

PSTAT 130



SAS BASE PROGRAMMING

- Lecture 1 -

SAS Background



- SAS was once an acronym for “Statistical Analysis System”
- Today, SAS is much more powerful
 - Original acronym is no longer used

SAS Components



- **This class**
 - Base SAS – basic procedures and data management
- **SAS has over 200 components, including**
 - SAS/STAT – statistical analysis
 - SAS/GRAPH – high quality graphics & presentations
 - SAS/ACCESS – reads data directly from databases
 - SAS/ETS – econometrics and time series
 - SAS/INSIGHT – data mining
 - SAS/QC – quality control
 - SAS/PH – clinical trials

Objectives

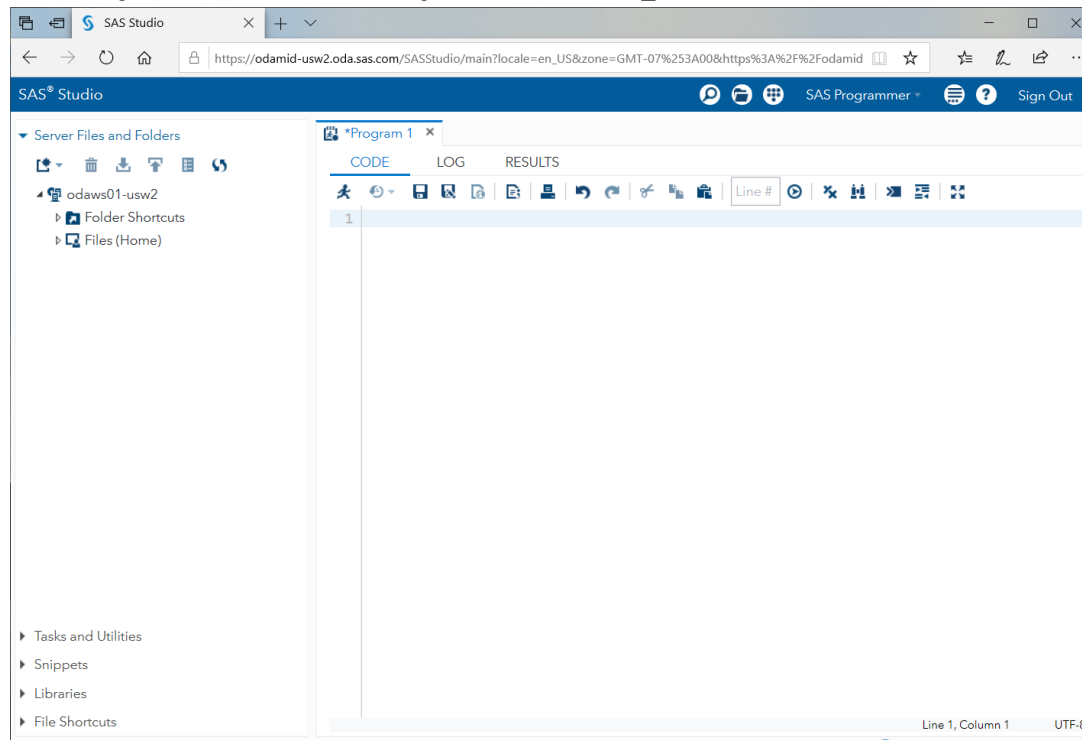


- Open the program
- Navigate the environment
- Basic syntax
- First SAS program
- Datalines statement

