SAS Macros:
An Introduction

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December 1, 2010

Overview

I. What, when, and why

II. Macro variables

III. Macro programs

IV. Macro functions and statements

V. Debugging tips and tricks

VI. Discussion / Questions

The what, when, and why of SAS macros

- **What:** The SAS macro facility is a tool for text substitution.
- **When:** Consider using the macro facility for situations involving routine or repetitive tasks.
- **Why:** Efficiency – You can write a program once, and then with only very small changes produce new results.

Macro variables

- A macro variable is simply a reference to a value. The value is not part of any dataset, it is just held by SAS for when you need it.
- %LET tells SAS that you want to define a macro variable. It is followed by the name of the macro variable, an equal sign, and the value of the macro variable.

```
%LET SUBJ = Reading;
%LET DESC = Reading Comprehension;
%LET I = 10;
```

- Macro variables are typically used to repeatedly insert a piece of text throughout a program. A macro variable is referenced in a program using the ampersand (&).

Example 1 – First without a macro variable

- TITLE1 BOLD HEIGHT=14PT 'Descriptive Statistics for Reading';
- PROC FREQ;
- TABLES READING;
- PROC UNIVARIATE NOPRINT;
- HISTOGRAM READING / MIDPOINTS = 0 TO 10 BY 1;
- PROC MEANS MAXDEC=2 N MEAN STD MIN MAX;
- VAR READING;
- RUN;

Example 1 – Now with a macro variable called SUBJ

- **%LET SUBJ = Reading;**
- TITLE1 BOLD HEIGHT=14PT "Descriptive Statistics for &SUBJ";
- PROC FREQ;
- TABLES **&SUBJ**;
- PROC UNIVARIATE NOPRINT;
- HISTOGRAM **&SUBJ** / MIDPOINTS = 0 TO 10 BY 1;
- PROC MEANS MAXDEC=2 N MEAN STD MIN MAX;
- VAR **&SUBJ**;
- RUN;

Example 1 – I only need one change to run the same program for Math

- **%LET SUBJ = Math;**
- TITLE1 BOLD HEIGHT=14PT "Descriptive Statistics for &SUBJ";
- PROC FREQ;
- TABLES &SUBJ /NOCUM;
- PROC UNIVARIATE NOPRINT;
- HISTOGRAM &SUBJ / MIDPOINTS = 0 TO 10 BY 1;
- PROC MEANS MAXDEC=2 N MEAN STD MIN MAX;
- VAR &SUBJ;
- RUN;

Macro variables (cont.)

- There is another type of macro variable called an automatic macro variable.
- These macro variables are automatically created when you start a SAS session or when you execute certain statements.
  - The most common examples of these are SYSDATE (or SYSDATE9), SYSTIME, and SYSLAST

Example 1 – With some automatic macro variables added

- %LET SUBJ = Reading;

- TITLE1 BOLD HEIGHT=14PT "Descriptive Statistics for &SUBJ";
- FOOTNOTE1 JUSTIFY=LEFT "Report Date: &SYSDATE9 Dataset Used: &SYSLAST";

- PROC FREQ;
- TABLES &SUBJ /NOCUM;

- PROC UNIVARIATE NOPRINT;
- HISTOGRAM &SUBJ / MIDPOINTS = 0 TO 10 BY 1;

- PROC MEANS MAXDEC=2 N MEAN STD MIN MAX;
- VAR &SUBJ;

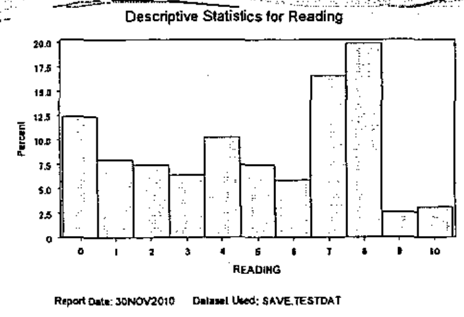
- RUN;

Output from Example 1

- *Descriptive Statistics for Reading*
- *The FREQ Procedure*

[illegible]	[illegible]	[illegible]
0	124	12.40
1	80	8.00
2	74	7.40
3	64	6.40
4	103	10.30
5	74	7.40
6	59	5.90
7	166	16.60
8	199	19.90
9	26	2.60
10	31	3.10

- *Report Date: 30NOV2010 Dataset Used: SAVE.TESTDAT*



- *Descriptive Statistics for Reading*
-
- *The MEANS Procedure*

N	Mean	Std Dev	Minimum	Maximum
1000	4.85	3.02	0.00	10.00

- *Report Date: 30NOV2010 Dataset Used: SAVE.TESTDAT*

Lots of Macro Variable Examples

- %LET EX1 = Can macro variables can have blanks?;
- %PUT &EX1;

- %LET EX2 = "What happens if there are quotation marks in my macro variable?";
- %PUT &EX2;

- %LET EX3 = 42 + 35;
- %PUT &EX3;

- %LET EX4a = Macro variables can;
- %LET EX4b = include macro variables;
- %LET EX4 = &EX4a &EX4b;
- %PUT &EX4;

