

Start Your Own SASAUTOS Macro Library

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Ever get tired of typing the same SAS® code over and over again? Do you keep writing SAS code for something trivial and you have to double check your syntax every time because you're a bad typist? Ever want a macro to do "what I mean", not "what I say" by assuming the least dangerous alternative? Ever want a macro that was self documenting, one you didn't have to go to your file cabinet or a previous program to find out how, when, and where you can use it? Ever want a list of macros that are accessible to you? Ever want to work smarter? You can be sure your boss isn't concerned with how much code you write but how quickly the task is completed. One way to complete tasks quickly is to work "smarter" by reducing the time to desired results. This paper attempts to explain our version of "working smarter" by starting your own SASAUTOS autocall library of frequently used SAS macro programs.

Why start an autocall library?

The veteran SAS user will eventually discover SAS program code that is used over and over again. The users logical tendency is to slap %Macro preceding the code and %Mend after it and move the macro code to the top of the program where it can be called by the SAS code below it. Several programs later, the user realizes the same macro code developed earlier is needed in a new program. At this point the user can't remember the name of the program where the macro code resides, so the macro is rewritten, tested, and copied into the new program. Now wait a minute, isn't there a better way to do this?

How many times have we typed in Proc Print or Proc Sort into our programs? We'd all be millionaires if we were getting paid for each Print and Sort we used. As new users of SAS we knew nothing of the superb features available in the Print and Sort procedures. We eventually decided to take advantage of those features and combine them with the SAS macro facility to start our own autocall macro library.

How does a user implement an autocall library?

In a MS® Windows environment the following statement is inserted near the top of the program so the autocall library is immediately available to your

program. See the SAS Guide to Macro Processing for the syntax used in other operating systems.

```
Options mautesource sasautos='c:\sasautos' ;
```

The statement identifies where to look for the autocall source library. Each macro definition is a separate file in the directory. The macro name must match the filename with a SAS extension. For example:

Directory of C:\SASAUTOS

QP	SAS
QTITLE	SAS
QSORT	SAS
GETAGE	SAS
QPTO	SAS
QHELP	SAS

Another way the autocall library can be setup in the MS Windows environment is to identify the autocall library in the C:\SAS\CONFIG.SAS :

```
-SASAUTOS (c:\sasautos)
```

To concatenate more than one autocall library:

```
Options mautesource sasautos=('c:\sasautos',  
                               'c:\mdbautos');  
OR  
-SASAUTOS (c:\mdbautos  
           c:\sasautos)
```

By default the system option MAUTESOURCE is active, meaning any macro in the autocall library can be called during the current SAS session.

We have provided several examples using the following sequence:

- 1) Actual SAS macro code
- 2) SAS code with macro calls to Step 1 macro.
- 3) Output generated by Step 2.
- 4) SASLOG output generated by Step 2.

%QP() or Quick Print macro using the Print procedure QP.SAS from the SASAUTOS directory:

```
%Macro QP(dsn,vars=,fmts=,where=,byvars=,ids=,options=,  
          pagebys=,sumbys=,sums=);  
%if &dsn= AND (&syslast=NULL_ OR &syslast= )%then  
%else %if &dsn= %then %let dsn=&syslast; %let dsn=HELP;  
%if &dsn=? AND %upcase(&dsn)=HELP %then %do ;  
Proc Print Data=&dsn &options ;
```

```

%if $where= %then Where ($where) %str(;;);
%if $vars= %then Var $vars %str(;;);
%if $ids= %then Id $ids %str(;;);
%if $byvars= %then By $byvars %str(;;);
%if $pageby= %then pageby $pageby %str(;;);
%if $sumby= %then sumby $sumby %str(;;);
%if $sums= %then sum $sums %str(;;);
%if $fmts= %then format $fmts %str(;;);

Title2 "adsn" ;
%Put >>> adsn OUTPUT USING PROC PRINT <<< ;
%End ;
%Mend ;

```

Quick Print Macro Call Example:

```

Data One ;
  patient=10; ht=74; wt=205; dob="11JUN60"D; male=1; female=0;
Output ;
  patient=11; ht=71; wt=198; dob="01JAN57"D; male=1; female=0;
Output ;
  patient=12; ht=54; wt=118; dob="21SEP62"D; male=0; female=1;
Output ;
  Label ht='HEIGHT (IN)' wt='WEIGHT (LBS)' dob='DATE OF BIRTH'
Run ;

%QP( ) ;
Title3 "QUICK PRINT EXAMPLE #1" ;
run ;

%QP(vars=ht wt dob male female,sums=male female,
options=noobs label,ids=patient,fmts=dob date7. patient z3.) ;
Title3 "QUICK PRINT EXAMPLE #2" ;
run ;

%QP(sums=female,where=female=1,
options=noobs label,fmts=dob date7. patient z3.) ;
Title3 "QUICK PRINT EXAMPLE #3" ;
run ;

%QP(byvars=descending male,vars=patient ht wt dob,ids=male,
options=noobs label,fmts=dob date7. patient z3.) ;
Title3 "QUICK PRINT EXAMPLE #4" ;
run ;

```

Quick Print Example Output:

WORK.ONE
QUICK PRINT EXAMPLE #1

OBS	PATIENT	HT	WT	DOB	MALE	FEMALE
1	10	74	205	162	1	0
2	11	71	198	-1095	1	0
3	12	54	118	994	0	1

WORK.ONE
QUICK PRINT EXAMPLE #2

PATIENT	HEIGHT (IN)	WEIGHT (LBS)	DATE OF BIRTH	MALE	FEMALE
010	74	205	11JUN60	1	0
011	71	198	01JAN57	1	0
012	54	118	21SEP62	0	1

WORK.ONE
QUICK PRINT EXAMPLE #3

PATIENT	HEIGHT (IN)	WEIGHT (LBS)	DATE OF BIRTH	MALE	FEMALE
012	54	118	21SEP62	0	1

WORK.ONE
QUICK PRINT EXAMPLE #4

MALE	PATIENT	HEIGHT (IN)	WEIGHT (LBS)	DATE OF BIRTH
1	010	74	205	11JUN60
	011	71	198	01JAN57
0	012	54	118	21SEP62

Quick Print Example Log:

```

303 Data One ;
304 patient=10; ht=74; wt=205; dob="11JUN60"D; male=1;
female=0; Output ;
305 patient=11; ht=71; wt=198; dob="01JAN57"D; male=1;
female=0; Output ;
306 patient=12; ht=54; wt=118; dob="21SEP62"D; male=0;