First Step



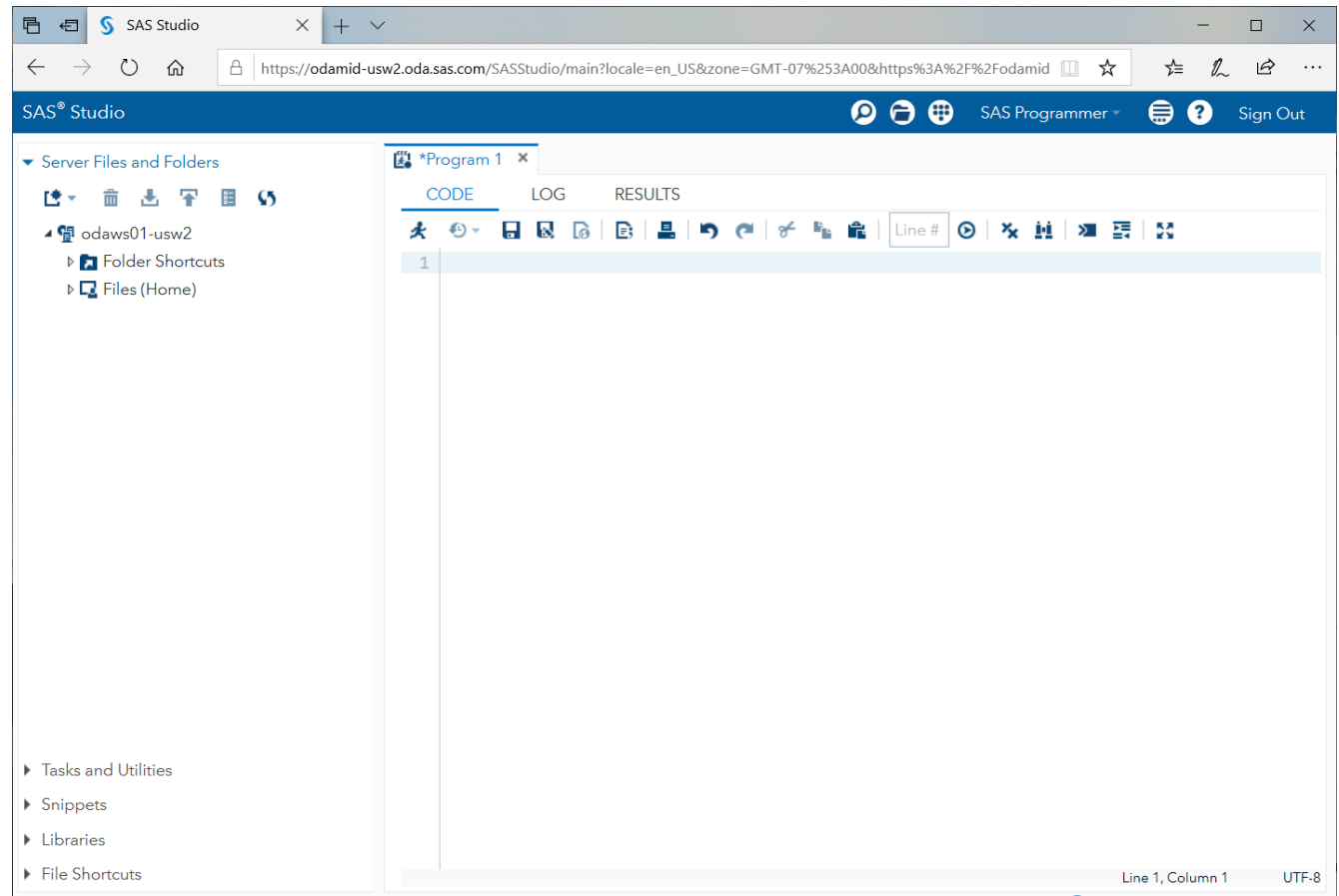
- Open SAS
 - SAS Studio through SAS OnDemand for Academics, *or*
 - SAS University Edition on your computer



The Main Windows



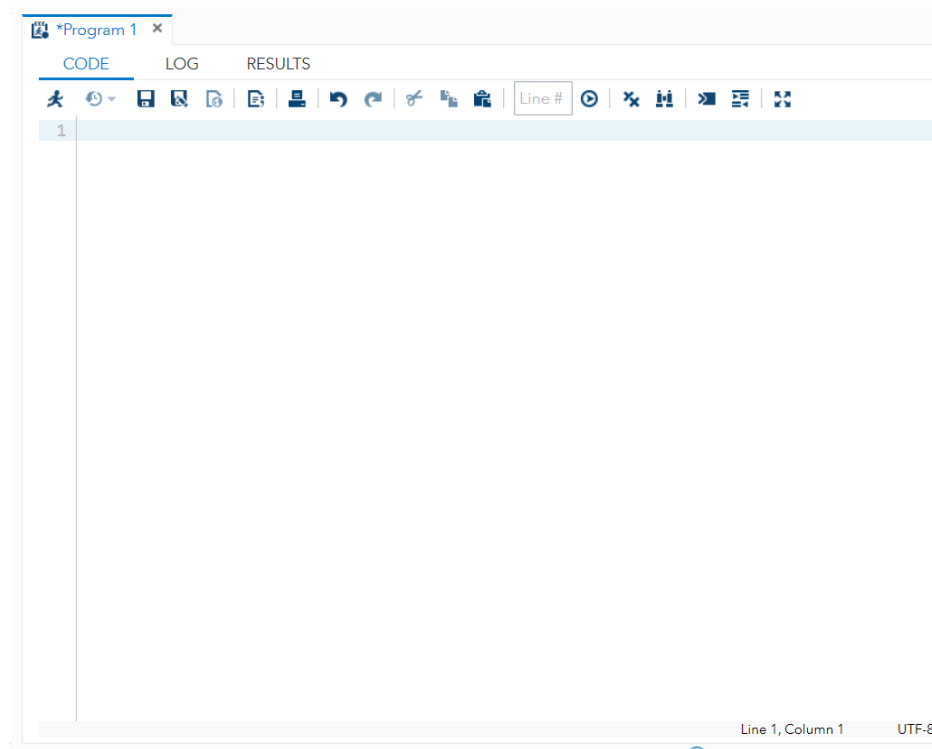
- Code
- Log
- Results
- Output Data
- Explorer