- %LET EX5 =   What happens with leading blanks?;
- %PUT &EX5;

MACRO VAR5.SAS

Lots of Macro Variable Examples— A look at my log

- 1 %LET EX1 = Can macro variables have blanks?;
- 2 %PUT &EX1;
- **Can macro variables have blanks?**

- 3 %LET EX2 = "What happens if there are quotation marks in my macro variable?";
- 4 %PUT &EX2;
- **"What happens if there are quotation marks in my macro variable?"**

- 5 %LET EX3 = 42 + 35;
- 6 %PUT &EX3;
- 42 + 35

- 7 %LET EX4a = Macro variables can;
- 8 %LET EX4b = include macro variables;
- 9 %LET EX4 = &EX4a &EX4b;
- 10 %PUT &EX4;
- **Macro variables can include macro variables**

- 11 %LET EX5 =   What happens with leading blanks?;
- 12 %PUT &EX5;
- **What happens with leading blanks?**

Combining Macro Variables with Text

- If the text comes before the macro variable, then no problem go ahead and include the macro variable.

- 787 %LET GRD = 8;
- 788
- 789 DATA SAVE.GRADE&GRD; SET SAVE.TESTDAT;
- 790 IF GRADE = &GRD;
- 791
- 792 RUN;

- NOTE: There were 1000 observations read from the data set SAVE.TESTDAT.
- NOTE: The data set SAVE.GRADE8 has 368 observations and 34 variables.

Combining Macro Variables with Text (cont.)

- If the text comes after the macro variable, you have to be able to tell SAS that the macro variable name has ended.

- What would happen if I ran this code?

- DATA SAVE.&SUBJDAT;SET SAVE.TESTDAT;
- KEEP ID GRADE &SUBJ;

- I get this WARNING and then I get an error.

  - WARNING: Apparent symbolic reference SUBJDAT not resolved.

Combining Macro Variables with Text (cont.)

- If the text comes after the macro variable, put a period after the macro variable to tell SAS that it has reached the end of the macro variable name.

  - **DATA SAVE.&SUBJ.DATA;SET SAVE.TESTDAT;**
  - KEEP ID GRADE &SUBJ;

- Here is what the log looks like:

  - 11 DATA SAVE.&SUBJ.DAT;SET SAVE.TESTDAT;
  - 12 KEEP ID GRADE &SUBJ;

- NOTE: There were 1000 observations read from the data set SAVE.TESTDAT.
- NOTE: The data set SAVE.READINGDAT has 1000 observations and 3 variables.

Macro Programs

- A macro program is a chunk of code that has been defined as a macro.

- %MACRO tells SAS that you are beginning a macro.
  - Follow %MACRO with the name you want to give your macro.

- %MEND tells SAS that you are ending a macro.
  - You can also give the name in the %MEND, but it is optional.

- In between %MACRO and %MEND you can put any SAS statements -- DATA steps, PROCs, other macros.

- To actually run a macro, you need to call it. Give the name of the macro with a percent sign before it.

Macro Program Example

- %MACRO *DESCRIP*;
- TITLE1 BOLD HEIGHT=14PT 'Descriptive Statistics for Reading';

- DATA SAVE.GRADE8;SET SAVE.TESTDAT;
- IF GRADE = 8;
- KEEP ID GRADE READING;

- PROC FREQ;
- TABLES READING;

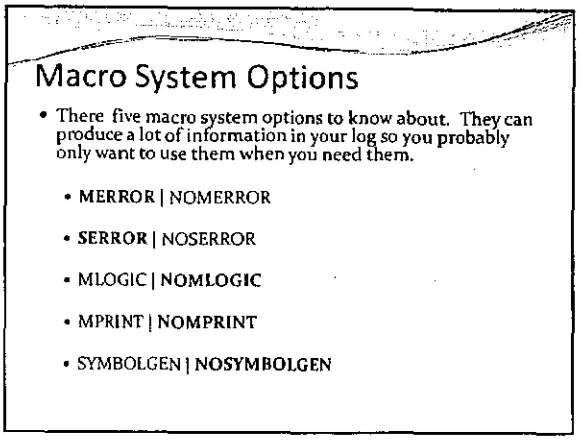
- PROC UNIVARIATE NOPRINT;
- HISTOGRAM READING / MIDPOINTS = 0 TO 10 BY 1;

- PROC MEANS MAXDEC=1 N MEAN STD MIN MAX;
- VAR READING;

- RUN;

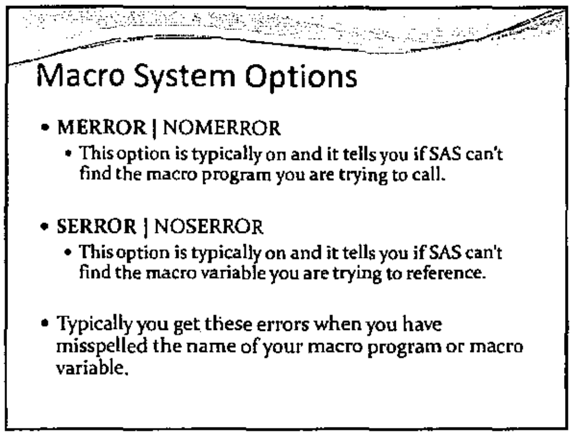
- %MEND DESCRIP;

