SAS® Software Tips: My experience as a SAS-L MVP
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Abstract
This paper covers a diverse range of SAS tips. I have broken the sections up into AF, General and 6.11 tips. The AF tips mainly apply to Frame programming in a GUI environment. The General tips should be applicable to most platforms. The 6.11 tips apply to the latest release of SAS, version 6.11. These tips have been tried out under MS Windows, but also should apply to other 6.11 platforms, such as OS/2.

Introduction
Since August 1994 I have produced a SAS Tip most days which is sent out over the Internet to various people, including the SAS-L user group. For my efforts I was voted the Most Valuable SAS-Ler (jointly with Ian Whitlock) at the last SUGI conference. In this paper I will share some of the best SAS Tips that I have come across in that time. Some are simple, elegant and undocumented. Others are clever techniques which make use of more familiar features of SAS in interesting ways. The tips are applicable to SAS users with a variety of levels of experience.

SAS/AF Tips
These tips apply to the SAS/AF product, which is used for interactive applications development.

Cursor shapes
Usually the shape of the mouse pointer is an arrow. But by using the _set_cursor_shape_ method you can tell SAS what shape that the mouse pointer should take when moving over a widget in a frame. This works, but is not supported in SAS 6.10. This is supported and documented in SAS 6.11.

Cursor shapes can be very useful in conveying information to the user as to what actions can be undertaken by clicking with the mouse. For instance using cursor shape 18 you get a circle with a diagonal line through the middle, which can be used to indicate that whatever the cursor is currently on can not be clicked on. Whereas cursor shape 19 is an arrow with an attached question mark. This symbol is often used to indicate that clicking on an object will provide help with its function.

Example instructions.
To try out cursor shapes, make 20 widgets in a frame (e.g. pushbuttons). As you move them they will be automatically named obj1 to obj20. Then copy the following code into the source window. Compile it. Test af it. Now you can see the mouse pointer change shape as it moves over each of the widgets.

Source code

```plaintext
null:
call notify (obj1:_set_cursor_shape_; 11) /* Hourglass */
call notify (obj2:_set_cursor_shape_; 1) /* Arrow */
call notify (obj3:_set_cursor_shape_; 4) /* Cross-hair */
call notify (obj4:_set_cursor_shape_; 41) /* Mad Money】 */
call notify (obj5:_set_cursor_shape_; 5) /* Hand */
call notify (obj6:_set_cursor_shape_; 8) /* Copy */
call notify (obj7:_set_cursor_shape_; 7) /* Question mark */
call notify (obj8:_set_cursor_shape_; 51) /* Small Money】 */
call notify (obj9:_set_cursor_shape_; 55) /* Big Money】 */
call notify (obj10:_set_cursor_shape_; 12) /* T-type arrow */
call notify (obj11:_set_cursor_shape_; 13) /* Four-way pointer */
call notify (obj12:_set_cursor_shape_; 14) /* Tri-type arrow */
call notify (obj13:_set_cursor_shape_; 15) /* Double click】 */
call notify (obj14:_set_cursor_shape_; 16) /* Time arrow */
call notify (obj15:_set_cursor_shape_; 17) /* Clock hammer】 */
call notify (obj16:_set_cursor_shape_; 18) /* Dollar & amp mark */
call notify (obj17:_set_cursor_shape_; 19) /* Vertical cursor */
return
```

Alternate way to test out cursor shapes
Make a slider or scrollbar. Set the min to 0 and the max to 19 and use the following code:

```plaintext
slider: call notify (slider:_set_cursor_shape_;18) return;
```

This code will cause the shape of the cursor to change as you move the slider/scrollbar to new positions. Clicking on the arrow at the right will take you through all the available cursor shapes.

You can also set the cursor shape on the FRAME itself.

```plaintext
null: call notify (null:_set_cursor_shape_; number);
```

Listing AF entries
A listing can be obtained of the attributes of certain AF catalog entries by entering an asterisk ("*") beside them in the "BUILD: DIRECTORY" window. The listing is sent to the MESSAGE window. The command will not work from the other BUILD window (accessed by entering 'BUILD'), nor will it work from the CATALOG window.