```

```

female=1; Output ;
307 Label ht='HEIGHT (IN)' wt='WEIGHT (LBS)' dob='DATE OF
BIRTH' ;
308 Run ;

```

NOTE: The data set WORK.ONE has 3 observations and 6 variables.
NOTE: The DATA statement used 0.66 seconds.

```

309 %QP( ) ;
MPRINT(QP): PROC PRINT DATA=WORK.ONE ;
MPRINT(QP): TITLE2 "WORK.ONE" ;
>>>> WORK.ONE OUTPUT USING PROC PRINT <<<
310 Title3 "QUICK PRINT EXAMPLE #1" ;
311 run ;

```

NOTE: The PROCEDURE PRINT used 0.16 seconds.

```

312 %QP(vars=ht wt dob male female,sums=male female,
313 options=noobs label,ids=patient,fmts=dob date7. patient
z3.) ;
MPRINT(QP): PROC PRINT DATA=WORK.ONE NOOBS LABEL ;
MPRINT(QP): VAR HT WT DOB MALE FEMALE ;
MPRINT(QP): ID PATIENT ;
MPRINT(QP): SUM MALE FEMALE ;
MPRINT(QP): FORMAT DOB DATE7. PATIENT Z3. ;
MPRINT(QP): TITLE2 "WORK.ONE" ;
>>>> WORK.ONE OUTPUT USING PROC PRINT <<<
314 Title3 "QUICK PRINT EXAMPLE #2" ;
315 run ;

```

NOTE: The PROCEDURE PRINT used 0.22 seconds.

```

316 %QP(sums=female,where=female=1,
317 options=noobs label,fmts=dob date7. patient z3.) ;
MPRINT(QP): PROC PRINT DATA=WORK.ONE NOOBS LABEL ;
MPRINT(QP): WHERE (FEMALE=1) ;
MPRINT(QP): SUM FEMALE ;
MPRINT(QP): FORMAT DOB DATE7. PATIENT Z3. ;
MPRINT(QP): TITLE2 "WORK.ONE" ;
>>>> WORK.ONE OUTPUT USING PROC PRINT <<<
318 Title3 "QUICK PRINT EXAMPLE #3" ;
319 run ;

```

NOTE: The PROCEDURE PRINT used 0.22 seconds.

```

320 %QP(byvars=descending male,vars=patient ht wt
dob,ids=male,
321 options=noobs label,fmts=dob date7. patient z3.) ;
MPRINT(QP): PROC PRINT DATA=WORK.ONE NOOBS LABEL ;
MPRINT(QP): VAR PATIENT HT WT DOB ;
MPRINT(QP): ID MALE ;
MPRINT(QP): BY DESCENDING MALE ;
MPRINT(QP): FORMAT DOB DATE7. PATIENT Z3. ;
MPRINT(QP): TITLE2 "WORK.ONE" ;
>>>> WORK.ONE OUTPUT USING PROC PRINT <<<
322 Title3 "QUICK PRINT EXAMPLE #4" ;
323 run ;

```

NOTE: The PROCEDURE PRINT used 0.27 seconds.

%QSORT or Quick Sort macro using the Sort procedure QSORT.SAS, see also QTITLE.SAS, QPTO.SAS, and GETAGE.SAS from the SASAUTOS directory:

```

%Macro QSORT(byvars=,in=,out=,vars=,rename=,where=,options=) ;

```

```

%if $byvars= %then %do ;
%if $in= OR $syslast= NULL %then %do ;
%if %scan($in,2)= AND %out= %then %let out=%scan($in,2) ;
%if $in= AND $syslast= %then %let in=$syslast ;
%if %out= %then %let out=$in ;
%if $rename= %then %let rename= $rename ;
%if $where= %then Proc Sort Data=$in(Where=($where)) ;
%else Proc Sort Data=$in ;
%if %out= %then out=%out ;
%else %if %out=$syslast %then Out=$syslast ;
%if ($vars= OR $rename=) AND $options= %then (Keep=$byvars
$vars $rename) ;
%else %if $options= %then (Keep=$byvars $rename) ;
options ; By $byvars ; Run ;
%End ;
%Mend ;

```

```

%Macro QTitle(client=,drug=,protocol=,program=) ;
/*****TITLE.SAS*****Title Header*****/
%if $client NE ? AND $drug NE ? AND $program NE ? AND
%upcase($client) NE HELP AND %upcase($drug) NE HELP AND
%upcase($protocol) NE HELP AND %upcase($program) NE HELP
%then %do ;

```

```

Title ; Footnote ;
Data Null ;
Length Head1 $132 ;
%if $drug= AND $protocol= AND $program= %then HEAD1= "client"
%str(;;);

```

```

%Else %if &drug NE %Then
  Head1="&client" &drug" %str(,);
%if &protocol NE %Then
  Head1="&client" &drug PROTOCOL &protocol" %str(,);
%if &program NE AND &protocol NE %Then
  Head1="&client" &drug PROTOCOL &protocol" ||
  &sysdate / PGM:
%program..SAS" %str(,);
%Else %if &program NE AND &protocol= %Then
  Head1="&client" &drug &protocol" ||
  &sysdate / PGM:
%program..SAS" %str(,);
Head1= HEAD1||REPEAT(" ",132-LENGTH(Trim(HEAD1)));
Call Symput('HEAD1',HEAD1);
Run;
Title1 "head1";
%End;

%Else %Do;
  %PUT = QTITLE MACRO DEFINITION, BY M.BODENSTAB, 1994 -----;
  %PUT QTITLE(CLIENT=,DRUG=,PROTOCOL=,PROGRAM=) ----;
%End;
%Mend;

%Macro QPto(print,log,options=);
%if &print= %Then %Do;

Proc Printto; Run;
%Put >>>> ALL OUTPUT ROUTED TO DEFAULT STANDARD OUTPUT <<<;
%End;

%Else %if &print= AND %Upcase(&print)=HELP %Then %Do;

Proc Printto
  %if &print= %Then Print=&print;
  %if &log= %Then Log=&log;
  %if &options= %Then &options;
  Run;
%Put >>>> PRINT OUTPUT=> &PRINT, LOG OUTPUT=> &LOG, OPTIONS=>
&OPTIONS <<<;
%End;
%Mend;

%Macro GetAge(vdate,bdate,cutage);
%if &vdate= AND &bdate= AND &cutage= %Then %Do;

  &cutage=INT(INTCK('month',&bdate,&vdate)/12);
  if (month(&bdate)=month(&vdate) and day(&bdate)>day(&vdate))
    then &cutage=&cutage-1;

%End;

%Else %Do;
  %Put *****;
  %Put *** W A R N I N G *** A SAS DATE IS REQUIRED, ABORTED!!;
  %Put *****;
  %Put *****;
  %Put GETAGE(SAS VISIT DATE,SAS DATE OF BIRTH, AGE);
  %Put *****;
  %STR(Quit);
%End;
%Mend;

