FLEXIBILITY BY DESIGN:
A LOOK AT NEW AND UPDATED SYSTEM OPTIONS IN SAS® 9.4

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INTRODUCTION

- SAS software contains many options that you can customize, making SAS an extremely flexible programming language.
- SAS contains several types of options, including data set options, LIBNAME statement options, and system options.
- This presentation covers new and updated SAS® 9.4 system options.
DETERMINING AVAILABLE OPTIONS IN SAS® 9.4

Use the OPTIONS procedure to generate a list of all available SAS options and their default settings. To generate the list, submit the following procedure:

```
proc options;
run;
```
PROC OPTIONS generates a very long list of options, but only a portion of the output is shown below:

```
SAS (r) Proprietary Software Release 9.4 TS1M0

Portable Options:

ANIMATION=STOP       Specifies whether to start or stop animation.
ANIMDURATION=MIN     Specifies the number of seconds that each animation frame displays.
ANIMLOOP=YES         Specifies the number of iterations that animated images repeat.
ANIMOVERLAY          Specifies that animation frames are overlaid in order to view all frames.
APPEND=              Specifies an option=value pair to insert the value at the end of the existing option value.
APPLETLOC=C:\Program Files\SASHome\SASGraphJavaApplets\9.4
                      Specifies the location of Java applets, which is typically a URL.
ARMAGENT=            Specifies an ARM agent (which is an executable module or keyword, such as LOG4SAS) that contains a specific implementation of the ARM API.
ARMLOG=              Location of the ARM log file.
```
TOPICS

- EXTENDOBS COUNTER = system option: creating very large SAS data sets
- BUFNO=, UBUFNO=, UBUFSIZE=, VBUFSIZE=, and DATAPAGESIZE= system options: improving performance by bypassing the file cache and using buffer options
- DTRESET | NODTRESET system option: obtaining the correct date and time in output
- LRECL= and DMSOUTSIZE system options: preventing truncation of external input and output files and SAS output files
TOPICS (CONTINUED)

- VARINITCHK= system option: handling uninitialized variables
- YEARCUTOFF= system option: reading two-digit years correctly
- PRESENV | NOPRESENV system option and the PRESENV procedure: preserving your SAS environment for use in a later SAS session
NEW SAS® DATA SET STRUCTURE

SAS® 9.3 introduced a new data set structure for 32-bit SAS:

- Applies to 32-bit SAS sessions ONLY
- Has a larger number of bits in which to store the observation count
- Can use only the V9 or the BASE engine
THE EXTENDOBSCOUNTER= SYSTEM OPTION

Option Syntax: EXTENDOBSCOUNTER=YES | NO
(alias: EOC=)

This option specifies which internal data set structure to use:

- the original structure
- the new structure with the larger number of bits in which to store the observation count
## EOC= SYSTEM OPTION SUMMARY

<table>
<thead>
<tr>
<th>Output</th>
<th>SAS 9.3 32-bit Data Set Option</th>
<th>SAS 9.3 64-bit Data Set Option</th>
<th>SAS 9.4 64-bit Data Set, LIBNAME, and System Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOC = NO</td>
<td>EOC = YES</td>
<td>EOC = NO</td>
<td>EOC = NO</td>
</tr>
<tr>
<td>SAS 9.2 32-bit</td>
<td>Read/Write</td>
<td>No access</td>
<td>Read/Write</td>
</tr>
<tr>
<td>SAS 9.3 32-bit</td>
<td>Read/Write</td>
<td>Read/Write</td>
<td>Read/Write</td>
</tr>
<tr>
<td>SAS 9.4 64-bit</td>
<td>Read/Write</td>
<td>Read/Write</td>
<td>Read/Write</td>
</tr>
</tbody>
</table>

Note: Bold headings indicate default values
FILE CACHING

For large data sets (greater than 2 GB) that exceed the size of your file cache, movement of data into and out of the cache degrades system performance.

- In Microsoft Windows operating environments:
  The file cache is provided by the operating system.