Code

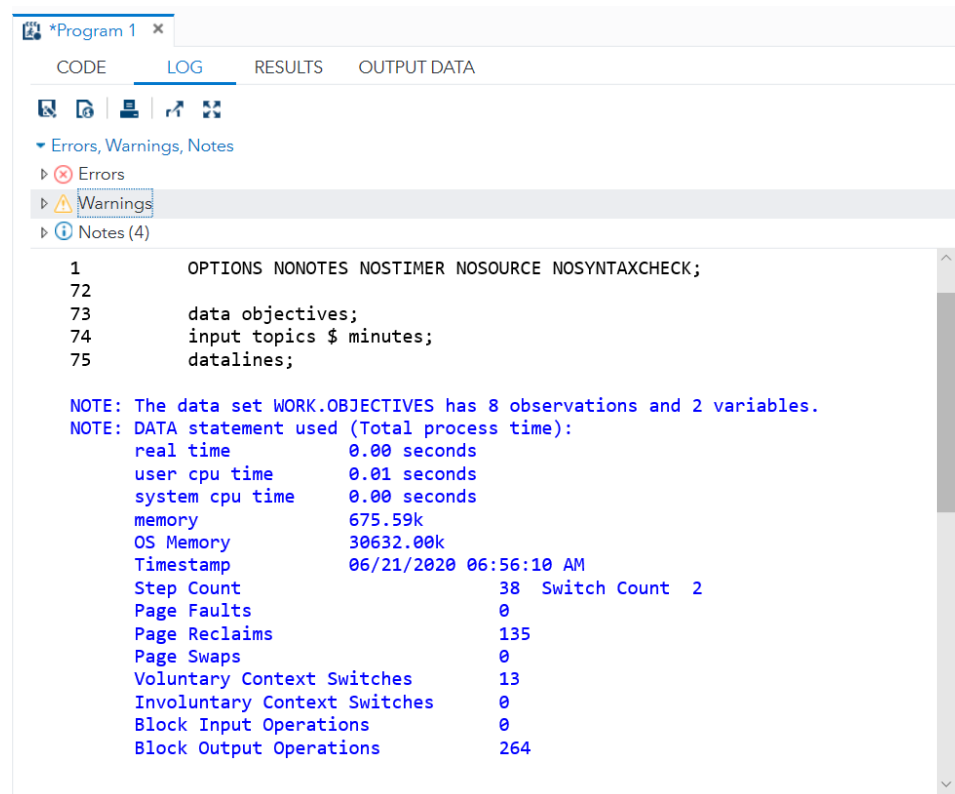


- Edit, execute, and save SAS programs



Log

- Displays status messages regarding the execution of SAS procedures



The screenshot shows the SAS Log window for a program named '*Program 1'. The 'LOG' tab is selected, displaying the execution log. The log includes the following content:

```
1      OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;  
72  
73      data objectives;  
74      input topics $ minutes;  
75      datalines;  
  
NOTE: The data set WORK.OBJECTIVES has 8 observations and 2 variables.  
NOTE: DATA statement used (Total process time):  
      real time           0.00 seconds  
      user cpu time       0.01 seconds  
      system cpu time     0.00 seconds  
      memory              675.59k  
      OS Memory           30632.00k  
      Timestamp           06/21/2020 06:56:10 AM  
      Step Count           38      Switch Count  2  
      Page Faults          0  
      Page Reclaims       135  
      Page Swaps           0  
      Voluntary Context Switches 13  
      Involuntary Context Switches 0  
      Block Input Operations 0  
      Block Output Operations 264
```


