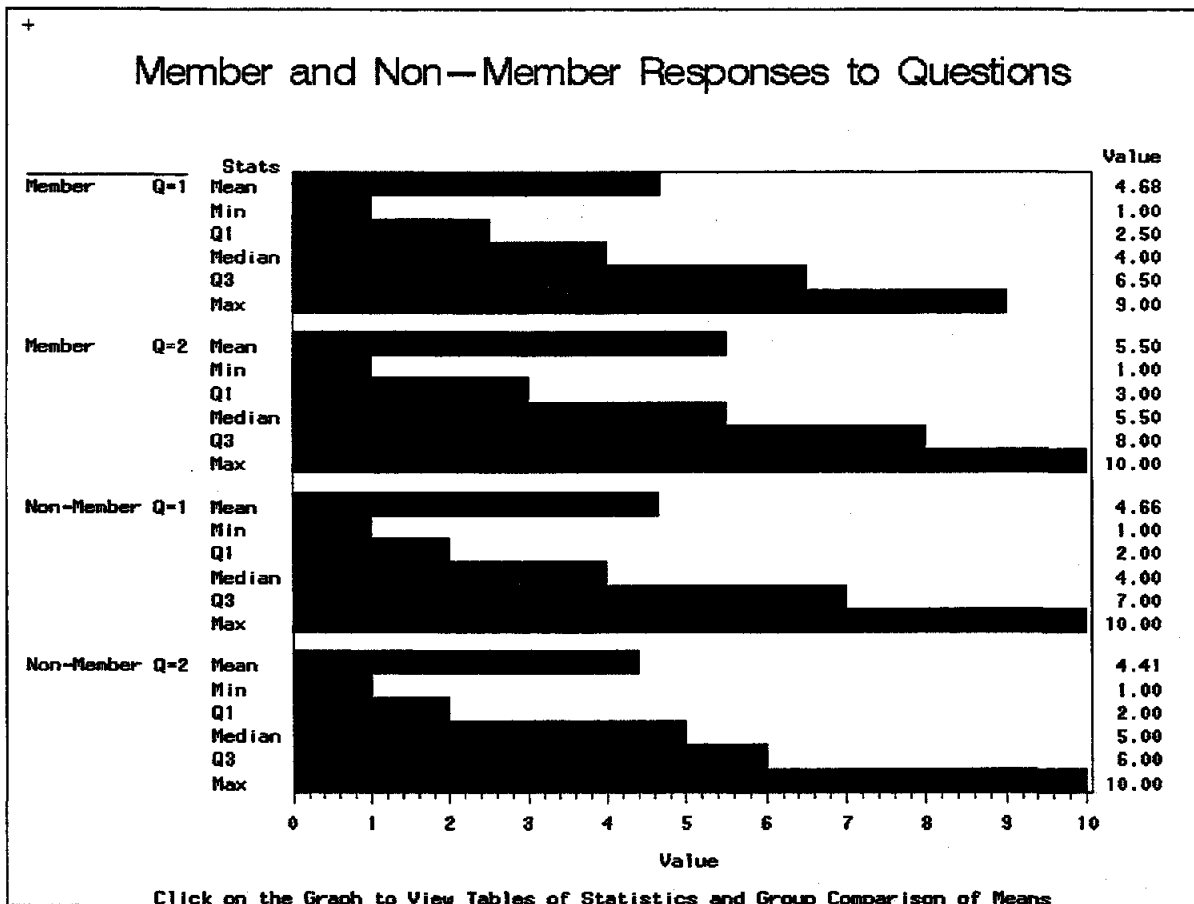


General Guidelines for Creating Useful Static HTML Reports

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HTML output is simple to create in SAS procedures and data steps and adds a level of flexibility and structure not available with standard listing files. Besides the advantage of being able to display reports on the Web, HTML files are also far easier to transfer to Excel and, once in Excel, easy to cut and paste into Power Point or Word. Furthermore, HTML reports can be physically related to each other via links. These links allow the viewer of the report to click a portion of one report and be transferred to another report that relates to the previous report. This capability allows drill-downs of data to be presented to the user. For example, the following graph can be linked to a table so that when the viewer clicks the graph, the table will appear. The table can also be linked so that the viewer can return to the graph.