- %*DESCRIP*



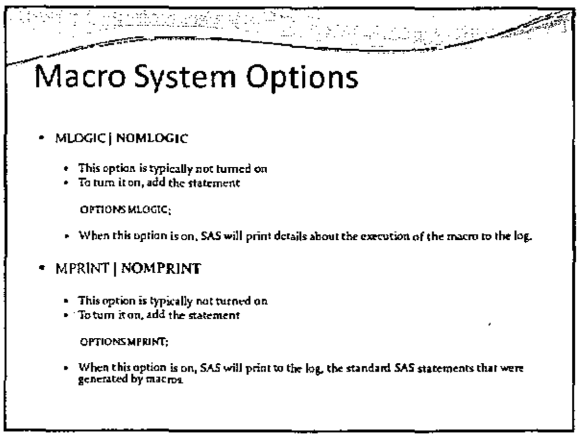
Macro System Options

- There five macro system options to know about. They can produce a lot of information in your log so you probably only want to use them when you need them.
  - MERROR | NOMERROR
  - SERROR | NOSERROR
  - MLOGIC | NOMLOGIC
  - MPRINT | NOMPRINT
  - SYMBOLGEN | NOSYMBOLGEN



Macro System Options

- MERROR | NOMERROR
  - This option is typically on and it tells you if SAS can't find the macro program you are trying to call.
- SERROR | NOSERROR
  - This option is typically on and it tells you if SAS can't find the macro variable you are trying to reference.
- Typically you get these errors when you have misspelled the name of your macro program or macro variable.

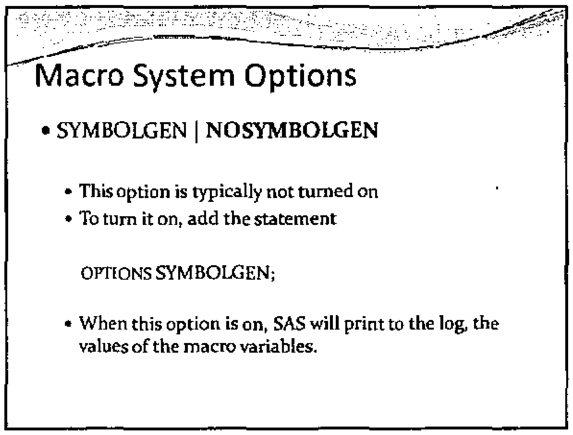


Macro System Options

- MLOGIC | NOMLOGIC
  - This option is typically not turned on
  - To turn it on, add the statement

    OPTIONS MLOGIC;
  - When this option is on, SAS will print details about the execution of the macro to the log.
- MPRINT | NOMPRINT
  - This option is typically not turned on
  - To turn it on, add the statement

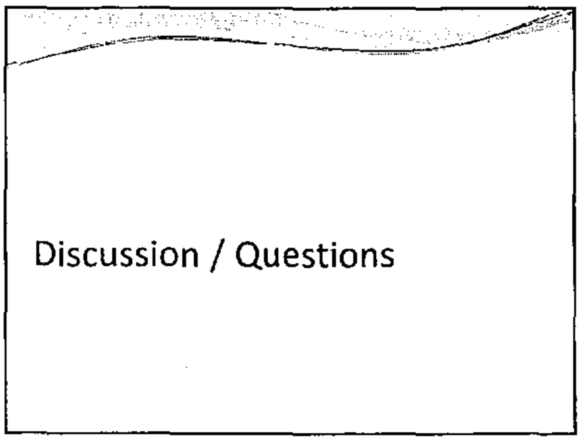
    OPTIONS MPRINT;
  - When this option is on, SAS will print to the log, the standard SAS statements that were generated by macros



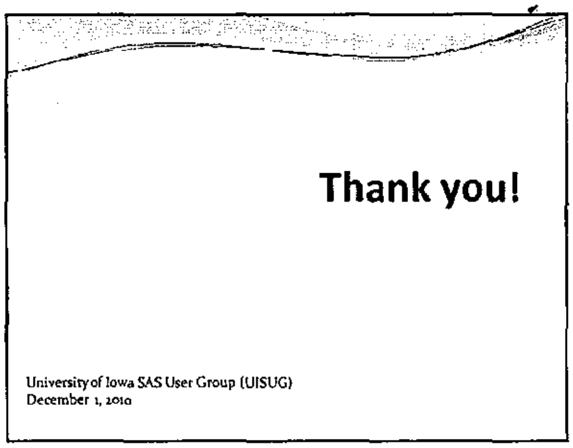
Macro System Options

- SYMBOLGEN | NOSYMBOLGEN
  - This option is typically not turned on
  - To turn it on, add the statement

    OPTIONS SYMBOLGEN;
  - When this option is on, SAS will print to the log, the values of the macro variables.



Discussion / Questions



Thank you!

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