

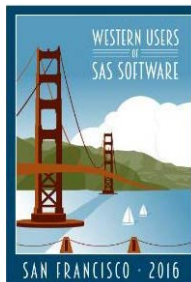


WESTERN USERS OF SAS SOFTWARE

SAN FRANCISCO • 2016

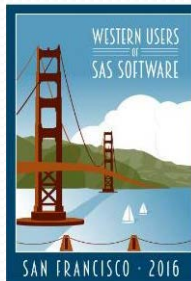
How SAS Thinks SAS Basics I

Susan J. Slaughter, Avocet Solutions



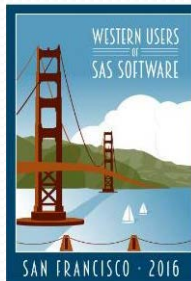
What is SAS Essentials?

- Section for people new to SAS
- Core presentations
 1. How SAS Thinks
 2. Introduction to DATA Step Programming
 3. Introduction to SAS Procedures
- We'll go fast
- Pay attention because there will be a test



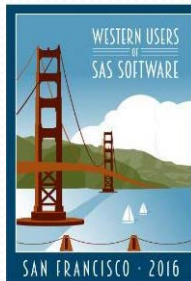
What is SAS?

- Originally stood for Statistical Analysis System
- Since 1980s officially no longer an acronym
- Pronounced “sass” not “S. A. S.”
- Better answers:
 - Company named SAS Institute
 - Family of software products
 - Programming language



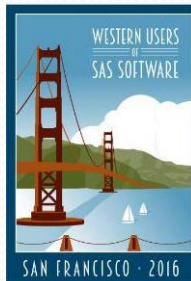
Susan says

- This is an overview
 - Keep in mind that there are many exceptions
- There are always at least 3 ways to do anything in SAS
 - Don't worry about it
- SAS is a big language
 - No one knows it all
- SAS is a language of defaults
 - Once you know what the default is, you can override it



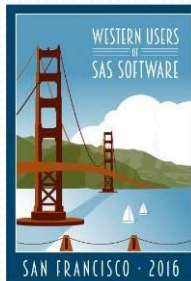
Ways to run SAS

- You have a choice of environments
- Programming environments (you write SAS program)
 - SAS windowing environment (“Display Manager”)
 - SAS Enterprise Guide
 - SAS Studio
- Point-and-click interfaces (SAS writes program for you)
 - SAS Enterprise Guide
 - SAS Studio



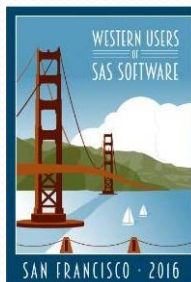
SAS Studio

- New interface, runs in a web browser
- SAS Studio Single-User, Basic, and Enterprise versions
 - Free with Base SAS license
- SAS University Edition
 - Download
 - Free for learning!
- SAS OnDemand for Academics
 - Use online
 - Free for learning!



SAS data sets

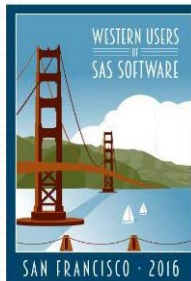
- Before SAS can use data, must be in a SAS data set
- Two parts of a SAS data set
 - Data
 - Descriptor (self-documenting)
- When you run SAS programs, they are compiled and then executed
 - What does this have to do with SAS data sets?
 - Descriptor is constructed during compilation
 - Data are added during execution



SAS data sets

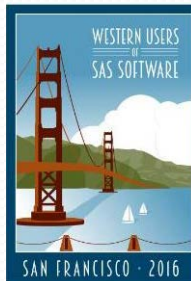
Descriptor portion contains:

- Information about data set
 - Name of data set
 - Date created
 - Number of observations and variables
- Information about variables
 - Name of variable
 - Type (character or numeric)
 - Length (in bytes)
 - Label (if any)
 - Informat and format (if any)