To get to the "BUILD: DIRECTORY" window enter:

BUILD libref.catalog
e.g. build sasuser.profile

Sample output from a "*" next to a SLIST entry.

```plaintext
SLIST
libref.libref number (s)
buildlib=8073 (s)
buildlib=8074 (s)
```

Sample output from a "*" next to an SCL entry.

```plaintext
SCL1
libref=8073 (s)
buildlib=8074 (s)
```
Making & using Windows Help

You can build your own Windows help files and then use them from your SAS/AF applications.

1. Get a tool to make input to the help compiler. There are many shareware tools available, such as "HELPL!" which can be found in many places, including the Internet CICA archive. "HELPL!" is a template for MS Word 2 or 6 which allows you to create help files using those word processors. You can get it from one of these sites:

2. Get the Microsoft Help compiler, to compile the Help source. This is freely available from this Internet URL:

3. Optionally get the Microsoft Shed editor, which lets you add graphics and hotspots to your help. This is also freely available from this URL:

4. Configure your tool, "HELPL!" for instance, to work with the help compiler and SHED editor (if you are using it).

5. Build, compile & test a Help file. Examples are provided in the packages, along with extensive online help.

6. Call your Help from your application, using the WINHELP SCL function.

Example

```
INIT: 
  PROC WHELP('help_contents', 'c:\windows\samplefile.hlp');
  PUT RS; 
  RETURN;
```

Syntax

```
WINHELP('b-method', 'b-methodparm1', 'b-methodparm2');
```

The WINHELP function starts the Windows Help application (WINHELP.EXE) with the help information that you request using the parameters.

The b-method argument must be one of eight help methods that this function supports. Depending on the value of b-method, the b-methodparm1 and b-methodparm2 arguments have various meanings.

The eight supported methods are:

- HELP_CONTENTS
- HELP_QUIT
- HELP_CONTEXT
- HELP_INDEX
- HELP_HELPHONHELP
- HELP_CONTEXTPOPOP
- HELP_KEY
- HELP_PARTIALKEY

Saving catalog space

To compress and reuse the space in a catalog, which would otherwise be wasted after doing many compiles, use REPAIR in PROC DATASETS. I have managed to save large amounts of space in some cases. There are other ways of compressing the space used by catalogs such as copying the catalog to a new catalog, deleting the old one and renaming the new one.

Example: this will compress sasuser profile

```
PROC DATASETS LIBRARY=sasuser;
  REPAIR profile / NO-EXC ;
RUN;
```

Catalog member Stats

In Proc Catalog you can use the undocumented STAT parameter on the CONTENTS keyword to give you space used by catalog members.

Example Code

```
options ls=532 ; * datelines wide or output looks a bit weird ;
PROC CATALOG CREATE=help.xls ;
  CONTENTS STAT ;
RUN;
```

Left side of output

```
# Name Type Date Description
1 ADDB2 CFY 04/05/94 .ID: Add a new object type
2 ADDB2 CFY 04/05/94 .ID: Add new data set definition
3 ADSMCF CFY 04/05/94 .ID: CRT for setup applications
```

1See online help for more information. The methods are described in more detail there.
Operating other programs from SAS with DDE

Using DDE SAS is able to control other programs by issuing commands to them which they recognize. The commands used depend on the application being controlled. A simple way to find out which commands to use is to turn on the applications macro recorder, do something and then edit the macro recorded to see what the commands are.

Steps to "remote control" applications from SAS.
1. Work out what commands to use, either with manual or macro recorder.
2. Allocate the fileref. Remember to use the applications program name and the word SYSTEM separated by a vertical bar.
3. Write commands to the fileref. Commands should be contained within square brackets.

The following are 2 examples, one controlling Lotus 123 and the other Microsoft Word.

