Statistical Methods and Computing, 22S:30/105
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Lab 3
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1 Using formats to get SAS to print something other than the values a variable actually contains

We will be using the billionaire dataset again today. Its variable called `region` contains abbreviations ("A" for Asia, "E" for Europe, etc.). If we want SAS to print out the complete words instead of the abbreviations, so that tables and graphs are more understandable, we need to run a "proc format" *before* the data step. The data step must then refer to the formats defined in the format procedure.

The `formchar` option is needed when printing tables as we will be doing later in the lab. You can copy it in from the file `formchar.sas` in the Datasets listing.

```
options linesize = 75
formchar = "|----|+|---+=|-/\<>*";



proc format ;
value $regfmt 'A' = 'Asia' 'E' = 'Europe' 'M' = 'Middle East'
              'O' = 'Other' 'U' = 'US' ;
run ;
```

Because the original data values in the region variable are characters rather than numbers, we have to use a dollar sign as the first character in the name of the format.

Note the format statement in the data step below. It tells SAS to apply the format you have defined here to a particular variable. When you use the format statement in a data step, you must put a period at the end of the format name.

2 Using labels to get SAS to print more descriptive variable names

```
data billion ;
input wealth age region $ ;
format region $regfmt. ;
label wealth = 'Wealth in Billion $'
         age = 'Age in Years' ;
datalines ;
< copy and paste data in here>
;
run ;
```

Now enter and run the following code to see how the formats and labels affect the output of the "print" and "freq" procedures.

```
proc print data = billion (obs = 20);
run ;

proc print label data = billion (obs = 20);
run ;

proc freq data = billion ;
```

```
tables region ;
run ;
```

3 Formats for numeric variables

Formats can also be used to group numeric data. Add a line to your format procedure and change one line in the data step as follows:

```
proc format ;
value $regfmt 'A' = 'Asia' 'E' = 'Europe' 'M' = 'Middle East'
              'O' = 'Other' 'U' = 'US' ;
value amtfmt low-<5 = '<5' 5-<10 = '5-<10' 10-<20 = '10-<20' 20-high = '20+' ;
run ;

data billion ;
input wealth age region $ ;
format region $regfmt. wealth amtfmt. ;
label wealth = 'Wealth in Billion $'
         age = 'Age in Years' ;
datalines ;
<data>
;
run ;
```

To see the effect of adding this format:

```
proc print data = billion ;
run ;

proc freq data = billion ;
tables wealth ;
run ;
```

4 Proc means

Gulanick (*Heart and Lung*, 1991) studied patients who were recovering from heart surgery. She was interested in whether different combinations of supervised exercise or teaching would affect patients' self-efficacy (or confidence) to perform physical activity.

Patients were randomly assigned to one of three groups. Group 1 received teaching, treadmill exercise testing, and exercise training three times per week. Group 2 received only teaching and exercise testing. Group 3 received only routine care without supervised exercise or teaching. After 4 weeks, each patient was scored on self-efficacy.

Self-efficacy was measured on a continuous scale and scores were assumed to be distributed normally in each of the populations of interest. Her results are in the dataset "gulanick.dat." We wish to produce a table that shows the number of observations and the mean and standard deviation of scores within each of the three groups.

```
proc format ;
value grpfmt 1 = 'Teaching and Training' 2 = 'Teaching' 3 = 'Neither' ;
run ;
```

```
data gulan ;
input score group ;
format group grpfmt. ;
datalines ;
< copy data in here>
;
run ;
```

We can use *proc means* to get various summary statistics in a more compact format than *proc univariate* provides. The default statistics provided are

- n = number of observations
- mean
- std dev = standard deviation
- minimum
- maximum

```
proc means data = gulan ;
var score ;
where group eq 1 ;   * restricts to those records with group = 1 ;
run ;
```

```
                          The MEANS Procedure

                       Analysis Variable : score

    N            Mean         Std Dev         Minimum         Maximum
   ------------------------------------------------------------------
   11     126.8181818      24.2520852     100.0000000     170.0000000
```

5 Confidence intervals

We can request other descriptive statistics by specifying them as part of the *proc means* statement. One that you will need soon is the *confidence interval* for the mean. Putting “clm alpha = .05” on the end of the *proc means* statement produces a 95% confidence interval.

```
                          The MEANS Procedure

                       Analysis Variable : score

                                            Lower 95%       Upper 95%
    N            Mean         Std Dev     CL for Mean     CL for Mean
   ------------------------------------------------------------------
   11     126.8181818      24.2520852     110.5254093     143.1109543
   ------------------------------------------------------------------
```