SAS data set names

- SAS data set names always have two levels:
libref.membername
- Libref
 - SAS data library reference
 - Specifies location (disk, folder, path)
- Member name
 - Individual data set in that library
- Separated by a period



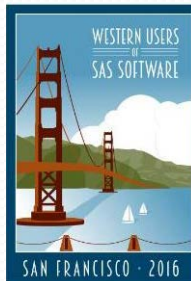
SAS data set names

MySASLib.students

- two level name
- member name = students
- libref = MySASLib
- will be permanent
- not erased by SAS

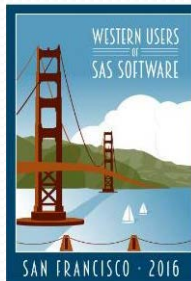
students

- one level name
- member name = students
- libref = WORK
- will be temporary
- erased by SAS
- real name WORK.students



SAS data libraries

- Built-in SAS data libraries
 - WORK temporary
 - SASUSER permanent
 - For your use
 - SASHELP permanent
 - Sample data sets
- Define your own SAS data libraries



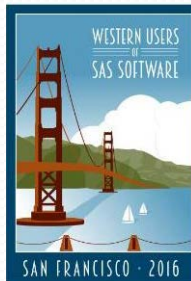
SAS data libraries

- Many ways to create permanent SAS data libraries
 - Depend on operating system
- LIBNAME statement always works
 - General form (on Windows):

```
LIBNAME libref 'drive:\directory-path' ;
```





- Example:

```
LIBNAME mysas 'c:\MySASLib' ;
```



SAS data sets

- SAS data sets are rectangular
 - Records = rows = observations
 - Fields = columns = variables

	 ID	 Name	 Age	 Major
1	78374	Thomas	21	
2	75638	Cathy	.	STA
3	78634	David	20	ENG

- Two types of variables

Numeric

Numbers

Add, subtract

Period (.) for missing

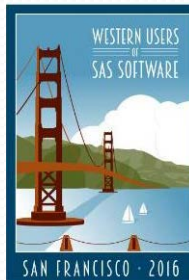
Character

Letters, numerals, \$#@!

Cannot add, subtract

Blank for missing

- Some data values can be numeric or character
 - Example: ID numbers



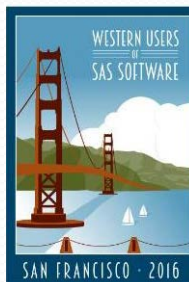
Dates in SAS

- SAS date values are number of days since January 1, 1960

<u>Date</u>	<u>SAS date value</u>
December 31, 1959	-1
January 1, 1960	0
January 1, 1961	366
September 7, 2016	20704

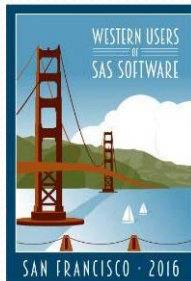
- Stored as ordinary numeric data values
- How many days old are you?

`DaysOld = TodayDate - BirthDate;`



SAS variable names

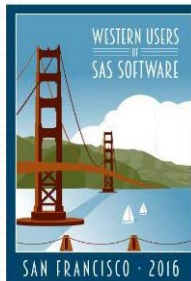
- Rules for names of variables
 - Start with letter or underscore
 - Contain only letters, numerals and underscores
 - Up to 32 characters long
 - Can be upper or lower case
 - SAS doesn't care whether upper or lowercase
 - Age, age, AGE and AgE all refer to the same variable
 - But SAS remembers the case of first occurrence of variables



Getting data into SAS

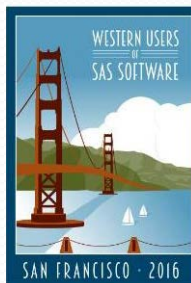
There are many ways

- Type it in yourself
 - in Viewtable window, Data Grid
- DATA step with INPUT statement
- Import wizard
- PROC IMPORT
- SAS data engines such as SPSS
- SAS/ACCESS for files such as Oracle