Results



- Displays generated report(s) as a single html file

The screenshot shows the SAS Results window for a program named *Program 1.sas. The window has tabs for CODE, LOG, RESULTS (which is selected), and OUTPUT DATA. Below the tabs is a toolbar with icons for opening, saving, printing, and other actions. A 'Table of Contents' link is visible. The main content area displays a table with 8 observations, each representing a topic and its duration in minutes.

Obs	topics	minutes
1	intro	5
2	windows	5
3	basics	10
4	library	5
5	steps	5
6	dataline	5
7	program	5
8	exercise	5

Output Data



- Visible when displaying output SAS dataset(s)

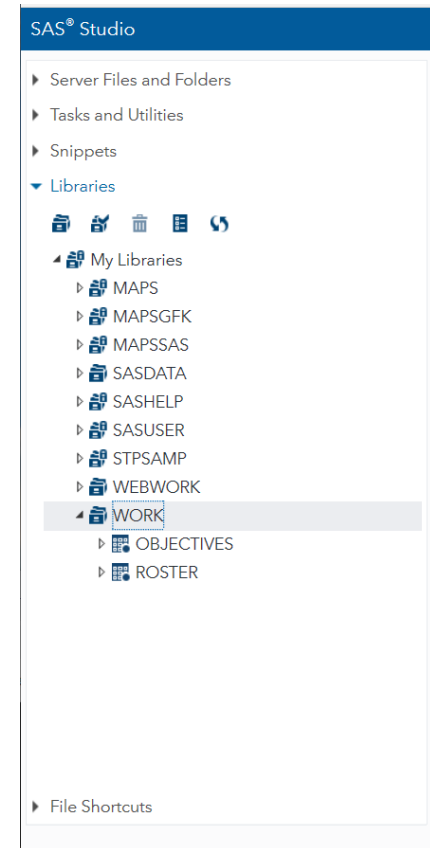
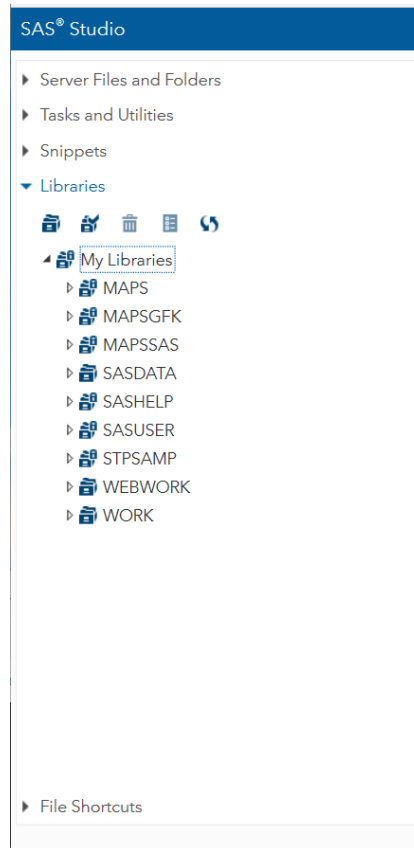
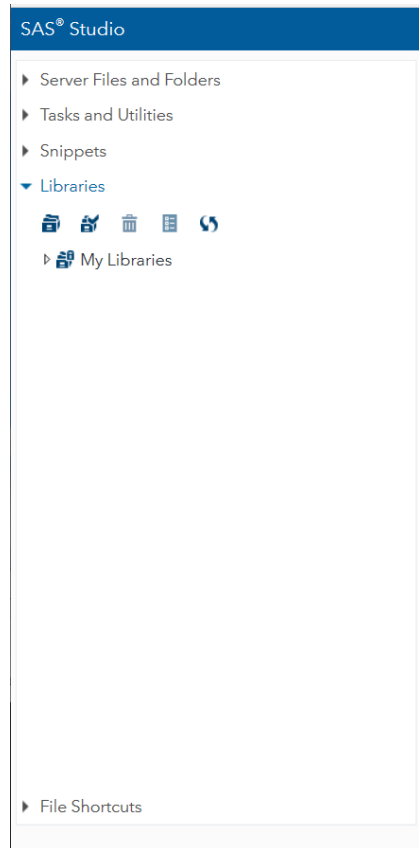
The screenshot shows the SAS Output Data window for a program named *Program 1. The 'OUTPUT DATA' tab is selected, displaying the dataset WORK.OBJECTIVES. The view is set to 'Column names'. The table has 8 rows and 2 columns. The columns are 'top...' and 'minutes'. The rows are numbered 1 through 8, with the first row highlighted. The 'minutes' column contains values 10, 5, 5, 5, 5, 5, 5, and 5 for rows 1 through 8 respectively.

