

Integrating SAS® and Microsoft Excel: Exploring the Many Options Available to You

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Topics Covered

- Importing Excel Data
 - Using Base SAS
 - Using the SAS/ACCESS Interface to PC Files
- Exporting SAS Data
 - Using Base SAS
 - Using the SAS/ACCESS Interface to PC Files

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In this workshop we explore several techniques that SAS provides for importing and exporting Excel data. Some of the techniques require only Base SAS and others require that you license the SAS/ACCESS Interface to PC Files.

SAS/ACCESS® 9.4 Interface to PC Files: Reference

<https://bit.ly/2W3Uwpc>

LabResults.xlsx Excel Workbook to Import

	A	B	C	D	E	F	G	H	I	J	K
1	Unique Subject Identifier	LAB Test or Examination Name	Age in AGEU at RFSTDTC	Age Units	Sex	Baseline Result in Std. Units	Baseline Std. Units	Visit 5 Result in Std. Units	Visit 5 Std. Units	Baseline Collection Date/Time	Visit 5 Collection Date/Time
2	01-701-1034	CALCIUM	77	YEARS	F	2.54490	mmol/L	2.44510	mmol/L	6/24/2014 15:30	7/29/2014 8:40
3	01-701-1133	CALCIUM	81	YEARS	F	2.32035	mmol/L	2.29540	mmol/L	10/23/2012 10:57	11/26/2012 11:52
4	01-701-1146	CALCIUM	75	YEARS	F	2.32035	mmol/L	2.32035	mmol/L	5/7/2013 13:52	6/16/2013 12:45
5	01-701-1287	CALCIUM	56	YEARS	F	2.27045	mmol/L	2.09580	mmol/L	1/17/2014 12:16	2/20/2014 11:09
6	01-701-1383	CALCIUM	72	YEARS	F	2.22055	mmol/L	2.27045	mmol/L	1/22/2013 11:43	3/12/2013 11:50
7	01-703-1258	CALCIUM	78	YEARS	F	2.17065	mmol/L	2.29540	mmol/L	7/10/2012 16:30	8/17/2012 11:15
8	01-703-1295	CALCIUM	88	YEARS	F	2.32035	mmol/L	2.32035	mmol/L	10/24/2013 12:10	12/18/2013 12:45
9	01-703-1335	CALCIUM	67	YEARS	F	2.34530	mmol/L	2.32035	mmol/L	12/28/2013 16:10	4/13/2014 10:00

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The workbook that we will import contains 34 worksheets with fictional lab results data.

Some of the column headings and worksheet names contain spaces or special characters such as a period (.) or forward slash (/). These characters can be problematic when used in SAS data set and variable names, but these problems are easily corrected using the appropriate SAS options, discussed later.

Techniques to import the Excel datetime values in the "Baseline Collection Date/Time" and "Visit 5 Collection Date/Time" columns are also discussed.

Importing Excel Data Using Base SAS

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In this section we explore Base SAS techniques for importing the "LabResults.xlsx" file shown earlier.

General Information

Base SAS can only import delimited files*

1. Save a worksheet in a delimited format, such as CSV
2. Use PROC IMPORT or DATA step to import CSV
3. Repeat for remaining worksheets

* SAS Enterprise Guide can import XLS and XLSX files
(see accompanying paper for details)

Although SAS Enterprise Guide can import *native* Excel files using Base SAS, you can only import *delimited* files using the IMPORT procedure or the DATA step.

Use Excel to save a worksheet in a delimited format such as comma-separated value (CSV), and then import the CSV file.

Repeat this process for each worksheet that you want to import.

Steps to Save a Worksheet as a CSV File

1. Use Excel to open the LabResults.xlsx file
2. Navigate to the CALCIUM worksheet
3. Select **File > Save As**
4. Specify **Calcium** for the name and then choose **CSV**



Importing a CSV File Using PROC IMPORT

```
proc import out=work.calcium
  file='Calcium.csv'
  dbms=csv
  replace;
  guessingrows=max;
run; quit;
```

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Use the IMPORT procedure to import the "Calcium.csv" file.

The "calcium" SAS data set is created and replaced if it already existed. The GUESSINGROWS statement causes PROC IMPORT to scan all the rows in each column to determine the data types.

"IMPORT Procedure". *Base SAS® 9.4 Procedures Guide, Seventh Edition*
<https://bit.ly/2Tb1jMa>

Importing a CSV File Using PROC IMPORT

Note underscores in variable names

Variables in Creation Order					
#	Variable	Type	Len	Format	Informat
1	Unique_Subject_Identifier	Char	11	\$11.	\$11.
2	LAB_Test_or_Examination_Name	Char	7	\$7.	\$7.
3	Age_in_AGEU_at_RFSTDTC	Num	8	BEST12.	BEST32.
4	Age_Units	Char	5	\$5.	\$5.
5	Sex	Char	1	\$1.	\$1.
6	Baseline_Result_in_Std__Units	Num	8	BEST12.	BEST32.
7	Baseline_Std__Units	Char	6	\$6.	\$6.
8	Visit_5_Result_in_Std__Units	Num	8	BEST12.	BEST32.
9	Visit_5_Std__Units	Char	6	\$6.	\$6.
10	Baseline_Collection_Date_Time	Num	8	DATETIME.	ANYDTDTM40.
11	Visit_5_Collection_Date_Time	Num	8	DATETIME.	ANYDTDTM40.