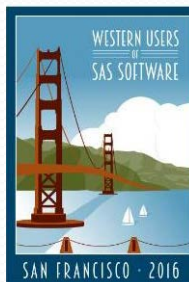
SAS programs

- First rule of SAS programming
 - Every SAS statement ends with a semicolon;
- No rules for formatting of code
 - Upper or lowercase
 - I will use uppercase for keywords, mixed case for variables
 - More than one statement per line
 - Statements can continue on next line
 - Any indention or none
 - Can be completely unreadable—not recommended



SAS programs

- You should always include comments in your programs!
- Two styles
 - ```
* This is a comment;
```
  - ```
/* This is another comment */
```
- Comments might include
 - Your name
 - Date
 - Purpose
 - Describe any non-obvious bits of code



DATA versus PROC steps

- Two basic parts of SAS programs

DATA step

Begin with DATA statement

Input and modify data

Create SAS data set

Flexibility of programming

PROC step

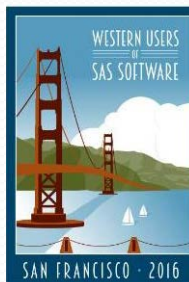
Begin with PROC statement

Perform analysis or task

Produce report

Like filling out a form

- This is a simplification, but good guideline
- Common mistake made by beginners is to use statements in wrong kind of step



DATA versus PROC steps

- A simple example

```
DATA temps;
```

```
    Farenheit = 68;
```

```
    Celsius = (Farenheit - 32) * 0.5556;
```

```
PROC PRINT DATA = temps;
```

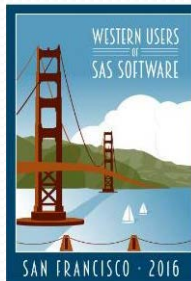
```
    TITLE 'Temperature Conversions';
```

```
RUN;
```

DATA
step

PROC
step

- A step ends when SAS encounters a DATA, PROC, RUN, QUIT, STOP or ABORT statement



Global SAS statements

- Global statements are not part of DATA or PROC steps
 - Only a few: OPTIONS, TITLE, FOOTNOTE, LIBNAME
 - Stay in effect until changed

```
OPTIONS NODATE;
```

```
TITLE 'Temperature Conversions';
```

```
DATA temps;
```

```
    Farenheit = 68;
```

```
    Celsius = (Farenheit - 32) * 0.5556;
```

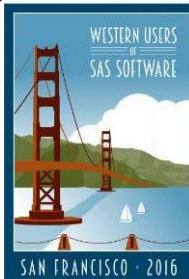
```
PROC PRINT DATA = temps;
```

```
RUN;
```

Global

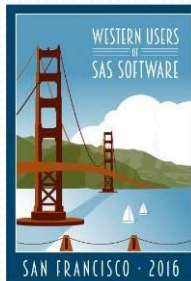
DATA
step

PROC
step



SAS log

- When you run SAS programs, you get SAS log containing
 - SAS statements that you submitted
 - Error messages
 - Program will not run!
 - Usually syntax or spelling problem
 - Warnings
 - There may be a problem
 - Notes
 - Data sets read and created
 - Number of observations and variables
 - May indicate a problem



SAS log

The screenshot displays the SAS software interface. The main window is titled "SAS" and contains a menu bar (File, Edit, View, Go, Tools, Solutions, Window, Help) and a toolbar. On the left, the "Explorer" pane shows the "Contents of 'Work'" directory with a folder named "Temps". The central "Log - (Untitled)" window displays the following SAS code and output:

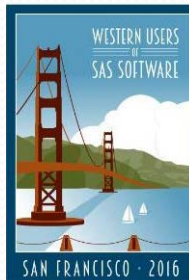
```
1 DATA temps;  
2   Farenheit = 68;  
3   Celsius = (Farenheit - 32) * 0.5556;  
  
NOTE: The data set WORK.TEMPS has 1 observations and 2 variables.  
NOTE: DATA statement used (Total process time):  
      real time      0.01 seconds  
      cpu time       0.00 seconds  
  
4 PROC PRINT DATA = temps;  
5   TITLE 'Temperature Conversions';  
6 RUN;  
  
NOTE: There were 1 observations read from the data set WORK.TEMPS.  
NOTE: PROCEDURE PRINT used (Total process time):  
      real time      0.54 seconds  
      cpu time       0.32 seconds
```