Sample LOG Listing: Example 1

```
FILENAME Lotus.DDE ' Lotus' NOTEB: *** Program name is fillw.exe
FILE NULL;
PUT 'RUN([CHART-RANGE "A:A/4"]);' ; *** Create a new chart:
PUT 'RUN([CHART-RANGE "X:A:A/4/New/"WSD]);' ; *** Set the X range:
PUT 'RUN([CHART-RANGE "Y:A:95:A:96/Bar"/WSD]);' ; *** Set the Y range and:
PLOT a bar chart;
PUT;
NOTE: The file Lotus is:
FILEPATH=1-200\system.
Return=1-512.
NOTE: 4 records were written to the file Lotus.
The minimum record length was 50.
The maximum record length was 48.
The DATA statement used 1.57 seconds.
```

Sample LOG Listing: Example 2

```
FILENAME Word.DDE ' Word' NOTEB: *** Program name is fillw.exe
FILE NULL;
PUT 'RUN([FILEOPEN "File"="phil.doc"]);' ; *** Open file called phil.doc;
PUT 'RUN([FILECLOSE]);' ; *** Close & save called macro;
PUT;
NOTE: The file Word is:
FILEPATH=1-200\system.
Return=1-512.
NOTE: 1 record was written to the file Word.
The minimum record length was 20.
The maximum record length was 0.
The DATA statement used 0.02 seconds.
```

Making sure numbers are numeric when using DDE

When using DDE to write numbers to a spreadsheet/database, they can sometimes be inadvertently read in as character values. This can happen if using a variable to hold your tab character, since after a variable is output a space is written. To get around this position the column pointer over the space that was written (see example).

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2Dynamic Data Exchange
Training and User Support Services

Example

```
FILENAME 'l62w/test.ws14a...s63' notab:
* Writing numeric values directly to spreadsheet via DDE:
data _null_.
  retain tab '99-x' *** define a tab character;
  file lotus => Direct output to spreadsheet via DDE link:
    if i > 0 then put i: 1
    if i = 0 then put i: 2
    put i: 3;
    put ' ' tab: tab
    put i: 4
    put i: 5
run;
```

**NOTE:** The file LOTUS is:
F:\V8\analysetest\analysetest\.
Z:\V8\analysetest\analysetest\.
NOTE: 2 records were written to the file LOTUS.
The minimum record length was 1.
The maximum record length was 5.
NOTE: THE DATA statement used 0.25 seconds.

Using the colon in variables lists

The colon can be used as a wildcard in variable lists.

Example

```
ABC: means all variable names beginning with ABC:
```

```
data sexp0011:
  a1:2;
  a2:2;
  b1:2;
  b2:2;
  c1:5;
  c2:5;
run;
```

**NOTE:** The data set WORK.X has 1 observations and 3 variables.
**NOTE:** The DATA statement used 0.01 CPU seconds and 14356.

```
proc print:
  var a b c;
  run;
```

**NOTE:** THE PROCEDURE PRINT used 0.01 CPU seconds and 14356.

Notice that the 3 variables starting with the letter ‘a’ have been kept. We can also use ‘a:’ in procedures.
The colon must be at the end of the name, not embedded—AB:C is invalid. Colons can be used in most places where other abbreviated variable lists such ABC1-ABC99 are allowed.

10 ways to minimise I/O

Generally SAS is I/O intensive, rather than CPU intensive. As my friend Ken Williams say “The Best I/O is the one you didn’t do”. Thus a saving in I/O will improve the performance of your SAS program.