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PROC IMPORT uses the Excel column headings for SAS variable names. But some of the resulting variable names, such as "Baseline Collection Date/Time", do not conform to the rules for SAS variable names because they contain spaces or non-alphanumeric characters. The IMPORT procedure alters these names to make them valid SAS names by replacing spaces and non-alphanumeric characters with underscores (_).

Variable names with underscore (_) substitutions are shown in the CONTENTS procedure output.

"Rules for SAS Variable Names". *SAS® 9.4 Language Reference: Concepts, Sixth Edition*
<https://bit.ly/2HBQ2IK>

Set Up the Program Environment

#SASGF



1. Start SAS
2. Select File > Open Program
3. Navigate to C:\HOW\DelGobbo
4. Select Setup.sas and then select Open
5. Review code and then submit

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Ex. 1a - Importing a CSV File Using PROC IMPORT

#SASGF



1. Go to SAS
2. Select File > Open Program > Exercise1a.sas
3. Review code and then submit
4. Examine the CONTENTS and PRINT procedure results in the Exercise1a.htm file

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Importing a CSV File Using PROC IMPORT

```
options validvarname=any;
```

Specify support for
special characters

```
proc import out=work.calcium
  file='Calcium.csv'
  dbms=csv
  replace;
  guessingrows=max;
run; quit;
```

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Underscores are substituted for spaces and special characters in the variable names because the VALIDVARNAME option is set to **V7** by default.

To use the Excel column headings for the SAS variable names without any substitutions, specify **ANY** for the VALIDVARNAME option prior to executing the IMPORT procedure.

"VALIDVARNAME= System Option". *SAS® 9.4 System Options: Reference, Fifth Edition*
<https://bit.ly/2TQrFaE>

Importing a CSV File Using PROC IMPORT

Note special
characters in
variable names

Variables in Creation Order					
#	Variable	Type	Len	Format	Informat
1	Unique Subject Identifier	Char	11	\$11.	\$11.
2	LAB Test or Examination Name	Char	7	\$7.	\$7.
3	Age in AGEU at RFSTDTC	Num	8	BEST12.	BEST32.
4	Age Units	Char	5	\$5.	\$5.
5	Sex	Char	1	\$1.	\$1.
6	Baseline Result in Std. Units	Num	8	BEST12.	BEST32.
7	Baseline Std. Units	Char	6	\$6.	\$6.
8	Visit 5 Result in Std. Units	Num	8	BEST12.	BEST32.
9	Visit 5 Std. Units	Char	6	\$6.	\$6.
10	Baseline Collection Date/Time	Num	8	DATETIME.	ANYDTDTM40.
11	Visit 5 Collection Date/Time	Num	8	DATETIME.	ANYDTDTM40.

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The SAS variable names shown in the PROC CONTENTS output match the column headings in the input data.

Importing a CSV File Using PROC IMPORT

```
options validvarname=any;

proc print data=work.calcium;
  var sex
    'unique subject identifier'n
    'baseline result in std. units'n
    'baseline collection date/time'n;
run; quit;
```

Use SAS name
literal syntax to
reference
variables

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Reference the variables using SAS name literal syntax.

"SAS Name Literals". *SAS® 9.4 Language Reference: Concepts, Sixth Edition*
<https://bit.ly/2O4fwJM>

Importing a CSV File Using PROC IMPORT

Obs	Sex	Unique Subject Identifier	Baseline Result in Std. Units	Baseline Collection Date/Time
1	F	01-701-1034	2.5449	24JUN14:15:30:00
2	F	01-701-1133	2.32035	23OCT12:10:57:00
3	F	01-701-1146	2.32035	07MAY13:13:52:00
4	F	01-701-1287	2.27045	17JAN14:12:16:00
5	F	01-701-1383	2.22055	22JAN13:11:43:00
6	F	01-703-1258	2.17065	10JUL12:16:30:00

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A portion of the PROC PRINT output.

Ex. 1b - Importing a CSV File Using PROC IMPORT

#SASGF



1. Go to SAS
2. Select File > Open Program > Exercise1b.sas
3. Follow TO DO instructions and then submit
4. Examine the CONTENTS and PRINT procedure results in the Exercise1b.htm file

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TO DO:

Line 9 - Add the option to support special characters in SAS variable names, and then run the code. Examine the variable names in the PROC CONTENTS and PROC PRINT results.

Hint: Refer to slide 11.

Importing a CSV File Using the DATA Step

- PROC IMPORT generates DATA step code
- Can recall, modify, and save this code
- Alternatively, write your own code

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The IMPORT procedure generates and submits DATA step code to import data from delimited files. When using the SAS windowing environment, you can recall the generated code and then make modifications to change the way that the data is imported. For example, you can specify a format for the datetime columns.

Alternatively, you can write your own DATA step code to import a delimited file.

"What Is the SAS Windowing Environment?" *SAS® 9.4 Language Reference: Concepts, Sixth Edition*

<https://bit.ly/2TRO6we>

Importing a CSV File Using the DATA Step

```
*****  
* PRODUCT:      SAS  
* VERSION:     9.4  
* CREATOR:    External File Interface  
* DATE:        <current-date>  
* DESC:        Generated SAS Datastep Code  
* TEMPLATE SOURCE: (None Specified.)  
*****/  
data WORK.CALCIUM;  
  ... ;  
run;
```

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A partial view of the SAS code generated by PROC IMPORT.

