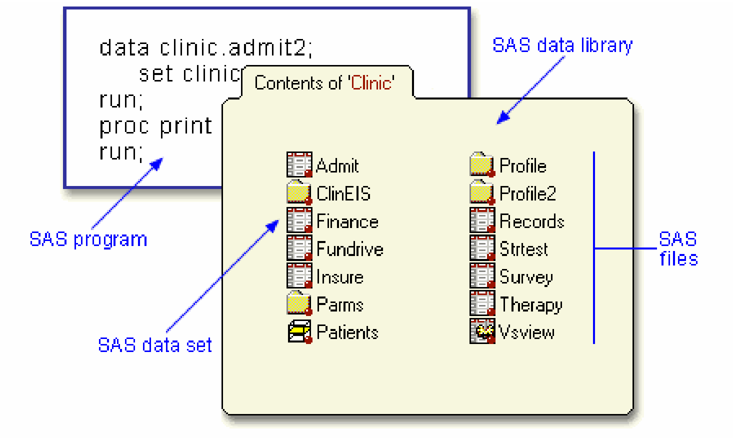
Chapter 1 Basic Concepts

Overview

Introduction

To program effectively using SAS, you need to understand basic concepts about **SAS programs** and the **SAS files** that they process. In particular, you need to be familiar with **SAS data sets**.

In this chapter, you'll examine a simple SAS program and see how it works. You'll see how SAS data sets are stored temporarily or permanently in **SAS libraries**. You'll also learn details about SAS data sets, which are files that contain data that is logically arranged in a form that SAS can understand.



```
data clinic.admit2;
   set clinic
run;
proc print
run;
```

Objectives

In this chapter, you learn about

- the structure and components of SAS programs
- the steps involved in processing SAS programs
- SAS libraries and the types of SAS files that they contain
- temporary and permanent SAS libraries
- the structure and components of SAS data sets.

SAS Programs

You can use SAS programs to access, manage, analyze, or present your data. Let's begin by looking at a simple SAS program.

```
data clinic.admit2;
   set clinic.admit;
run;
proc print data=clinic.admit2;
run;
```

This program creates a new SAS data set from an existing SAS data set and then prints a listing of the new data set. A SAS data set is a data file that is formatted in a way that SAS can understand.

Let's see how this program works.

Components of SAS Programs

Our sample SAS program contains two steps: a **DATA step** and a **PROC step**.

```
data clinic.admit2;
   set clinic.admit;
run;
proc print data=clinic.admit2;
run;
```

These two types of steps, alone or combined, form most SAS programs.

A SAS program can consist of a DATA step

or a PROC step

DATA Step
PROC Step
PROC Step

or any combination of DATA and PROC steps.

DATA steps typically create or modify SAS data sets. They can also be used to produce custom-designed reports. For example, you can use DATA steps to

- put your data into a SAS data set
- compute values
- check for and correct errors in your data
- produce new SAS data sets by subsetting, merging, and updating existing data sets.

PROC (procedure) steps are pre-written routines that enable you to analyze and process the data in a SAS data set and to present the data in the form of a report. PROC steps sometimes create new SAS data sets that contain the results of the procedure. PROC steps can list, sort, and summarize data. For example, you can use PROC steps to

- create a report that lists the data
- produce descriptive statistics
- create a summary report
- produce plots and charts.

Characteristics of SAS Programs

Next let's look at the individual statements in our sample program. SAS programs consist of **SAS statements**. A SAS statement has two important characteristics:

- It usually begins with a SAS **keyword**.
- It always ends with a **semicolon**.

As you've seen, a DATA step begins with a DATA statement, which begins with the keyword DATA. A PROC step begins with a PROC statement, which begins with the keyword PROC. Our sample program contains ❶a DATA statement, ❷a SET statement, ❸a RUN statement, ❹a PROC PRINT statement, and ❺another RUN statement.

Statements	Sample Program Code
❶a DATA statement	`data clinic.admit2;`
❷a SET statement	`   set clinic.admit;`
❸a RUN statement	`run;`
❹a PROC PRINT statement	`proc print data=clinic.admit2;`
❺another RUN statement	`run;`

Layout for SAS Programs

SAS statements are in free format. This means that

- they can begin and end anywhere on a line
- one statement can continue over several lines
- several statements can be on a line.

Blanks or special characters separate "words" in a SAS statement.

You can specify SAS statements in uppercase or lowercase. In most situations, text that is enclosed in quotation marks is case sensitive.

You've examined the general structure of our sample program. But what happens when you run the program?

Processing SAS Programs

When you submit a SAS program, SAS begins reading the statements and checking them for errors.

DATA and PROC statements signal the beginning of a new step. When SAS encounters a subsequent DATA, PROC, or RUN statement (for DATA steps and most procedures) or a QUIT statement (for some procedures), SAS stops reading statements and executes the previous step in the program. In our sample program, each step ends with a RUN statement.

```
data clinic.admit2;
   set clinic.admit;
run;
proc print data=clinic.admit2;
run;
```

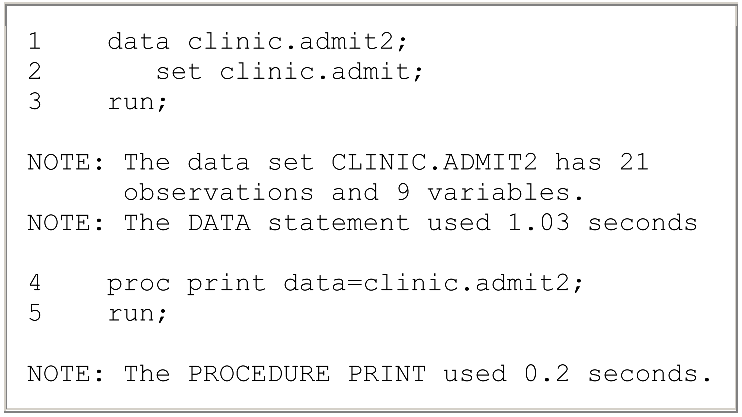
The beginning of a new step (DATA or PROC) implies the end of the previous step. Though the RUN statement is not always required between steps in a SAS program, using it can make the SAS program easier to read and debug, and it makes the SAS log easier to read.