- In UNIX and Linux operating environments:
  The file cache is provided by the operating system.

- In the z/OS operating environment:
  There is no caching for SAS libraries.
BYPASSING THE FILE CACHE WITH SAS® SYSTEM OPTIONS

- **Under Windows**: Use the SGIO (scatter-read/gather-write) system option.
- **Under UNIX and Linux**: Use the ENABLEDIRECTIO and USEDIRECTIO= system options.
- **Under z/OS**: No options are needed because all input and output is direct-to-disk I/O.
THE SGIO OPTION

Option Syntax:  SGIO=YES

Criteria for using the SGIO system option:
- an 8-KB, multiple page size (64-bit systems)
- sequential access
- SAS® 8 or later
THE SGIO OPTION (CONTINUED)

NOTE: SGIO processing active for file WORKTMPDATA.

NOTE: SGIO processing disabled for file WORKTMPDATA since the page size does not meet the criteria. See the Windows Companion for more details.
THE ENABLEDIRECTIO OPTION

The ENABLEDIRECTIO option is used in a LIBNAME statement to enable direct I/O for an entire library.

Example:

libname mylib '/u/user/library-directory-name'
   enabledirectio;
THE USEDIRECTIO= OPTION

**Option Syntax:** USERDIRECTIO=YES | NO

- Use this option in a LIBNAME statement to specify direct I/O for every data set in a library without a data set option.
  
  **Example:**
  ```
  libname newlib '.' enabledirectio
  usedirectio=yes;
  ```

- Use the USEDIRECTIO=YES|NO data set option to enable or disable direct I/O for a particular data set within a library.
  
  **Example:**
  ```
  data mylib.newdataset (usedirectio=yes);
  ```
NO OPTIONS FOR Z/OS

- The z/OS environment uses either bound or UNIX System Services (USS) libraries.
- All input and output is direct-to-disk I/O, so no file caching is needed.
IMPROVING PERFORMANCE BY USING BUFFER OPTIONS
BUFFERING OPTIONS

The following buffering options help increase I/O performance:
- BUFNO=
- VBUFSIZE=
- UBUFNO=
- UBUFSIZE=
- DATAPAGESIZE=

These options apply to the Windows, UNIX, Linux, and z/OS operating environments, but they are especially useful under z/OS because z/OS does not have file caching.
THE BUFNO= SYSTEM OPTION

Option Syntax: BUFNO=n | nK | nM | nG | hexX | MIN | MAX

This table shows the effect on performance when you use more buffers for large SAS data sets.

<table>
<thead>
<tr>
<th>10 Million Observations</th>
<th>BUFNO=1</th>
<th>BUFNO=10</th>
<th>BUFNO=100</th>
<th>BUFNO=1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write</td>
<td>Real Time</td>
<td>72.21</td>
<td>70.83</td>
<td>35.06</td>
</tr>
<tr>
<td></td>
<td>CPU Time</td>
<td>16.08</td>
<td>12.75</td>
<td>12.32</td>
</tr>
<tr>
<td>Read</td>
<td>Real Time</td>
<td>98.13</td>
<td>76.02</td>
<td>50.75</td>
</tr>
<tr>
<td></td>
<td>CPU Time</td>
<td>10.35</td>
<td>8.22</td>
<td>8.42</td>
</tr>
</tbody>
</table>
THE VBUFSIZE= SYSTEM OPTION

Option Syntax: VBUFSIZE=n | nK | nM | nG | hexX | MIN | MAX

- Applies to DATA step views
- Is not used in SQL views
- Reduces task switching
- Provides the ability to set the default view-buffer size for an entire session
The VBUFSIZE= System Option (continued)

This table shows the correlation between the view buffer size and processing time.

