SAS and Data Management

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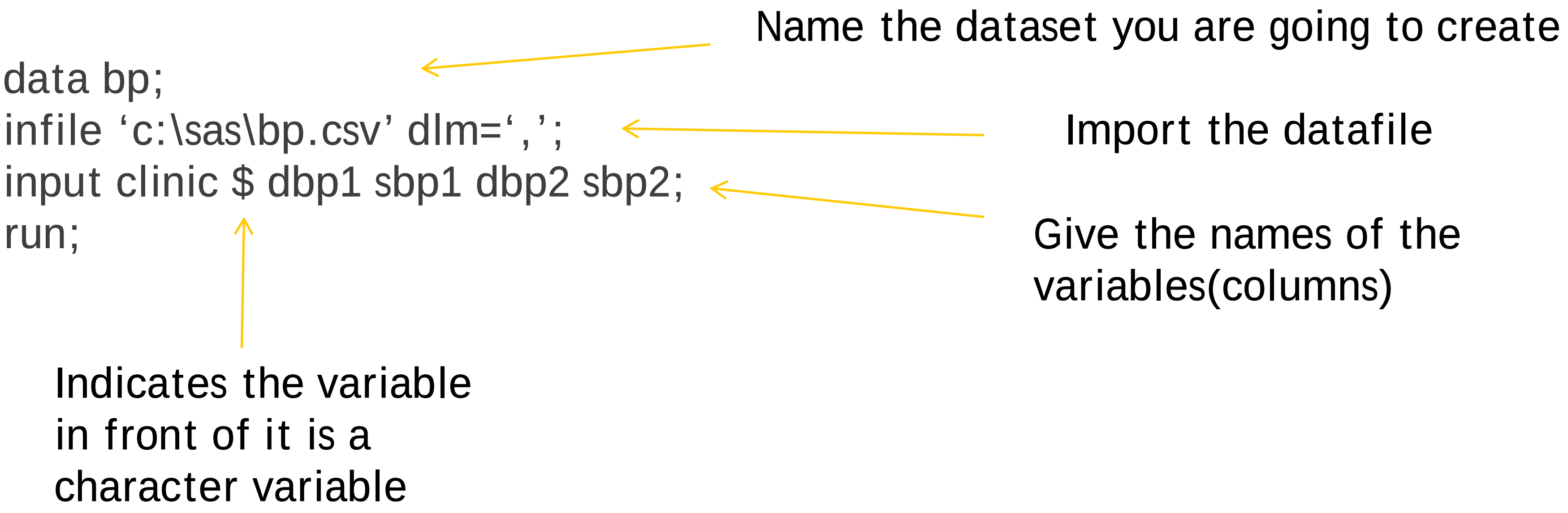
Review of Previous Material

Review

- **INFILE** statement



```
data bp;
infile ‘c:\sas\bp.csv’ dlm=‘,’;
input clinic $ dbp1 sbp1 dbp2 sbp2;
run;
```

Name the dataset you are going to create

Import the datafile

Give the names of the variables(columns)

Indicates the variable in front of it is a character variable

Review (cont.)

- **LIBNAME** statemnt

- General Format
  - `libname <name of library> "<folder location>";`
- Example
  - `libname class "H:\SASUsersGroup\datasets\";`

```
data class.bp;
 set bp;
run;
```

← Create “permanent” dataset

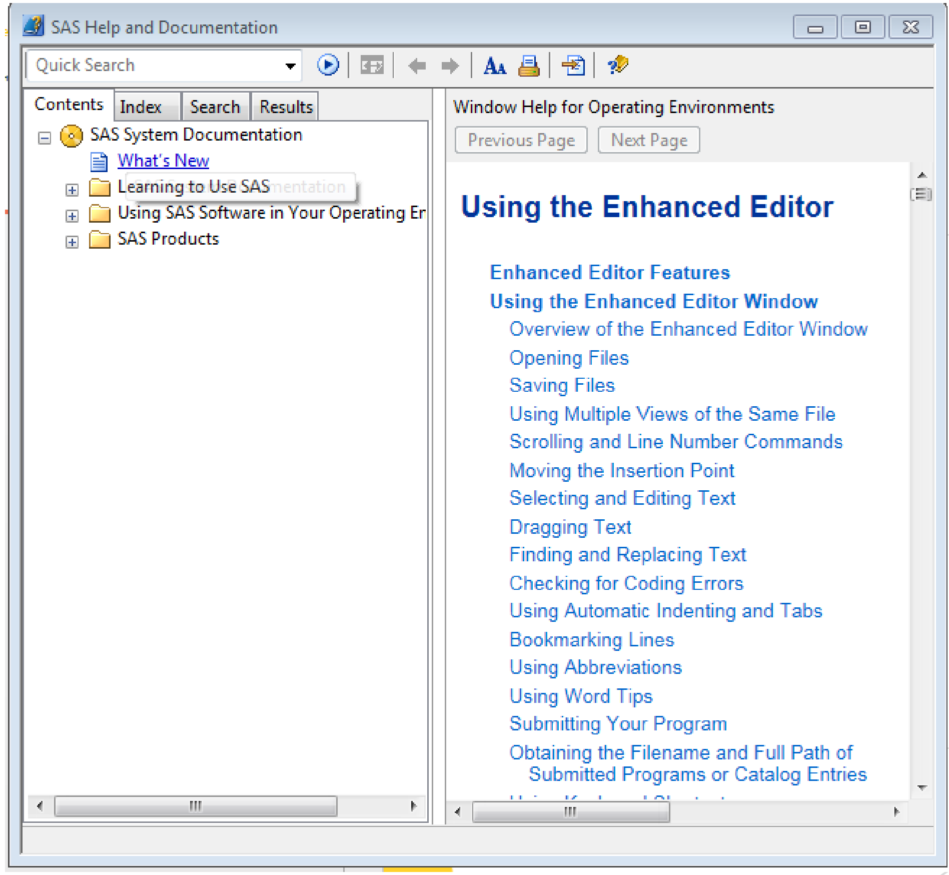
```
data bp;
  set class.bp;
run;
```

← Create temporary “work” dataset from “permanent” dataset in library

SAS Help

Internal Help

- Press “F1” to access Internal Help



Window Help for Operating Environments

Using the Enhanced Editor

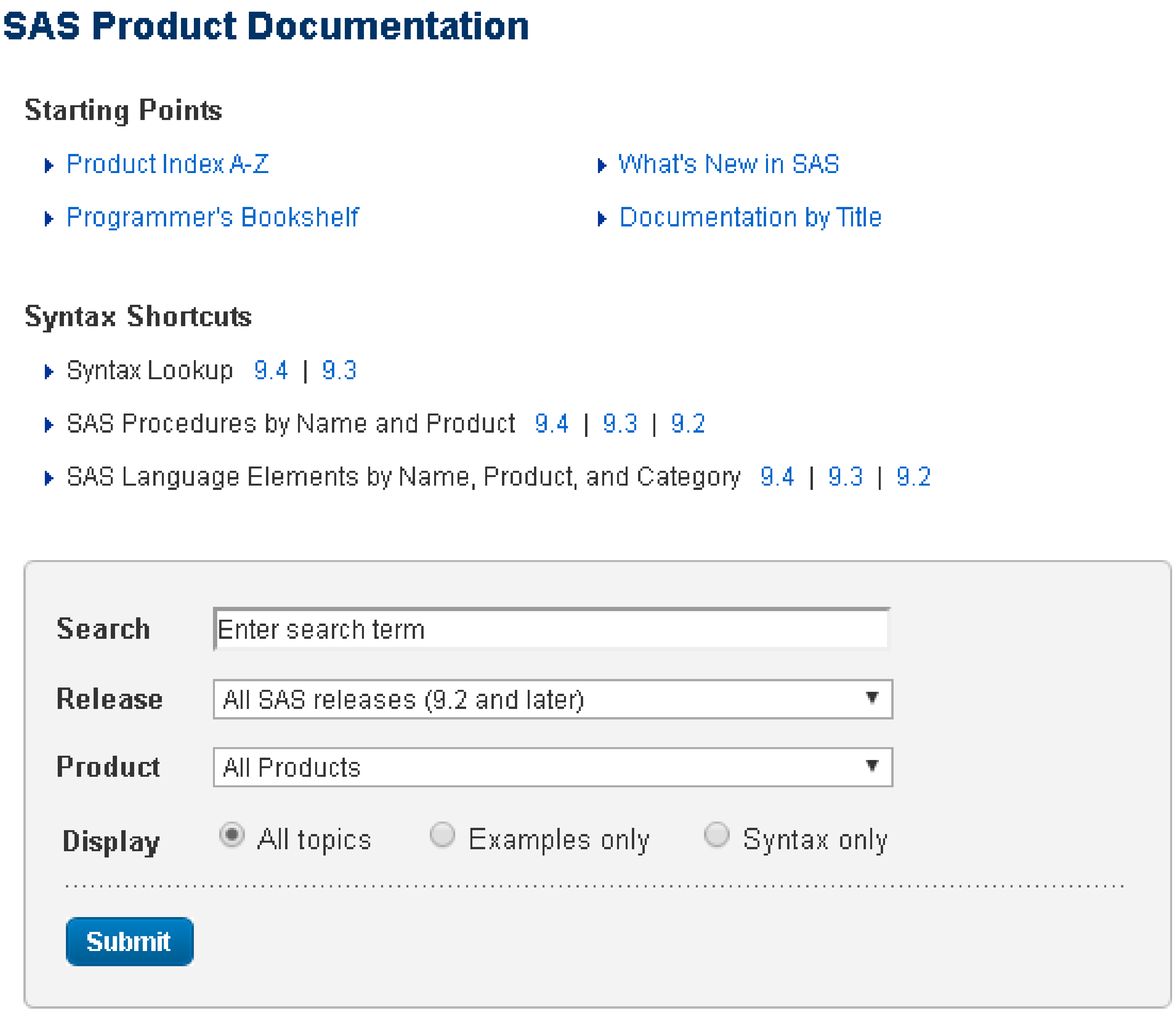
- Enhanced Editor Features
- Using the Enhanced Editor Window
  - Overview of the Enhanced Editor Window
  - Opening Files
  - Saving Files
  - Using Multiple Views of the Same File
  - Scrolling and Line Number Commands
  - Moving the Insertion Point
  - Selecting and Editing Text
  - Dragging Text
  - Finding and Replacing Text
  - Checking for Coding Errors
  - Using Automatic Indenting and Tabs
  - Bookmarking Lines
  - Using Abbreviations
  - Using Word Tips
  - Submitting Your Program
  - Obtaining the Filename and Full Path of Submitted Programs or Catalog Entries

Questions?