Log Messages

Each time a step is executed, SAS generates a log of the processing activities and the results of the processing. The SAS log collects messages about the processing of SAS programs and about any errors that occur.

When SAS processes our sample program, you see the log messages shown below. Notice that you get separate sets of messages for each step in the program.

SAS Log



```
1    data clinic.admit2;
2       set clinic.admit;
3    run;

NOTE: The data set CLINIC.ADMIT2 has 21
      observations and 9 variables.
NOTE: The DATA statement used 1.03 seconds

4    proc print data=clinic.admit2;
5    run;

NOTE: The PROCEDURE PRINT used 0.2 seconds.
```

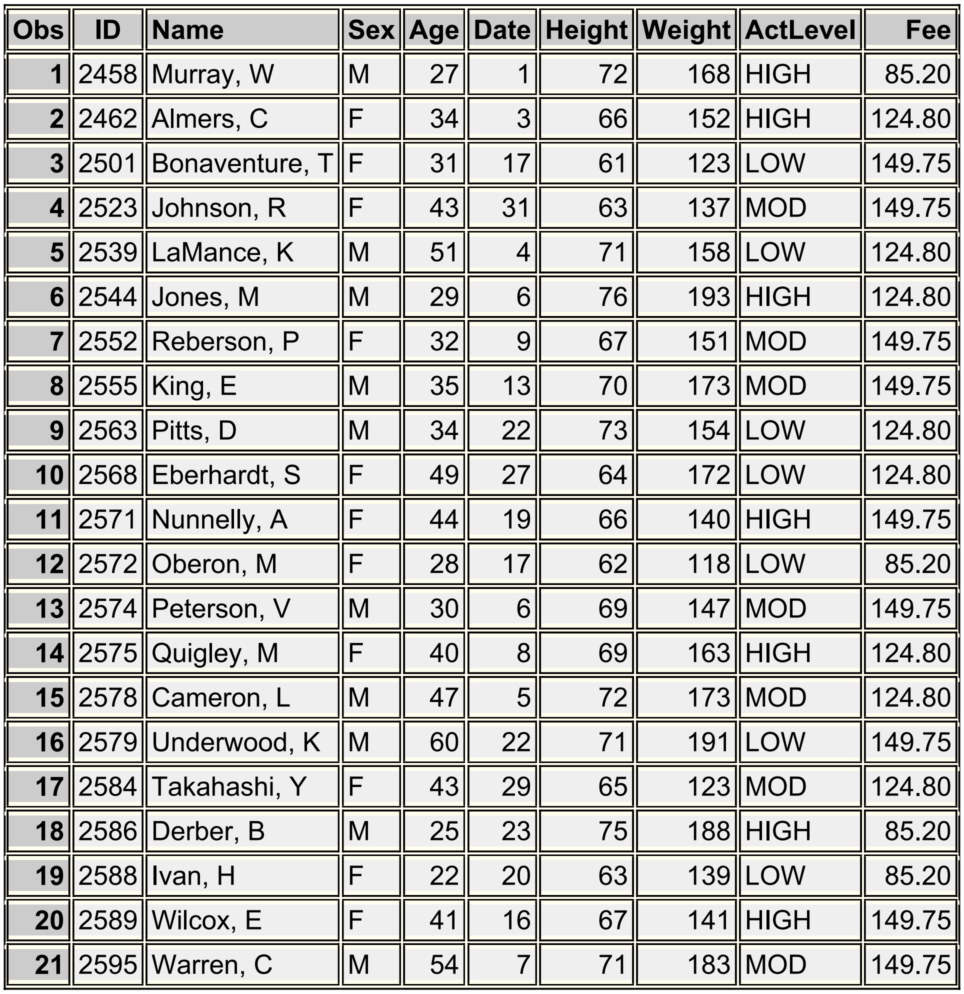
Results of Processing

Suppose you submit the sample program below.

```
data clinic.admit2;
   set clinic.admit;
run;
proc print data=clinic.admit2;
run;
```

When the program is processed, it

- creates the SAS data set **Clinic.Admit2** in the DATA step. The DATA step produces messages in the SAS log, but it does not create a report or other output.
- creates the following HTML report of the SAS data set **Clinic.Admit2**:



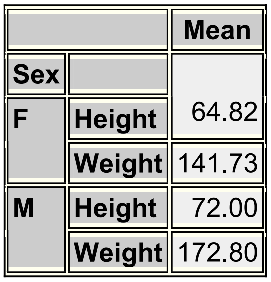
Obs	ID	Name	Sex	Age	Date	Height	Weight	ActLevel	Fee
1	2458	Murray, W	M	27	1	72	168	HIGH	85.20
2	2462	Almers, C	F	34	3	66	152	HIGH	124.80
3	2501	Bonaventure, T	F	31	17	61	123	LOW	149.75
4	2523	Johnson, R	F	43	31	63	137	MOD	149.75
5	2539	LaMance, K	M	51	4	71	158	LOW	124.80
6	2544	Jones, M	M	29	6	76	193	HIGH	124.80
7	2552	Reberson, P	F	32	9	67	151	MOD	149.75
8	2555	King, E	M	35	13	70	173	MOD	149.75
9	2563	Pitts, D	M	34	22	73	154	LOW	124.80
10	2568	Eberhardt, S	F	49	27	64	172	LOW	124.80
11	2571	Nunnelly, A	F	44	19	66	140	HIGH	149.75
12	2572	Oberon, M	F	28	17	62	118	LOW	85.20
13	2574	Peterson, V	M	30	6	69	147	MOD	149.75
14	2575	Quigley, M	F	40	8	69	163	HIGH	124.80
15	2578	Cameron, L	M	47	5	72	173	MOD	124.80
16	2579	Underwood, K	M	60	22	71	191	LOW	149.75
17	2584	Takahashi, Y	F	43	29	65	123	MOD	124.80
18	2586	Derber, B	M	25	23	75	188	HIGH	85.20
19	2588	Ivan, H	F	22	20	63	139	LOW	85.20
20	2589	Wilcox, E	F	41	16	67	141	HIGH	149.75
21	2595	Warren, C	M	54	7	71	183	MOD	149.75

Throughout this book, procedure output is shown in HTML in the style shown above unless otherwise noted. You can learn how to create HTML output in Chapter 2, **Referencing Files and Setting Options**.