Group	Question	N	Mean	Std	Max	Q3	Median	Q1	Min
Member	1	44	4.68	2.48	9	7	4	3	1
	2	44	5.50	2.71	10	8	6	3	1
N/on-Member	1	56	4.66	3.25	10	7	4	2	1
	2	56	4.41	2.57	10	6	5	2	1

[Click here to view graph.](#)

HTML files are particularly good for transporting Proc Tabulate results into Excel, where they can be used as source data or copied as is into Power Point for presentation. Or, they can be copied from Power Point into a Word document for inclusion as an example. Then they can be resized until they fit the page and then fixed to that place by turning off the 'float over location' option. Thereafter, they are part of the Word document. That was the process followed with the table below

Silver Slings Survey Results

Which of the following is your favorite benefit of being a Silver Slings member?

Answer	Cell One		Cell Two		Cell Three		Total	
	Count	Pct	Count	Pct	Count	Pct	Count	Pct
Free Aspirin	65	31.6	61	33.2	74	36.6	200	33.8
No-Cost Crutches	27	13.1	29	15.8	27	13.4	83	14
Express Ambulance	41	19.9	34	18.5	33	16.3	108	18.2
Annual Checkup	25	12.1	27	14.7	29	14.4	81	13.7
Wrist Id Bracelet	48	23.8	33	17.9	39	19.9	120	20.3
Total	206	100	184	100	202	100	592	100

Though HTML output was available in Version 6, it is much easier to use in Version 8 because of the availability of the Output Delivery System (ODS). Below are the basic ODS statements. Their use is illustrated in the solution to the example problem that follows.

- ODS OUTPUT *object1*=data_set_name1 *object2*=data_set_name2 ...;

Captures the data in one or more ODS objects and places it in designated SAS data sets.

- ODS LISTING CLOSE;

Closes the LISTING destination to output. Without it, output will go to both the listing and the HTML files.

- ODS HTML BODY= *fileref*;

•
•
•

ODS HTML CLOSE;

Opens the HTML output destination and assigns an HTML file to receive all ODS output until the ODS HTML CLOSE statement.

- FILE PRINT ODS; or, FILE PRINT ODS =(variables=(Customer Address BusinessPhone));

Directs the print listing output to Output Delivery System, which will route it to the HTML file. The 'variables=' option can be used to limit which variables will form the columns of the HTML.

- PUT _ODS_; or, PUT _ODS_ @1 Customer @2 Address @3 HomePhone;

Writes each record to the ODS output destination. Can also be used to control which variables have their *values* written to the columns (1,2,3) of the HTML.

The Example Problem

A survey is given to two groups of people. One group consists of members of an organization, and the other group consists of non-members of the organization. Questions in the survey ask that the respondents rate on a scale of one to ten how much they value specific goods or services. In the analysis of the survey we want to see the distribution of responses to each question for each group. And we want to know if any rated items are valued more by one group than the other. For this paper the survey responses are generated using random number functions in a SAS data step for the two groups for two questions.

The SAS procedures UNIVARIATE and TTEST are selected for the analysis. The minimum, maximum, and Quantile statistics from UNIVARIATE show the distribution of the responses by each group. The UNIVARIATE procedure calculates the N, mean, and standard deviation statistics that are input to the TTEST procedure to determine if the mean response for a given question is statistically different for each group.

Using Proc UNIVARIATE with ODS

Before ODS the a proc Univariate step for this example would be coded as follows:

```
proc univariate data=testCase noprint;
  by group q;
  var rating;
  output out=stats
         n=N
         mean=Mean
         std=Std
         min=Min
         q1=Q1
         median=Median
         q3=Q3
         max=Max;
run;
```

Since SAS Version 7 the output delivery system provides output tables with all calculated statistics for each combination by variables automatically. There is no need to request statistics in an "output" statement. With ODS, the noprint option is replaced with the "ODS LISTING CLOSE" statement. The following PROC UNIVARIATE and ODS code provide access to all calculated statistics:

```
ods listing close;

ods output Moments =MomentsOut
          Quantiles=QuantilesOut;

proc univariate data=testCase;
  by group q;
  var rating;
run;
```