SAS Help

Online Help

- http://support.sas.com/documentation/



SAS Product Documentation

Starting Points

- Product Index A-Z
- What's New in SAS
- Programmer's Bookshelf
- Documentation by Title

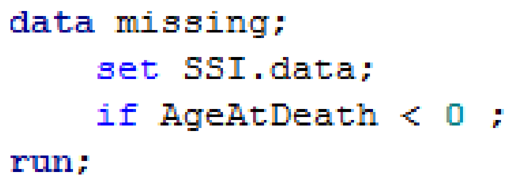
Syntax Shortcuts

- Syntax Lookup 9.4 | 9.3
- SAS Procedures by Name and Product 9.4 | 9.3 | 9.2
- SAS Language Elements by Name, Product, and Category 9.4 | 9.3 | 9.2

Search	Enter search term
Release	All SAS releases (9.2 and later) ▼
Product	All Products ▼
Display	● All topics ○ Examples only ○ Syntax only

Missing Data

- SAS puts "." in place of a Missing Value
- Arithmetic operations with a missing value will result in a missing return value
- In logical operations missing values are equal to other missing values
  - Missing values are less than non-missing values
  - e.g. when excluding missing data you can use the line below, assuming the value of your data is non-negative

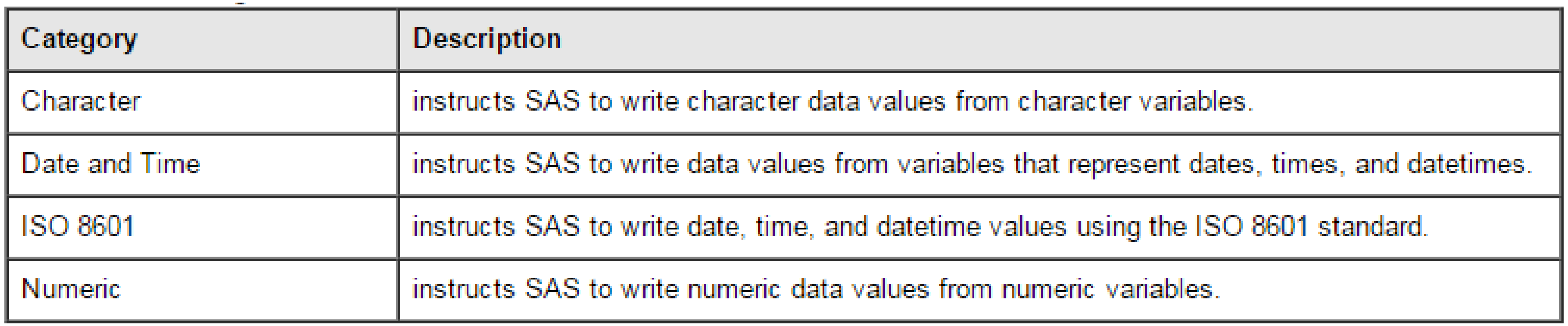


```
data missing;
    set SSI.data;
    if AgeAtDeath < 0 ;
run;
```

- Note: when exporting data with missing values to Excel, the missing values will show up as "." not blank

Formats

SAS Formats



Category	Description
Character	instructs SAS to write character data values from character variables.
Date and Time	instructs SAS to write data values from variables that represent dates, times, and datetimes.
ISO 8601	instructs SAS to write date, time, and datetime values using the ISO 8601 standard.
Numeric	instructs SAS to write numeric data values from numeric variables.

SAS Format List

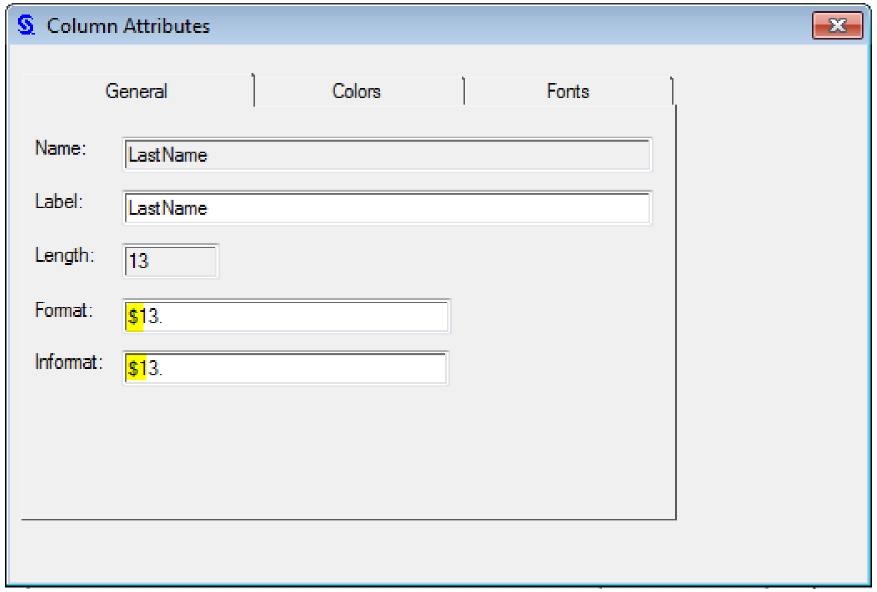
Formats (cont.)

- Letters are always character formats
- Numbers can be either numerical format or character format
  - Be careful when performing equations or merging data that they are in the correct format

Formats (cont.)

Double click the Column Header in your Data set to see Column Attributes

Character Format



Name: LastName

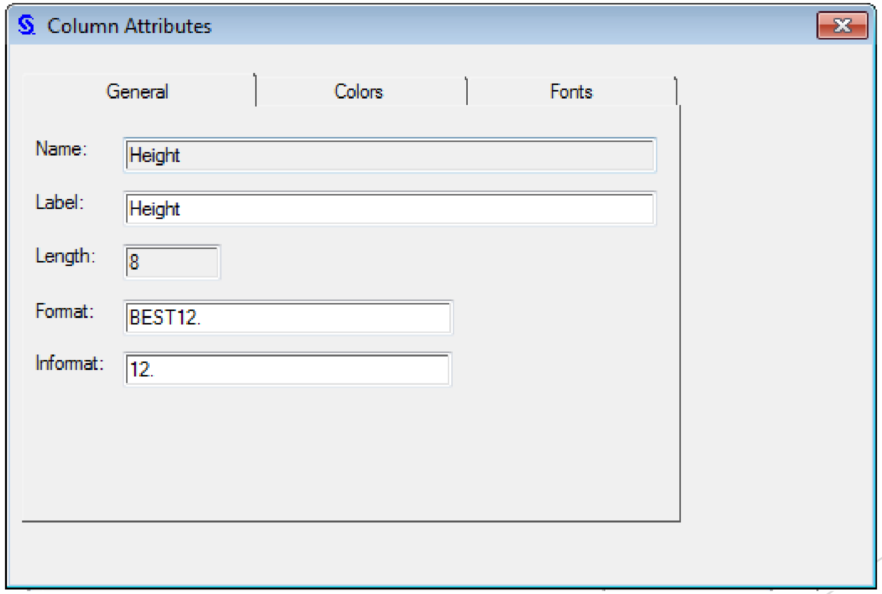
Label: LastName

Length: 13

Format: $13.

Informat: $13.

Numerical Format



Name: Height

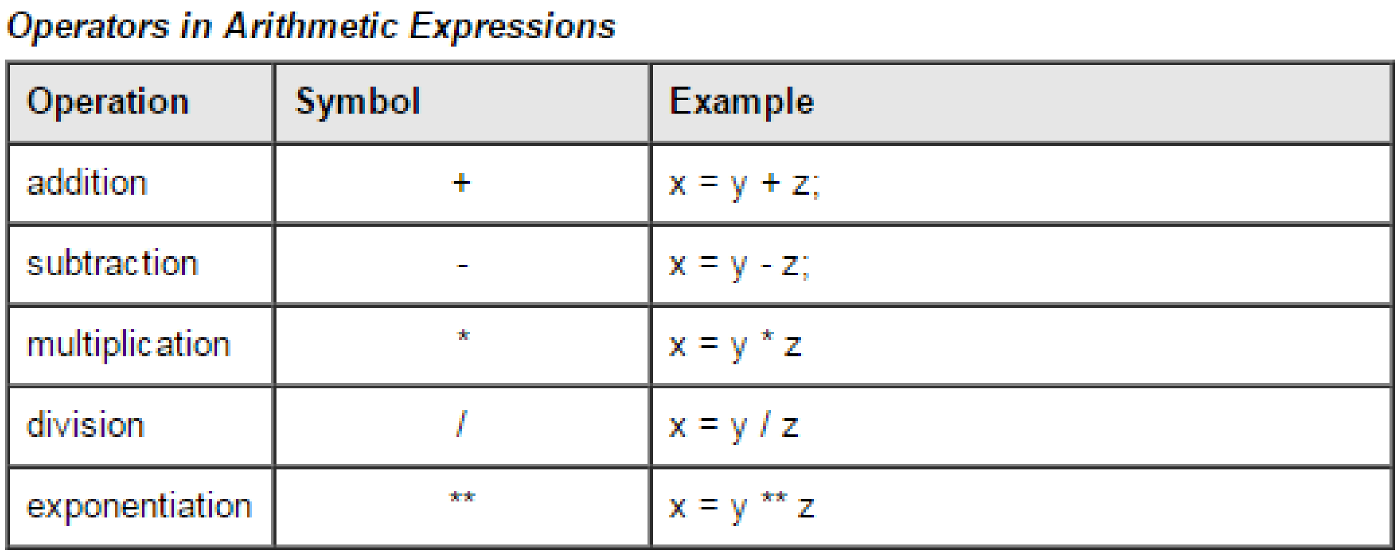
Label: Height

Length: 8

Format: BEST12.