10 ways to minimise I/O

1. Use the LENGTH statement to minimise variable lengths. Numerics are 8 bytes by default, however it only takes 3 bytes to store a SAS date value. Under MVS to minimum number of bytes for a numeric is 2, whereas under windows it is 3.
2. Use the CLASS statement rather than the BY statement, which might require a SORT. When doing a summation, for example, a CLASS statement will summarise all the data in memory, not requiring data to be pre-sorted. Whereas a BY statement requires that the data be sorted before it is summarised, since each BY group is processed one at a time. Having to sort the data as well as summarise it requires much more I/O.
3. Use the DROP and/or KEEP statements to minimise observation length. Either use DROP to drop variables not required from the dataset. Otherwise use KEEP to specify which variables are to be kept. This minimises the bytes per observation, which means more observations can be written for each I/O, resulting in less I/Os.
4. Only SORT when necessary. Sorting does I/O to read data in and then some more to write it out. Often I/O is also done to temporary sort work datasets during the sort process itself.
5. Read raw data only once, keeping it in permanent datasets if required again. This avoids having to read through the raw data again when it is required.
6. Create multiple datasets from the one dataset if possible, rather than reading through one dataset once for each dataset that is to be created.
7. Use the WHERE statement with procedures to avoid doing a dataset. Otherwise you need to do a dataset before the proc to select the data required.
8. Use the `_NULL_` datastep when you don’t need to keep the output. Even just specifying “DATA;” will still create a dataset. If you don’t want to write data to a dataset then use “data _null_”.
9. Compress large SAS datasets, but beware that compression can use more space. Compression works best when there is a lot of text data in a dataset, it doesn’t work well where data is all numeric. If compression does save space, then I/Os will be reduced. Remember to check the compression ratios in the LOG.
10. Develop & test programs on a small subset of the data. This means that you do less I/O while testing/developing the code. Once the code is tested then it can be run against the entire dataset. Test data can sometimes be placed on faster devices which do I/O quicker - eg. RAM disk, SCSI drives, cached disk drives.

Note: the list is not comprehensive, it merely attempts to provide a few ideas for investigation. Not all of the points will always reduce I/O time.

Do-it-yourself log messages

Entering code like this ...

```
data _null_.
  put 'NOTE: this is a note';
  put 'WARNING: this is a warning';
  put 'ERROR: this is an error';
run;
```

causes the SAS log to highlight this in exactly the same way it highlights its own Note, Warning and Error messages. It does not seem to be documented in any of the manuals or SAS Notes anywhere.
appears to be happening is SAS examines the first word that is sent to the log and if it is NOTE, WARNING: or ERROR: it highlights it. This works on MVS SAS 6.07+, Windows SAS 6.08+ and most other versions. Under MVS overprinting is used for highlighting, whereas in GUI environments colours are used.
Under OS/2 Display Manager session, the NOTE statement appeared with black print, WARNING with yellow, ERROR with red, all just as though they had been issued by the SAS system itself.
Note: the keywords must be entered in uppercase, or it will not work - i.e. ERROR, not error.

**SQL Coalesce function**

In PROC SQL the COALESCE function can be used to set default values when variables have missing values and is almost essential when doing left, right or full joins where the key fields are included in the output set only once.⁴

**Example**

To replace missing values of name from dataset x, with values of name from y ...

```sql
select address0.
    coalesce(x.name, y.name) as name
from x
    left join
    y on x.name = y.name;
```

**Format Nesting**

From SAS 6.07 onwards you can refer to other formats from within formats (Value formats, not Pictures). You can also nest your formats up to five levels deep⁵, although this can degrade performance.

**Example**

```plaintext
proc format;
    value grades
        1 = "A"
        2 = "B"
        3 = "C"
    value column
        1 = "1"
        2 = "2"
        3 = "3"
    value grades2
        1 = "A"
        2 = "B"
        3 = "C"
    value column2
        1 = "1"
        2 = "2"
        3 = "3"
    run;
```

Output of dataset

```
Name:
  1
  2
```

New SAS 6.11 Features

**Where on Output dataset⁶**

In SAS 6.11 you can use a where clause on an output dataset. However in previous versions of SAS (I tried 6.08 on MVS) you are unable to do this.

**Useful application**

When doing a PROC SUMMARY you may want to keep a range of _TYPE_ values, perhaps for use in a data warehouse. Using this tip you can only write out the values of _TYPE_ that you wish to keep. This can be very useful, particularly in saving space.

**Example using SAS 6.08 TS425, under MVS**

Note: the WHERE= option causes a warning message telling us that it is not used in this context.

```plaintext
   1 data x;
   2 do i=1 to 10; output _null_; run;
   3 data y(where=(x gt 5));
   4 set x;
   5 run;
```

WARNING 70-63: The option WHERE= is not valid in this context. Option ignored.

Note: The DATA statement used 0.02 CPU seconds and 1496K.