```

Quick Sort, Quick Title, Quick Printto, and GETAGE Macro Call Example:

```

Filename PGM_LST "C:\WPWIN\DOC\PGM_NAME.LST";
%QTitle(client=SPONSOR NAME,program=PGM_NAME);

%QPTO(PGM_LST,options=New); *<== Route output to a file;

Data Two(Drop=today);
  length patient ht wt dob male female 8;
  Input patient ht wt dob date7. male female;
  today='25MAY95'D;
  %Getage(today,dob,age);
  Label ht='HEIGHT (IN)' wt='WEIGHT (LBS)' dob='DATE OF BIRTH';
  Cards;
10 74 205 11JUN60 1 0
11 71 198 01JAN57 1 0
12 54 118 21SEP62 0 1
13 56 149 20JUL49 0 1
13 56 149 20JUL49 0 1
14 59 131 01JAN57 0 1
Run;

%QSort(byvars=descending age);

%QP(options=noobs,fmts=patient z3.);
Title3 "QUICK SORT EXAMPLE #1";
run;

%QSort(byvars=age,where=age>35,vars=patient male female,
  rename=patient=patno);

%QP(options=noobs,fmts=patno z3.);
Title3 "QUICK SORT EXAMPLE #2";
run;

%QSort(byvars=patno age male female,options=nodupkey);

%QP(options=noobs,fmts=patno z3.);
Title3 "QUICK SORT EXAMPLE #3";

```

```

run;

%QPTO(); *<== Close output file reset to default output;

```

Quick Sort, Quick Title, Quick Printto, and GETAGE Example Output:

```

SPONSOR NAME 31MAY95 / PGM: PGM_NAME.SAS
WORK.TWO
QUICK SORT EXAMPLE #1

```

PATIENT	HT	WT	DOB	MALE	FEMALE	AGE
013	56	149	-3817	0	1	45
013	56	149	-3817	0	1	45
011	71	198	-1095	1	0	38
014	59	131	-1095	0	1	38
010	74	205	162	1	0	34
012	54	118	994	0	1	32

```

SPONSOR NAME 31MAY95 / PGM: PGM_NAME.SAS
WORK.TWO
QUICK SORT EXAMPLE #2

```

PATNO	MALE	FEMALE	AGE
011	1	0	38
014	0	1	38
013	0	1	45
013	0	1	45

```

SPONSOR NAME 31MAY95 / PGM: PGM_NAME.SAS
WORK.TWO
QUICK SORT EXAMPLE #3

```

PATNO	MALE	FEMALE	AGE
011	1	0	38
013	0	1	45
014	0	1	38

Quick Sort, Quick Title, Quick Printto, and GETAGE Example Log:

```

2522 Filename PGM_LST "C:\WPWIN\DOC\PGM_NAME.LST";
2523 %QTitle(client=SPONSOR NAME,program=PGM_NAME);
MPRINT(QTITLE): TITLE;
MPRINT(QTITLE): FOOTNOTE;
MPRINT(QTITLE): DATA NULL;
MPRINT(QTITLE): LENGTH HEAD1 $132;
MPRINT(QTITLE): ;
MPRINT(QTITLE): HEAD1="SPONSOR NAME " ||
" 31MAY95 / PGM: PGM_NAME.SAS";
MPRINT(QTITLE): HEAD1= HEAD1||REPEAT("
",132-LENGTH(Trim(HEAD1)));
MPRINT(QTITLE): CALL SYMPUT('HEAD1',HEAD1);
MPRINT(QTITLE): RUN;

```

NOTE: The DATA statement used 0.27 seconds.

```

MPRINT(QTITLE): TITLE1 "SPONSOR NAME
31MAY95 / PGM: PGM_NAME.SAS
";

```

```

2524 *****;
2525 %QPTO(PGM_LST,options=New); *<== Route output to a
file;
MPRINT(QPTO): PROC PRINTTO PRINT=PGM_LST NEW;
MPRINT(QPTO): RUN;

```

NOTE: The PROCEDURE PRINTTO used 0.11 seconds.

```

>>>> PRINT OUTPUT=> PGM_LST, LOG OUTPUT=> , OPTIONS=> New <<<
2526 Data Two(Drop=today);
2527 length patient ht wt dob male female 8;
2528 Input patient ht wt dob date7. male female;
2529 today='25MAY95'D;
2530 %Getage(today,dob,age);
MPRINT(GETAGE): AGE=INT(INTCK('month',DOB,TODAY)/12);
MPRINT(GETAGE): IF (MONTH(DOB)=MONTH(TODAY) AND
DAY(DOB)>DAY(TODAY)) THEN AGE=AGE-1;
2531 Label ht='HEIGHT (IN)' wt='WEIGHT (LBS)' dob='DATE OF
BIRTH';
2532 Cards;

```

NOTE: The data set WORK.TWO has 6 observations and 7 variables.
NOTE: The DATA statement used 0.66 seconds.

```

2539 Run;
2540 %QSort(byvars=descending age);
MPRINT(QSORT): PROC SORT DATA=WORK.TWO OUT=WORK.TWO;
MPRINT(QSORT): BY DESCENDING AGE;
MPRINT(QSORT): RUN;