You've seen the results of submitting our sample program. For other SAS programs, the results of processing might vary:

- SAS programs often invoke procedures that create output in the form of a report, as is the case with the TABULATE procedure.

```
proc tabulate data=clinic.admit;
  class sex;
  var height weight;
  table sex*(height weight),mean;
run;
```

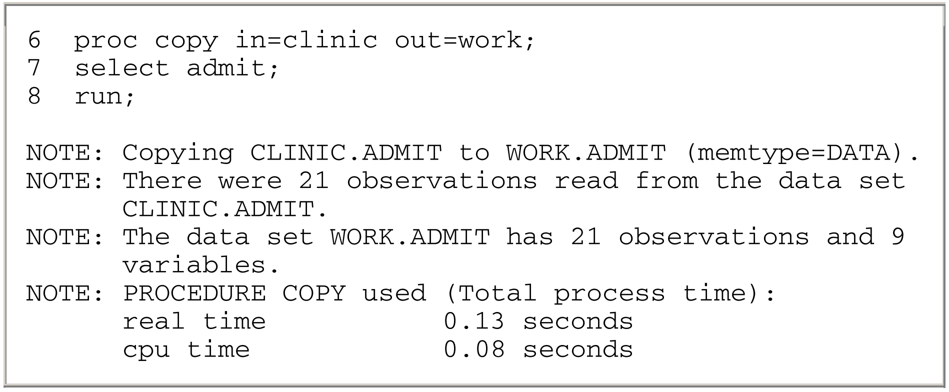


		Mean
Sex		
F	Height	64.82
	Weight	141.73
M	Height	72.00
	Weight	172.80

- Other SAS programs perform tasks such as sorting and managing data, which have no visible results except for **messages in the log**. (All SAS programs produce log messages, but some SAS programs produce **only** log messages.)

```
proc copy in=clinic out=work;
   select admit;
run;
```

SAS Log



```
6   proc copy in=clinic out=work;
7   select admit;
8   run;

NOTE: Copying CLINIC.ADMIT to WORK.ADMIT (memtype=DATA).
NOTE: There were 21 observations read from the data set
      CLINIC.ADMIT.
NOTE: The data set WORK.ADMIT has 21 observations and 9
      variables.
NOTE: PROCEDURE COPY used (Total process time):
      real time           0.13 seconds
      cpu time            0.08 seconds
```

You can turn off log messages by using system options, which you can learn about in Chapter 2, **Referencing Files and Setting Options**.

SAS Libraries

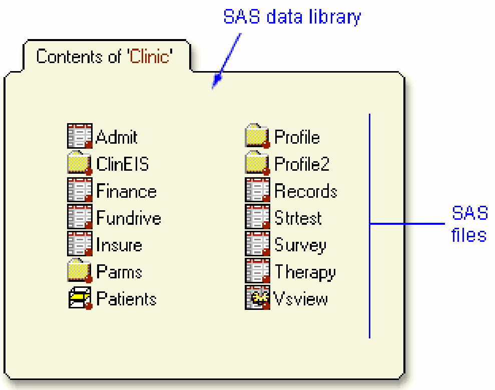
You've learned about SAS programs and SAS data sets. Now let's look at **SAS libraries** to see how SAS data sets and other SAS files are organized and stored.

How SAS Files Are Stored

Every SAS file is stored in a **SAS library**, which is a collection of SAS files. A SAS data library is the highest level of organization for information within SAS.

SAS libraries have different implementations depending on your operating environment, but a library usually corresponds to the level of organization that your host operating system uses to access and store files. In some operating environments, a library is a physical collection of files. In others, the files are only logically related.

For example, in the Windows and UNIX environments, a library is typically a group of SAS files in the same folder or directory.



The table below summarizes the implementation of SAS libraries in various operating environments.

Environment	Library
Windows, **UNIX**, **OpenVMS** (directory based-systems)	a group of SAS files that are stored in the same directory. Other files can be stored in the directory, but only the files that have SAS file extensions are recognized as part of the SAS library. (Refer to the online documentation for more information.)
CMS	a group of SAS files that have the same file type.
z/OS	a specially formatted host data set in which only SAS files are stored.

Storing Files Temporarily or Permanently

Depending on the library name that you use when you create a file, you can store SAS files temporarily or permanently.

Temporary SAS libraries last only for the current SAS session.

Storing files temporarily:

If you don't specify a library name when you create a file (or if you specify the library name **Work**), the file is stored in the temporary SAS data library. When you end the session, the temporary library and all of its files are deleted.

Permanent SAS libraries are available to you during subsequent SAS sessions.

Storing files permanently:

To store files permanently in a SAS data library, you specify a library name other than the default library name **Work**.

For example, by specifying the library name **Clinic** when you create a file, you specify that the file is to be stored in a permanent SAS data library until you delete it.

You can learn how to set up permanent SAS libraries in Chapter 2, **Referencing Files and Setting Options**.

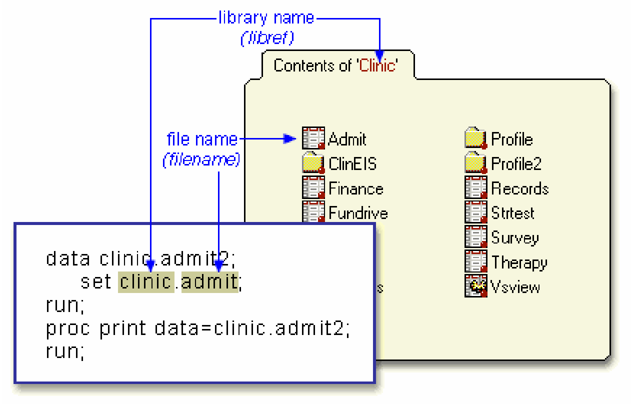
Referencing SAS Files

Two-Level Names

To reference a permanent SAS data set in your SAS programs, you use a **two-level name**:

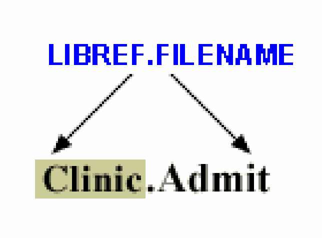
libref.filename

In the two-level name, ***libref*** is the name of the SAS data library that contains the file, and ***filename*** is the name of the file itself. A period separates the libref and filename.



```
data clinic.admit2;
   set clinic.admit;
run;
proc print data=clinic.admit2;
run;
```

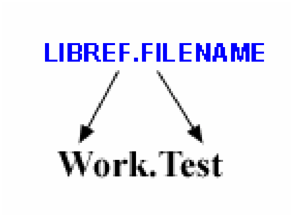
For example, in our sample program, **Clinic.Admit** is the two-level name for the SAS data set **Admit**, which is stored in the library named **Clinic**.