6 Using `proc tabulate` to summarize the distributions of quantitative variables in different groups

```
proc tabulate data = gulan ;
class group ;  * class statement identifies qualitative variables ;
var score ;    * var statement identifies quantitative variables ;
tables group , score * (n mean std) ;
run ;
```

```
       ---------------------------------------------------------
       |                |                score                 |
       |                |--------------------------------------|
       |                |     N      |    Mean    |    Std     |
       |----------------+------------+------------+------------|
       |group           |            |            |            |
       |----------------|            |            |            |
       |Teaching and    |            |            |            |
       |Training        |       11.00|      126.82|       24.25|
       |----------------+------------+------------+------------|
       |Teaching        |       12.00|      128.42|       25.04|
       |----------------+------------+------------+------------|
       |Neither         |       13.00|      103.92|       17.71|
       ---------------------------------------------------------
```

7 More on `proc means`

The following code will produce means for this dataset of the values in the variables “wealth” and “age.”

```
proc means data = billion n mean ;
var wealth age ;
title 'Average Age and Wealth of 1992 Billionaires' ;
run ;
```

```
                          The MEANS Procedure

         Variable    Label                     N            Mean
         ------------------------------------------------------
         wealth      Wealth in Billion $     233       2.6815451
         age         Age in Years            225      64.0311111
         ------------------------------------------------------
              Average Age and Wealth of 1992 Billionaires
```

Since our dataset contains an observation for every billionaire in the world in 1992, if the population of interest is billionaires in 1992, is this a population mean or a sample mean?

If we want a separate mean for each region, we must first make sure that the dataset is sorted in order by region, and then run “proc means” with an additional “by” statement.

```
proc sort ;
by region ;
run ;
```

```
proc means data = billion n mean ;
var wealth age ;
by region ;
title 'Average Age and Wealth of 1992 Billionaires' ;
title2 'By Region' ;
run ;
```

```
              Average Age and Wealth of 1992 Billionaires              7
                               By Region    10:19 Friday, March 14, 2014

----------------------------- region=Asia ------------------------------

                          The MEANS Procedure

         Variable    Label                    N            Mean
         ------------------------------------------------------
         wealth      Wealth in Billion $     38       2.6210526
         age         Age in Years            37      63.6486486
         ------------------------------------------------------


---------------------------- region=Europe -----------------------------

         Variable    Label                    N            Mean
         ------------------------------------------------------
         wealth      Wealth in Billion $     80       2.2075000
         age         Age in Years            76      64.0263158
         ------------------------------------------------------


-------------------------- region=Middle East --------------------------

         Variable    Label                    N            Mean
         ------------------------------------------------------
         wealth      Wealth in Billion $     22       4.2636364
         age         Age in Years            22      64.2272727
         ------------------------------------------------------


----------------------------- region=Other -----------------------------

         Variable    Label                    N            Mean
         ------------------------------------------------------
         wealth      Wealth in Billion $     29       2.2344828
         age         Age in Years            28      64.1428571
         ------------------------------------------------------


------------------------------ region=US -------------------------------

         Variable    Label                    N            Mean
         ------------------------------------------------------
         wealth      Wealth in Billion $     64       2.9687500
         age         Age in Years            62      64.1451613
         ------------------------------------------------------

proc means data = billion ;
class region ;
var wealth age ;
run ;

                   N
   region        Obs   Variable   Label                      Maximum
   -----------------------------------------------------------------
   Asia           38   wealth     Wealth in Billion $     14.0000000
                       age        Age in Years            83.0000000

   Europe         80   wealth     Wealth in Billion $     11.7000000
                       age        Age in Years            96.0000000

   Middle East    22   wealth     Wealth in Billion $     37.0000000
                       age        Age in Years           102.0000000

   Other          29   wealth     Wealth in Billion $      6.2000000
                       age        Age in Years            84.0000000

   US             64   wealth     Wealth in Billion $     24.0000000
                       age        Age in Years            88.0000000
   -----------------------------------------------------------------
```

Proc tabulate for the billionaire data.

```
proc tabulate data = billion ;
class region ;
var age ;
tables region, age * (mean stddev) ;
run ;
```

```
-------------------------------------------
|                |      Age in Years       |
|                |-------------------------|
|                |    Mean    |   StdDev   |
|----------------+------------+------------|
|region          |            |            |
|----------------|            |            |
|Asia            |       63.65|        9.96|
|----------------+------------+------------|
|Europe          |       64.03|       14.70|
|----------------+------------+------------|
|Middle East     |       64.23|       19.53|
|----------------+------------+------------|
|Other           |       64.14|       13.08|
|----------------+------------+------------|
|US              |       64.15|       11.88|
-------------------------------------------
```