Ex. 2 - Importing a CSV File Using the DATA Step

#SASGF



1. Go to SAS
2. Select **File > Open Program > Exercise2.sas**
3. Submit the code
4. Then select **Run > Recall Last Submit** to recall the code generated by PROC IMPORT
5. Review the DATA step code

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TO DO:

Run the code. Then select **Run > Recall Last Submit** to recall the code generated by PROC IMPORT.

Importing Excel Data Using the SAS/ACCESS Interface to PC Files

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In this section we explore SAS/ACCESS techniques for importing the "LabResults.xlsx" file shown earlier.

Importing LabResults.xlsx Using PROC IMPORT

Prior conversion to a delimited file is not necessary

```
options validvarname=any;

proc import out=work.calcium
  file='LabResults.xlsx'
  dbms=xlsx
  replace;
  sheet='calcium';
run; quit;
```

GUESSINGROWS not needed

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The SAS/ACCESS Interface to PC Files enables you to import Excel data directly from an XLSX file, without first saving the data in a delimited file.

To read data from the "LabResults.xlsx" file, use PROC IMPORT and the XLSX engine. The first worksheet is imported by default. Use the SHEET statement to import a specific sheet.

The GUESSINGROWS statement that we used when importing a delimited file is not supported and, in this situation, not needed, because the XLSX engine scans all the rows in each column to determine the data types.

Importing LabResults.xlsx Using PROC IMPORT

Variables in Creation Order						
#	Variable	Type	Len	Format	Informat	Label
1	Unique Subject Identifier	Char	11	\$11.	\$11.	Unique Subject Identifier
2	LAB Test or Examination Name	Char	7	\$7.	\$7.	LAB Test or Examination Name
3	Age in AGEU at RFSTDTC	Num	8	BEST.		Age in AGEU at RFSTDTC
4	Age Units	Char	5	\$5.	\$5.	Age Units
5	Sex	Char	1	\$1.	\$1.	Sex
6	Baseline Result in Std. Units	Num	8	BEST.		Baseline Result in Std. Units
7	Baseline Std. Units	Char	6	\$6.	\$6.	Baseline Std. Units
8	Visit 5 Result in Std. Units	Num	8	BEST.		Visit 5 Result in Std. Units
9	Visit 5 Std. Units	Char	6	\$6.	\$6.	Visit 5 Std. Units
10	Baseline Collection Date/Time	Num	8	DATETIME16.		Baseline Collection Date/Time
11	Visit 5 Collection Date/Time	Num	8	DATETIME16.		Visit 5 Collection Date/Time

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The SAS variable names shown in the PROC CONTENTS output match the column headings in the input data.

Importing LabResults.xlsx Using PROC IMPORT

```
options validvarname=any;

proc import out=work.calcium
  file='LabResults.xlsx'
  dbms=xlsx
  replace;
  sheet='calcium';
format 'visit 5 collection date/time'\n
      'baseline collection date/time'\n e8601dt19. ;
run; quit;
```

2014-06-24T15:30:00

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To apply a format to the datetime columns, use a FORMAT statement.

Ex. 3 - Importing LabResults.xlsx Using PROC IMPORT

#SASGF



1. Go to SAS
2. Select File > Open Program > Exercise3.sas
3. Follow TO DO instructions and then submit
4. Examine the CONTENTS and PRINT procedure results in the Exercise3.htm file

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TO DO:

Line 15 - Specify the DBMS engine value to import XLSX files.

Line 17 - Supply the statement to import the CALCIUM worksheet.

Examine the PROC CONTENTS and PROC PRINT results.

Hint: Refer to slide 20 or slide 22.

Importing LabResults.xlsx Using the DATA Step

XLSX Libname Engine - Each worksheet interpreted as a SAS data set

```
options validvarname=any;
libname xl xlsx 'LabResults.xlsx';
data work.calcium;
set xl.calcium;
attrib 'Baseline Collection Date/Time'n
      'Visit 5 Collection Date/Time'n format=e8601dt19. ;
run;
```



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When you use the XLSX LIBNAME engine, each worksheet is interpreted as a SAS data set in the library. This means that you can access worksheet data like a SAS data set.

This code imports the "CALCIUM" worksheet and specifies a format for the SAS datetime values.

"LIBNAME Statement Syntax for the XLSX Engine". *SAS/ACCESS® 9.4 Interface to PC Files: Reference, Fourth Edition*
<https://bit.ly/2O7GFMb>

Importing LabResults.xlsx Using the DATA Step

Variables in Creation Order						
#	Variable	Type	Len	Format	Informat	Label
1	Unique Subject Identifier	Char	11	\$11.	\$11.	Unique Subject Identifier
2	LAB Test or Examination Name	Char	7	\$7.	\$7.	LAB Test or Examination Name
3	Age in AGEU at RFSTDTC	Num	8	BEST.		Age in AGEU at RFSTDTC
4	Age Units	Char	5	\$5.	\$5.	Age Units
5	Sex	Char	1	\$1.	\$1.	Sex
6	Baseline Result in Std. Units	Num	8	BEST.		Baseline Result in Std. Units
7	Baseline Std. Units	Char	6	\$6.	\$6.	Baseline Std. Units
8	Visit 5 Result in Std. Units	Num	8	BEST.		Visit 5 Result in Std. Units
9	Visit 5 Std. Units	Char	6	\$6.	\$6.	Visit 5 Std. Units
10	Baseline Collection Date/Time	Num	8	E8601DT19.		Baseline Collection Date/Time
11	Visit 5 Collection Date/Time	Num	8	E8601DT19.		Visit 5 Collection Date/Time

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The SAS variable names shown in the PROC CONTENTS output match the column headings in the input data.