```

NOTE: The data set WORK.TWO has 6 observations and 7 variables.
NOTE: The PROCEDURE SORT used 0.39 seconds.

```

2541 %QP(options=noobs,fmts=patient z3.);
MPRINT(QP): PROC PRINT DATA=WORK.TWO NOOBS;

```

```

MPRINT(QP):  FORMAT PATIENT Z3. ;
MPRINT(QP):  TITLE2 "WORK.TWO" ;
>>> WORK.TWO OUTPUT USING PROC PRINT <<<
2542 Title3 "QUICK SORT EXAMPLE #1" ;
2543 run ;

NOTE: The PROCEDURE PRINT used 0.17 seconds.

2544 %qsort(byvars=age,where=age>35,vars=patient male
female,rename=patient=patno) ;
MPRINT(QSORT):  PROC SORT DATA=WORK.TWO (WHERE=(AGE>35))
OUT=WORK.TWO (KEEP=AGE PATIENT MALE FEMALE
RENAME=(PATIENT=PATNO)) ;
MPRINT(QSORT):  BY AGE ;
MPRINT(QSORT):  RUN ;

NOTE: The data set WORK.TWO has 4 observations and 4 variables.
NOTE: The PROCEDURE SORT used 0.48 seconds.

2545 %QP(options=noobs,fmts=patno z3.) ;
MPRINT(QP):  PROC PRINT DATA=WORK.TWO NOOBS ;
MPRINT(QP):  FORMAT PATNO Z3. ;
MPRINT(QP):  TITLE2 "WORK.TWO" ;
>>> WORK.TWO OUTPUT USING PROC PRINT <<<
2546 Title3 "QUICK SORT EXAMPLE #2" ;
2547 run ;

NOTE: The PROCEDURE PRINT used 0.16 seconds.

2548 %qsort(byvars=patno age male female,options=nodupkey) ;
MPRINT(QSORT):  PROC SORT DATA=WORK.TWO OUT=WORK.TWO
(KEEP=PATNO AGE MALE FEMALE) NODUPKEY ;
MPRINT(QSORT):  BY PATNO AGE MALE FEMALE ;
MPRINT(QSORT):  RUN ;

NOTE: 1 observations with duplicate key values were deleted.
NOTE: The data set WORK.TWO has 3 observations and 4 variables.
NOTE: The PROCEDURE SORT used 0.44 seconds.

2549 %QP(options=noobs,fmts=patno z3.) ;
MPRINT(QP):  PROC PRINT DATA=WORK.TWO NOOBS ;
MPRINT(QP):  FORMAT PATNO Z3. ;
MPRINT(QP):  TITLE2 "WORK.TWO" ;
>>> WORK.TWO OUTPUT USING PROC PRINT <<<
2550 Title3 "QUICK SORT EXAMPLE #3" ;
2551 run ;

NOTE: The PROCEDURE PRINT used 0.17 seconds.

2552 *****;
2553 %QPTO();  *--- Close output file reset to default
output ;
MPRINT(QPTO):  PROC PRINTTO ;
MPRINT(QPTO):  RUN ;

NOTE: The PROCEDURE PRINTTO used 0.05 seconds.

>>> ALL OUTPUT ROUTED TO DEFAULT STANDARD OUTPUT <<<

```

How does a user document an autocall library?

In order for more than one user to get the full benefit of a macro in an autocall library it needs to be documented thoroughly. The documentation also needs to be accessible and easy to read. Below is our attempt to provide online documentation for the QP and QSORT macros.

%QP() or Quick Print macro with self-documenting features.

```

%Macro QP(filename,vars=,fmts=,where=,byvars=,ids=,options=,
pagebys=,sumbys=,sums=);

%if &filename= AND (&syslast=_NULL_ OR &syslast=) %then %let
filename=HELP ;
%else %if &filename= %then %let filename=&syslast ;

%if &filename=? AND %upcase(&filename)=HELP %then %do ;
Proc Print Data=&filename options ;
%if &where= %then Where (&where) %str(;;);
%if &vars= %then Var &vars %str(;;);
%if &ids= %then Id &ids %str(;;);
%if &byvars= %then By &byvars %str(;;);
%if &pagebys= %then pageby &pagebys %str(;;);
%if &sumbys= %then sumby &sumbys %str(;;);
%if &sums= %then sum &sums %str(;;);
%if &fmts= %then format &fmts %str(;;);
Title2 "&filename" ;
%Put >>> &filename OUTPUT USING PROC PRINT <<< ;
%End ;

%else %do ;
%Put = QP MACRO DEFINITION, BY M.BODENSTAB, 1994 --QUICK PRINT;
%Put *****;
%Put QP(DATASET NAME,VARS=,FMTS=,WHERE=,BYVARS=,IDS=,
%Put QP(MACRO CALLS. NOTE: THIS WILL STOP YOUR SAS PGM EXECUTION.
%Put QP(?) OR QP(HELP) *****;
%Put --- DEFINITION FOR PARAMETERS 1-10 FOLLOWS *****;
%Put --(1) DATASET NAME IS ANY PERMANENT OR WORK SAS DATASET. ---
%Put -- THIS IS A POSITIONAL PARAMETER AND MUST BE THE FIRST ---
%Put -- PARAMETER SPECIFIED IN THE MACRO CALL. ---
%Put -->QP(DEMO) OR QP(PROTOCOL.DEMO) OR QP(MACROVER..DEMO) ---
%Put --(2) VARS= IS JUST LIKE SPECIFYING VARIABLES IN A VAR
STATEMENT=;
%Put -->QP(DEMO,VARS=INV PT DRUG SEX AGE) *****;
%Put --(3) FMTS= IS JUST LIKE SPECIFYING FORMATS FOR ANY VARS ---
%Put -->QP(DEMO,VARS=INV PT DRUG,FMTS=DRUG DRG. INV PT Z3.) ---
%Put --(4) WHERE= IS JUST LIKE SPECIFYING A WHERE STATEMENT FOR;
%Put -- SUBSETTING DATA.
%Put -->QP(DEMO,WHERE=DRUG CONTAINS "ASPR",FMTS=DRUG $DRG.) ---
%Put --(5) BYVARS= IS JUST LIKE SPECIFYING A BY STATEMENT WHEN;
%Put -- DATA IS EXPECTED TO BE IN SORTED ORDER.
%Put -->QP(DEMO,WHERE=DRUG CONTAINS "ASPR",BYVARS=INV PT AGE) ---
%Put --(6) IDS= IS JUST LIKE SPECIFYING AN ID STATEMENT.
%Put -- ALL OBSERVATIONS WILL BEGIN WITH THE VARS SPECIFIED IN=;
%Put -- THE ID STATEMENT EVEN IF THE OBSERVATION WRAPS TO=;
%Put -- ANOTHER LINE/PAGE.
%Put -->QP(DEMO,WHERE=DISP=3,BYVARS=INV PT AGE,IDS=INV PT AGE,
%Put --(7) OPTIONS= JUST LIKE SPECIFYING OPTIONS FOR PROC PRINT;
%Put -- INCLUDING LABEL(DISPLY LABELS), N(N=AFter BY GROUPS) ---
%Put -- DOUBLE(DBLE SPACING), NOOBS, ROUND, UNIFORM, & SPLIT=;
%Put -- ANOTHER LINE/PAGE.
%Put -->QP(DEMO,WHERE=DISP=3,BYVARS=DRUG,OPTIONS=N DOUBLE) ---
%Put --(8) PAGEBYS= IS LIKE SPECIFYING A PAGEBY STATEMENT.
%Put -- BEGINS PRINTING A NEW PAGE WHENEVER THE VALUE OF THE
%Put -- IS SPECIFIED BY VARIABLE CHANGES. SEE MANUAL FOR MORE INFO;
%Put -->QP(DEMO,WHERE=DISP=3,BYVARS=DRUG,PAGEBYS=DRUG) ---
%Put --(9) SUMBYS= IS LIKE SPECIFYING A SUMBY STATEMENT. PRINTS;
%Put -- SUBTOTALS FOR THE SPECIFIED BY VARIABLE WHENEVER ITS=;
%Put -- VALUE CHANGES. SEE MANUAL FOR MORE INFO.
%Put -->QP(OUTLIERS,BYVARS=LAB LOWS HIGHS,SUMBYS=LAB) ---
%Put --(10) SUMS= IS LIKE SPECIFYING A SUM STATEMENT. PRINTSTOTLS;
%Put -- FOR THE SPECIFIED VARIABLES. SEE MANUAL FOR INFO.=;
%Put -->QP(OUTLIERS,BYVARS=LAB LOWS HIGHS,SUMS=LOWS HIGHS) ---
%Put -- END OF QP HELP *****;
%Str(Quit); ;
%End ;
%Mend ;