Below the log window, the "Results Viewer - sashtml.htm" window displays the output of the PROC PRINT statement:

Obs	Farenheit	Celsius
1	68	20.0016

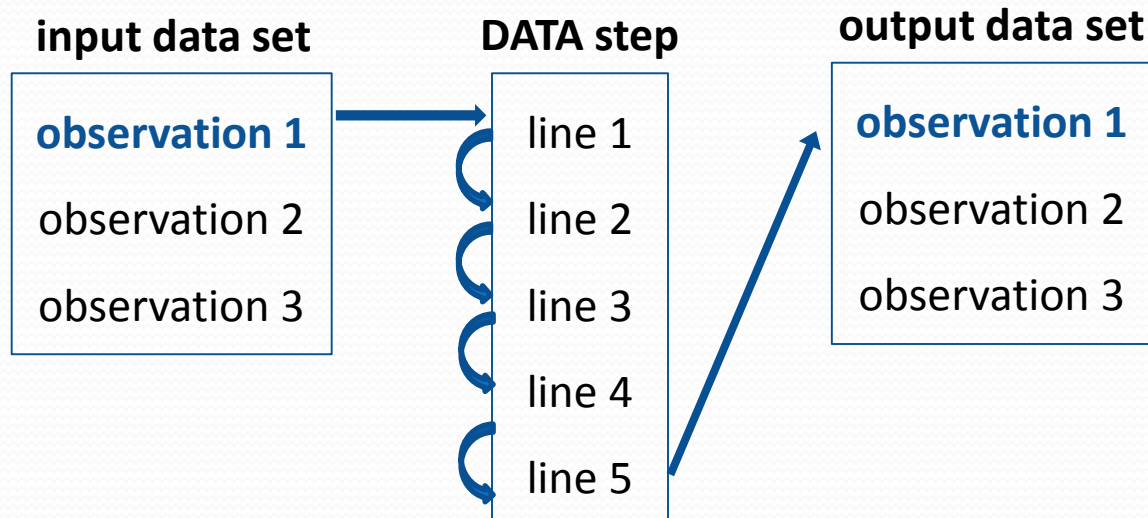
The taskbar at the bottom shows the following open windows: "Results", "Explorer", "Output - (Untitle...", "Log - (Untitled)", "WUSS 2015 SAS ...", and "Results Viewer ...". The system tray shows the user name "C:\Users\Susan Slaughter".

Be sure to
check
your SAS
log!