Ex. 4 - Importing LabResults.xlsx Using the DATA Step



1. Go to SAS
2. Select File > Open Program > Exercise4.sas
3. Follow TO DO instructions and then submit
4. Examine the CONTENTS and PRINT procedure results in the Exercise4.htm file

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TO DO:

Line 13 - Specify the SET statement needed to set the CALCIUM worksheet from the XL library.

Examine the PROC CONTENTS and PROC PRINT results.

Hint: Refer to slide 24.

Importing LabResults.xlsx Using PROC DATASETS

Each worksheet copied to a SAS data set in WORK

```
options validvarname=any;

libname xl xlsx 'LabResults.xlsx';

proc datasets nolist;
copy in=xl out=work;
run; quit;

ERROR: The value 'ALANINE AMINOTRANSFERASE'n is
not a valid SAS name.
```

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It's cumbersome to import all the worksheets in a workbook to SAS data sets using PROC IMPORT or the DATA step because the process needs to be repeated for each worksheet. Instead, use the DATASETS procedure to copy all the worksheets to individual data sets in a SAS library.

The Excel column headings and worksheet names are used verbatim for the SAS variable names and data set names.

When worksheet names don't conform to the rules for SAS data set names, you'll get an error. For example, the space character in the worksheet named "ALANINE AMINOTRANSFERASE" causes the error shown here.

"Rules for SAS Data Set Names, View Names, and Item Store Names". *SAS® 9.4 Language Reference: Concepts, Sixth Edition*
<https://bit.ly/2JgSdO6>

Importing LabResults.xlsx Using PROC DATASETS

Each worksheet copied to a SAS data set in WORK

```
options validvarname=any validmemname=extend;  
  
libname xl xlsx 'LabResults.xlsx';  
  
proc datasets nolist;  
  copy in=xl out=work;  
run; quit;
```

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The errors occur because the VALIDMEMNAME option is set to **COMPAT** by default.

Earlier, we specified the VALIDVARNAME option to support variable names with embedded spaces and special characters. Here, we want to enable embedded spaces and special characters in data set names, so we use the VALIDMEMNAME option.

"VALIDMEMNAME= System Option". *SAS® 9.4 System Options: Reference, Fifth Edition*
<https://bit.ly/2HABeUK>

Importing LabResults.xlsx Using PROC DATASETS

#	Name	Member Type	File Size
1	ALANINE AMINOTRANSFERASE	DATA	128
2	ALBUMIN	DATA	128
3	ALKALINE PHOSPHATASE	DATA	128
4	ANISOCYTOSIS	DATA	128
5	ASPARTATE AMINOTRANSFERASE	DATA	128
6	BASOPHILS	DATA	128
7	BILIRUBIN	DATA	128
8	CALCIUM	DATA	128
9	CHLORIDE	DATA	128
10	CHOLESTEROL	DATA	128
11	COLOR	DATA	128
12	CREATINE KINASE	DATA	128

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The SAS data set names shown in the PROC DATASETS output match the worksheet names in the input data.

Importing LabResults.xlsx Using PROC DATASETS

Reference the data sets using SAS name literal syntax

```
proc print data=work.'alanine aminotransferase'n;  
  var ... ;  
run; quit;
```

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"SAS Name Literals". *SAS® 9.4 Language Reference: Concepts, Sixth Edition*
<https://bit.ly/2O4fwJM>

Ex. 5 - Importing LabResults.xlsx Using PROC DATASETS

#SASGF



1. Go to SAS
2. Select File > Open Program > Exercise5.sas
3. Run code and examine the log for error messages
4. Follow TO DO instructions
5. Examine the DATASETS procedure results in the Exercise5.htm file

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TO DO:

Run the code once and then examine the log for error messages.

Examine the data set names in the PROC DATASETS results.

Recall the code, add the option to support special characters in data set names (line 12), and then run the code.

Hint: Refer to slide 28.

Exporting SAS Data Using Base SAS

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In this section we explore Base SAS techniques for exporting the "LabResults" SAS data set.

LabResults SAS Data Set to Export (Partial)

Variable	Type	Length	Format	Label
AGE	Numeric	8		Age in AGEU at RFSTDTC
AGEU	Character	6		Age Units
COUNTRY	Character	3		Country
SEX	Character	1		Sex
arm	Character	20		Description of Planned Arm
baseline_lbdtn	Numeric	8	E8601DT19.	Baseline Collection Date/Time
baseline_lbstresn	Numeric	8		Baseline Result in Std. Units
baseline_lbstresu	Character	8		Baseline Std. Units
baseline_visitnum	Numeric	8		Baseline Visit Number
lbtest	Character	38		LAB Test or Examination Name
race	Character	78		Race
studyid	Character	12		Study Identifier
usubjid	Character	11		Unique Subject Identifier
visit5_lbdtn	Numeric	8	E8601DT19.	Visit 5 Collection Date/Time
visit5_lbstresn	Numeric	8		Visit 5 Result in Std. Units
visit5_lbstresu	Character	8		Visit 5 Std. Units
visit5_visitnum	Numeric	8		Visit 5 Visit Number
...

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The variable values in the SAS dataset are similar to the values in the "LabResults.xlsx" file that we imported earlier.

The SAS data set contains two SAS datetime variables ("baseline_lbdtn" and "visit5_lbdtn"), labels, and more variables than we want to export to Excel. The order of the variables in the SAS data set is different than the order we want in our Excel workbook. The variable names conform to the v7 style naming rules.