Informat: 12.

Numeric Expressions



Operators in Arithmetic Expressions

Operation	Symbol	Example
addition	+	x = y + z;
subtraction	-	x = y - z;
multiplication	*	x = y * z
division	/	x = y / z
exponentiation	**	x = y ** z

SAS Numeric Expressions

Numeric Expressions (cont.)

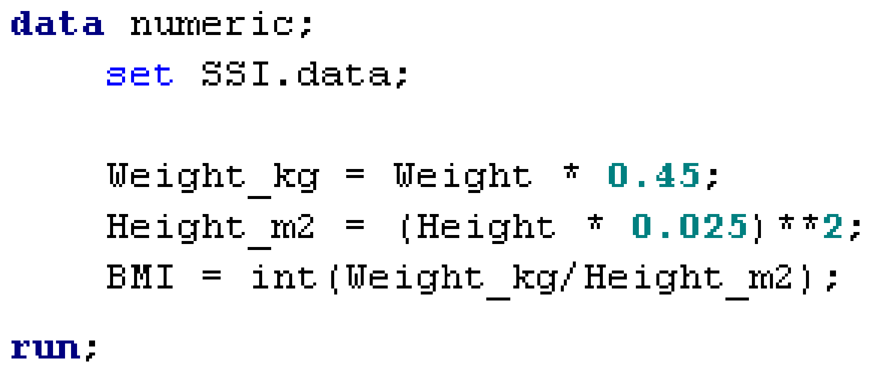
Exercise

- Calculate BMI using Height and Weight

$$\text{BMI} = \frac{(\text{weight in kilograms})}{\text{height in meters}^2}$$

- Calculate number of years in the study

Numeric Expressions (cont.)



```
data numeric;
    set SSI.data;

    Weight_kg = Weight * 0.45;
    Height_m2 = (Height * 0.025)**2;
    BMI = int(Weight_kg/Height_m2);
run;
```

Numeric Functions

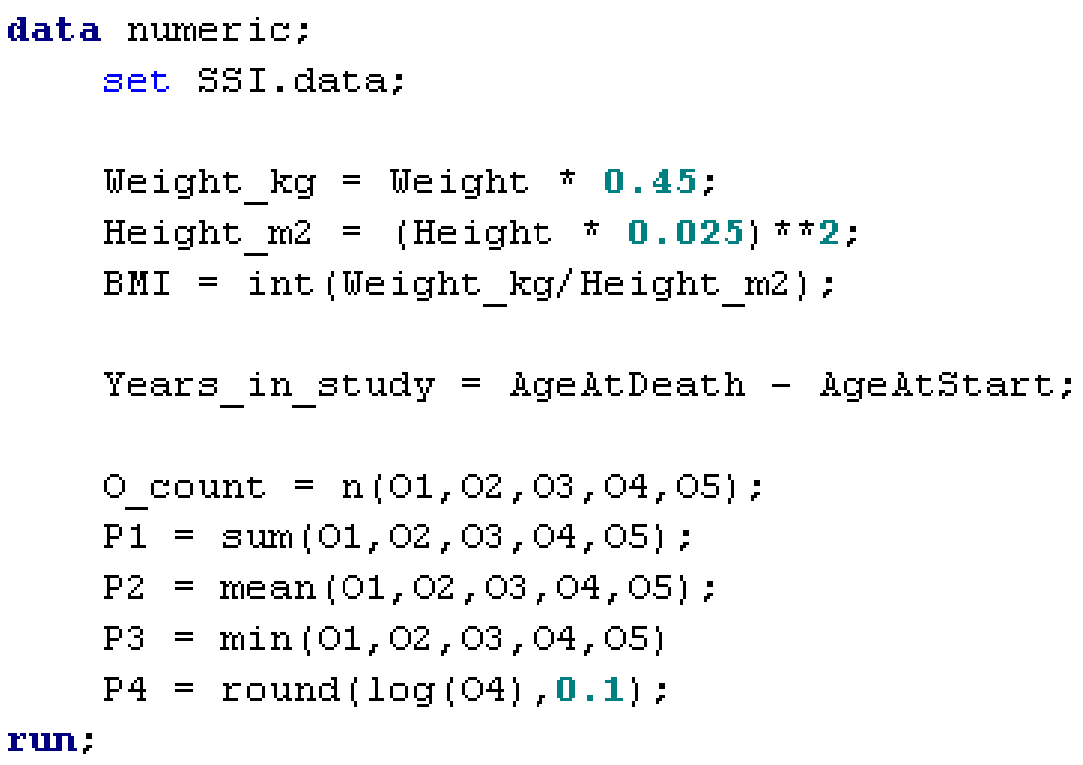
SAS Function	Description
ABS(x)	|x|
EXP(x)	e^x
FACT(x)	x!
LOG(x)/**LOG10**(x)	ln(x)/log_10(x)
ROUND(x,unit)	Round x to nearest multiple of unit
Int(x)	Round x to nearest integer
SQRT(x)	$\sqrt{x}$
MAX(arg-1,arg-2,…)	Maximum value of arguments
MIN(arg-1,arg-2,…)	Minimum value of arguments
STD(arg-1,arg-2,…)	Standard Deviation of arguments
MEAN(arg-1,arg-2,…)	Mean of arguments
SUM(arg-1,arg-2,…)	Sum of arguments
N((arg-1,arg-2,…)	Counts the number of arguments

Numeric Functions (cont.)

Exercise

- Calculate the number of arguments in O1-O5 as **O_count**
- Calculate the sum of O1-O5 as **P1**
- Calculate the mean of O1-O5 as **P2**
- Find the minimum value of O1-O5 as **P3**
- Calculate ln(O4) and round to the nearest tenth as **P4**

Numeric Functions (cont.)

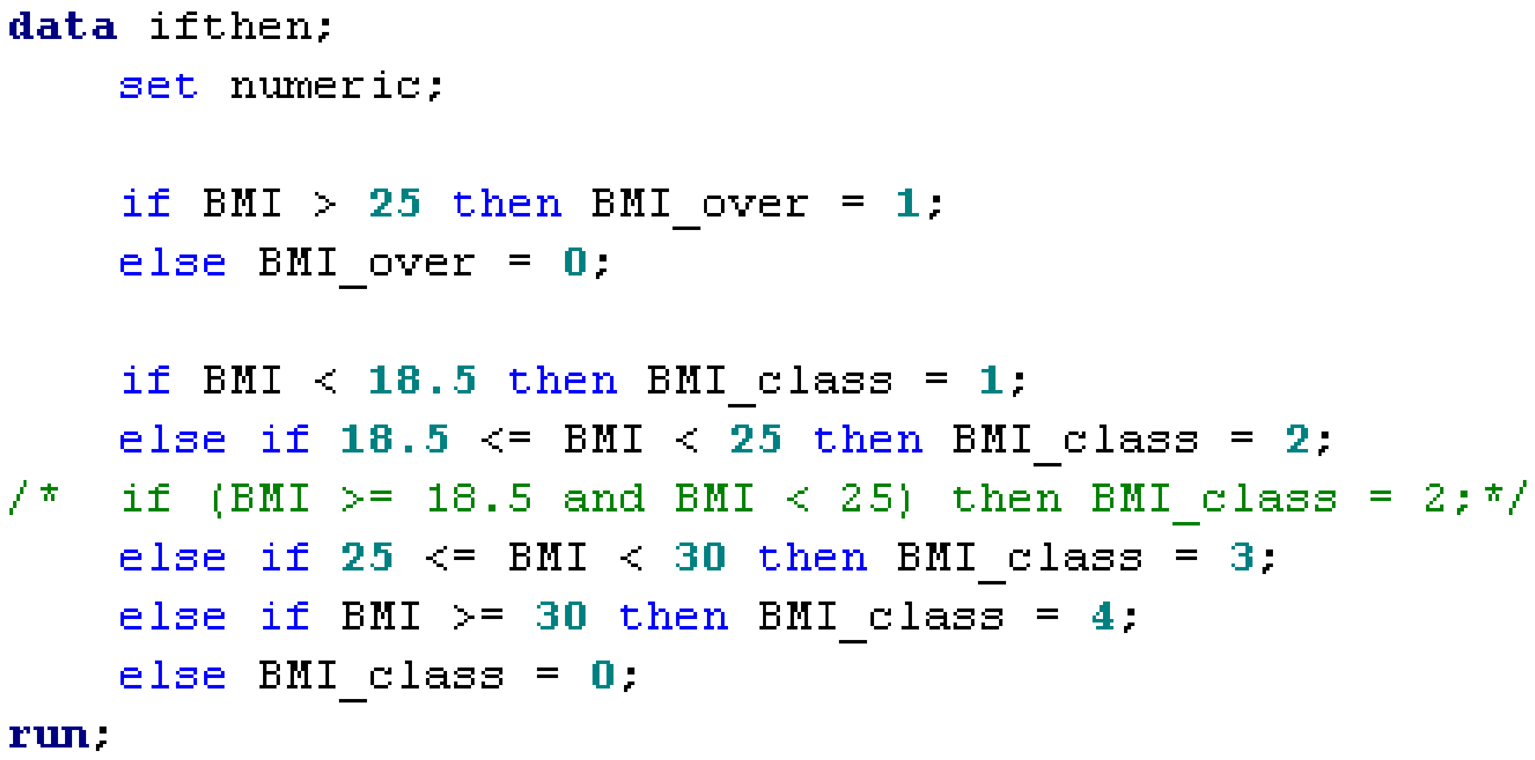


```
data numeric;
    set SSI.data;

    Weight_kg = Weight * 0.45;
    Height_m2 = (Height * 0.025)**2;
    BMI = int(Weight_kg/Height_m2);

    Years_in_study = AgeAtDeath - AgeAtStart;

    O_count = n(O1,O2,O3,O4,O5);
    P1 = sum(O1,O2,O3,O4,O5);
    P2 = mean(O1,O2,O3,O4,O5);
    P3 = min(O1,O2,O3,O4,O5)
    P4 = round(log(O4),0.1);
run;
```