```

```

%Put OPTIONS=,PAGEBYS=,SUMBYS=,SUMS=) *****;
%Put --- ALL PARAMETERS ARE OPTIONAL. THE FIRST PARAMETER(DATASET;
%Put --NAME), IF SPECIFIED, MUST COME BEFORE ANY OTHER PARAMETER;
%Put --IN THE LIST ABOVE. ORDER IS NOT IMPORTANT FOR THE OTHER ;
%Put -- PARAMETERS. REMEMBER TO INCLUDE THE PERCENT SIGN IN
FRONT=;
%Put --- OF THE QP() MACRO CALL. *****;
%Put -->QP() BY ITSELF, IS JUST LIKE SAYING ---> PROC PRINT ---;
%Put -->ONLINE HELP CAN BE SENT TO YOUR SASLOG WITH THE FOLLOWING;
%Put -->MACRO CALLS. NOTE: THIS WILL STOP YOUR SAS PGM EXECUTION.
*****;
%Put -->QP(?) OR QP(HELP) *****;
%Put --- DEFINITION FOR PARAMETERS 1-10 FOLLOWS *****;
%Put --(1) DATASET NAME IS ANY PERMANENT OR WORK SAS DATASET.=;
%Put -- THIS IS A POSITIONAL PARAMETER AND MUST BE THE FIRST ;
%Put -- PARAMETER SPECIFIED IN THE MACRO CALL. *****;
%Put -->QP(DEMO) OR QP(PROTOCOL.DEMO) OR QP(MACROVER..DEMO) ---
%Put --(2) VARS= IS JUST LIKE SPECIFYING VARIABLES IN A VAR
STATEMENT=;
%Put -->QP(DEMO,VARS=INV PT DRUG SEX AGE) *****;
%Put --(3) FMTS= IS JUST LIKE SPECIFYING FORMATS FOR ANY VARS ---
%Put -->QP(DEMO,VARS=INV PT DRUG,FMTS=DRUG DRG. INV PT Z3.) ---
%Put --(4) WHERE= IS JUST LIKE SPECIFYING A WHERE STATEMENT FOR;
%Put -- SUBSETTING DATA.
%Put -->QP(DEMO,WHERE=DRUG CONTAINS "ASPR",FMTS=DRUG $DRG.) ---
%Put --(5) BYVARS= IS JUST LIKE SPECIFYING A BY STATEMENT WHEN;
%Put -- DATA IS EXPECTED TO BE IN SORTED ORDER.
%Put -->QP(DEMO,WHERE=DRUG CONTAINS "ASPR",BYVARS=INV PT AGE) ---
%Put --(6) IDS= IS JUST LIKE SPECIFYING AN ID STATEMENT.
%Put -- ALL OBSERVATIONS WILL BEGIN WITH THE VARS SPECIFIED IN=;
%Put -- THE ID STATEMENT EVEN IF THE OBSERVATION WRAPS TO=;
%Put -- ANOTHER LINE/PAGE.
%Put -->QP(DEMO,WHERE=DISP=3,BYVARS=INV PT AGE,IDS=INV PT AGE,
%Put --(7) OPTIONS= JUST LIKE SPECIFYING OPTIONS FOR PROC PRINT;
%Put -- INCLUDING LABEL(DISPLY LABELS), N(N=AFter BY GROUPS) ---
%Put -- DOUBLE(DBLE SPACING), NOOBS, ROUND, UNIFORM, & SPLIT=;
%Put -- ANOTHER LINE/PAGE.
%Put -->QP(DEMO,WHERE=DISP=3,BYVARS=DRUG,OPTIONS=N DOUBLE) ---
%Put --(8) PAGEBYS= IS LIKE SPECIFYING A PAGEBY STATEMENT.
%Put -- BEGINS PRINTING A NEW PAGE WHENEVER THE VALUE OF THE
%Put -- IS SPECIFIED BY VARIABLE CHANGES. SEE MANUAL FOR MORE INFO;
%Put -->QP(DEMO,WHERE=DISP=3,BYVARS=DRUG,PAGEBYS=DRUG) ---
%Put --(9) SUMBYS= IS LIKE SPECIFYING A SUMBY STATEMENT. PRINTS;
%Put -- SUBTOTALS FOR THE SPECIFIED BY VARIABLE WHENEVER ITS=;
%Put -- VALUE CHANGES. SEE MANUAL FOR MORE INFO.
%Put -->QP(OUTLIERS,BYVARS=LAB LOWS HIGHS,SUMBYS=LAB) ---
%Put --(10) SUMS= IS LIKE SPECIFYING A SUM STATEMENT. PRINTSTOTLS;
%Put -- FOR THE SPECIFIED VARIABLES. SEE MANUAL FOR INFO.=;
%Put -->QP(OUTLIERS,BYVARS=LAB LOWS HIGHS,SUMS=LOWS HIGHS) ---
%Put -- END OF QP HELP *****;
%Str(Quit); ;
%End ;
%Mend ;