"Rules for SAS Variable Names". *SAS® 9.4 Language Reference: Concepts, Sixth Edition*
<https://bit.ly/2HBQ2IK>

"VALIDVARNAME= System Option". *SAS® 9.4 System Options: Reference, Fifth Edition*
<https://bit.ly/2TQrFaE>

General Information

PROC EXPORT and DATA step create only delimited files; ODS creates XLSX files*

1. Export to a delimited format, such as CSV
2. Import CSV to an Excel worksheet
3. Repeat to create multi-sheet workbooks

* SAS Enterprise Guide can create XLS and XLSX files
(see accompanying paper for details)

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Although ODS and SAS Enterprise Guide can export SAS data to *native* Excel files using Base SAS, you can only export to *delimited* files using the EXPORT procedure or the DATA step.

Use Excel open the delimited format file, such as comma-separated value (CSV), and then save the file as in a native Excel file format.

Repeat this process for each delimited file to create a multi-sheet workbook.

Exporting to a CSV File Using PROC EXPORT

Export entire data set to CSV

```
proc export data=sample.LabResults  
  file='LabResults.csv'  
  dbms=csv  
  replace  
  label;  
run; quit;
```

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You can export an entire SAS data set to a CSV file using PROC EXPORT. If you want to use SAS variable labels for the Excel column headings, use the LABEL option.

"EXPORT Procedure". *Base SAS® 9.4 Procedures Guide, Seventh Edition*
<https://bit.ly/2UDs65p>

Exporting to a CSV File Using PROC EXPORT

- Can use DROP, KEEP and WHERE data set options
- More flexibility with a view

```
proc sql;
  create view work.LabResults_Subset as
    select usubjid, lbtest, age, ...
    from sample.LabResults
    where (lbtest eq 'CALCIUM');
quit;
```

Use the SELECT statement to specify the variables and their order.

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Although PROC EXPORT lets you specify data set options such as WHERE, DROP, and KEEP for the input data set, you cannot choose the order in which variables are written to the file. To create a customized output file, create a view with the SQL procedure.

The code above selects variables in a specific order from the "LabResults" data set, but only includes data for the calcium lab test.

Exporting to a CSV File Using PROC EXPORT

Use the view with PROC EXPORT

```
proc export data=work.LabResults_Subset  
  file='Calcium.csv'  
  dbms=csv  
  replace  
  label;  
run; quit;
```

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The resulting data is exported to a CSV file, and SAS variable labels are used for the Excel column headings.

Exporting to a CSV File Using PROC EXPORT

#SASGF



Open the CSV file using Excel

	A	B	C	D	E	F	G	H	I	J	K
1	Unique Subject Identifier	LAB Test or Examination Name	Age in AGEU at RFSTDT	Age Units	Sex	Baseline Result in Std. Units	Baseline Std. Units	Visit 5 Result in Std. Units	Visit 5 Std. Units	Baseline Collection Date/Time	Visit 5 Collection Date/Time
2	01-701-1034	CALCIUM	77	YEARS	F	2.5449	mmol/L	2.4451	mmol/L	6/24/2014 15:30	7/29/2014 8:40
3	01-701-1133	CALCIUM	81	YEARS	F	2.32035	mmol/L	2.2954	mmol/L	10/23/2012 10:57	11/26/2012 11:52
4	01-701-1146	CALCIUM	75	YEARS	F	2.32035	mmol/L	2.32035	mmol/L	5/7/2013 13:52	6/16/2013 12:45
5	01-701-1287	CALCIUM	56	YEARS	F	2.27045	mmol/L	2.0958	mmol/L	1/17/2014 12:16	2/20/2014 11:09
6	01-701-1383	CALCIUM	72	YEARS	F	2.22055	mmol/L	2.27045	mmol/L	1/22/2013 11:43	3/12/2013 11:50
7	01-703-1258	CALCIUM	78	YEARS	F	2.17065	mmol/L	2.2954	mmol/L	7/10/2012 16:30	8/17/2012 11:15
8	01-703-1295	CALCIUM	88	YEARS	F	2.32035	mmol/L	2.32035	mmol/L	10/24/2013 12:10	12/18/2013 12:45
9	01-703-1335	CALCIUM	67	YEARS	F	2.3453	mmol/L	2.32035	mmol/L	12/28/2013 16:10	4/13/2014 10:00

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To have Excel properly interpret the SAS datetime values, from Excel, select the **Data** tab of the ribbon, and then select **From Text/CSV**.

Exporting to an XLSX File Using ODS

- Saves procedure results to XLSX file
- Supports rich formatting including colors, fonts, and Excel number formats
- Can include graphic images created by procedures
- Available in SAS 9.4 M3 and later
- Works on all operating systems

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My favorite technique for saving output to Excel.

Any procedure output can be exported to Excel using the ODS EXCEL destination. An advantage of this technique is that you can create attractive, *native* multi-sheet workbooks with little effort.

Exporting to an XLSX File Using ODS

```
ods Excel file='LabResults.xlsx'  
    options(suppress_bylines='yes'  
            sheet_name='#byval(lbtest)');  
  
proc print data=sample.LabResults noobs label;  
    by lbtest;  
    var ... ;  
run; quit;  
  
ods Excel close;
```

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The first ODS statement uses the EXCEL destination to generate the XLSX output and then store the output in a file. The BY statement in the PRINT procedure ensures that a separate worksheet is created for each distinct value of the "lbtest" BY variable.

We use **#byval** to automatically name the worksheets based on the value of the "lbtest" variable. The **suppress_bylines** option specifies that BY line text should not be included in the output.