If-Then/Else Statements

- Logical SAS expression
- **Then** : Statement that is executed if the expression is true
- **Else** : Statement that is executed if the expression is false
- **If - Then/Else** : Statements are nested to produce a series of evaluations
  - Stops once a true statement is encountered
  - More computationally efficient than repeated if statements

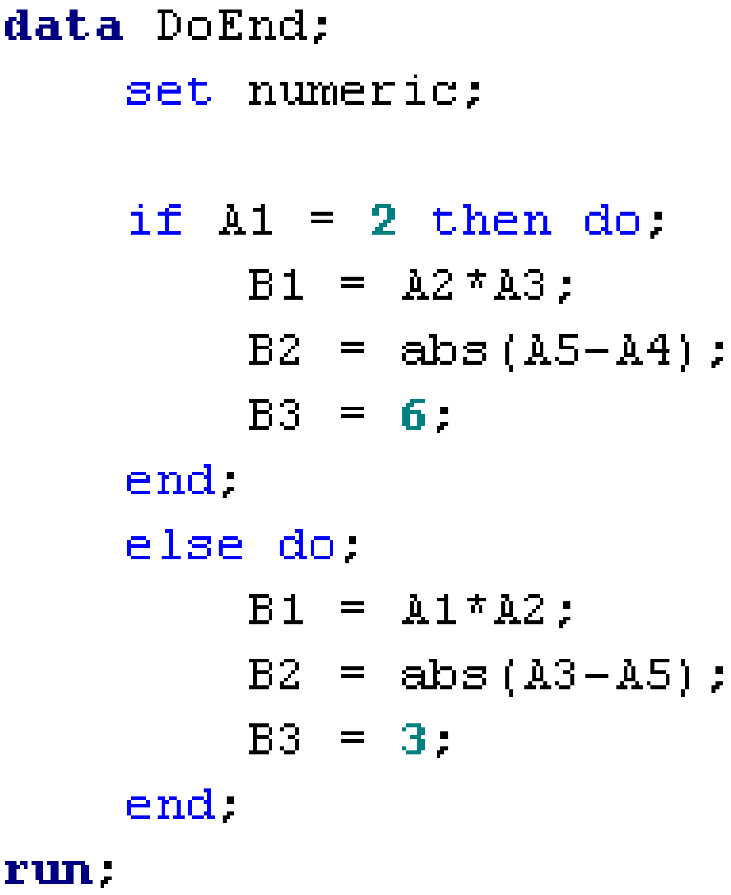
If –Then/Else Statements (cont.)



```
data ifthen;
    set numeric;

    if BMI > 25 then BMI_over = 1;
    else BMI_over = 0;

    if BMI < 18.5 then BMI_class = 1;
    else if 18.5 <= BMI < 25 then BMI_class = 2;
/*  if (BMI >= 18.5 and BMI < 25) then BMI_class = 2;*/
    else if 25 <= BMI < 30 then BMI_class = 3;
    else if BMI >= 30 then BMI_class = 4;
    else BMI_class = 0;
run;
```

Do…End Statements

- The **DO** Statement specifies a group of statements to be executed as a unit.



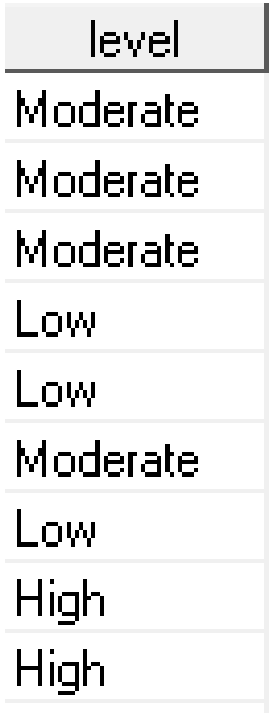
```
data DoEnd;
    set numeric;

    if A1 = 2 then do;
        B1 = A2*A3;
        B2 = abs(A5-A4);
        B3 = 6;
    end;
    else do;
        B1 = A1*A2;
        B2 = abs(A3-A5);
        B3 = 3;
    end;
run;
```

Working with Character Variables

- The **Length** Statement is a data step statement specifying the internal storage lengths of variables
- Length can only be set prior to the assignment of values
- Helpful when merging datasets
  - Variables need to be the same length
- Syntax: **LENGTH** variable-1 <**$**>length … variable-n <**$**>length;
  - **$**: Specifies the variable is a character type
  - length**:** number of characters

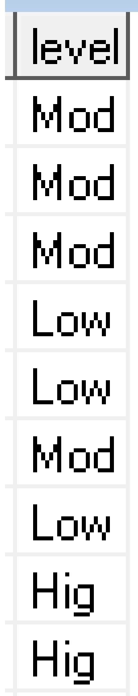
Working with Character Variables (cont.)

Using the **LENGTH** Statement



level
Moderate
Moderate
Moderate
Low
Low
Moderate
Low
High
High

Without the **LENGTH** Statement

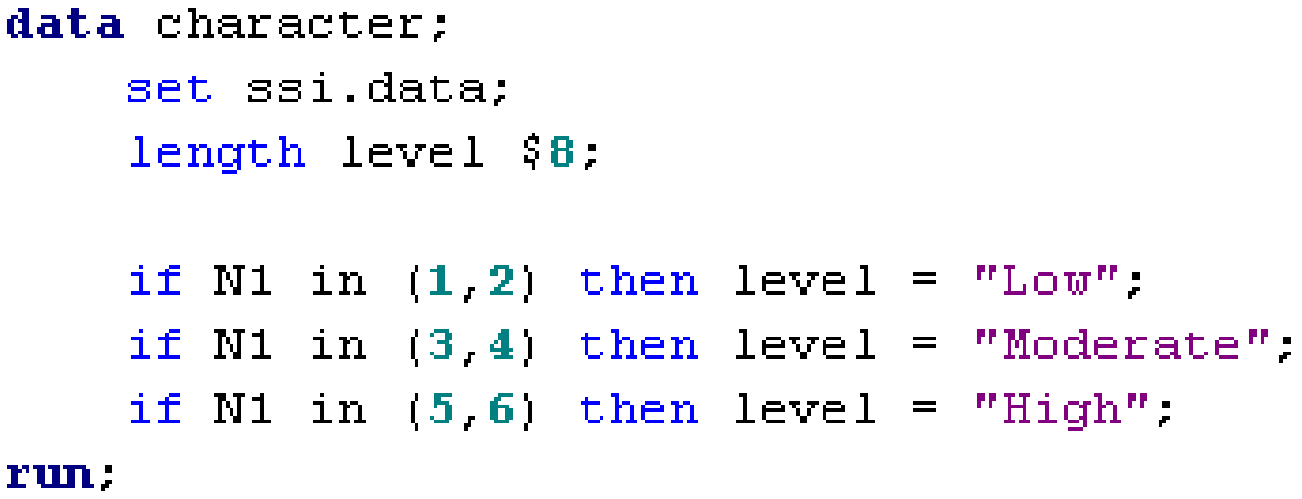


level
Mod
Mod
Mod
Low
Low
Mod
Low
Hig
Hig

Working with Character Variables (cont.)

- Exercise
- Create 3 different levels for **N1**
  - N1 = (1,2,3,4,5,6)

Working with Character Variables (cont.)



```
data character;
    set ssi.data;
    length level $8;

    if N1 in (1,2) then level = "Low";
    if N1 in (3,4) then level = "Moderate";
    if N1 in (5,6) then level = "High";
run;
```

Character Functions

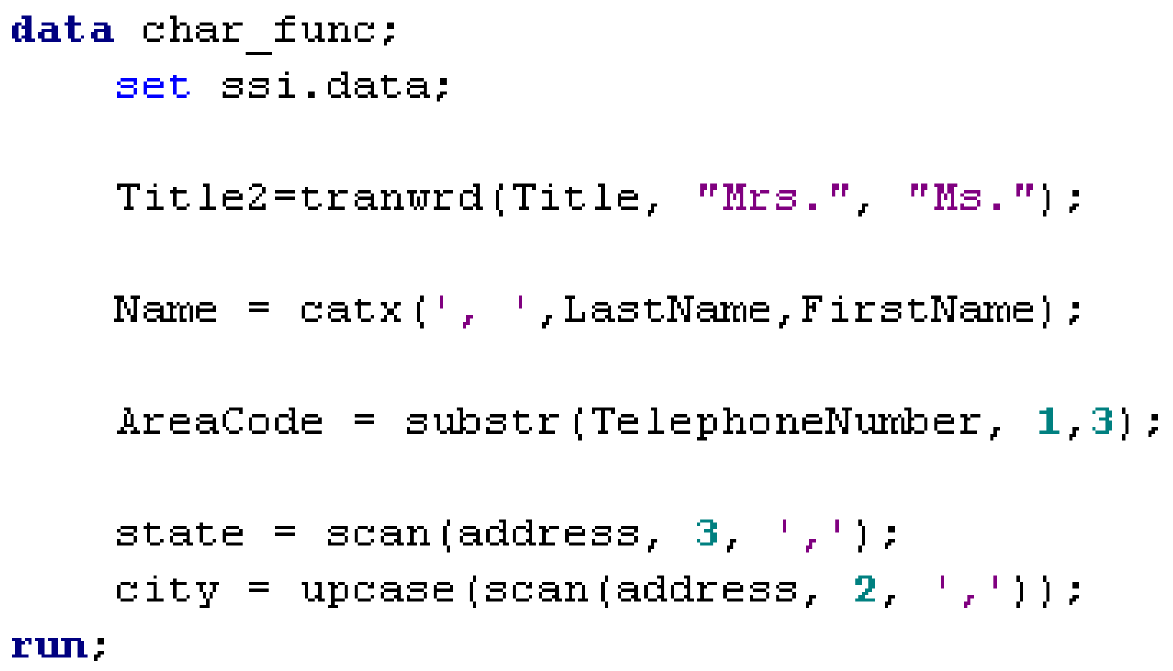
SAS Function	Description
Upcase(str)/**Lowercase**(str)	Convert to uppercase/lowercase
Length(str)	Length excluding trailing blanks
Lengthc(str)	Length including trailing blanks
Strip(str)	Removes leading and trailing blanks
Tranwrd(str, target, replacement)	Replaces all occurrences
Catx(delimiter, srt-1, str-2, …)	Concatenates variables separated by delimiter
Index(source,excerpt)	Searches sources for excerpt and returns position number
Scan(str,count)	Returns the nth character from string
Substr(str,position,n)	Returns n number of characters from str starting at position

SAS Character Functions

Character Functions (cont.)

