More on SAS Macro Programming

22S:166
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Overview

- purpose is to make SAS programming more efficient and to reduce coding errors
- macro variables
  - enable substitution of text into SAS programs
- macro programs
  - enable performing the same task on different inputs without rewriting cod

Example dataset

```
Data Set Name: BOOKS.YTDSALES                Observations:         6959
Member Type:   DATA                          Variables:            10
Engine:        V8                            Indexes:              0
Created:       7:36 Friday, October 19, 2001 Observation Length:   216
Last Modified: 7:36 Friday, October 19, 2001 Deleted Observations: 0
Protection:                                  Compressed:           NO
Data Set Type:                               Sorted:               NO
Label:
          -----Alphabetic List of Variables and Attributes-----

 #  Variable  Type  Len  Pos  Format     Informat  Label

 6  author    Char   50  115                       First Author
 8  cost      Num     8    8  DOLLAR9.2             Wholesale Cost
 4  datesold  Num     4   32  MMDDYY8.   MMDDYY8.   Date Book Sold
 9  listpric  Num     8   16  DOLLAR9.2             List Price
 7  publishr  Char   50  165                       Publisher
 2  saleid    Num     8    0  8.                    Sale ID
 3  saleinit  Char    3   62                       Sales Person Initials
10  salepric  Num     8   24  DOLLAR9.2             Sale Price
 1  section   Char   26   36                       Section
 5  title     Char   50   65
```


Macro variables

- `%let` keyword defines a macro variable and assigns it a value
- use & before macro variable name when referencing variable
- use `%eval` keyword to convert a macro variable's value to numeric
- when referencing macro variables in character literals, use double quotes

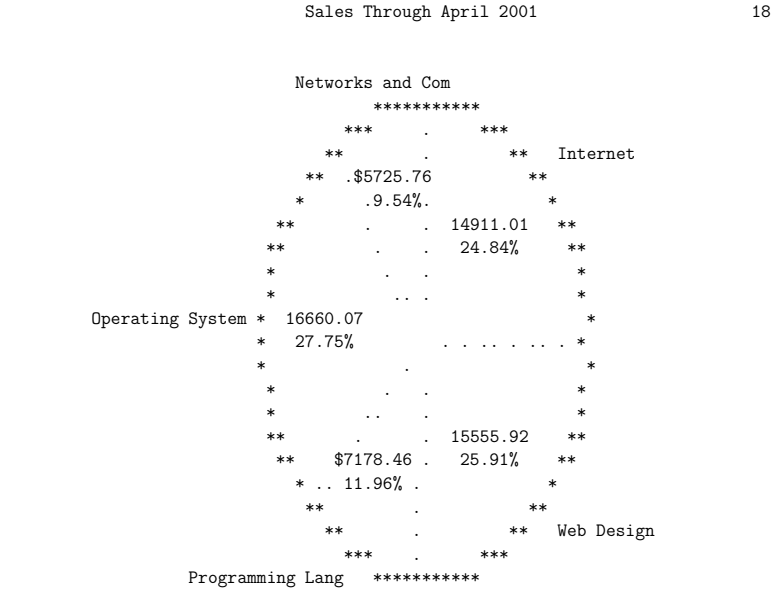
Macro variables example

```
%let repmonth=4;
%let repyear=2001;
%let repmword=%sysfunc(mdy(&repmonth,1,&repyear),monname9.);

data month&repmonth;
  set books.ytdsales;
  mosale=month(datesold);
  label mosale='Month of Sale';
run;

proc tabulate data=month&repmonth;
  title "Sales During &repmword &repyear";
  where mosale=&repmonth and year(datesold)=&repyear;
  class section;
  var salepric listpric cost;
  tables section all='**TOTAL**',
         (salepric listpric cost)*(n*f=4. sum*f=dollar9.2);
run;
* proc gchart data=month&repmonth ;
proc chart data=month&repmonth
           (where=(mosale < %eval(&repmonth+1) and
                  year(datesold)=&repyear));
  title "Sales Through &repmword &repyear";
  pie section / sumvar=salepric noheading ;
run;
```