Referencing Temporary SAS Files

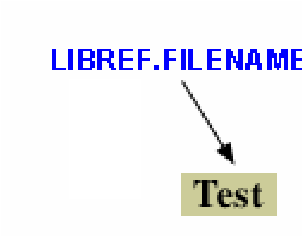
To reference temporary SAS files, you can specify the default libref **Work**, a period, and the filename. For example, the two-level name **Work.Test** references the SAS data set named **Test** that is stored in the temporary SAS library **Work**.

Temporary
SAS File



Alternatively, you can use a **one-level name** (the filename only) to reference a file in a temporary SAS library. When you specify a one-level name, the default libref **Work** is assumed. For example, the one-level name **Test** also references the SAS data set named **Test** that is stored in the temporary SAS library **Work**.

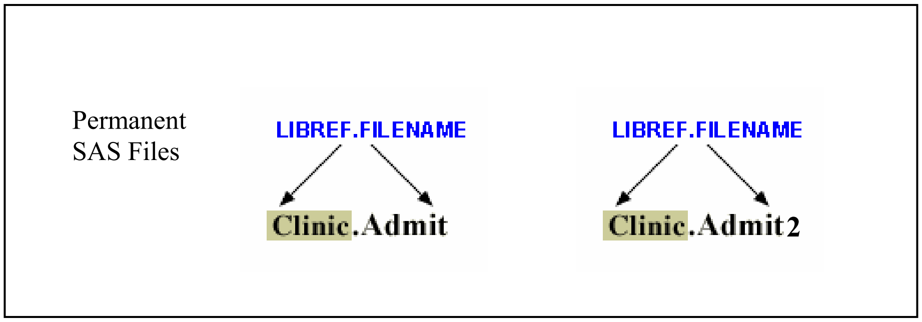
Temporary
SAS File,
One-Level
Name



If the USER library is assigned, SAS uses the **User** library rather than the **Work** library for one-level names. **User** is a permanent library. For more information, see the *SAS Language Reference: Concepts* documentation.

Referencing Permanent SAS Files

You can see that **Clinic.Admit** and **Clinic.Admit2** are permanent SAS data sets because the library name is **Clinic,** not **Work**.



So referencing a SAS file in any library **except Work** indicates that the SAS file is stored permanently. For example, when our sample program creates **Clinic.Admit2**, it stores the new **Admit2** data set permanently in the SAS library **Clinic.**

Rules for SAS Names

SAS data set names

- can be 1 to 32 characters long
- must begin with a letter (A–Z, either uppercase or lowercase) or an underscore (_)
- can continue with any combination of numbers, letters, or underscores.

These are examples of valid data set names:

- **Payroll**
- **LABDATA1995_1997**
- **_EstimatedTaxPayments3**

SAS Data Sets

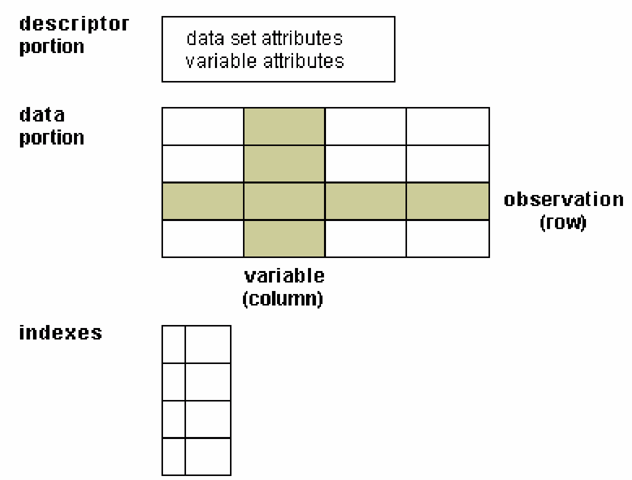
So far, you've seen the components and characteristics of SAS programs, including how they reference SAS data sets. Data sets are one type of SAS file. There are other types of SAS files (such as catalogs), but this chapter focuses on SAS data sets. For many procedures and for some DATA step statements, data must be in the form of a SAS data set to be processed. Now let's take a closer look at SAS data sets.

Overview of Data Sets

As you saw in our sample program, for many of the data processing tasks that you perform with SAS, you

- access data in the form of a SAS data set
- analyze, manage, or present the data.

Conceptually, a SAS data set is a file that consists of two parts: a **descriptor portion** and a **data portion**. Sometimes a SAS data set also points to one or more indexes, which enable SAS to locate records in the data set more efficiently. (The data sets that you see in this chapter do not contain indexes.)

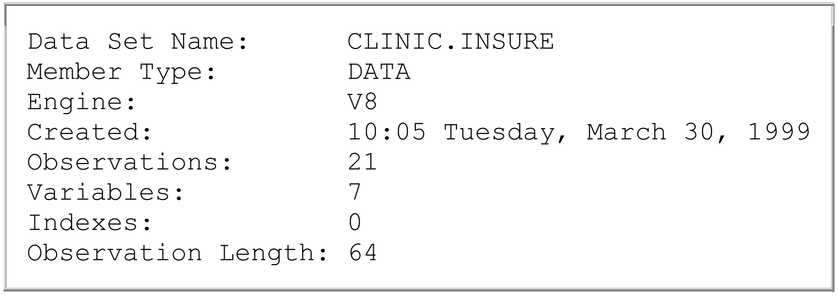


Descriptor Portion

The descriptor portion of a SAS data set contains information about the data set, including

- the name of the data set
- the date and time that the data set was created
- the number of observations
- the number of variables.