- Exercise
- Change all titles “Mrs.” to “Ms.”
- Create variable **Name** with format “Last, First”
  - Hint: delimiters need “” around them
- Create variable **AreaCode** from **TelephoneNumber**
- Create variable **State** extracted from **Address**
- Create an all capitalized variable **City**

Character Functions (cont.)



```
data char_func;
    set ssi.data;

    Title2=tranwrd(Title, "Mrs.", "Ms.");

    Name = catx(', ',LastName,FirstName);

    AreaCode = substr(TelephoneNumber, 1,3);

    state = scan(address, 3, ',');
    city = upcase(scan(address, 2, ','));
run;
```

Date Variables

SAS Function	Description
DATE() / **TODAY**()	Returns todays date
DAY(x)	Returns day of month of date variable
MONTH(x)	Returns month of date variable
YEAR(x)	Returns year of date variable
WEEK(x)	Returns week of date variable
DATEPART(x)	Pulls date from Date-Time variable
TIMEPART(x)	Pulls time from Date-Time variable
'DDMMMYYYY'**d**	Creates date variable

SAS Date Functions

Date Variables (cont.)

- Formatting Date Variables
- Internal SAS dates are just a string of numbers.
  - 0 = 1Jan1960
  - Each day after 1Jan1960 adds 1
  - Each day before 1Jan1960 subtracts 1
- Formatting makes it easier to read
  - Use **PUT**() function to create new formatted variables

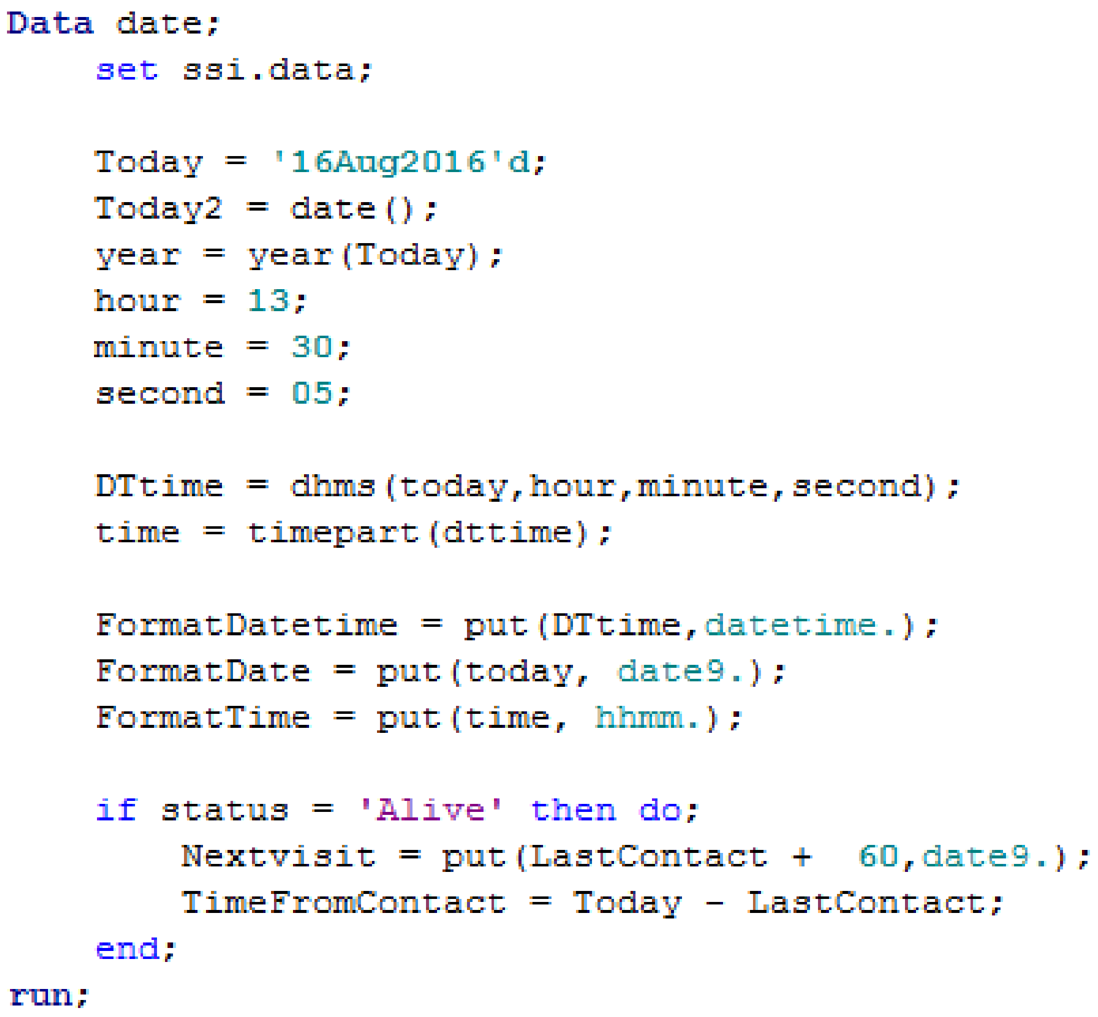
SAS Format	Description
Date9.	DDMMYYYY
Datetime.	DDMMYYYY:HH:MM:SS
Time.	HHH:MM:SS

SAS Date and Time Formats

Date Variables (cont.)

- Exercises
- Find today's date two different ways
- Find the current year
- Create **HOUR, MINUTE,** and **Second** variables
- Use variables created above to create a date-time variable, **DTTIME**
- Find **TIME** using **DTTIME**
- Format **DTTIME**, **TIME**, **TODAY**
- If the subject is still alive
  - calculate when they should have their next visit
    - 60 days from last visit
  - Calculate the number of days between **LastContact** and **TODAY**
  - Hint: Try using a **DO** loop!

Date Variables (cont.)

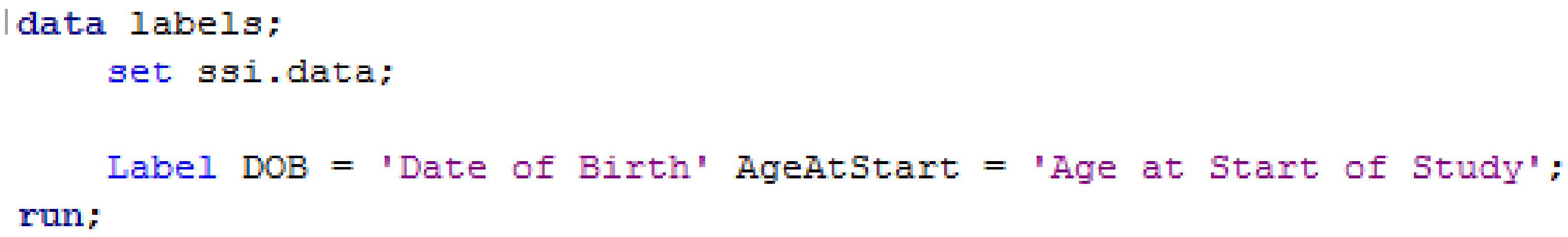


```
Data date;
    set ssi.data;

    Today = '16Aug2016'd;
    Today2 = date();
    year = year(Today);
    hour = 13;
    minute = 30;
    second = 05;

    DTtime = dhms(today,hour,minute,second);
    time = timepart(dttime);

    FormatDatetime = put(DTtime,datetime.);
    FormatDate = put(today, date9.);
    FormatTime = put(time, hhmm.);

    if status = 'Alive' then do;
        Nextvisit = put(LastContact +  60,date9.);
        TimeFromContact = Today - LastContact;
    end;
run;
```

Variable Labels

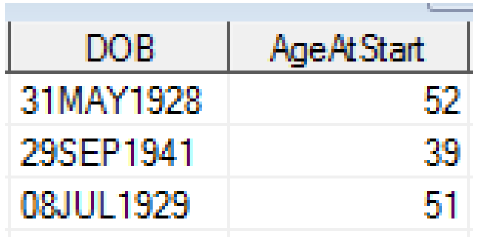
- Using a **LABEL** statement in SAS will permanently associate a label with a variable
- Syntax: **LABEL** variable-1=label-1 … variable-n=label-n;

Variable Labels (cont.)