The UNIVARIATE step creates ODS output tables "Moments" and "Quantiles" automatically. Every SAS procedure produces ODS output objects that can be viewed in the Results viewer. The names of the objects are different for each procedure. There are two ways to find out the names of the output objects. The easiest way is to look in the Results viewer. The Results directory tree under Univariate will have one node for each by variable combination. Select a node and then select the response variable node (Rating in this example). Below the Rating node, icons for Moments and Quantiles are displayed. These folder icons contain two displays of the calculated statistics. The first is an HTML presentation that can be opened with a browser. The second is a table represented with a table icon. Any object represented with a table icon can be opened with the SAS table viewer, and it can be captured in a SAS data set by using an ODS output statement. The second way to discover the name of the ODS objects is to proceed the proc step with the statement "ODS trace on;" and follow the proc step with the statement "ODS trace off". For the example problem ODS trace produces the following in the SAS log:

```
17 ods trace on;
18 proc univariate data=testCase;
19   by group q;
20   var rating;
21
22   run;
```

NOTE: Writing HTML Body file: sashtm.htm

Output Added:

```
-----
Name:      Moments
Label:     Moments
Template:  base.univariate.Moments
Path:     Univariate.ByGroup1.Rating.Moments
-----
```

Output Added:

```
-----
Name:      BasicMeasures
Label:     Basic Measures of Location and Variability
Template:  base.univariate.Measures
Path:     Univariate.ByGroup1.Rating.BasicMeasures
-----
```

Output Added:

```
-----
Name:      TestsForLocation
Label:     Tests For Location
Template:  base.univariate.Location
Path:     Univariate.ByGroup1.Rating.TestsForLocation
-----
```

Output Added:

```
-----
Name:      Quantiles
Label:     Quantiles
Template:  base.univariate.Quantiles
Path:     Univariate.ByGroup1.Rating.Quantiles
-----
```

Output Added:

```
-----
Name:      ExtremeObs
Label:     Extreme Observations
Template:  base.univariate.ExtObs
Path:     Univariate.ByGroup1.Rating.ExtremeObs
-----
```

Only the "Moments" and "Quantiles" output are accessible as tables. These objects can be captured with the following ODS output statement that captures the data in the tables to SAS data sets "MomentsOut" and "QuantilesOut".

```
ods output Moments =MomentsOut
           Quantiles=QuantilesOut;
```

The data captured is in the tables below.

ODS Output: Moments Data Set from Proc Univariate

Group	Q	VarName	Label1	cValue1	nValue1	Label2	Cvalue2	nValue2
1	1	Rating	N	44	44	Sum Weights	44	44
1	1	Rating	Mean	4.68181818	4.68181	Sum Observations	206	206
1	1	Rating	Std Deviation	2.47567447	2.47567	Variance	6.1289640	6.12896
1	1	Rating	Skewness	0.37409287	0.37409	Kurtosis	-0.943339	-0.94334
1	1	Rating	Uncorrected SS	1228	1228	Corrected SS	263.54545	263.5455
1	1	Rating	Coeff Variation	52.8784837	52.87848	Std Error Mean	0.3732219	0.373222

ODS Output: Quantiles Data Set from Proc Univariate

Group	Q	VarName	Quantile	Estimate
1	1	Rating	100% Max	9
1	1	Rating	99%	9
1	1	Rating	95%	9
1	1	Rating	90%	9
1	1	Rating	75% Q3	6.5
1	1	Rating	50% Median	4
1	1	Rating	25% Q1	2.5
1	1	Rating	10%	2
1	1	Rating	5%	1
1	1	Rating	1%	1
1	1	Rating	0% Min	1

NOTE: This illustration only shows statistics for Group=1 and q=1; however, each table contain data for all by variable combinations.