Let's look at another SAS data set. The table below lists part of the descriptor portion of the data set **Clinic.Insure**, which contains insurance information for patients who are admitted to a wellness clinic. (It's a good idea to give your data set a name that is descriptive of the contents.)

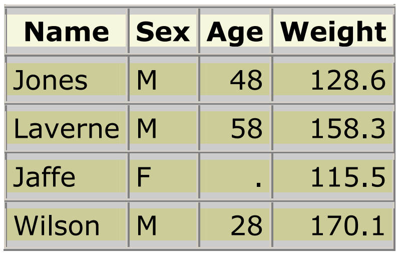


```
Data Set Name:      CLINIC.INSURE
Member Type:        DATA
Engine:             V8
Created:            10:05 Tuesday, March 30, 1999
Observations:       21
Variables:          7
Indexes:            0
Observation Length: 64
```

Data Portion

The data portion of a SAS data set is a collection of data values that are arranged in a rectangular table. In the example below, the name *Jones* is a data value, the weight *158.3* is a data value, and so on.

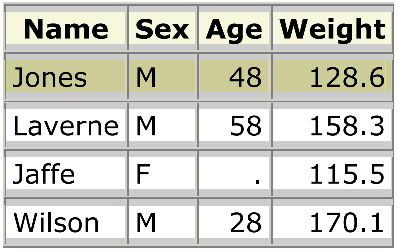
Data portion



Name	Sex	Age	Weight
Jones	M	48	128.6
Laverne	M	58	158.3
Jaffe	F	.	115.5
Wilson	M	28	170.1

Observations (Rows)

Rows (called **observations**) in the data set are collections of data values that usually relate to a single object. The values *Jones*, *M*, *48*, and *128.6* constitute a single observation in the data set shown below.



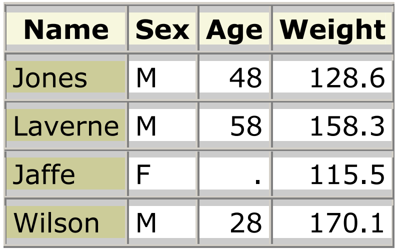
Observation

Name	Sex	Age	Weight
Jones	M	48	128.6
Laverne	M	58	158.3
Jaffe	F	.	115.5
Wilson	M	28	170.1

This data set has four observations, each containing information about an individual. A SAS data set can store any number of observations.

Variables (Columns)

Columns (called **variables**) in the data set are collections of values that describe a particular characteristic. The values *Jones*, *Laverne*, *Jaffe*, and *Wilson* constitute the variable `Name` in the data set shown below.



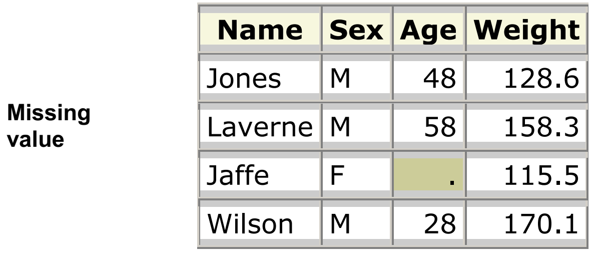
Variable

Name	Sex	Age	Weight
Jones	M	48	128.6
Laverne	M	58	158.3
Jaffe	F	.	115.5
Wilson	M	28	170.1

This data set contains four variables for each observation: `Name`, `Sex`, `Age`, and `Weight`. A SAS data set can store thousands of variables.

Missing Values

The rectangular arrangement of rows and columns in a SAS data set implies that every variable must exist for each observation. If a data value is unknown for a particular observation, a missing value is recorded in the SAS data set.


Missing value

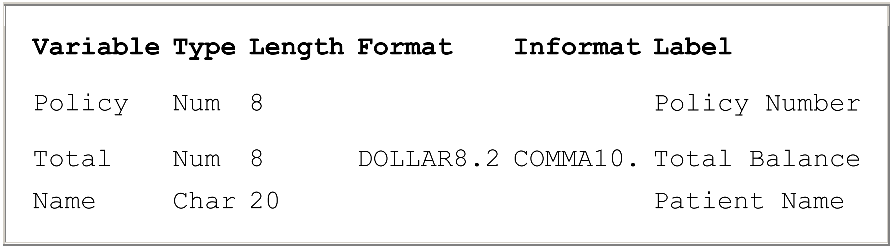
Name	Sex	Age	Weight
Jones	M	48	128.6
Laverne	M	58	158.3
Jaffe	F	.	115.5
Wilson	M	28	170.1

Variable Attributes

In addition to general information about the data set, the descriptor portion contains information about the attributes of each variable in the data set. The attribute information includes the variable's name, type, length, format, informat, and label.

When you write SAS programs, it's important to understand the attributes of the variables that you use. For example, you might need to combine SAS data sets that contain same-named variables. In this case, the variables must be the same type (character or numeric).

The following is a partial listing of the attribute information in the descriptor portion of the SAS data set **Clinic.Insure**. Let's look at the **name**, **type**, and **length** variable attributes. You'll learn about the format, informat, and label attributes later in this chapter.

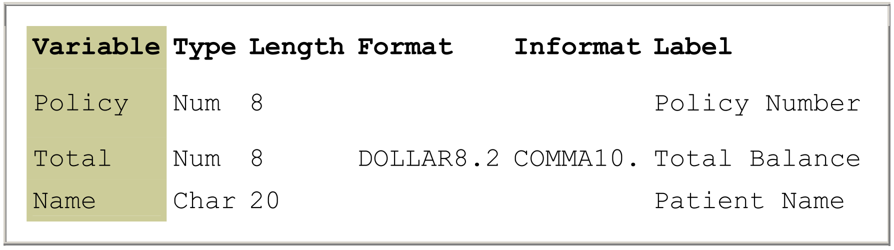


```
Variable Type Length Format    Informat Label

Policy   Num  8                         Policy Number

Total    Num  8      DOLLAR8.2 COMMA10. Total Balance
Name     Char 20                        Patient Name
```

Name

Each variable has a name that conforms to SAS naming conventions. Variable names follow exactly the same rules as SAS data set names. Like data set names, variable names

- can be 1 to 32 characters long
- must begin with a letter (A–Z, either uppercase or lowercase) or an underscore (_)
- can continue with any combination of numbers, letters, or underscores.