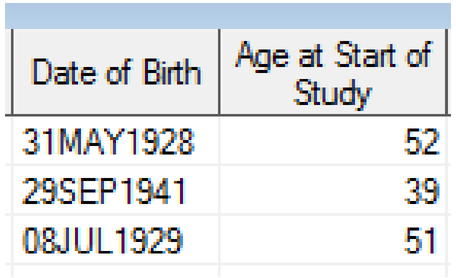
```
data labels;
     set ssi.data;

     Label DOB = 'Date of Birth' AgeAtStart = 'Age at Start of Study';
run;
```

Before Label



DOB	AgeAtStart
31MAY1928	52
29SEP1941	39
08JUL1929	51

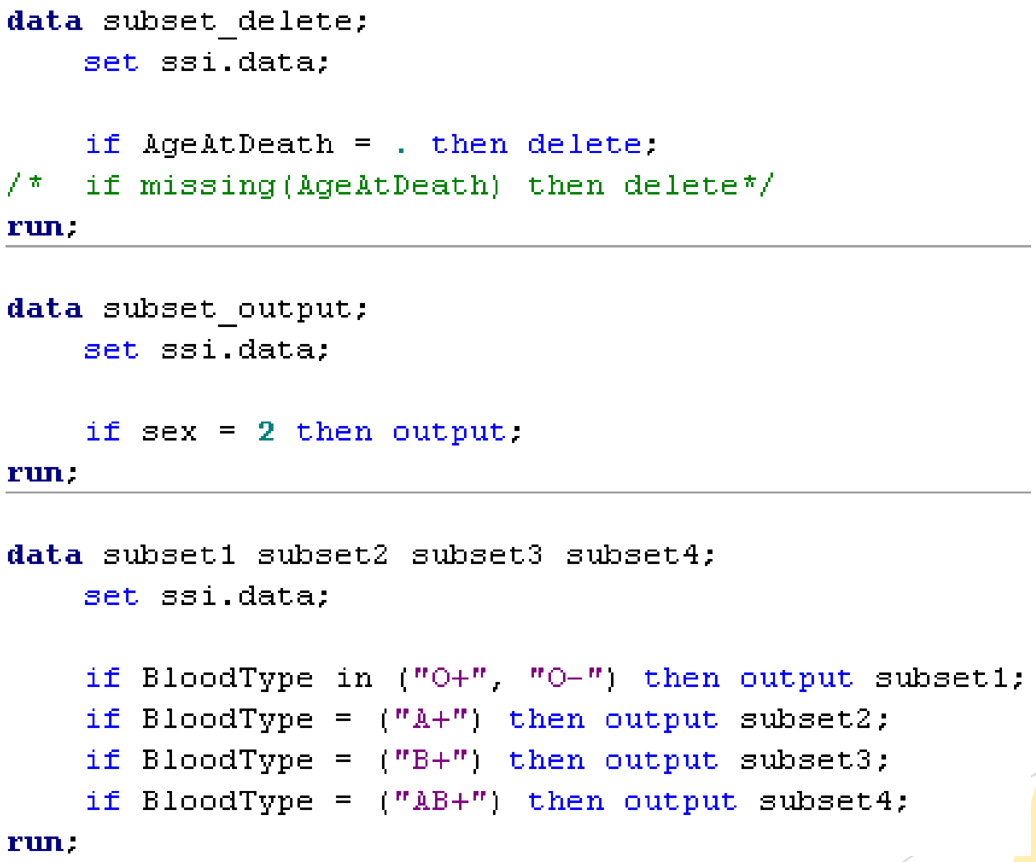
After Label



Date of Birth	Age at Start of Study
31MAY1928	52
29SEP1941	39
08JUL1929	51

Sub-Setting Data

- **Delete** Statement
  - Use the delete statement to exclude subjects with certain observations
  - e.g. delete those with a missing value
- **Output** Statement
  - The output statement only includes observations that meet the criteria specified
    - e.g. only include females
    - You can also use the output statement to create individual datasets



```
data subset_delete;
    set ssi.data;

    if AgeAtDeath = . then delete;
/*  if missing(AgeAtDeath) then delete*/
run;
```

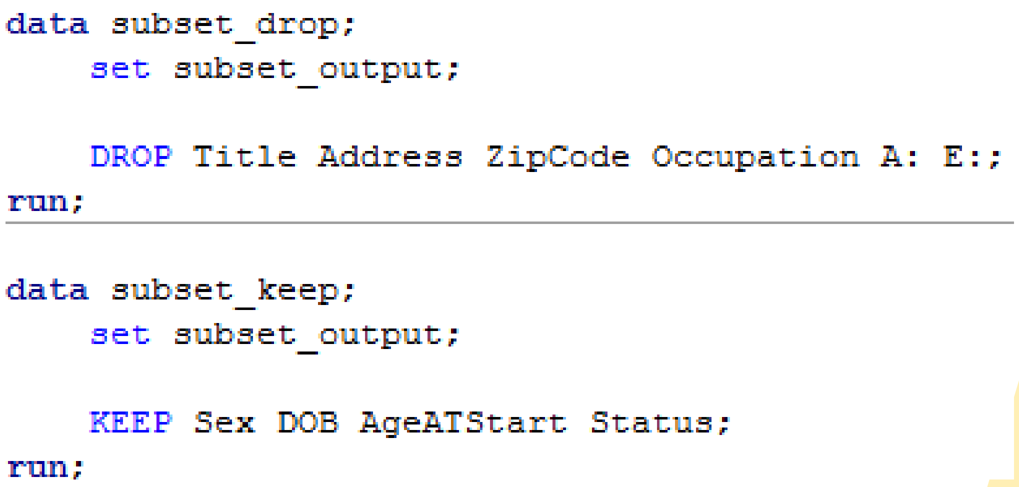
```
data subset_output;
    set ssi.data;

    if sex = 2 then output;
run;
```

```
data subset1 subset2 subset3 subset4;
    set ssi.data;

    if BloodType in ("O+", "O-") then output subset1;
    if BloodType = ("A+") then output subset2;
    if BloodType = ("B+") then output subset3;
    if BloodType = ("AB+") then output subset4;
run;
```

Sub-Setting Data (cont.)

DROP/KEEP Statement

- Use the **DROP** statement to get rid of unwanted variables
- Use the **KEEP** statement to keep only variables you want
- If you have a set of variables with same pre-fix that are numbered differently you can lump them all together using “**:**” rather than type all out separately



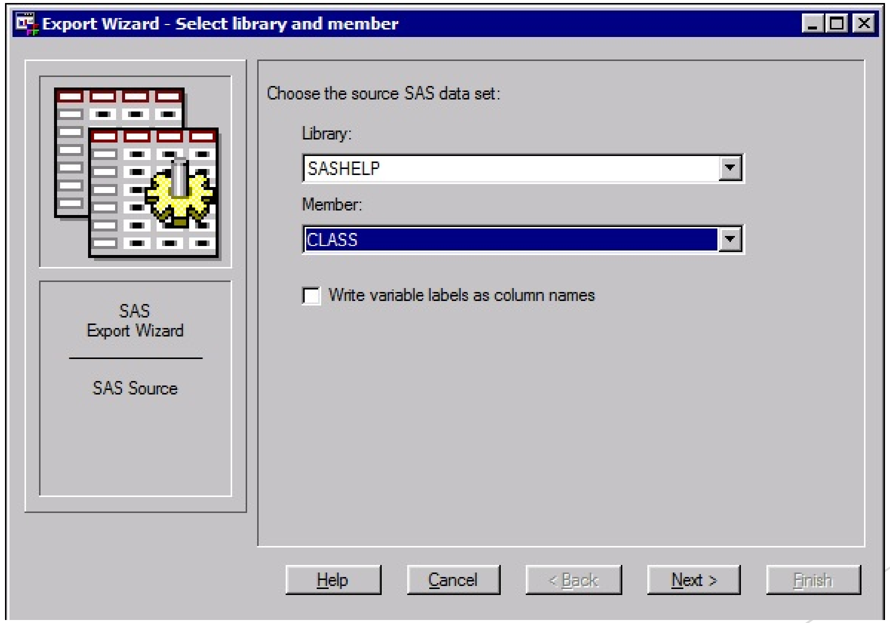
```
data subset_drop;
    set subset_output;

    DROP Title Address ZipCode Occupation A: E:;
run;
```

```
data subset_keep;
    set subset_output;

    KEEP Sex DOB AgeATStart Status;
run;
```

Exporting Data

Using the Export Wizard

- Select **File » Export Data**
- The window dialog box will appear
- Select your SAS library libref
  - Library: **WORK**
- Select the **member** of the library
  - Member: **Export**
- Click **Next**



Export Wizard - Select library and member

Choose the source SAS data set:

Library: SASHELP

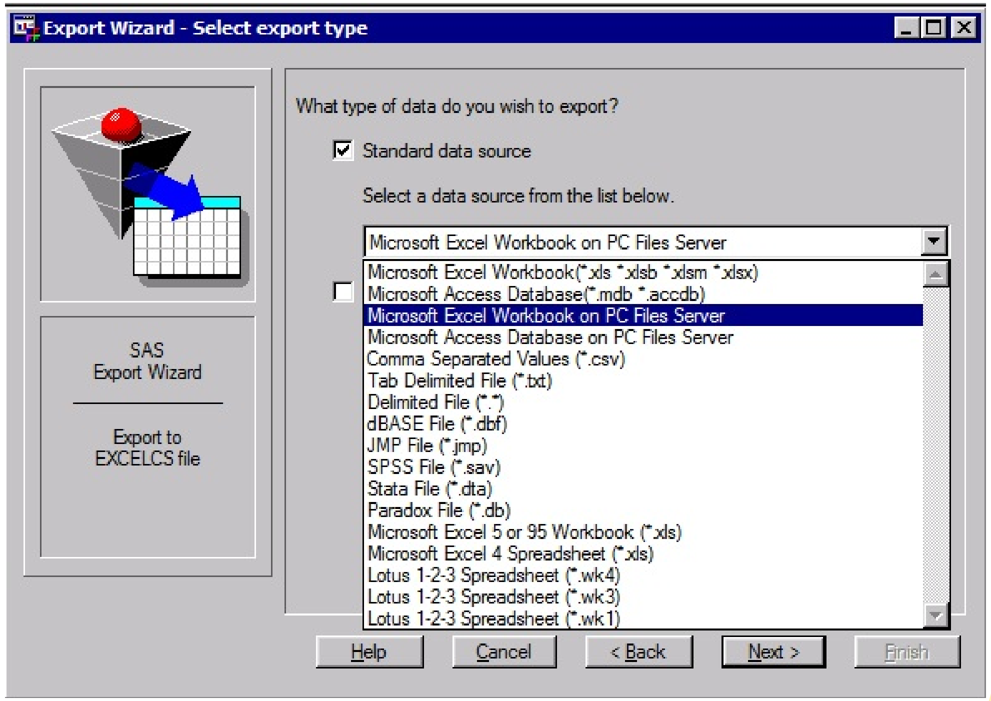
Member: CLASS

□ Write variable labels as column names

Exporting Data (cont.)