	top...	minutes
1	basics	10
2	dataline	5
3	exercise	5
4	intro	5
5	library	5
6	program	5
7	steps	5
8	windows	5

Explorer



- Navigate libraries, data sets, and other SAS objects



Getting Started



- How to create a new program?
 - F4
 - Right-click in the Explorer window: New → SAS Program

Getting Started



- How to submit/execute a program?
 - Submitting the entire program
 - ✦ F3
 - ✦ Click on the “running man” symbol in the toolbar



- Submitting a portion of the program
 - ✦ Highlight the portion you'd like to submit
 - F3
 - <right click> → Run all or selected code (F3)

Getting Started



- How to save a program?
 - Click on the save button in the toolbar



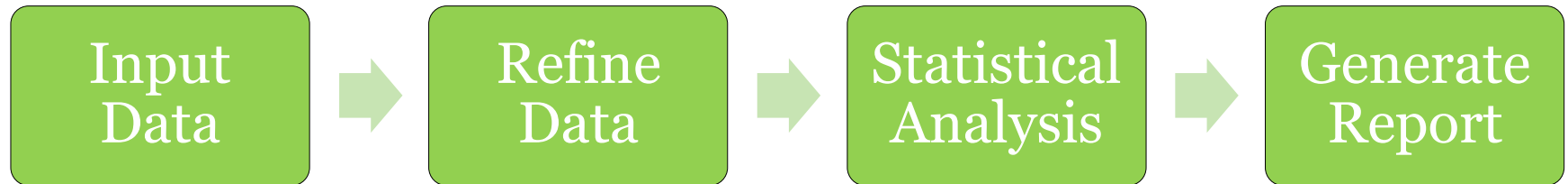
- Ctrl + S

File Extensions



- What are the file extensions for
 - A SAS program?
 - ✦ .sas
 - A SAS data set?
 - ✦ .sas7bdat
 - A SAS log file?
 - ✦ .log
 - A SAS report file?
 - ✦ .html (by default)
 - ✦ .lst (for a listing report)

The Basics: SAS Process



The Basics



- SAS statements
 - Always begin with a keyword
 - Always end with a semicolon (;)
 - Are **free format**
 - ✦ i.e. Can begin at any location and end at any location
 - Entire program can be written on one line, or many lines
 - ✦ EXCEPT when using the `datalines;` statement
- SAS
 - Is not case sensitive
 - ✦ i.e. `daTa nOtCaSeSeNsItIvE;`
 - ✦ EXCEPT in the case of string comparisons

The Basics



- Names of SAS data sets and variables must
 - Be no longer than 32 characters
 - Begin with a letter or underscore
 - Contain only letters, numbers, or underscores (_)

The Basics



- Two types of variables
 - Character
 - ✦ Contains any value: letters, numbers, special characters, and blanks. Character values are stored with a length of 1 to 32,767 bytes. One byte equals one character.
 - Numeric
 - ✦ Stored as floating point numbers in 8 bytes of storage by default. Eight bytes of floating point storage provide space for 16 to 17 significant digits. You are not restricted to 8 digits.