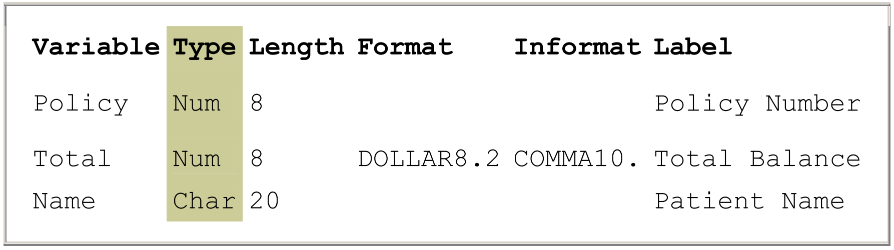


Variable	Type	Length	Format	Informat	Label
Policy	Num	8			Policy Number
Total	Num	8	DOLLAR8.2	COMMA10.	Total Balance
Name	Char	20			Patient Name

Type

A variable's type is either **character** or **numeric**.

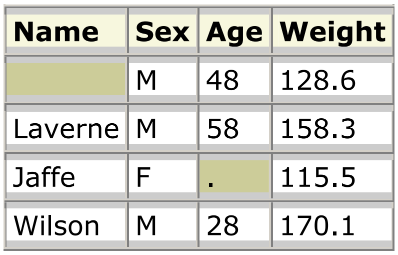
- Character variables, such as `Name` (shown below), can contain **any values**.
- Numeric variables, such as `Policy` and `Total` (shown below), can contain **only numeric values** (the digits 0 through 9, +, -, ., and E for scientific notation).



Variable	Type	Length	Format	Informat	Label
Policy	Num	8			Policy Number
Total	Num	8	DOLLAR8.2	COMMA10.	Total Balance
Name	Char	20			Patient Name

A variable's type determines how missing values for a variable are displayed. In the following data set, `Name` and `Sex` are character variables, and `Age` and `Weight` are numeric variables.

- For character variables such as `Name`, a **blank** represents a missing value.
- For numeric variables such as `Age`, a **period** represents a missing value.

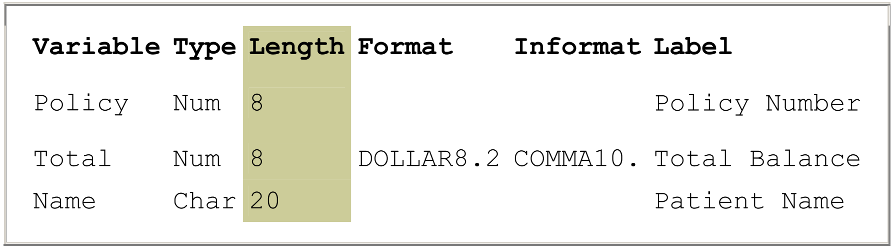


Name	Sex	Age	Weight
	M	48	128.6
Laverne	M	58	158.3
Jaffe	F	.	115.5
Wilson	M	28	170.1

Length

A variable's **length** (the number of bytes used to store it) is related to its type.

- Character variables can be up to **32,767 bytes** long. In the example below, `Name` has a length of 20 characters and uses 20 bytes of storage.
- All numeric variables have a default length of **8**. Numeric values (no matter how many digits they contain) are stored as floating-point numbers in 8 bytes of storage, unless you specify a different length.

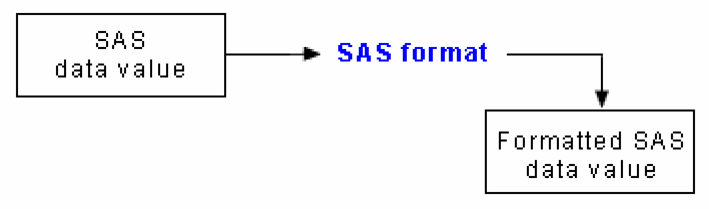


Variable	Type	Length	Format	Informat	Label
Policy	Num	8			Policy Number
Total	Num	8	DOLLAR8.2	COMMA10.	Total Balance
Name	Char	20			Patient Name

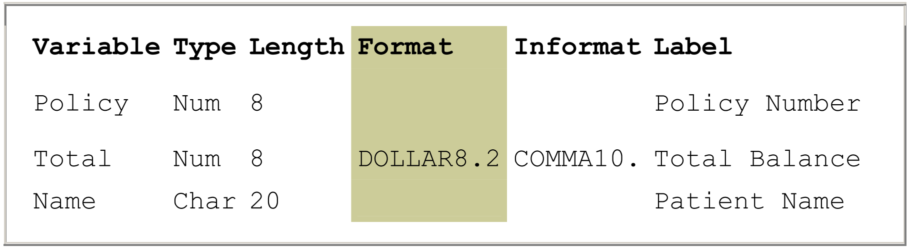
You've seen that each SAS variable has a name, type, and length. In addition, you can define **format**, **informat**, and **label** attributes for variables. Let's look briefly at these optional attributes—you'll learn more about them in later chapters as you need to use them.

Format

Formats are variable attributes that affect the way data values are written. SAS software offers a variety of character, numeric, and date and time formats. You can also create and store your own formats. To write values out using a particular form, you select the appropriate format.



For example, to display the value *1234* as $1234.00 in a report, you can use the DOLLAR8.2 format, as shown for `Total` below.



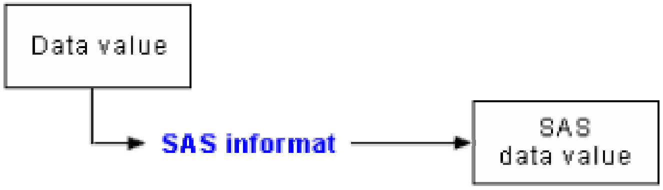
Variable	Type	Length	Format	Informat	Label
Policy	Num	8			Policy Number
Total	Num	8	DOLLAR8.2	COMMA10.	Total Balance
Name	Char	20			Patient Name

Usually you have to specify the maximum width (***w***) of the value to be written. Depending on the particular format, you might also need to specify the number of decimal places (***d***) to be written. For example, to display the value *5678* as 5,678.00 in a report, you can use the COMMA8.2 format, which specifies a width of 8 including 2 decimal places.