The TTEST Procedure

We have now captured more statistics than we ever wanted to know about the responses to questions 1 and 2. The next step is to select the number of observations, mean, and standard deviation from the MomentsOut data set for input into proc TTEST with the following data step:

```

data Moments (keep=Group q _Stat_ Value);
  set MomentsOut (where=(Label1 in('N','Mean','Std Deviation')));
  _Stat_ = Label1;
  if _Stat_ eq 'Std Deviation' then
    _Stat_ = 'Std';
  Value = nValue1;
run;

```

Proc TTEST requires an input data set containing a character variable called `_stat_` containing the names of the three statistics for each combination of by variables along with a numeric variable that contains the value of the statistic. The column named "Label1" contains the names of the statistics, and the column "nValue1" contains the numeric representations of the statistics.

The QuantilesOut data set is prepared by the following data step for transformation into input data for the tabular data presentation.

```

data Quantiles (Keep=Group q Quantile Q_Value);
  set QuantilesOut
    (where=(Quantile in('100% Max','75% Q3','50% Median',
                        '25% Q1','0% Min')));
  Q_Value=estimate;
  select(Quantile);
    when('100% Max')   Quantile='Max';
    when('75% Q3')    Quantile='Q3';
    when('50% Median') Quantile='Median';
    when('25% Q1')    Quantile='Q1';
    when('0% Min')    Quantile='Min';
  end;
run;

```

Proc TTEST produces the ODS output objects "Ttests" and "Equality" containing the T and F statistic calculations respectively. The code required for the T-test is below. It is followed by the data tables from the Results viewer.

```

ods output Ttests  =Ttests(keep= q Variances ProbT)
           Equality =Equality(keep=q ProbF);

```

```

PROC SORT DATA=Moments;
  by q;
run;

```

```

proc ttest data=Moments;
  class Group;
  by q;
  var value;
run;

```

ODS Output: Ttests Data Set from Proc Ttest

Q	Variable	Method	Variances	Tvalue	DF	Probt
1	Value	Pooled	Equal	0.035694	98	0.971599
1	Value	Satterthwaite	Unequal	0.036861	97.92406	0.970671
2	Value	Pooled	Equal	2.054864	98	0.042553
2	Value	Satterthwaite	Unequal	2.042113	90.1561	0.044062

ODS Output: Equality Data Set from Proc Ttest

Q	Variable	Method	NumDF	DenDF	FValue	ProbF
1	Value	Folded F	55	43	1.722235	0.066411
2	Value	Folded F	43	55	1.108247	0.713139

The T-test determines if the value of each question mean response is significantly different (default alpha=.05). Two values of the T statistic are calculated for each question. The Pooled method assumes the variances of the two populations are equal, and the Satterthwaite method assumes unequal variances. The F statistic tests for equality of variances. Based on the value of ProbF the proper method for calculating T is selected by the following code:

```
data TVar(keep=q EqProbT UnEqProbT);
  set Ttests;
  retain EqProbT;
  by q;
  select(Variances);
    when('Equal')      EqProbT=Probt;
    when('Unequal')    UnEqProbT=Probt;
  end;
  if last.q then Output;
run;

data EqualMeans (keep= q Equal Probt ProbF);
  length Equal $3;
  merge TVar Equality;
  by q;
  if ProbF ge .05 then Probt=EqProbT;
  else Probt=UnEqProbT;
  if Probt ge .05 then Equal='Yes';
  else Equal='No';
run;
```

A value of ProbF equal to .05 or more indicates equal variances. A value of Probt equal to or greater than .05 indicates equal means. In this example the variances are equal for both questions. Question 1 means are equal, and question 2 means are unequal.

Publishing the results in HTML format

Presentation of analysis results in HTML format is accomplished by directing the ODS output objects to HTML files. Hyperlink navigation is enabled by HTML code imbedded in a footnote that allows the viewer of tabular data to link to the graphical presentation of the response statistics. The graphic representation of the data includes an HTML anchor that links one to the tabular representation.