```

The following macro calls can be used to print autocall macro documentation to the SASLOG.

Quick Print call for online help:

```
%QP( ? ) or %QP( Help )
```

Quick Print online documentation printed to your SASLOG:

```

--- QP MACRO DEFINITION, BY M.BODENSTAB, 1994 --QUICK PRINT---
QP(DATASET NAME,VARS=,FMTS=,WHERE=,BYVARS=,IDS=,OPTIONS=,
PAGEBYS=,SUMBYS=,SUMS=)
--- ALL PARAMETERS ARE OPTIONAL. THE FIRST PARAMETER(DATASET =
--- NAME), IF SPECIFIED, MUST COME BEFORE ANY OTHER PARAMETER =
--- IN THE LIST ABOVE. ORDER IS NOT IMPORTANT FOR THE OTHER =
--- PARAMETERS. REMEMBER TO INCLUDE THE PERCENT SIGN IN FRONT
--- OF THE QP() MACRO CALL.
-->QP() BY ITSELF, IS JUST LIKE SAYING ---> PROC PRINT---
-->ONLINE HELP CAN BE SENT TO YOUR SASLOG WITH THE FOLLOWING --
-->MACRO CALLS. NOTE: THIS WILL STOP YOUR SAS PGM EXECUTION. --
-->QP(?) OR QP(HELP)
--- DEFINITION FOR PARAMETERS 1-10 FOLLOWS ---
--(1) DATASET NAME IS ANY PERMANENT OR WORK SAS DATASET. ---
-- THIS IS A POSITIONAL PARAMETER AND MUST BE THE FIRST ---
-- PARAMETER SPECIFIED IN THE MACRO CALL. ---

```

```

-->QP(DEMO) OR QP(Protocol.Demo) OR QP(MacroVar..Demo)-----
--(2) VARS= IS JUST LIKE SPECIFYING VARIABLES IN A VAR STATEMENT
-->QP(DEMO,VARS=INV PT DRUG SEX AGE)-----
--(3) FMTS= IS JUST LIKE SPECIFYING FORMATS FOR ANY VARIABLES.
-->QP(DEMO,VARS=INV PT DRUG,FMTS=DRUG DRG. INV PT Z3.)-----
--(4) WHERE= IS JUST LIKE SPECIFYING A WHERE STATEMENT FOR
--SUBSETTING DATA.
-->QP(DEMO,WHERE=DRUG CONTAINS "ASPR",FMTS=DRUG $DRG.)-----
--(5) BYVARS= IS JUST LIKE SPECIFYING A BY STATEMENT WHEN
--DATA IS EXPECTED TO BE IN SORTED ORDER.
-->QP(DEMO,WHERE=DRUG CONTAINS "ASPR",BYVARS=INV PT AGE)-----
--(6) IDS= IS JUST LIKE SPECIFYING AN ID STATEMENT.
--ALL OBSERVATIONS WILL BEGIN WITH THE VARS SPECIFIED IN
--THE ID STATEMENT EVEN IF THE OBSERVATION WRAPS TO
--ANOTHER LINE/PAGE.
-->QP(DEMO,WHERE=DISP^=3,BYVARS=INV PT AGE,IDS=INV PT AGE)-----
--(7) OPTIONS= IS JUST LIKE SPECIFYING OPTIONS FOR PROC PRINT.
--INCLUDING LABEL(DISPLY LABELS), N(N=AFTER BY GROUPS),
--DOUBLE(DOUBLE SPACING), NOOBS, ROUND, UNIFORM, & SPLIT.
--ANOTHER LINE/PAGE.
-->QP(DEMO,WHERE=DISP^=3,BYVARS=DRUG,OPTIONS=N DOUBLE)-----
--(8) PAGEBYS= IS LIKE SPECIFYING A PAGEBY STATEMENT.
--BEGINS PRINTING A NEW PAGE WHENEVER THE VALUE OF THE
--SPECIFIED BY VARIABLE CHANGES. SEE MANUAL FOR MORE INFO.
-->QP(DEMO,WHERE=DISP^=3,BYVARS=DRUG,PAGEBYS=DRUG)-----
--(9) SUMBYS= IS LIKE SPECIFYING A SUMBY STATEMENT. PRINTS
--SUBTOTALS FOR THE SPECIFIED BY VARIABLE WHENEVER ITS
--VALUE CHANGES. SEE MANUAL FOR MORE INFO.
-->QP(OUTLIERS,BYVARS=LAB LOWS HIGHS,SUMBYS=LAB)-----
--(10)SUMS= IS LIKE SPECIFYING A SUM STATEMENT. PRINTS TOTALS
--FOR THE SPECIFIED VARIABLES. SEE MANUAL FOR MORE INFO.
-->QP(OUTLIERS,BYVARS=LAB LOWS HIGHS,SUMS=LOWS HIGHS)-----
--> END OF QP HELP-----

