An Introduction to Macro Processing

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What is its primary function?

What are its applications?

The Macro Processor

The SAS® Macro Facility

- Macros
- Macro variables
- Macro program statements
- Macro functions

To produce strings of text which are most often used to construct SAS statements or parts of SAS statements

To perform conditional execution of SAS code
To generate repetitive code
To provide users with a building tool
To allow the design of complex, user-friendly menus and systems

The SAS System before Macro

Source Code ——> Supervisor

SAS Compiler

or

Procedure Parser

1121
The SAS System after Macro

Checks for &’s and %’s followed by non-blank tokens and passes them to the macro processor.

Passes the first word of each statement to the macro processor if the IMPLMAC option is in effect.

Handling of %’s

Handling of &’s

Processing of SAS Code

The Role of the Wordscanner

Major Components of the Macro Processor

- Symbolic Substitution
- Open Code Handler
- Macro Compiler
- Macro Executor

The SAS supervisor performs sequential execution.
The SAS compiler accepts tokens until it encounters a step boundary.
These statements force step boundaries
- a DATA statement
- a PROC statement
- a RUN statement
- a PARMCARDS or CARDS statement

What Happens When?

- Time when a macro is being compiled
- Begins when `%MACRO` is encountered and ends when `%MEND` is encountered
- All other processing is stopped

- Time when a macro is being executed
- Begins when `%macroname` is encountered and stops when the end of the compiled macro is encountered
- The other components are still functioning

**Processing of Macro Code**

**Macro Compile Time**

**Macro Execution Time**

**Example 1**
Source Code

```sas
%MACRO SHOW;
  DATA ONE;
  X=1;
  PUT X=;
  PROC PRINT;
  RUN;
%MEND SHOW;
%SHOW
```

The tokens are passed to the wordscanner

The macro is compiling

The compiled macro is now stored in the work area

Name: show

```sas
DATA ONE;
X=1;
PUT X=;
PROC PRINT;
RUN;
```
Processing of Macro Variables
%LET

CALL SYMPUT

Corn,1/('on

Mistakes

Report for NA

OBS DAY DEPT SALES
1 MONDAY HARDWARE 100
2 MONDAY SPORTS 200
3 MONDAY TOYS 500

A macro program statement
Assigns a macro variable a value which is a character string
Executed at SAS compile time

A DATA step function
Assigns a macro variable a value which is a character string or the value of a DATA step variable
Executed at SAS execution time

Example 2
DATA SALES;
  INPUT DAY $ DEPT $ SALES;
  IF DAY='MONDAY' THEN
    %LET WEEKDAY=MONDAY;
  ELSE
    %LET WEEKDAY=NA;
  CARDS;
  MONDAY HARDWARE 100
  MONDAY SPORTS  200
  MONDAY TOYS   500
  PROC PRINT;
  TITLE "Report for &WEEKDAY";
RUN;

Example 3
DATA SALES;
  INPUT DAY $ DEPT $ SALES;
  IF DAY='MONDAY' THEN
    CALL SYMPUT('WEEKDAY',MONDAY);
  ELSE
    CALL SYMPUT('WEEKDAY',NA);
  CARDS;
  MONDAY HARDWARE 100
  MONDAY SPORTS  200
  MONDAY TOYS   500
  PROC PRINT;
  TITLE "Report for &WEEKDAY";
RUN;
Report for MONDAY

PBS DAY DEPT SALES
1 MONDAY HARDWARE 100
2 MONDAY SPORTS 200
3 MONDAY TOYS 500

The result:

WARNING 1301
APPARENT SYMBOLIC
REFERENCE NOT
RESOLVED

&VAL

The results:

ERROR 180
STATEMENT IS NOT
VALID OR IT IS
USED OUT OF
PROPER ORDER

Four-Digit Errors

- Are generated by the
  macro processor
- For Example:
  ERROR 1550  ERROR 1552

Example 4

%MACRO MAKEIT;
  CALL SYMPUT('VAL',X);
%MEND MAKEIT;

DATA TEST;
  X=10;
  %MAKEIT
  PUT "&VAL";
RUN;

Example 5

%MACRO MAKEIT;
  CALL SYMPUT('VAL',X);
RUN;
%MEND MAKEIT;

DATA TEST;
  X=10;
  %MAKEIT
  PUT "&VAL";
RUN;

Error Handling

Three-Digit Errors

- Are generated by the
  SAS compiler or
  the wordscanner
- For Example:
  ERROR 180  ERROR 200

* * * * *

* * * * *
Three-Digit Errors
The following options may help
• MPRINT
• SYMBOLGEN
• NOMLOGIC
• NOMACROGEN

Four-Digit Errors
The following options may help
• MACROGEN
• SYMBOLGEN
• MLOGIC*
• NOMPRTINT
THE %PUT statement may be used anywhere in the code in order to trace execution.
* Be aware that MLOGIC may generate a large amount of output

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