**Example using SAS 6.11, under MS Windows 3.1**

Note: the WHERE= option works correctly in this case.

```plaintext
   * data x: do i=1 to 10; output _null_; run;
   1 data y(where=(x gt 5));
   2 set x;
   3 run;
```

Note: The DATA statement used 0.32 CPU seconds and 2790K.

⁵See “Changes & Enhancements for SAS 6.07”, page 213
⁶Please note that this paper was written without any printed SAS 6.11 documentation, so my 6.11 tips are based on online documentation and/or trial and error.
Data Encryption

From SAS 6.11 on data can now be natively encrypted by SAS using the ENCRYPT= dataset name option. When using ENCRYPT=, you must specify a read password (READ=).

To test the encryption I loaded the unencrypted file into an editor and could see text clearly. I then loaded the encrypted file and couldn’t make out anything, showing that the encryption worked.

Example

```
data test(read=encrypt=); set excesse.house; run;
```

Catalog engine

There is a new engine in SAS 6.11 which lets you read SAS Catalog members using a dataset. Usage is like this...

```
FILENAME test CATALOG=A:; run;
```

I thought that a good way to demonstrate what this can do was to include a sample macro which makes use of it.

The macro reads all the members of a particular type from a SAS catalog and then creates a SAS dataset for each one. It then combines all of these datasets into one and writes the contents out to a text file. I wrote this so that I could take all my SCL data away from me and view it with my text editor.

The macro uses “Call Execute” functions, which put SAS code onto a stack which is then run after the current dataset finishes.

Example macro

```
%macro catalog(ldbname, cdname, cdtype);
  %libname . libname catalog in .
  %dataset . dataset which contains members.
  %cdtype . Type of members that you will analyze.
  %delete . The dataset that I am about to create.
  %prgdataset . libname.
  %delete_all . run quit.
  %run .
  %create . Create the SAS code to be run:
  %data .
  %read .

  %for each catalog member of the specified type .
  %from libname catalog .
  %set member . var=value
  %libname . libname catalog in .
  %nm . members'@quote(timeout=1000)
  %nmtype . @quote(timeout=1000)

  %end成员 .
  %run .
%
```

A better way to view & edit data

There is a nice new DM command in SAS 6.11 called VIEWTABLE. You can use it instead of FSVIEW, FSEDIT or FSBrowse to look at data and optionally change it. You can invoke the command on its own or put a dataset name after it. It lets you browse and/or edit a dataset with a "spreadsheet" look and feel. It seems to use the new data table object to do this.

It also provides a lot more functionality including letting you build where clauses with a where clause builder. Quite a useful tool, especially for those who aren’t very familiar with SAS.

Conclusion

Although a paper such as this doesn’t strictly require a conclusion I thought I would put one in to make several recommendations to those of you who want more SAS tips. There are many sources of information (Tips!) about SAS.

How to get more tips

If you want more tips then you can obtain them in one of the following ways:

- If you are using a SAS product then make sure you have all of the available manuals for it that are available from SAS Institute. Make sure you go through each manual to ensure you are familiar with what is there. I have discovered many tips by doing that.

- Look through the online help, including the sample programs. This is a great source of information.

- Subscribe to the internet SAS user group SAS-L. Here you will not only receive my tips, but many other tips from the SAS-L community. To subscribe to SAS-L send a message to listserv@uga.cc.uga.edu with the following in the body of the message, “subscribe sas-1 firstname surname” - leave quotes off and substitute your name.

- Find out about the books available from SAS Institute through the “Books By Users” programme. There are many excellent books available there.

- Get yourself onto the “SAS Communications” mailing list since that free quarterly magazine has a section with Tips & Techniques. Call your local SAS office to receive this. Be aware that there is an American and European version of this. The European one is called “Inform” and is also well worth receiving if you can.
• Subscribe to the SAS journal “Observations”. This one is not free, but has several lengthy articles covering a topic in depth. You can subscribe to this through your local SAS office.
• Buy the books that SAS provides covering tips & techniques, eg. “Macro tips & techniques”, “SAS Tips & Techniques”, etc.
• Watch out for my new book coming soon from the SAS Books By Users program. It will contain over 100 tips.

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