Tabular Presentation

The following ODS statement opens the HTML destination and gives the path and filename of the HTML file for the tabular data. Subsequent data steps write the data to the HTML file.

```
ods html body='..\Reports\CompareQ.htm';
Title1 'Member/Non-Member Responses to Questions 1 and 2';
Title2 'Statistics';
footnote '<a href=StatGraf.htm> <font color=red>
        Click here to view graph.</font></a>';

data _null_;
  set stats;
  by group;
  if first.group=0 then group=.;
  file print ods;
  put _ods_;
run;

title 'Group Mean Responses by Member and Non-Members Groups';
footnote ;

data _null_;
  length q 3 Equal $3 ProbT ProbF 8;
  format ProbT ProbF 5.3;
  label q      = 'Question'
        Equal = 'Means Equal'
        ProbT  = 'Pr>T'
        ProbF  = 'Pr>|F|';
  set EqualMeans;
  file print ods;
  put _ods_;
run;

ods html close;
```

NOTE: The creation of data sets stats and EqualMeans by a series of transformations and merges can be seen in the program listing at the end of the paper following the comment line:
"**** Transpose and Combine the Datasets ***;"

The ODS and file statements inside the data _NULL_ steps direct the output to the file designated in the first ODS HTML statement. That HTML file is closed with the HTML CLOSE statement. The first footnote statement has HTML code included between the <> characters to establish a link to the graphic data file and designates that the instructions: "Click Here to view graph" will be in red.

The resulting tabular presentation is:

Member/Non-Member Responses to Questions 1 and 2 Statistics

group	Question	N	Mean	Std	Max	Q3	Median	Q1	Min
Member	1	44	4.68	2.48	9	7	4	3	1
	2	44	5.50	2.71	10	8	6	3	1
Non-Member	1	56	4.66	3.25	10	7	4	2	1
	2	56	4.41	2.57	10	6	5	2	1

[Click here to view graph.](#)

Group Mean Responses by Member and Non-Members Groups

Question	Means Equal	Pr>T	Pr> F
1	Yes	0.972	0.066
2	No	0.043	0.713

Graphic Data Presentation

A chart data set based on the data in the stats data set is created with the following code:

```
proc transpose data=Stats out=Xstats(rename=(_name_=stats Coll=value));
  by Group Question;
run;

proc format ;
  value QGrp
    1 = 'Member      Q=1'
    2 = 'Member      Q=2'
    3 = 'Non-Member  Q=1'
    4 = 'Non-Member  Q=2'
  ;
run;
```

```

Data Chart (keep=GrpQ stats value drill);
  set Xstats;
  label stats = 'Stats'
        value = 'Value'
        GrpQ = '_____';

  if stats ne 'N';      /* Drop N and          */
  if stats ne 'Std';    /* Std from the Chart */

  /* Provide reference for drill-down to the data table */
  drill='href=CompareQ.htm';

  /* Combine Group and Question into a single variable */
  select(Group);
    when(1) do;
      if Question eq 1 then GrpQ=1;
      if Question eq 2 then GrpQ=2;
    end;
    when(2) do;
      if Question eq 1 then GrpQ=3;
      if Question eq 2 then GrpQ=4;
    end;
  end; **Select**;
run;

```

The drill variable in the chart data set contains the name of the HTML file that contains the tabular HTML data. Proc GCHART below references the value of drill for the hyperlink to the tabular data.