Export Wizard (cont.)

- The **Select Export Type** dialog box will appear
- Select what data source you would like to export to
- Most common are *.xlsx, *.csv, and *.txt
    - We will export ***.xlsx**



Export Wizard - Select export type

What type of data do you wish to export?

☑ Standard data source

Select a data source from the list below.

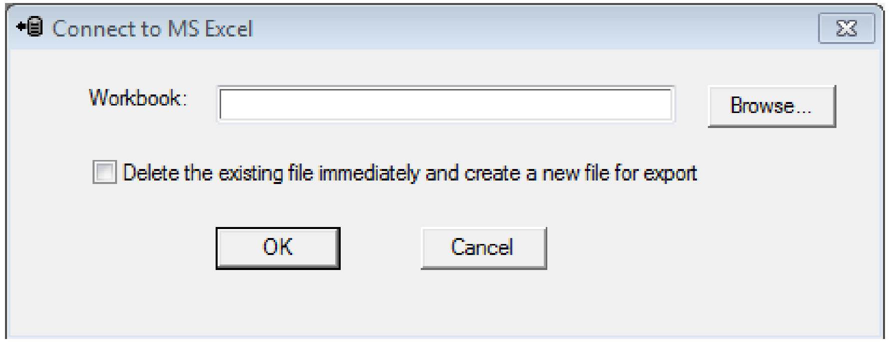
Microsoft Excel Workbook on PC Files Server

Microsoft Excel Workbook(*.xls *.xlsb *.xlsm *.xlsx)
Microsoft Access Database(*.mdb *.accdb)
Microsoft Excel Workbook on PC Files Server
Microsoft Access Database on PC Files Server
Comma Separated Values (*.csv)
Tab Delimited File (*.txt)
Delimited File (*.*)
dBASE File (*.dbf)
JMP File (*.jmp)
SPSS File (*.sav)
Stata File (*.dta)
Paradox File (*.db)
Microsoft Excel 5 or 95 Workbook (*.xls)
Microsoft Excel 4 Spreadsheet (*.xls)
Lotus 1-2-3 Spreadsheet (*.wk4)
Lotus 1-2-3 Spreadsheet (*.wk3)
Lotus 1-2-3 Spreadsheet (*.wk1)
SAS
Export Wizard
Export to
EXCELCS file
Help
Cancel
< Back
Next >
Finish

Exporting Data (cont.)

Export Wizard (cont.)

- Click the **Browse** button to point to a folder where you want the data saved
  - e.g. save to your **H:\ drive**

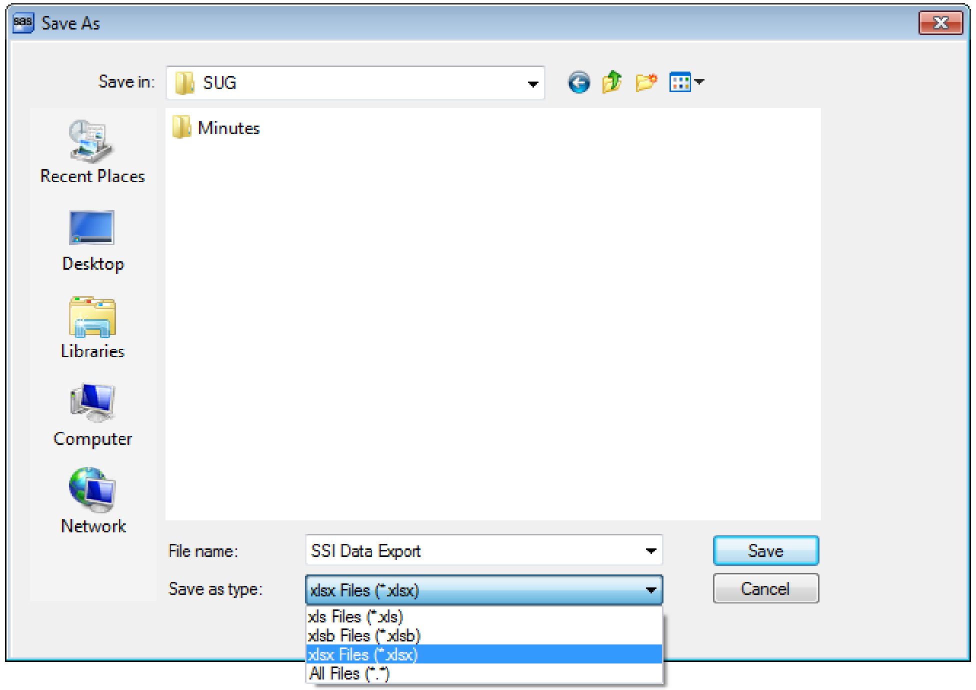


□ Delete the existing file immediately and create a new file for export

Exporting Data (cont.)

Export Wizard (cont.)

- Enter **File Name**
- Be sure to scroll down to **.xlsx file**
  - Default is old version of Microsoft office
- Click **Save**
- Then click **OK**



Save As

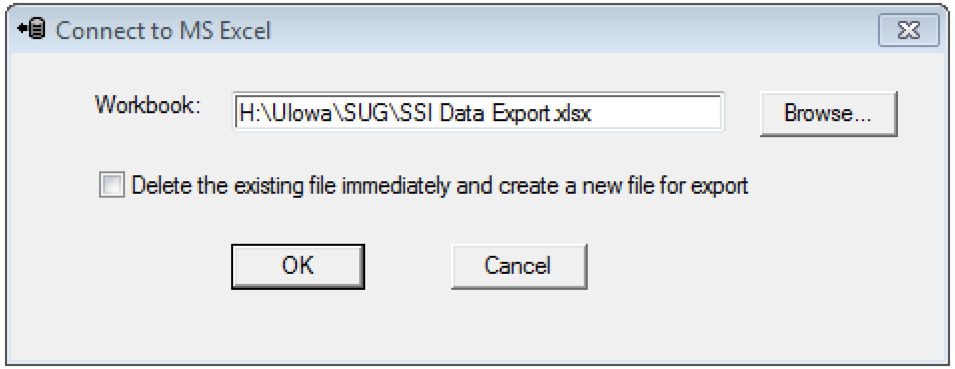
Save in: SUG

Minutes

File name: SSI Data Export

Save as type: xlsx Files (*.xlsx)

xls Files (*.xls)
xlsb Files (*.xlsb)
xlsx Files (*.xlsx)
All Files (*.*)



Connect to MS Excel

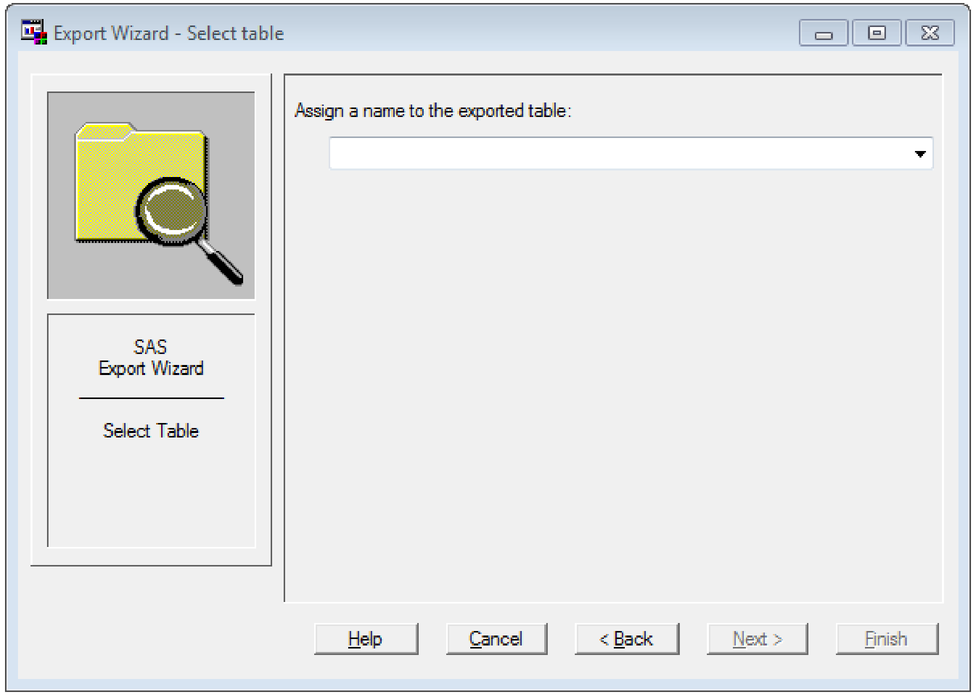
Workbook: H:\UIowa\SUG\SSI Data Export.xlsx

☐ Delete the existing file immediately and create a new file for export

Exporting Data (cont.)