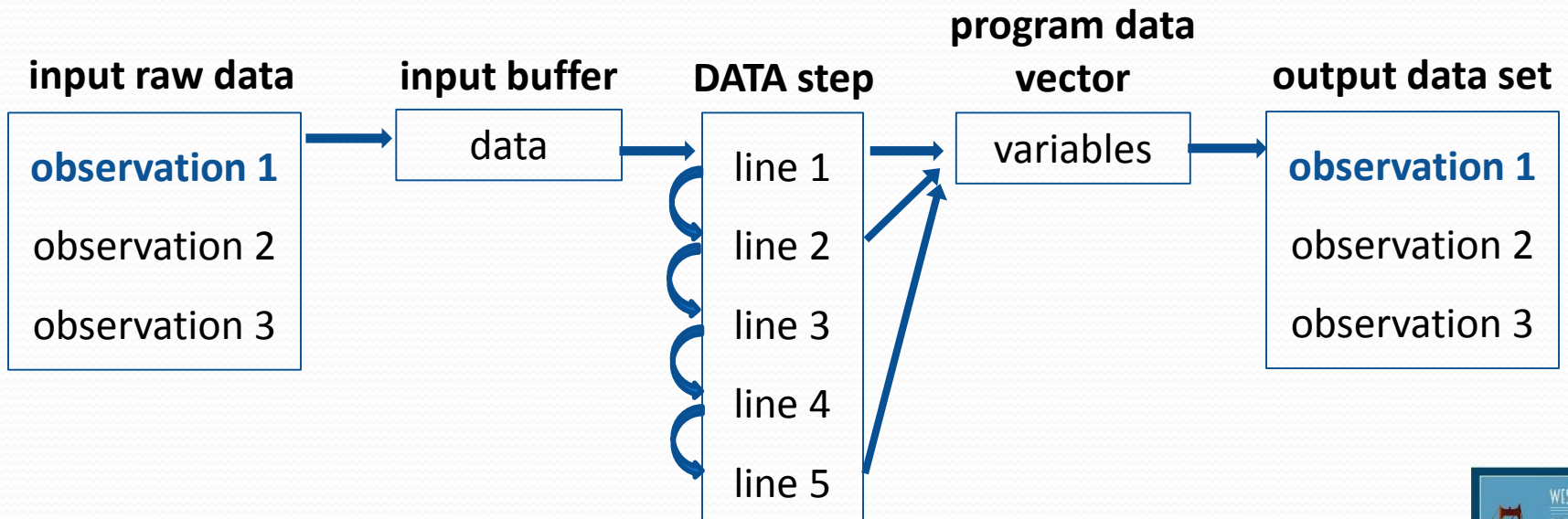
DATA step's built-in loop

- DATA steps execute line-by-line and observation-by-observation



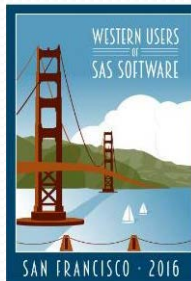
DATA step's built-in loop

- Behind the scenes SAS builds
 - Input Buffer (if reading raw data)
 - Program Data Vector