The Basics



- **Comments**
 - What are they?
 - Why should we use them?
 - Single line: begin with an asterisk (*) and ends with a semicolon (;)
 - Multiple lines: begins with a /* and ends with a */

The Basics



- SAS has context-sensitive help.
 - Highlight a keyword, right click on it, click on “Syntax Help”

Libraries



- SAS file names contain 2 levels
 - Level 1: <library-name>
 - Level 2: <data-set-name>
 - ✦ i.e. <library-name>.<data-set-name>
- What does this mean?
 - SAS references folders called libraries when accessing SAS data sets
 - Libraries are simply pointers to folder locations on the disk drive
 - ✦ i.e. '/home/user'

Libraries



- SAS has a number of existing libraries including:
 - work
 - sashelp
- work
 - Is a temporary library
 - Is the default library
- sashelp
 - Is a permanent library
- New libraries must be assigned

Libraries

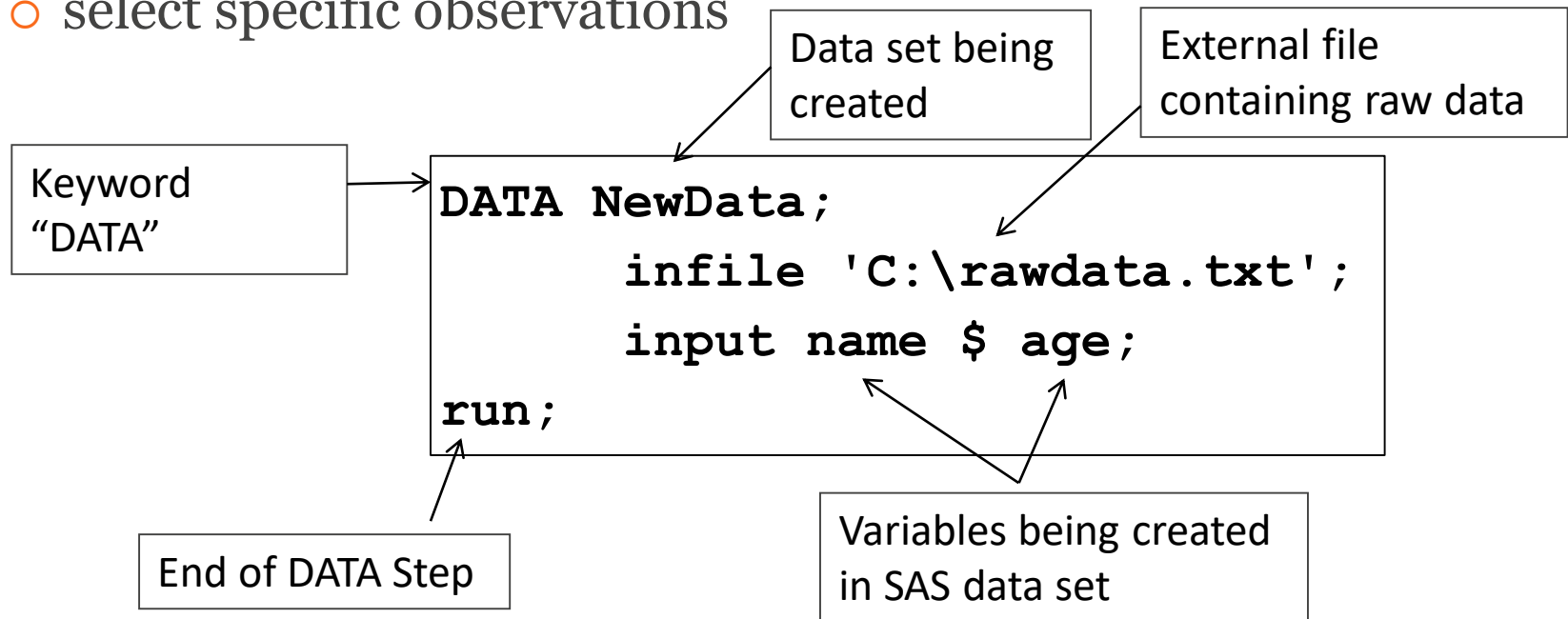


- To define a library, you need
 - The **libname** keyword
 - A user-defined libref name
 - A folder location
- Library references (libref) must
 - Start with a letter or an underscore
 - Be 8 characters or less
- General format:
 - `libname home '/home/user';`