```

%QSORT() or Quick Sort macro with self-documenting features.

```

Macro QSORT(bvvars=,in=,out=,vars=,rename=,where=,options=) ;

%if %bvvars^=? AND %Upcase(%bvvars)^=HELP %then %do ;
%if %bvvars^=? %then %do ;
%if %in^=? OR %syslast^=? %then %do ;
%if %Scan(%in,2)^=? AND %out^=? %then %let out=%Scan(%in,2) ;
%if %in^=? AND %syslast^=? %then %let in=%syslast ;
%if %out^=? %then %let out=%in ;
%if %rename^=? %then %let rename=%rename(%rename) ;
%if %where^=? %then %let Proc Sort Data=%in(%where(%where)) ;
%else Proc Sort Data=%in ;
%if %out^=? %then %let out=%out ;
%else %if %out=%syslast %then %let out=%syslast ;
%if (%vars^=? OR %rename^=?) AND %options^=? %then (Keep=%bvvars
&vars %rename) ;
%else %if %options^=? %then (Keep=%bvvars %rename) ;
&options ; By %bvvars ; Run ;
%end ;

%else %do ;
%put ;
%put ***** ;
%put *** W A R N I N G *** NO INPUT DS NAME OR DEFAULT DS,
ABORTED!! ;
%put ***** ;
%put QSORT(BY VAR LIST, INPUT DS NAME, OUTPUT DS NAME, RENAME=
LIST) ;
%put ***** ;
%put ;
%put QSORT(BYVARS=HELP) ;
%end ;
%end ;

%else %do ;
%put ;
%put ***** ;
%put *** W A R N I N G *** A BY VAR LIST IS REQUIRED, MACRO
ABORTED!! ;
%put ***** ;
%put QSORT(BY VAR LIST, INPUT DS NAME, OUTPUT DS NAME, RENAME=
LIST) ;
%put ***** ;
%put ;
%put QSORT(BYVARS=HELP) ;
%end ;
%end ;

%else %do ;
%put =QSORT MACRO DEFINITION, BY M.BODENSTAB, 1994 ==PROC SORT;
%put QSORT(BYVARS=,IN=,OUT=,VARS=,RENAME=,WHERE=,OPTIONS=) ==;
%put =====;
%put = THE FIRST PARAMETER IS REQUIRED BECAUSE THIS IDENTIFIES
HOW==;
%put = TO SORT YOUR DATA. ORDER OF MACRO PARAMS IN THE CALL ==;
%put == LIST ABOVE IS NOT IMPORTANT. REMEMBER TO INCLUDE THE;
%put == PERCENT SIGN IN FRONT OF THE QSORT(...) MACRO CALL. ==;
%put =====;

```

```

%put -ONLINE HELP CAN BE SENT TO YOUR SASLOG WITH THE FOLLOWING;
%put -MACRO CALLS. NOTE: THIS WILL STOP YOUR SAS PGM EXECUTION;
%put ==>QSORT(BYVARS=?) OR QSORT(BYVARS=HELP)-----;
%put =====;
%put == DEFINITION FOR PARAMETERS 1-7 FOLLOWS-----;
%put ==(1) BYVARS=IS A LIST OF VARS THAT YOU WANT TO SORT BY. ==;
%put == THIS PARAMETER MUST BE SPECIFIED IN THE MACRO CALL. THE;
%put == DESCENDING OPTION CAN BE INCLUDED ALSO. SEE MANUAL==;
%put ==>QSORT(BYVARS=INV PT VISIT)-----;
%put =====;
%put ==(2) IN= IS USED TO SPECIFY THE DATA SET NAME TO SORT. ==;
%put == IF LEFT BLANK, THE MACRO WILL SORT THE MOST RECENTLY==;
%put == CREATED SAS DATA SET. ==;
%put ==>QSORT(BYVARS=INV PT VISIT,IN=VITALS)-----;
%put =====;
%put ==(3) OUT=IS USED TO SPECIFY THE NEW SORTED DATA SET NAME. ==;
%put == IF LEFT BLANK, THE MACRO WILL SORT THE ORIGINAL, IN=, ==;
%put == THE ORIGINAL. THE "EXCEPTION" IS WHEN THE IN=DATA SET;
%put == IS A PERMANENT SAS DATA SET. IF IN=XXPROOON.STAT AND;
%put == OUT=IS NOT SPECIFIED, THEN THE NEW SORTED DATASET WILL;
%put == BE NAMED WORK.STAT. (A SAS WORK DATA SET) ==;
%put ==>QSORT(BYVARS=INV PT VISIT,IN=VITALS,OUT=VITALS2)-----;
%put ==>QSORT(BYVARS=INV PT,IN=XXPROOON.STAT,OUT=XXPROOON.STAT2);
%put =====;
%put ==(4)VARS=A LIST OF VARIABLES, OTHER THAN THE BYVARS LIST, ==;
%put == THAT WILL KEEP SELECTED VARIABLES WITH THE NEW SORTED;
%put == DATA SET. THE DEFAULT, IF VARS= IS NOT USED, IS TO ==;
%put == KEEP ALL VARIABLES IN THE NEW DATA SET. ==;
%put ==>QSORT(BYVARS=INV PT,IN=DEMO,OUT=DEMO2,VARS=DRUG DISP AGE;
%put =====;
%put ==(5)RENAME= IS USED FOR RENAMING VARIABLES THAT APPEAR IN;
%put == THE BYVAR OR VARS LIST. OLD NAME=NEW NAME ==;
%put ==>QSORT(BYVARS=INVPT,IN=DEMO,VARS=DRG SEX,RENAME=SEX=GEND);
%put =====;
%put ==(6) WHERE= SUBSETTING OF DATA FROM THE INPUT DATA SET. ==;
%put == IN=, TO THE NEW SORTED DATA SET. ==;
%put ==>QSORT(BYVARS=INV PT,IN=STAT,OUT=STAT2,VARS=DRUG DISP SEX;
%put > AGE,WHERE=DISP ^= 3 AND AGE>=65)-----;
%put =====;
%put ==(7)OPTIONS=IS FOR SPECIFYING OPTIONS FOR PROC SORT LIKE ==;
%put == NODUPKEY. NODUPKEY IS USED TO CREATE A DATA SET OF
UNIQUE==;
%put == KEY VARIABLES, BYVARS, FROM A MULTI-RECORD DATA SET.==;
%put == THIS IS USEFULL FOR MERGING BACK IN KEY VARIABLES THAT;
%put == MAY HAVE BEEN LEFT BEHIND IN A PREVIOUS PROCEDURE OR ==;
%put == DATA STEP. SEE MANUAL FOR OTHER AVAILABLE OPTIONS. ==;
%put ==>QSORT(BYVARS=INV PT DRUG DISP,IN=STAT,OUT=STAT2,
%put ==> OPTIONS=NODUPKEY)-----;
%put ==> END OF QSORT HELP-----;
%put =====;
%put %Str(Quit);
%end ;
%mend ;

```

How does a user get a list of all the macros available via the autocall library?