The graphic is created by proc GCHART as a GIF file, which is directed to the HTML output destination file as follows:

```

ods html body='../Reports\StatGraf.htm';
goptions device=gif goutmode=replace;

Title 'Member and Non-Member Responses to Questions';
footnote 'Click on the Graph to View Tables of Statistics and
        Group Comparison of Means';

Proc Gchart data=Chart;
  format GrpQ QGrp.;
  hbar stats /
      name='Group'
      sumvar=value
      midpoints= 'Mean' 'Min' 'Q1' 'Median' 'Q3' 'Max'
      space=0
      group=GrpQ
      html=drill;
run;

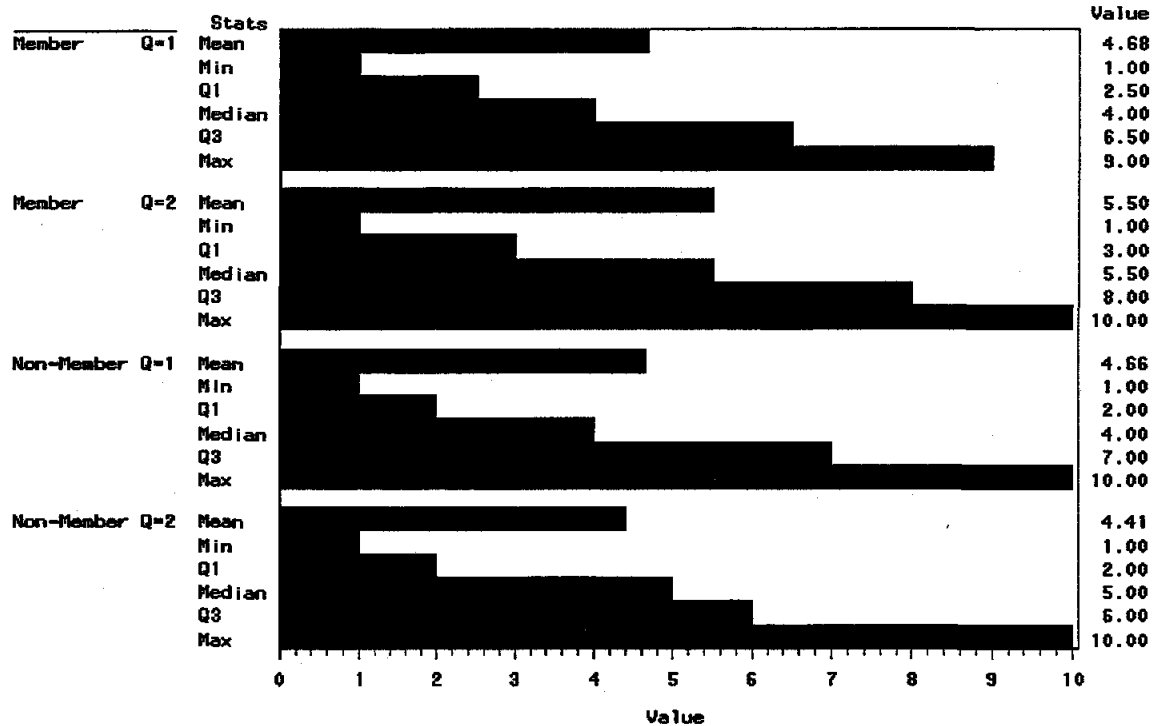
quit;
ods html close;

```

The device=gif GOPTION designates that a GIF file will be created. The HBAR option name='Group' assigns a filename in the default SAS directory. The file StatGraf.htm is opened to view the graphic presentation. For the hyperlinks to work properly the tabular HTML file, graphic HTML file, and the graphic GIF file must all be located in the same directory.

The resulting graphic output is that shown on the first page:

Member and Non-Member Responses to Questions



Click on the Graph to View Tables of Statistics and Group Comparison of Means

The complete program listing begins on the next page.

Program Listing

```
libname pap '..\SasData';

data pap.testCase (keep=id group q rating);
do i=1 to 100;
  id=99+i;
  group=round(ranuni(0))+1;
  do q=1 to 2;
    if group eq 1 then Rating=round(9*(ranuni(0)),1)+1;
    else Rating=round(abs(4*(normal(0)+1)),1);
    if rating gt 10 then rating =10;
    if rating eq 0 then rating=1;
  output;
end;
end;
run;

proc format ;
  value grp
    1='Member'
    2='Non-Member'
    .=' ';
run;
proc sort data=pap.testCase;
by group q;
run;

ods listing close;

ods output Moments =MomentsOut
           Quantiles=QuantilesOut;

proc univariate data=pap.testCase;
by group q;
var rating;

run;

data Moments (keep=Group q _Stat_ Value);
set MomentsOut (where=(Label1 in('N','Mean','Std Deviation')));
_Stat_=Label1;
if _Stat_ eq 'Std Deviation' then _Stat_='Std';
Value = nValue1;

run;
```

```

data Quantiles (Keep=Group q Quantile Q_Value);
  set QuantilesOut (where=(Quantile in('100% Max','75% Q3','50%
Median','25% Q1','0% Min')));
  Q_Value=estimate;
  select(Quantile);
  when('100% Max')    Quantile='Max';
  when('75% Q3')      Quantile='Q3';
  when('50% Median')  Quantile='Median';
  when('25% Q1')      Quantile='Q1';
  when('0% Min')      Quantile='Min';
end;
run;