The second ODS statement closes the Excel destination and releases the XLSX file so that it can be opened with Excel.

"#BYVALn | #BYVAL(variable-name)". *SAS® 9.4 Global Statements: Reference*.

<https://bit.ly/2O9Jk7R>

Exporting to an XLSX File Using ODS

E8601DT format not supported before 9.4 M6

text values

A	B	C	D	E	F	G	H	I	J	K
Unique Subject Identifier	LAB Test or Examination Name	Age in AGEU at Age RFSTDTC	Age Units	Sex	Baseline Result Baseline in Std. Units	Baseline Units	Visit 5 Result Visit 5 in Std. Units	Visit 5 Units	Baseline Collection Date/Time	Visit 5 Collection Date/Time
2 01-701-1034	CALCIUM	77	YEARS	F	2.54490	mmol/L	2.44510	mmol/L	2014-06-24T15:30:00	2014-07-29T08:40:00
3 01-701-1133	CALCIUM	81	YEARS	F	2.32035	mmol/L	2.29540	mmol/L	2012-10-23T10:57:00	2012-11-26T11:52:00
4 01-701-1146	CALCIUM	75	YEARS	F	2.32035	mmol/L	2.32035	mmol/L	2013-05-07T13:52:00	2013-06-16T12:45:00
5 01-701-1287	CALCIUM	56	YEARS	F	2.27045	mmol/L	2.09580	mmol/L	2014-01-17T12:16:00	2014-02-20T11:09:00
6 01-701-1383	CALCIUM	72	YEARS	F	2.22055	mmol/L	2.27045	mmol/L	2013-01-22T11:43:00	2013-03-12T11:50:00
7 01-703-1258	CALCIUM	78	YEARS	F	2.17065	mmol/L	2.29540	mmol/L	2012-07-10T16:30:00	2012-08-17T11:15:00
8 01-703-1295	CALCIUM	88	YEARS	F	2.32035	mmol/L	2.32035	mmol/L	2013-10-24T12:10:00	2013-12-18T12:45:00
9 01-703-1335	CALCIUM	67	YEARS	F	2.34530	mmol/L	2.32035	mmol/L	2013-12-28T16:10:00	2014-04-13T10:00:00

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#byval

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SAS variable labels are used for the Excel column headings because the LABEL option was specified in the PROC PRINT statement.

In SAS 9.4 M5 and earlier, the SAS datetime column values are interpreted by Excel as text strings. This issue has been corrected in SAS 9.4 M6.

Exporting to an XLSX File Using ODS

```
ods Excel file='LabResults.xlsx'  
    options(suppress_bylines='yes'  
            sheet_name='#byval(lbtest)') ;  
  
proc print data=sample.LabResults noobs label;  
    by lbtest;  
    var ... ;  
    format baseline_lbdtn visit5_lbdtn datetime18.;  
run; quit;  
  
ods Excel close;
```

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If you are using SAS 9.4 M5 or earlier, use the DATETIME format instead of E8610DT to overcome this problem.

Exporting to an XLSX File Using ODS

Using the SAS DATETIME format

Excel datetime values

	A	B	C	D	E	F	G	H	I	J	K
1	Unique Subject Identifier	LAB Test or Examination Name	Age in AGEU at Age RFSTDTC	Units	Sex	Baseline Result	Baseline in Std. Units	Visit 5 Result	Visit 5 in Std. Units	Baseline Collection Date/Time	Visit 5 Collection Date/Time
2	01-701-1034	CALCIUM	77	YEARS	F	2.54490	mmol/L	2.44510	mmol/L	24Jun14:15:30:00	29Jul14:08:40:00
3	01-701-1133	CALCIUM	81	YEARS	F	2.32035	mmol/L	2.29540	mmol/L	23Oct12:10:57:00	26Nov12:11:52:00
4	01-701-1146	CALCIUM	75	YEARS	F	2.32035	mmol/L	2.32035	mmol/L	07May13:13:52:00	16Jun13:12:45:00
5	01-701-1287	CALCIUM	56	YEARS	F	2.27045	mmol/L	2.09580	mmol/L	17Jan14:12:16:00	20Feb14:11:09:00
6	01-701-1383	CALCIUM	72	YEARS	F	2.22055	mmol/L	2.27045	mmol/L	22Jan13:11:43:00	12Mar13:11:50:00
7	01-703-1258	CALCIUM	78	YEARS	F	2.17065	mmol/L	2.29540	mmol/L	10Jul12:16:30:00	17Aug12:11:15:00
8	01-703-1295	CALCIUM	88	YEARS	F	2.32035	mmol/L	2.32035	mmol/L	24Oct13:12:10:00	18Dec13:12:45:00
9	01-703-1335	CALCIUM	67	YEARS	F	2.34530	mmol/L	2.32035	mmol/L	28Dec13:16:10:00	13Apr14:10:00:00

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Ex. 6a - Exporting to an XLSX File Using ODS

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1. Go to SAS
2. Select File > Open Program > Exercise6a.sas
3. Run the code
4. Examine the LabResults_Exercise6a.xlsx file

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TO DO:

Run the code and then examine the LabResults_Exercise6a.xlsx file using Excel.

Exporting to an XLSX File Using ODS

Use a style override to apply an *Excel* number format

```
var baseline_lbdtn visit5_lbdtn /  
  style(column)=[tagattr='format:m/d/yyyy h:mm'] ;
```

PROC PRINT
data values

Style attribute name

Excel number format specified
as part of the attribute value

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You can alter the attributes or style elements used by specific parts of your SAS output by using style overrides. These specific parts of your SAS output are called *locations*. The COLUMN location, used here, controls the appearance of data cells in the output.