The autocall library is overflowing with practical macros but the user can't remember the name of the macro they found so useful a month ago. We've gone this far so why not a macro which lists all available macros in the library. And while we're at it, we will provide the user with macro specific online documentation.

%QHELP() or Quick Help macro with self-documenting features:

```

Macro QHelp(macname);

%if %macname^=? AND %Upcase(%macname)^=HELP
%then %do ;
%if %Upcase(%macname)=PRINT %then %QPF(?);
%else %if %Upcase(%macname)=QP %then %QPF(?);
%else %if %Upcase(%macname)=SORT %then %QSort(ByVars=?);
%else %if %Upcase(%macname)=QSORT %then %QSort(ByVars=?);
%else %if %Upcase(%macname)=TITLE %then %QTitle(Drug=?);
%else %if %Upcase(%macname)=AGE %then %QAge(VDate=?);
%else %if %Upcase(%macname)=GETAGE %then %QAge(VDate=?);
%else %if %Upcase(%macname)=QPTO %then %QPTO(Print=?);
%else %do ;
%put ***** ;
%put *** W A R N I N G *** THE (%MACNAME) KEYWORD CANNOT BE
FOUND.****;
%put ***** ;
%QHelp();
%end ;
%end ;

%else %do ;
%put QHELP MACRO DEFINITION, BY M.BODENSTAB, 1995 ==QUICK HELP;

```

```

%Put QHELP(MACNAME)
%Put = ONLINE INDEX AND RETRIEVAL OF MACRO LIBRARY HELP DOCUMN;
%Put = TATION. ONLINE HELP WILL BE SENT TO YOUR SASLOG.
%Put = REMEMBER TO INCLUDE THE PERCENT SIGN IN FRONT OF THE;
%Put = MACRO CALL QHELP( )
%Put =====
%Put --QHELP( ) BY ITSELF IS JUST LIKE ASKING FOR AN INDEX OF --
%Put -- THE MACRO LIBRARY.
%Put --QHELP(?) OR QHELP(HELP)-----
%Put =====
%Put --QHELP(MACNAME) WHERE MACNAME IS THE NAME OF ONE OF THE;
%Put -- MACROS LISTED BELOW WILL RETRIEVE HELP FOR THAT MACRO.;
%Put --QHELP(QTITLE) OR QHELP(TITLE) FOR TITLE HELP-----
%Put --QHELP(OP ) OR QHELP(PRINT) FOR PROC PRINT HELP-----
%Put --QHELP(QSORT ) OR QHELP(SORT ) FOR PROC SORT HELP-----
%Put --QHELP(GETAGE) OR QHELP(AGE ) FOR COMPUTE AGE HELP-----
%Put --QHELP(QPTO ) FOR PROC PRINTTO HELP-----
%Put =====
%Put = INDEX OF MACROS FOLLOWS-----
%Put -- QTITLE = TITLE1 FORMAT.
%Put -- OP = PRINTING WITH PROC PRINT.
%Put -- GETAGE = COMPUTING AGE FROM TWO SAS DATES.
%Put -- QSORT = SORTING WITH PROC SORT.
%Put -- QPTO = RE-ROUTING OUTPUT WITH PROC PRINTTO.
%Put == END OF QHELP HELP-----
%Str(Quit; ) ;
%End ;
%MEnd ;

```

Quick Help call for online macro library index:

```
%QHELP( ? ) or %QHELP( Help )
```

Quick Help online index printed to your SASLOG:

```

= QHELP MACRO DEFINITION, BY M.BODENSTAB, 1995 --QUICK HELP----
= QHELP(MACNAME)
= ONLINE INDEX AND RETRIEVAL OF MACRO LIBRARY HELP DOCUMN-
= TATION. ONLINE HELP WILL BE SENT TO YOUR SASLOG.
= REMEMBER TO INCLUDE THE PERCENT SIGN IN FRONT OF THE
= MACRO CALL QHELP( )
=====
--QHELP( ) BY ITSELF IS JUST LIKE ASKING FOR AN INDEX OF
-- THE MACRO LIBRARY.
--QHELP(?) OR QHELP(HELP)-----
=====
-- MACROS LISTED BELOW WILL RETRIEVE HELP FOR THAT MACRO.
--QHELP(QTITLE) OR QHELP(TITLE) FOR TITLE HELP-----
--QHELP(OP ) OR QHELP(PRINT) FOR PROC PRINT HELP-----
--QHELP(QSORT ) OR QHELP(SORT ) FOR PROC SORT HELP-----
--QHELP(GETAGE) OR QHELP(AGE ) FOR COMPUTE AGE HELP-----
--QHELP(QPTO ) FOR PROC PRINTTO HELP-----
=====
--- INDEX OF MACRO FOLLOWS-----
-- QTITLE = TITLE1 FORMAT.
-- OP = PRINTING WITH PROC PRINT.
-- GETAGE = COMPUTING AGE FROM TWO SAS DATES.
-- QSORT = SORTING WITH PROC SORT.
-- QPTO = RE-ROUTING OUTPUT WITH PROC PRINTTO.
--- END OF QHELP HELP-----

```

Quick Help call for online macro documentation:

```

%QHELP( Print )or
%QHELP( OP )or
%QHELP( Sort )...

```

Any of the above macro calls will send online documentation about the macro requested to your SASLOG.

We provide access to our autocall macro library via a directory on our local area network fileserver. This arrangement allows any SAS and authorized network user to access the entire library. The macros are called by our programs daily, thus we write less code and reduce the amount of time spent due to typing incorrect syntax. We are confident in what the macros do because they are tested and well documented. But if the syntax for a macro escapes the user, the online autocall library index is at their

fingertips.

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