```

```

ods output Ttests =Ttests(keep= q Variances ProbT)
           Equality =Equality(keep=q ProbF);

```

```

PROC SORT DATA=Moments;
by q;
run;

```

```

proc ttest data=Moments;
class Group;
by q;
var value;
run;

```

```

data TVar(keep=q EqProbT UnEqProbT);
set Ttests;
retain EqProbT;
by q;

```

```

  select(Variances);
  when('Equal')      EqProbT=ProbT;
  when('Unequal')    UnEqProbT=ProbT;
end;
if last.q then Output;

```

```
run;
```

```

data EqualMeans (keep= q Equal ProbT ProbF);
merge TVar Equality;
length Equal $3;

```

```

if ProbF ge .05 then ProbT=EqProbT;
else ProbT=UnEqProbT;

```

```

if ProbT ge .05 then Equal='Yes';
else Equal='No';

```

```
run;
```

```

**** Transpose and Combine the Datasets ***;
proc sort data=Moments ;
by Group ;
run;

```

```

proc transpose data=Moments out=Xmoments( drop=_Name_);
by group q;
id _stat_;
var Value;
run;
proc transpose data=Quantiles out=Xquantiles( drop=_Name_);
by group q;
id Quantile;
var Q_Value;
run;

data Stats (rename=(q=Question));
length group q N Mean Std 8;
merge Xmoments Xquantiles;
by group q;

format mean std 5.2 group q 2.0 N min max median Q3 Q1 3.0 group grp.;

run;

ods html body='../Reports\CompareQ.htm';
Title 'Member/Non-Member Responses to Questions 1 and 2';
title2 'Statistics';
footnote
'<a href=c:\paper\Reports\StatGraf.htm> <font color=red>Click here to
view graph.</font></a>';
data _null_;
set stats;
by group;

if first.group=0 then group=.;

file print ods;
put _ods_;

run;
title 'Comparison of Group Mean Responses by Member and Non-Members
Groups';
footnote ;
data _null_;
length q 3 Equal $3 ProbT ProbF 8;
set EqualMeans;
file print ods;

put _ods_;

format ProbT ProbF 5.3;
label q= 'Question'
      Equal='Means Equal'
      ProbT='Pr>T'
      ProbF='Pr>|F|';
run;

ods html close;

ods listing;

```

```

proc transpose data=Stats out=Xstats(rename=(_name_=stats Coll=value));
  by Group Question;
run;

proc format ;
value QGrp
  1='Member      Q=1'
  2='Member      Q=2'
  3='Non-Member  Q=1'
  4='Non-Member  Q=2'
;
run;

Data Chart (keep=GrpQ stats value drill);
set Xstats;

  label stats = 'Stats'
        value = 'Value'
        GrpQ = '_____';

  if stats ne 'N';      /* Drop N and          */
  if stats ne 'Std';    /* Std from the Chart */

  drill='href=CompareQ.htm'; /* Add a variable containing the HREF to
tables */
  select(Group); /* Combine Group and Question into a single variable */
    when(1) do;
      if Question eq 1 then GrpQ=1;
      if Question eq 2 then GrpQ=2;
    end;
  when(2) do;
      if Question eq 1 then GrpQ=3;
      if Question eq 2 then GrpQ=4;
    end;
  end; **Select**;

run;

```

```

ods listing close;
options nodate nonumber;
goptions reset=all;
ods html body='../Reports\StatGraf.htm';
goptions device=gif goutmode=replace;

Title 'Member and Non-Member Responses to Questions';
footnote 'Click on the Graph to View Tables of Statistics and Group
Comparison of Means';
Proc Gchart data=Chart;
    format GrpQ QGrp.;
    hbar stats /
        name='Group'
        sumvar=value
        midpoints= 'Mean' 'Min' 'Q1' 'Median' 'Q3' 'Max'
        space=0
        group=GrpQ
        html=drill;
run;
quit;
ods html close;
ods listing;

```