<table>
<thead>
<tr>
<th>Processing Time</th>
<th>VBUFSIZE=128K</th>
<th>VBUFSIZE=256K</th>
<th>VBUFSIZE=512K</th>
<th>VBUFSIZE=1024K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Time</td>
<td>99.53</td>
<td>72.36</td>
<td>64.67</td>
<td>61.25</td>
</tr>
<tr>
<td>CPU</td>
<td>8.61</td>
<td>8.43</td>
<td>8.73</td>
<td>8.48</td>
</tr>
<tr>
<td>Process 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Time</td>
<td>99.69</td>
<td>72.50</td>
<td>64.76</td>
<td>61.38</td>
</tr>
<tr>
<td>CPU</td>
<td>8.62</td>
<td>8.47</td>
<td>8.74</td>
<td>8.50</td>
</tr>
</tbody>
</table>
THE UBUFNO= AND UBUFSIZE= SYSTEM OPTIONS

- In SAS releases prior to 9.4, you have no control over the size and number of utility buffers for a SAS sort.
- The UBUFNO= and UBUFSIZE= system options are new options that are introduced in SAS 9.4.
- These options have no effect when operating-system file caching is used.
- These options are especially useful for performance tuning under z/OS because z/OS does not have file-caching capability for SAS libraries.
THE UBUFNO= SYSTEM OPTION

Option Syntax: UBUFNO=n | hexX | MIN | MAX

- This option enables you to specify the number of buffers for utility files that are used in the SORT procedure.
- The following table illustrates the correlation between the number of buffers and processing time.

<table>
<thead>
<tr>
<th>Processing Time</th>
<th>UBUFNO=1</th>
<th>UBUFNO=5</th>
<th>UBUFNO=10</th>
<th>UBUFNO=15</th>
<th>UBUFNO=20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Time</td>
<td>23.10</td>
<td>22.09</td>
<td>20.62</td>
<td>19.74</td>
<td>19.25</td>
</tr>
<tr>
<td>CPU</td>
<td>11.61</td>
<td>11.72</td>
<td>11.36</td>
<td>11.46</td>
<td>11.46</td>
</tr>
</tbody>
</table>
THE UBUFSIZE= SYSTEM OPTION

**Option Syntax:** UBUFSIZE=n | nK | nM | nG | hexX | MIN | MAX

- This option enables you to specify the buffer size for utility files that are used in the SORT procedure.

- The following table illustrates the correlation between buffer size and processing time.

<table>
<thead>
<tr>
<th>Processing Time</th>
<th>UBUFSIZE=128K</th>
<th>UBUFSIZE=256K</th>
<th>UBUFSIZE=512K</th>
<th>UBUFSIZE=1024K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Time</td>
<td>22.74</td>
<td>20.46</td>
<td>19.97</td>
<td>19.21</td>
</tr>
<tr>
<td>CPU</td>
<td>11.45</td>
<td>11.09</td>
<td>11.67</td>
<td>10.95</td>
</tr>
</tbody>
</table>
THE DATAPAGESIZE= SYSTEM OPTION

Option Syntax: DATAPAGESIZE=COMPAT93 | CURRENT

- The DATAPAGESIZE= option
  - applies to Windows and UNIX; not applicable to z/OS
  - controls the algorithm that determines optimal buffer size when you also have UBUFNO=0 and UBUFSIZE=0
  - handles utility files that take up vastly more space than in SAS 9.3

- DATAPAGESIZE=COMPAT93 specifies that the page size be determined by the SAS 9.3 algorithm.

- DATAPAGESIZE=CURRENT specifies that page size be determined by the algorithm in the current release.
OBTAINING THE CORRECT DATE AND TIME IN OUTPUT
THE DTRESET SYSTEM OPTION

Option Syntax: DTRESET | NODTRESET

• Use DTRESET to obtain the current date and time in SAS output titles.

• Use NODTRESET to keep the session start date and time in SAS output titles.
PREVENTING TRUNCATION OF FILES AND OUTPUT
THE LRECL= SYSTEM OPTION

Option Syntax: LRECL=n | nK | hexX | MIN | MAX

• In releases of SAS earlier than 9.4, you might receive the following message:

  One or more lines were truncated.