Output

Sales During April 2001 1

	Sale Price		List Price		Wholesale Cost	
	N	Sum	N	Sum	N	Sum
Section						
Internet	145	$4,579.71	145	$4,680.75	145	$3,318.77
Networks and Communication	55	$1,633.01	55	$1,665.25	55	$1,177.46
Operating Systems	132	$4,016.45	132	$4,108.40	132	$2,916.03
Programming Languages	60	$1,835.07	60	$1,878.00	60	$1,330.98
Web Design	131	$4,015.50	131	$4,114.45	131	$2,910.87
TOTAL	523	$16079.73	523	$16446.85	523	$11654.09



Using built-in SAS macro variables

```
title "Sales Report";
title2 "As of &systime &sysday &sysdate";
title3 "Using SAS Version: &sysver";
proc means data=books.ytdsales n sum;
  var salepric;
run;
```

Output

Sales Report 13
As of 06:38 Friday 19OCT01
Using SAS Version: 8.00

The MEANS Procedure

Analysis Variable : salepric Sale Price

N	Sum
6959	210588.23

Using `call symput` to assign a value from a data step variable to a macro variable

- embedded **`put`** statement also formats the value before assigning it
- **`retain`** statement used in following example
  - initializes a variable at the beginning of a data step
  - tells SAS to carry its value forward as it sequentially processes records in the dataset

Example of `call symput`

```
data temp;
  set books.ytdsales end=lastobs;
  retain sumintwb 0;
  if section in ('Internet','Web Design') then
    sumintwb=sumintwb + salepric;
  if lastobs then
    call symput('INTWEBSL',put(sumintwb,dollar10.2));


run;
proc chart data=temp;
  title "Internet and Web Design Sales: &intwebsl";
  title2 "As of &enddate";
  hbar section / sumvar=salepric;
  format salepric dollar10.2;
run;
```


Output

Internet and Web Design Sales: $107320.40
As of &enddate

Section		Freq	Sale Price Sum
Internet	**************************	1777	$53,998.95
Networks and Com	**********	649	$19,472.97
Operating System	**************************	1877	$56,964.04
Programming Lang	**********	900	$26,830.81
Web Design	**************************	1756	$53,321.45

$30,000.00

Sale Price

Writing macro programs

- like subroutines or functions
- macro function is defined by the following structure

```
%macro macro-name
.
.  < statements to be executed by macro >
.
%mend macro-name
```

- code inside macro is essentially just SAS code
- but special macro keywords are used to control conditional and iterative processing
- macro must be defined before it can be called

Example of macro function

```
%macro daily;
  proc means data=books.ytdsales(where=(datesold=today()))
                  maxdec=2 sum;
    title "Daily Sales Report for &sysdate";
    class section;
    var salepric;
  run;
  %if &sysday=Friday %then %do;
     proc means data=books.ytdsales
          (where=(today()-6 le datesold le today()))
          sum maxdec=2;
       title "Weekly Sales Report Week Ending &sysdate";
       class section;
       var salepric;
     run;
  %end;
%mend daily;
```


Calling the macro

- call a macro using `%macroname`

Example

`%daily`

Output

Daily Sales Report for 19OCT01

The MEANS Procedure

Analysis Variable : salepric Sale Price

Section	N Obs	Sum
Internet	7	212.66
Networks and Communication	5	123.76
Operating Systems	6	224.91
Programming Languages	3	81.36
Web Design	2	58.90

Weekly Sales Report Week Ending 19OCT01

The MEANS Procedure

Analysis Variable : salepric Sale Price

Section	N Obs	Sum
Internet	46	1391.95
Networks and Communication	15	420.37
Operating Systems	36	1171.83
Programming Languages	24	719.03
Web Design	35	1049.40

Example of macro to do iterative processing

- the following macro copies the book sales data into 12 separate datasets, one for each month of the year

```
%macro makesets;
  data
    %do i=1 %to 12;
      month&i
    %end;
    ;
    set books.ytdsales;
    mosale=month(datesold);
    if mosale=1 then output month1;
    %do i=2 %to 12;
      else if mosale=&i then output month&i;
    %end;
  run;
%mend makesets;

%makesets
```