The DATA Step



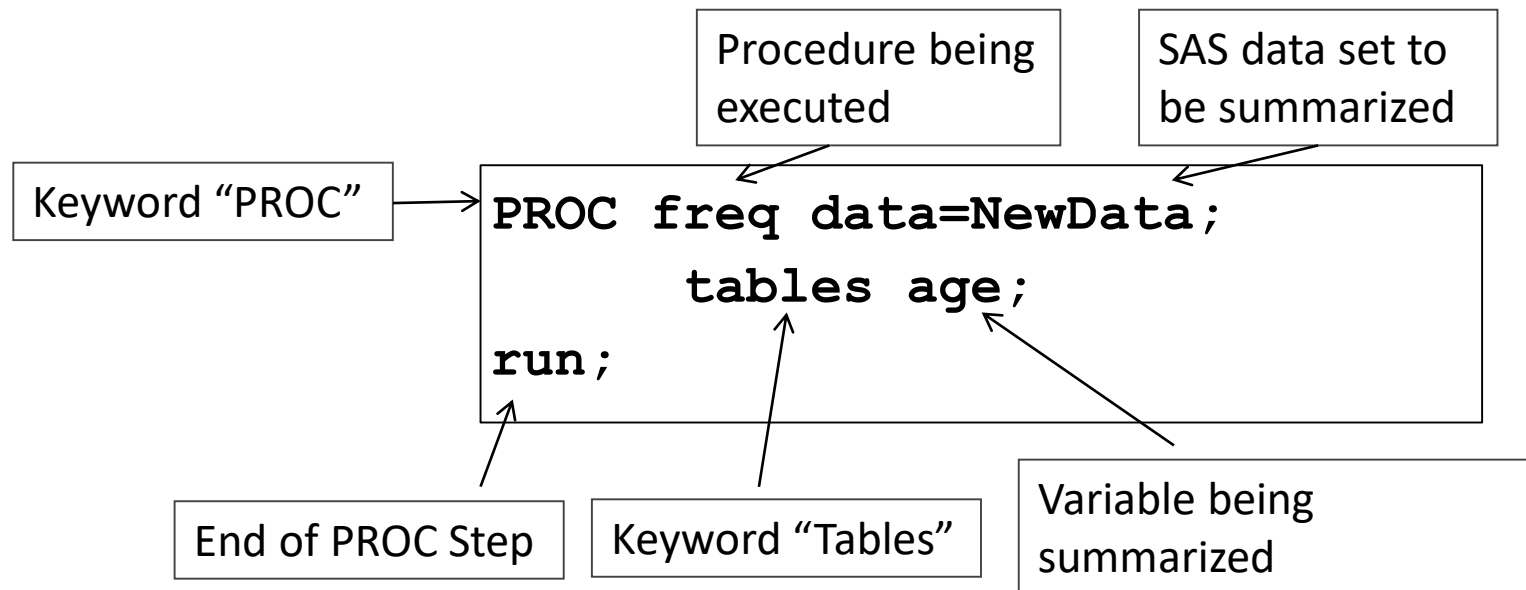
- DATA Step: A set of statements that
 - read in a data file
 - assign variable names, labels, and formats
 - select specific observations



The PROC Step



- **PROC Step:** A set of statements that
 - perform “utility” operations on a data set
 - analyze data
 - output results or reports



First SAS Program



```
DATA intelligence;  
input IQ;  
datalines;  
99  
140  
125  
118  
104  
;  
run;
```

i.e. work.intelligence

```
PROC print;  
run;
```

CODE LOG RESULTS OUTPUT DATA



► Table of Contents

Obs	IQ
1	99
2	140
3	125
4	118
5	104

Datalines Statement



- Allows raw data to be placed within a SAS program
 - When is this used?
 - Why is this useful?
- Properties
 - Can only be used once in a DATA step
 - By default, each data line is a separate observation
 - Default delimiter is a blank space
 - Is the last statement in the DATA step

Datalines Statement



- Requires the use of an input statement
 - Input statement
 - ✦ Identifies the order of values in the data lines
 - ✦ Creates variable names
 - ✦ Assigns variable types
 - ✦ Assigns input values to corresponding variables
- Variables take one of two types
 - Character (\$)
 - Numeric

Datalines Statement



- Structure:

```
datalines;  
< data >  
;
```

- Keyword `datalines;` precedes the data
- Data is listed
- The null statement `(;)` follows the last line of data
 - This indicates the end of the input data

Recall Our First SAS Program



```
DATA intelligence;  
input IQ;  
datalines;  
99  
140  
125  
118  
104  
;  
run;
```

i.e. work.intelligence

CODE LOG RESULTS OUTPUT DATA



► Table of Contents

Obs	IQ
1	99
2	140
3	125
4	118
5	104

Class Exercise



- Create a dataset called HouseReps
- This data set should contain two variables
 - State
 - Reps
- Use the following data:
CA 53
NJ 12
NY 27
TX 36
WA 10