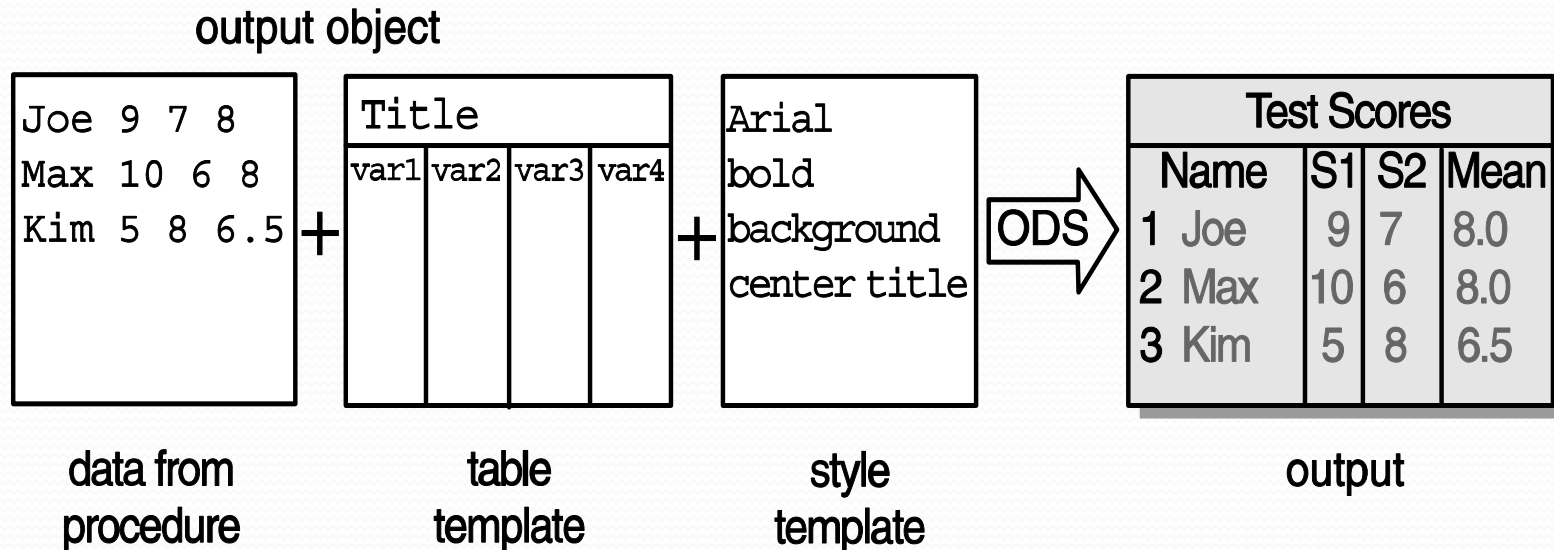
Output Delivery System

- ODS handles all procedure output
- Susan says: You always use ODS!
- Output formats are called destinations
- Many destinations
 - HTML (default starting SAS 9.3)
 - LISTING (text, default SAS 9.2 and earlier)
 - PDF
 - RTF
 - POWERPOINT
 - OUTPUT (SAS data set)



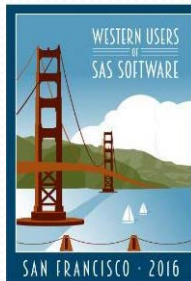
Output Delivery System

- How ODS works:



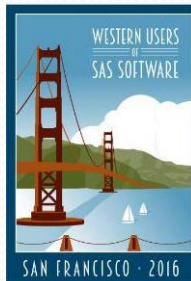
Resources: Software

- Free software!
 - Free for purposes of learning
 - SAS University Edition
 - SAS Studio interface
 - You download
 - SAS OnDemand for Academics
 - SAS Studio interface is default
 - Use online, zero footprint



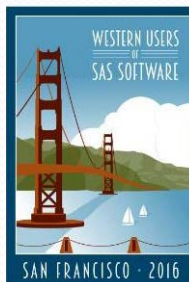
Resources: Training

- Free training!
 - support.sas.com/training/
 - SAS Programming 1: Essentials online self-paced course
 - Statistics 1: Introduction to ANOVA, Regression, and Logistic Regression online self-paced course
 - Nearly 200 free tutorials



Resources: Help

- Free help!
 - communities.sas.com
 - sascommunity.org
 - blogs.sas.com
- Free SAS papers!
 - wuss.org
 - lexjansen.com (every SAS conference paper ever published)



Pop quiz

1) What is SAS?

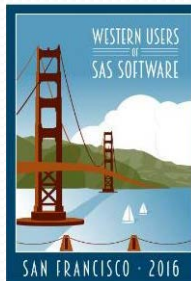
Company, software, programming language

2) Every SAS statement ends with what?

A semicolon;

3) Would a Social Security number be an example of numeric or character data?

Character



Pop quiz

- 4) Someone tells you that the SAS date value for his date of birth is 17. On what date was he born?

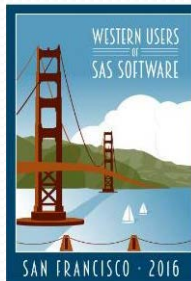
January 18, 1960

- 5) Is this a valid SAS variable name:
ABCDEFGHIJKLMNOPQRSTUVWXYZ?

Yes

- 6) Complete this sentence: “DATA steps execute _____.”

DATA steps execute line-by-line and observation-by-observation.



Pop quiz

7) What do you see in the SAS log?

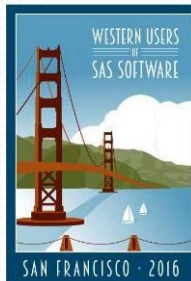
SAS statements you submitted and messages (errors, warnings, notes) from SAS

8) The current default format for output in SAS is what?

HTML

Extra credit: What do the letters SAS stand for?

Nothing



Thank you!

I hope you can stay for the next presentation.

Susan Slaughter
Avocet Solutions

Can download slides from
www.avocetsolutions.com