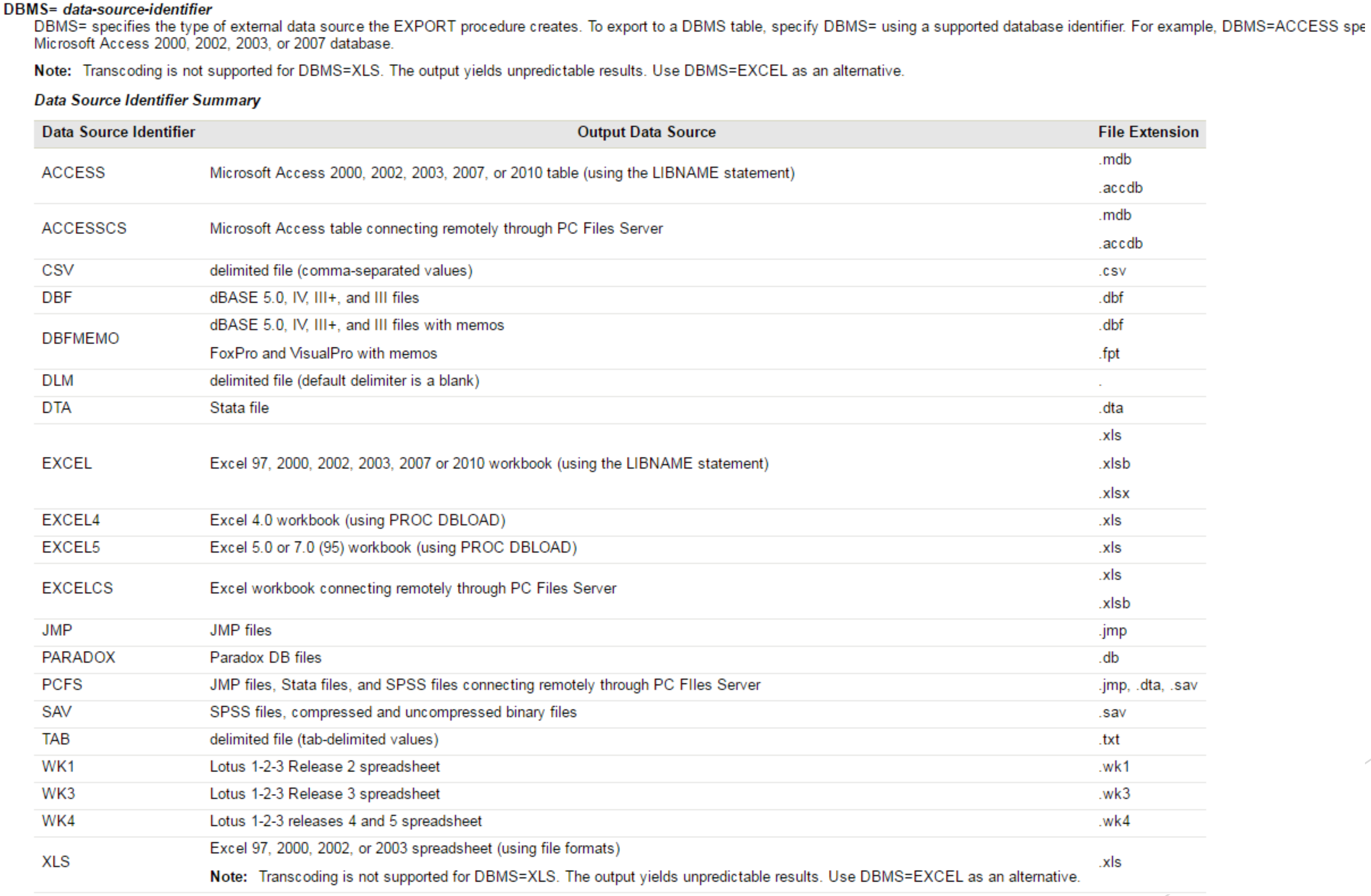
Export Wizard (cont.)

- Assign a name to the exported table
  - This names the sheet in excel
- You can be done here and click **Finish**
- If you want to save the code click **Next**
- Assign a file directory where it will be saved and click **Finish**
  - It will save a file with code for **Proc Export**


Export Wizard - Select table
SAS
Export Wizard
Select Table
Assign a name to the exported table:
Help
Cancel
< Back
Next >
Finish

Exporting Data (cont.)

Using Proc Export



DBMS= ***data-source-identifier***

DBMS= specifies the type of external data source the EXPORT procedure creates. To export to a DBMS table, specify DBMS= using a supported database identifier. For example, DBMS=ACCESS spe Microsoft Access 2000, 2002, 2003, or 2007 database.

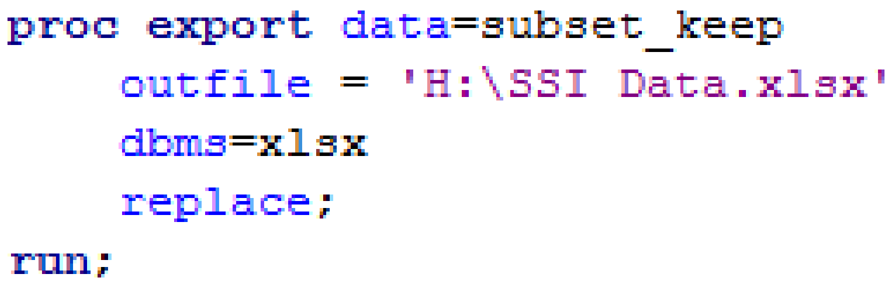
Note: Transcoding is not supported for DBMS=XLS. The output yields unpredictable results. Use DBMS=EXCEL as an alternative.

Data Source Identifier Summary

Data Source Identifier	Output Data Source	File Extension
ACCESS	Microsoft Access 2000, 2002, 2003, 2007, or 2010 table (using the LIBNAME statement)	.mdb .accdb
ACCESSCS	Microsoft Access table connecting remotely through PC Files Server	.mdb .accdb
CSV	delimited file (comma-separated values)	.csv
DBF	dBASE 5.0, IV, III+, and III files	.dbf
DBFMEMO	dBASE 5.0, IV, III+, and III files with memos FoxPro and VisualPro with memos	.dbf .fpt
DLM	delimited file (default delimiter is a blank)	.
DTA	Stata file	.dta
EXCEL	Excel 97, 2000, 2002, 2003, 2007 or 2010 workbook (using the LIBNAME statement)	.xls .xlsb .xlsx
EXCEL4	Excel 4.0 workbook (using PROC DBLOAD)	.xls
EXCEL5	Excel 5.0 or 7.0 (95) workbook (using PROC DBLOAD)	.xls
EXCELCS	Excel workbook connecting remotely through PC Files Server	.xls .xlsb
JMP	JMP files	.jmp
PARADOX	Paradox DB files	.db
PCFS	JMP files, Stata files, and SPSS files connecting remotely through PC FIles Server	.jmp, .dta, .sav
SAV	SPSS files, compressed and uncompressed binary files	.sav
TAB	delimited file (tab-delimited values)	.txt
WK1	Lotus 1-2-3 Release 2 spreadsheet	.wk1
WK3	Lotus 1-2-3 Release 3 spreadsheet	.wk3
WK4	Lotus 1-2-3 releases 4 and 5 spreadsheet	.wk4
XLS	Excel 97, 2000, 2002, or 2003 spreadsheet (using file formats) **Note:** Transcoding is not supported for DBMS=XLS. The output yields unpredictable results. Use DBMS=EXCEL as an alternative.	.xls

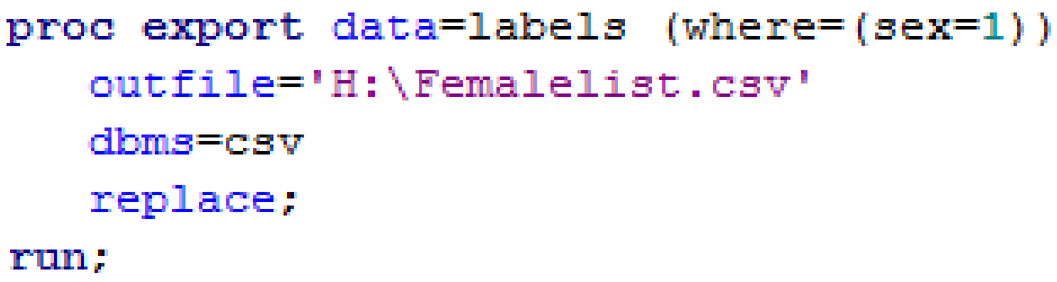
Exporting Data (cont.)

Using Proc Export (cont.)



```
proc export data=subset_keep
     outfile = 'H:\SSI Data.xlsx'
     dbms=xlsx
     replace;
run;
```

Using proc Export to subset data



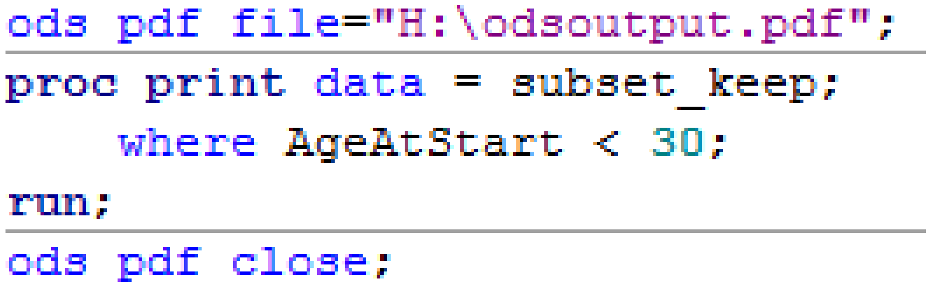
```
proc export data=labels (where=(sex=1))
    outfile='H:\Femalelist.csv'
    dbms=csv
    replace;
run;
```

SAS Proc Export

Exporting Data (cont.)

Using ODS

- SAS Output Delivery System
- Gives flexibility in generating reports
- Great for printing graphs or plots



```
ods pdf file="H:\odsoutput.pdf";
proc print data = subset_keep;
    where AgeAtStart < 30;
run;
ods pdf close;
```

SAS ODS output Tip Sheet