• This message indicates that the default buffer size is too small to hold an entire row, so data is dropped.

• In SAS 9.4, the default value for the LRECL= option is now 32767 bytes (instead of 256 bytes in earlier releases).
THE DMSOUTSIZE SYSTEM OPTION

Output WINDOW FULL

Window is full and must be cleared. Select

- F to file,
- P to print,
- S to save or
- C to clear the window without saving.

OK
THE DMSOUTSIZE SYSTEM OPTION
(CONTINUED)

Option Syntax: DMSOUTSIZE=n | nK | hexX | MIN | MAX

-DMSOUTSIZE (in SAS command)

- Former default value: 1 million lines (999,999)
- New default value: 2 billion lines (2,147,483,647)
- Similar option for the SAS log window:
  DMSLOGSIZE (default value: 2 billion lines)
THE VARINITCHK= SYSTEM OPTION

Option Syntax: VARINITCHK=NONOTE | NOTE | WARN | ERROR

The VARINITCHK= option is helpful for handling uninitialized variables. When a variable is uninitialized, you receive a message similar to the following:

NOTE: Variable xxx is uninitialized.
THE VARINITCHK= SYSTEM OPTION (CONTINUED)

The VARINITCHK= option enables you to change the status of a message so that SAS provides more information about the problem. You specify VARINITCHK= in an OPTIONS statement, as follows:

```plaintext
options varinitchk=note;
options varinitchk=warn;
options varinitchk=error;
options varinitchk=nonote;
```
READING TWO-DIGIT YEARS CORRECTLY
THE YEARCUTOFF= SYSTEM OPTION

Option Syntax: YEARCUTOFF=nnnn | nnnnn

- This option helps determine the correct century (first two digits) for a four-digit year that is read with only the last two digits.
- Former default value: 1920
- New default value: 1926
THE YEARCUTOFF= SYSTEM OPTION (CONTINUED)

This table illustrates the effect of the YEARCUTOFF= system option on two-digit years.

<table>
<thead>
<tr>
<th>Input Date</th>
<th>YEARCUTOFF= System Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-Digit Year</td>
<td>1910</td>
</tr>
<tr>
<td>1/20/10</td>
<td>01/20/1910</td>
</tr>
<tr>
<td>1/20/20</td>
<td>01/20/1920</td>
</tr>
<tr>
<td>1/20/25</td>
<td>01/20/1925</td>
</tr>
<tr>
<td>1/20/28</td>
<td>01/20/1928</td>
</tr>
</tbody>
</table>
THE PRESENV SYSTEM OPTION

Option Syntax: PRESENV | NOPRESENV

- This option enables SAS to save and store your environment for later use.

- To initiate the process for saving your session, submit this statement at the beginning of your SAS session:

  options presenv;
THE PRESENV SYSTEM OPTION
(CONTINUED)

This OPTIONS statement saves the following items:

- global SAS statements (for example, the FILENAME, LIBNAME, TITLE, and FOOTNOTE statements)
- compiled macros in the SAS Work library
- temporary formats in the SAS Work library
- option settings in your session
At the end of the session that you want to preserve, submit the following PRESENV procedure:

```
libname outdata 'c:\temp\outdata';
filename outcode 'c:\temp\outpgm\outpgm.sas';

proc presenv permdir=outdata
  sascode=outcode
  show_comments;
run;
```
THE PRESENV SYSTEM OPTION
(CONTINUED)

Use the NOPRESENV form of the PRESENV option to restore your environment in a new session.

```
options nopresenv;
%include 'c:\temp\outpgm\outpgm.sas';
run;
```
 REVIEW

- EXTENDOBSCOUNTER=
- BUFNO=
- UBUFNO=
- UBUFSIZE=
- VBUFSIZE=
- DMSOUTSIZE

- DTRESET | NODTRESET
- LRECL=
- YEARCUTOFF=
- PRESENV | NOPRESENV
- PROC PRESENV