To specify the *Excel* format applied to a column, use the TAGATTR attribute. Isolate the variable in a separate VAR statement, and then apply the style override.

Exporting to an XLSX File Using ODS

```
ods Excel file='LabResults.xlsx' ... ;  
  
proc print data=sample.LabResults noobs label;  
by lbtest;  
var ... ;  
var baseline_lbdtn visit5_lbdtn /  
    style(column)=[tagattr='format:m/d/yyyy h:mm'] ;  
format ... ;  
run; quit;  
  
ods Excel close;
```

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We specify the Excel **m/d/yyyy h:mm** format for the two datetime variables.

Exporting to an XLSX File Using ODS

Excel number format

	A	B	C	D	E	F	G	H	I	J	K
1	Unique Subject Identifier	LAB Test or Examination Name	Age in AGEU at RFSTDTC	Age Units	Sex	Baseline Result in Std. Units	Baseline Std. Units	Visit 5 Result in Std. Units	Visit 5 Std. Units	Baseline Collection Date/Time	Visit 5 Collection Date/Time
2	01-701-1034	CALCIUM	77 YEARS	F		2.54490 mmol/L		2.44510 mmol/L		6/24/2014 15:30	7/29/2014 8:40
3	01-701-1133	CALCIUM	81 YEARS	F		2.32035 mmol/L		2.29540 mmol/L		10/23/2012 10:57	11/26/2012 11:52
4	01-701-1146	CALCIUM	75 YEARS	F		2.32035 mmol/L		2.32035 mmol/L		5/7/2013 13:52	6/16/2013 12:45
5	01-701-1287	CALCIUM	56 YEARS	F		2.27045 mmol/L		2.09580 mmol/L		1/17/2014 12:16	2/20/2014 11:09
6	01-701-1383	CALCIUM	72 YEARS	F		2.22055 mmol/L		2.27045 mmol/L		1/22/2013 11:43	3/12/2013 11:50
7	01-703-1258	CALCIUM	78 YEARS	F		2.17065 mmol/L		2.29540 mmol/L		7/10/2012 16:30	8/17/2012 11:15
8	01-703-1295	CALCIUM	88 YEARS	F		2.32035 mmol/L		2.32035 mmol/L		10/24/2013 12:10	12/18/2013 12:45
9	01-703-1335	CALCIUM	67 YEARS	F		2.34530 mmol/L		2.32035 mmol/L		12/28/2013 16:10	4/13/2014 10:00

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The final XLSX file with the Excel number format applied.

For extensive information about using ODS to create Excel files, refer to earlier papers by this author:

<http://support.sas.com/rnd/papers/intro-multisheet-excel-with-sas/index.html>

or

https://www.lexjansen.com/search/search_sgf.php?q=delgobbo

Ex. 6b - Exporting to an XLSX File Using ODS

#SASGF



1. Go to SAS
2. Select File > Open Program > Exercise6b.sas
3. Follow TO DO instructions
4. Examine the LabResults_Exercise6b.xlsx file

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TO DO:

Line 18 - Specify the Excel **m/d/yyyy h:mm** number format for the datetime variables.

Examine the LabResults_Exercise6b.xlsx file using Excel.

Hint: Refer to slide 46.

Exporting SAS Data Using the SAS/ACCESS Interface to PC Files

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In this section we explore SAS/ACCESS techniques for exporting the "LabResults" SAS data set.

The SAS/ACCESS Interface to PC Files enables you to create *native* Excel files. The techniques export SAS data to Excel XLSX files.

Exporting to an XLSX File Using PROC EXPORT

Create a view with variables in a specific order and all data

```
proc sql;
  create view work.LabResults_Subset as
    select usubjid, lbtest, age, ...
      from sample.LabResults
  quit;
```

Use the SELECT statement to specify the variables and their order.

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This code creates a "LabResults_Subset" SAS view, selecting variables in a specific order.

Exporting to an XLSX File Using PROC EXPORT

Use the view with WHERE data set option

```
proc export data=work.LabResults_Subset(where=
(lbtest eq 'CALCIUM'))
  file='LabResults.xlsx'
  dbms=xlsx
  replace
  label;
  sheet='CALCIUM';
run; quit;
```

Repeat for other lab tests to create multi-sheet workbook

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To create a workbook named "LabResults.xlsx" with a worksheet for a specific value of "lbtest", use the WHERE data set option and the EXPORT procedure SHEET statement.

To create a multi-sheet workbook, run PROC EXPORT again with values corresponding to a different lab test.