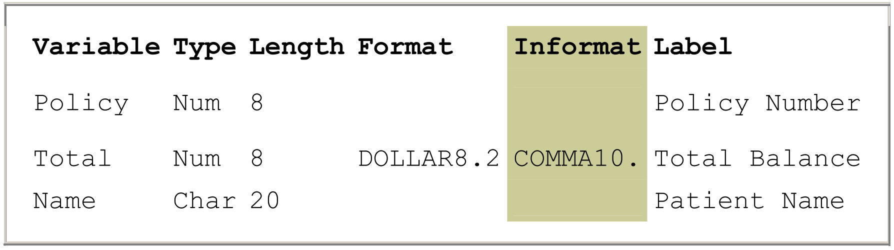
You can permanently assign a format to a variable in a SAS data set, or you can temporarily specify a format in a PROC step to determine the way the data values appear in output.

Informat

Whereas **formats** write values **out** by using some particular form, **informats** read data values in certain forms **into** standard SAS values. Informats determine how data values are read into a SAS data set. You **must** use informats to read numeric values that contain letters or other special characters.



For example, the numeric value *$1,234.00* contains two special characters, a dollar sign ($) and a comma (,). You can use an informat to read the value while removing the dollar sign and comma, and then store the resulting value as a standard numeric value. For `Total` below, the COMMA10. informat is specified.

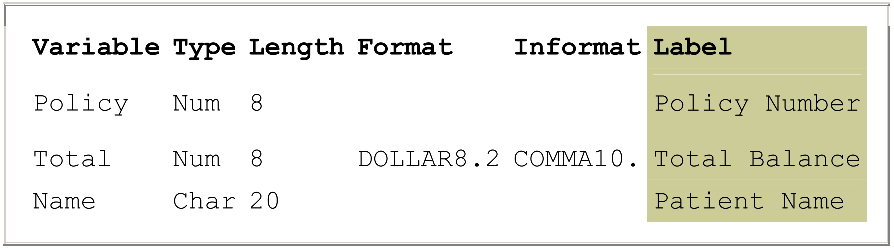


Variable	Type	Length	Format	Informat	Label
Policy	Num	8			Policy Number
Total	Num	8	DOLLAR8.2	COMMA10.	Total Balance
Name	Char	20			Patient Name

Label

A variable can have a **label**, which consists of descriptive text up to 256 characters long. By default, many reports identify variables by their names. You might want to display more descriptive information about the variable by assigning a label to the variable.

For example, you can label `Policy` as **Policy Number**, `Total` as **Total Balance**, and `Name` as **Patient Name** to display these labels in reports.



Variable	Type	Length	Format	Informat	Label
Policy	Num	8			Policy Number
Total	Num	8	DOLLAR8.2	COMMA10.	Total Balance
Name	Char	20			Patient Name

You might even want to use labels to shorten long variable names in your reports. Assigning labels to variables is discussed in Chapter 4, **Creating List Reports**.

Summary

Text Summary

Components of SAS Programs

SAS programs consist of two types of steps: DATA steps and PROC (procedure) steps. These two steps, alone or combined, form most SAS programs. A SAS program can consist of a DATA step, a PROC step, or any combination of DATA and PROC steps. **DATA steps** typically create or modify SAS data sets, but they can also be used to produce custom-designed reports. **PROC steps** are pre-written routines that enable you to analyze and process the data in a SAS data set and to present the data in the form of a report. PROC steps sometimes create new SAS data sets that contain the results of the procedure.

Characteristics of SAS Programs

SAS programs consist of **SAS statements**. A SAS statement usually begins with a SAS keyword and always ends with a semicolon. A DATA step begins with the keyword DATA. A PROC step begins with the keyword PROC. SAS statements are in free format, so they can begin and end anywhere on a line. One statement can continue over several lines, and several statements can be on a line. Blanks or special characters separate "words" in a SAS statement.

Processing SAS Programs

When you submit a SAS program, SAS reads SAS statements and checks them for errors. When it encounters a subsequent DATA, PROC, RUN, or QUIT statement, SAS executes the previous step in the program.

Each time a step is executed, SAS generates a log of the processing activities and the results of the processing. The SAS log collects messages about the processing of SAS programs and about any errors that occur.

The results of processing can vary. Some SAS programs open an interactive window or invoke procedures that create output in the form of a report. Other SAS programs perform tasks such as sorting and managing data, which have no visible results other than messages in the log.

SAS Libraries

Every SAS file is stored in a **SAS library**, which is a collection of SAS files such as SAS data sets and catalogs. In some operating environments, a SAS library is a physical collection of files. In others, the files are only logically related. In the Windows and UNIX environments, a SAS library is typically a group of SAS files in the same folder or directory.

Depending on the libref you use, you can store SAS files in temporary SAS libraries or in permanent SAS libraries.

- Temporary SAS files that are created during the session are held in a special workspace that is assigned the default libref **Work**. If you don't specify a libref when you create a file (or if you specify **Work**), then the file is stored in the temporary SAS library. When you end the session, the temporary library is deleted.
- To store a file permanently in a SAS library, you assign it a libref other than the default **Work**. For example, by assigning the libref **Clinic** to a SAS library, you specify that files within the library are to be stored until you delete them.

Referencing SAS Files

To reference a SAS file, you use a two-level name, ***libref.filename***. In the two-level name, ***libref*** is the name for the SAS library that contains the file, and ***filename*** is the name of the file itself. A period separates the libref and filename.

To reference temporary SAS files, you specify the default libref **Work**, a period, and the filename. Alternatively, you can simply use a one-level name (the filename only) to reference a file in a temporary SAS library. Referencing a SAS file in any library **except Work** indicates that the SAS file is stored permanently.

SAS data set names can be 1 to 32 characters long, must begin with a letter (A–Z, either uppercase or lowercase) or an underscore (_), and can continue with any combination of numbers, letters, or underscores.