Passing parameters to macros

- parameters may be passed to a macro program
  - by position
  - by keyword
- parameters are named in parentheses after macro name in macro definition
- values are listed in parentheses after macro name in maro call

Example of macro program with positional parameters

```
options mprint mlogic;

%macro listparm(start,stop,opts);
  title "Books Sold by Section Between &start and &stop";
  proc means data=books.ytdsales &opts;
    where "&start"d le datesold le "&stop"d;
    class section;
    var salepric;
  run;
%mend listparm;

*----First call to LISTPARM, all 3 parameters specified;
%listparm(01JUN1998,15JUN1998,n sum)

*----Second call to LISTPARM, first 2 parameters specifed and;
*----third parameter is null;
%listparm(01SEP1998,15SEP1998,)
```


Output

Books Sold by Section Between 01JUN2001 and 15JUN2001 20

The MEANS Procedure

Analysis Variable : salepric Sale Price

Section	N Obs	N	Sum
Internet	84	84	2533.78
Networks and Communication	26	26	820.8350000
Operating Systems	71	71	2092.13
Programming Languages	46	46	1368.66
Web Design	66	66	2002.66

Books Sold by Section Between 01SEP2001 and 15SEP2001 21

The MEANS Procedure

Analysis Variable : salepric Sale Price

Section	N Obs	N	Mean	Std Dev
Internet	77	77	30.0097403	6.7365196
Networks and Communication	24	24	28.7466667	4.2080094
Operating Systems	81	81	29.9080864	5.0282968
Programming Languages	41	41	29.6634146	4.7974602
Web Design	82	82	29.8243902	5.1119165

Section	N Obs	Minimum	Maximum
Internet	77	15.9600000	42.9500000
Networks and Communication	24	19.9500000	35.9500000
Operating Systems	81	15.9500000	39.9500000
Programming Languages	41	15.9600000	39.9500000
Web Design	82	18.9500000	42.9500000

Passing parameters by keyword

- enables setting defaults in macros

Example

```
options mprint mlogic;

%macro keyparm(start=01JAN2001,stop=31DEC2001,
               opts=N SUM MIN MAX);
  title "Books Sold by Section Between &start and &stop";
  proc means data=books.ytdsales &opts;
    where "&start"d le datesold le "&stop"d;
    class section;
    var salepric;
  run;
%mend keyparm;

*----First call to KEYPARM: specify all keyword parameters;
%keyparm(start=01JUN2001,stop=15JUN2001,opts=n sum)

*----Second call to KEYPARM: specify start and stop,;
*----opts is null: should see default stats for PROC MEANS;
%keyparm(start=01SEP2001,stop=15SEP2001,opts=)

*----Third call to KEYPARM: use defaults for start and stop,;
*----specify opts;
%keyparm(opts=n sum)
```


Output

Books Sold by Section Between 01JUN2001 and 15JUN2001 22

The MEANS Procedure

Analysis Variable : salepric Sale Price

Section	N Obs	N	Sum
Internet	84	84	2533.78
Networks and Communication	26	26	820.8350000
Operating Systems	71	71	2092.13
Programming Languages	46	46	1368.66
Web Design	66	66	2002.66

Books Sold by Section Between 01SEP2001 and 15SEP2001 23

The MEANS Procedure

Analysis Variable : salepric Sale Price

Section	N Obs	N	Mean	Std Dev
Internet	77	77	30.0097403	6.7365196
Networks and Communication	24	24	28.7466667	4.2080094
Operating Systems	81	81	29.9080864	5.0282968
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Analysis Variable : salepric Sale Price

Section	N Obs	Minimum	Maximum
Internet	77	15.9600000	42.9500000
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Web Design	82	18.9500000	42.9500000

The MEANS Procedure

Analysis Variable : salepric Sale Price

Section	N Obs	N	Sum
Internet	1777	1777	53998.95
Networks and Communication	649	649	19472.97
Operating Systems	1877	1877	56964.04
Programming Languages	900	900	26830.81
Web Design	1756	1756	53321.45