Exporting to an XLSX File Using PROC EXPORT

Results of code executed for CALCIUM and EOSINOPHILS

	A	B	C	D	E	F	G	H	I	J	K
1	Unique Subject Identifier	LAB Test or Examination Name	Age in AGEU at RFSTDTC	Age Units	Sex	Baseline Result in Std. Units	Baseline Std. Units	Visit 5 Result in Std. Units	Visit 5 Std. Units	Baseline Collection Date/Time	Visit 5 Collection Date/Time
2	01-701-1034	CALCIUM		77 YEARS	F	2.5449	mmol/L	2.4451	mmol/L	6/24/2014 15:30	7/29/2014 8:40
3	01-701-1133	CALCIUM		81 YEARS	F	2.32035	mmol/L	2.2954	mmol/L	10/23/2012 10:57	11/26/2012 11:52
4	01-701-1146	CALCIUM		75 YEARS	F	2.32035	mmol/L	2.32035	mmol/L	5/7/2013 13:52	6/16/2013 12:45
5	01-701-1287	CALCIUM		56 YEARS	F	2.27045	mmol/L	2.0958	mmol/L	1/17/2014 12:16	2/20/2014 11:09
6	01-701-1383	CALCIUM		72 YEARS	F	2.22055	mmol/L	2.27045	mmol/L	1/22/2013 11:43	3/12/2013 11:50
7	01-703-1258	CALCIUM		78 YEARS	F	2.17065	mmol/L	2.2954	mmol/L	7/10/2012 16:30	8/17/2012 11:15
8	01-703-1295	CALCIUM		88 YEARS	F	2.32035	mmol/L	2.32035	mmol/L	10/24/2013 12:10	12/18/2013 12:45
9	01-703-1335	CALCIUM		67 YEARS	F	2.3453	mmol/L	2.32035	mmol/L	12/28/2013 16:10	4/13/2014 10:00

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Ex. 7 - Exporting to an XLSX File Using PROC EXPORT

1. Go to SAS
2. Select File > Open Program > Exercise7.sas
3. Follow TO DO instructions
4. Examine the LabResults_Exercise7.xlsx file

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TO DO:

Review the PROC SQL code that creates the LABRESULTS_SUBSET view.

Line 21 - Specify the LBTEST value to subset the data to include only CALCIUM results.

Line 26 - Specify the worksheet name (CALCIUM).

Examine the LabResults_Exercise7.xlsx file using Excel.

Hint: Refer to slide 51.

Export Multiple Data Sets to an XLSX File Using PROC DATASETS

#SASGF

XLSX Libname Engine - Each SAS data set is in its own worksheet

```
libname xl xlsx 'SASHelp.xlsx';

proc datasets nolist;
  copy in=sashelp out=xl;
  select shoes class retail / memtype=data;
run; quit;
```

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To export all or some of the SAS data sets in a library to an Excel workbook, use PROC DATASETS. In the exported file, the data for each data set is in its own worksheet, and the SAS data set name is used for the Excel worksheet name.

To specify which data sets are copied to the Excel workbook, use the DATASETS procedure with a SELECT statement.

Export Multiple Data Sets to an XLSX File Using PROC DATASETS

#SASGF

	A	B	C	D	E	F	G
1	Region	Product	Subsidiary	Stores	Sales	Inventory	Returns
2	Africa	Boot	Addis Ababa	12	29761	191821	769
3	Africa	Men's Casual	Addis Ababa	4	67242	118036	2284
4	Africa	Men's Dress	Addis Ababa	7	76793	136273	2433
5	Africa	Sandal	Addis Ababa	10	62819	204284	1861
6	Africa	Slipper	Addis Ababa	14	68641	279795	1771
7	Africa	Sport Shoe	Addis Ababa	4	1690	16634	79
8	Africa	Women's Casual	Addis Ababa	2	51541	98641	940
9	Africa	Women's Dress	Addis Ababa	12	108942	311017	3233
10	Africa	Boot	Algiers	21	21297	73737	710
11	Africa	Men's Casual	Algiers	4	63206	100982	2221
12	Africa	Men's Dress	Algiers	13	123743	428575	3621

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The resulting XLSX file has 3 worksheets named "SHOES", "CLASS", and "RETAIL". SAS variable names, not labels, are used for the Excel column headings.

Ex. 8 - Export Multiple Data Sets to an XLSX File Using PROC DATASETS



1. Go to SAS
2. Select File > Open Program > Exercise8.sas
3. Follow TO DO instructions
4. Examine the SASHelp_Exercise8.xlsx file

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TO DO:

Run the code.

Optionally, add or remove SAS datasets in the SELECT statement (Line 14).

Examine the SASHelp_Exercise8.xlsx file using Excel.

Summary and Conclusion

- Many techniques available
- Generally can only work with delimited files using Base SAS
- SAS Enterprise Guide can import/export XLS and XLSX files using Base SAS
- ODS EXCEL can export to XLSX files using Base SAS
- SAS/ACCESS provides direct access to *native* Excel files
- Use VALIDVARNAME and VALIDMEMNAME options

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Resources

- Data, code, slides, and paper
bit.ly/2T8tw6c
(github.com/sascommunities/sas-global-forum-2019/blob/master/2991-2019-DelGobbo)
- Vince's Related Papers
www.sas.com/reg/gen/corp/867226?page=Resources

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Vince's Related Papers

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Contact Information

Please send questions, comments and feedback to:

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If your registered in-house or local SAS users group would like to request this presentation as your annual SAS presentation (as a seminar, talk, or workshop) at an upcoming meeting, please submit an online User Group Request Form (bit.ly/2W2KGUB) at least eight weeks in advance.

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About the Author

Vince DelGobbo is a Senior Software Developer in the Platform Research and Development Division at SAS. His group's responsibilities include the SAS/IntrNet Application Dispatcher, SAS Stored Processes, and SAS Viya Job Execution. He is involved in the development of new Web- and server-based technologies, bringing 3rd-party metadata into SAS, and integrating SAS output with Microsoft Office. He was also involved in the early development of the ExcelXP ODS tagset. Vince has been a SAS Software user since 1982, and joined SAS in 1992.

User Group Request Form

https://www.sas.com/en_us/connect/user-groups/resources/request-user-group-assistance.html