Overview of SAS Data Sets

For many of the data processing tasks that you perform with SAS, you access data in the form of a **SAS data set** and use SAS programs to analyze, manage, or present the data. Conceptually, a SAS data set is a file that consists of two parts: a descriptor portion and a data portion. Some SAS data sets also contain one or more indexes, which enable SAS to locate records in the data set more efficiently.

The **descriptor portion** of a SAS data set contains information about the data set.

The **data portion** of a SAS data set is a collection of data values that are arranged in a rectangular table. **Observations** in the data set correspond to rows or data lines in a raw data file or in an external database. An observation is the information about each object in a SAS data set. **Variables** in the data set correspond to columns in a raw data file or in an external database. A variable is the set of data values that describe a particular characteristic. If a data value is unknown for a particular observation, a missing value is recorded in the SAS data set.

Variable Attributes

In addition to general information about the data set, the descriptor portion contains attribute information for each variable in the data set. The attribute information includes the variable's name, length, and type. A variable's type determines how missing values for a variable are displayed by SAS. For character variables, a **blank** represents a missing value. For numeric variables, a **period** represents a missing value.

Points to Remember

- Before referencing SAS files, you must assign a name (libref, or library reference) to the library in which the files are stored (or specify that SAS is to assign the name automatically).
- You can store SAS files either temporarily or permanently.
- Variable names follow the same rules as SAS data set names. However, your site might choose to restrict variable names to those valid in SAS Version 6, to uppercase variable names automatically, or to remove all restrictions on variable names.

⚠ After completing Chapter 1 and before continuing with Chapter 2 of this book, you should take one of the tutorials located on the CD that accompanies this book. These tutorials teach you how to create and manage your SAS programs by using the programming workspace provided in SAS, SAS Enterprise Guide, and SAS Learning Edition.

Which tutorial you take will depend on the version of SAS that you are running on your machine.

- If you are running SAS 8 or SAS 9, take the **Using the Programming Workspace: SAS Windowing Environment** tutorial.
- If you are running SAS Enterprise Guide 1.3 or SAS Learning Edition 1.0, take the **Using the Programming Workspace: SAS Enterprise Guide 1.3** tutorial.
- If you are running SAS Enterprise Guide 2.0, take the **Using the Programming Workspace: SAS Enterprise Guide 2.0** tutorial.

Now, insert the CD and print one of the following tutorials:

- Using the Programming Workspace: SAS Windowing Environment
- Using the Programming Workspace: SAS Enterprise Guide 1.3
- Using the Programming Workspace: SAS Enterprise Guide 2.0

If you do not find the release or version of SAS that you are running at your site, check the following companion Web site for updates:

`support.sas.com/certbasetutorials`

Ensure that you read the **Before You Begin** section on the CD for instructions on how to create the sample data and how to use the contents of the CD.

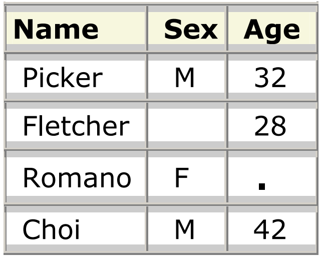
Practice

After you complete this chapter, practice what you learned by using the sample data and SAS programs for Chapter 1, **Basic Concepts**, which are located on the CD-ROM. Follow the directions for creating your sample data in the Before You Begin section.

Quiz

Select the best answer for each question. After completing the quiz, you can check your answers using the answer key in the appendix.

1. How many observations and variables does the data set below contain?



Name	Sex	Age
Picker	M	32
Fletcher		28
Romano	F	.
Choi	M	42

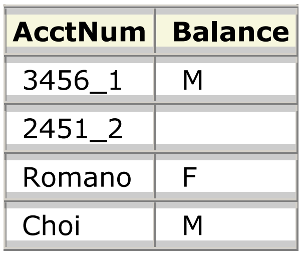
a. 3 observations, 4 variables
b. 3 observations, 3 variables
c. 4 observations, 3 variables
d. can't tell because some values are missing

2. How many program steps are executed when the program below is processed?

```
data user.tables;
   infile jobs;
   input date name $ job $;
run;
proc sort data=user.tables;
   by name;
run;
proc print data=user.tables;
run;
```

a. three
b. four
c. five
d. six

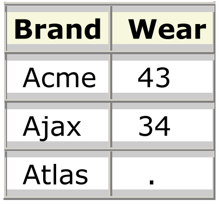
3. What type of variable is the variable AcctNum in the data set below?



AcctNum	Balance
3456_1	M
2451_2	
Romano	F
Choi	M

a. numeric
b. character
c. can be either character or numeric
d. can't tell from the data shown

4. What type of variable is the variable Wear in the data set below?



Brand	Wear
Acme	43
Ajax	34
Atlas	.

a. numeric
b. character
c. can be either character or numeric
d. can't tell from the data shown

5. Which of the following variable names is valid?

a. 4BirthDate
b. $Cost
c. _Items_
d. Tax-Rate

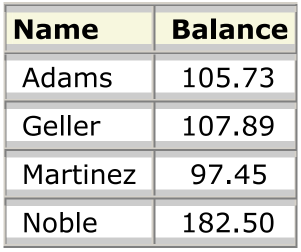
6. Which of the following files is a permanent SAS file?

a. **`Sashelp.PrdSale`**
b. **`Sasuser.MySales`**
c. **`Profits.Quarter1`**
d. all of the above

7. In a DATA step, how can you reference a temporary SAS data set named **Forecast**?

a. **`Forecast`**
b. **`Work.Forecast`**
c. **`Sales.Forecast`** (after assigning the libref **`Sales`**)
d. only *a* and *b* above

8. What is the default length for the numeric variable Balance?



Name	Balance
Adams	105.73
Geller	107.89
Martinez	97.45
Noble	182.50

a. 5
b. 6
c. 7
d. 8

9. How many statements does the following SAS program contain?

```
proc print data=new.prodsale
                label double;
  var state day price1 price2; where state='NC';
  label state='Name of State';
run;
```

a. three
b. four
c. five
d. six

10. What is a SAS data library?

a. a collection of SAS files, such as SAS data sets and catalogs
b. in some operating environments, a physical collection of SAS files
c. in some operating environments, a logically related collection of SAS files
d. all of the above