

ENHANCING SAS OUTPUT WITH OUTPUT DELIVERY SYSTEM (ODS)

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OUTLINE

- ODS Conceptually
- SAS 9.3 – ODS
- Different types of output
 - Listing, HTML, PDF, RTF, Excel
- Tracing and selecting procedure output
- Creating SAS dataset from ODS
- Styles, titles, footnotes
- Traffic-lighting

ODS Conceptually..

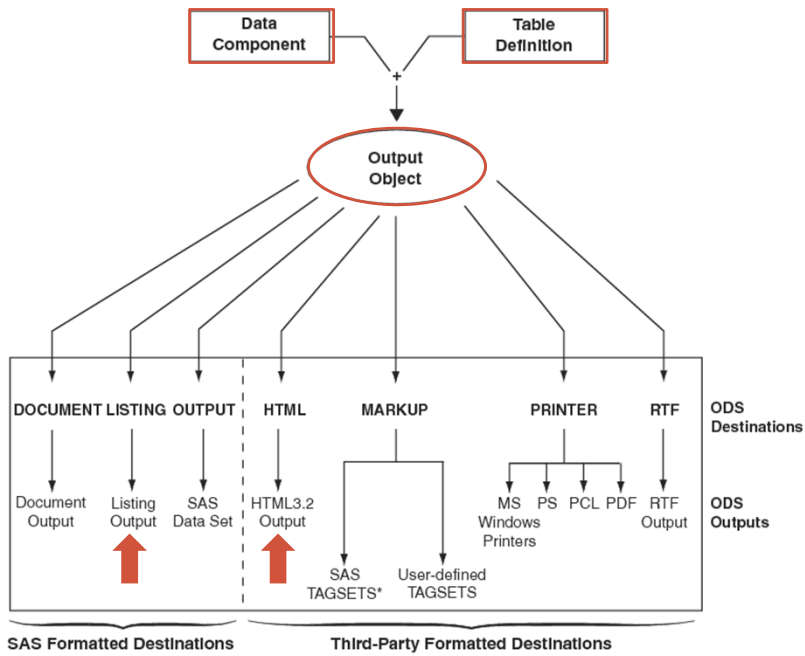


Data = Passengers

Sends them to proper destination

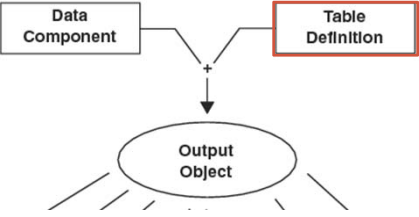


ODS Processing: What Goes In and What Comes Out



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ODS Processing: What Goes In and What Comes Out

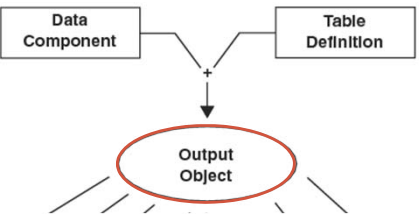


```
graph TD; DC[Data Component] --- J((+)); TD[Table Definition] --- J; J --> OO([Output Object]);
```

- View → Results → View → Templates
 - Click on “SAShelp.Tmplmst” → Click on “Styles”
 - Default is HTMLblue
 - Double click to see the PROC TEMPLATE code
 - You can modify and create your own template

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ODS Processing: What Goes In and What Comes Out



```
graph TD; DC[Data Component] --- J((+)); TD[Table Definition] --- J; J --> OO([Output Object]);
```

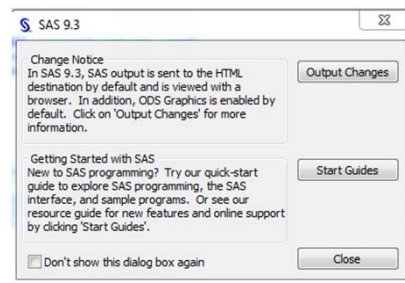
```
ods trace on;
proc-or-DATA-step;
ods trace off;
```

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SAS 9.3 – Major change!

- Default for output have changed in Windowing environment in Windows and Unix
 - ODS graphics – unabled
 - Listing – close
 - HTML (BLUE) – open
 - ODS HTML statement

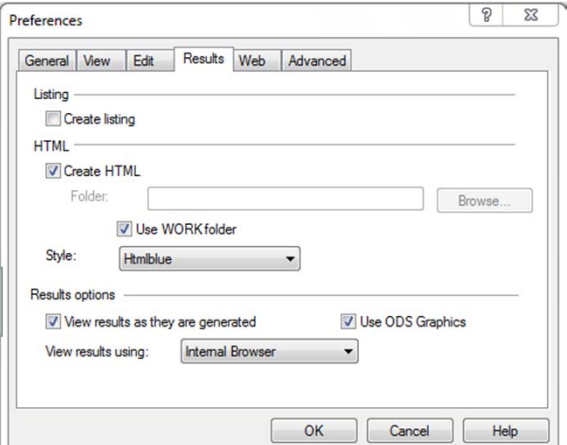


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Need back my listing output

```
ods graphics off;
ods html close;
ods listing;
```

Tools → Options →
Preferences → Results



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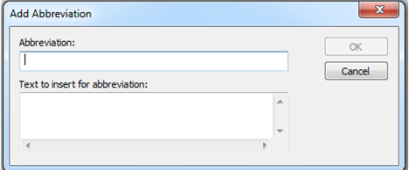
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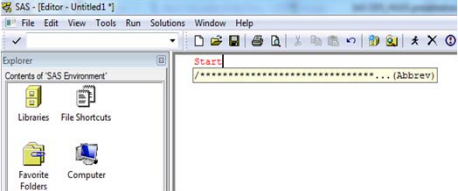
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***** TIP # 1**

- Tools → Add abbreviation → “Write abbreviation” → “Write Text to insert for abbreviation”



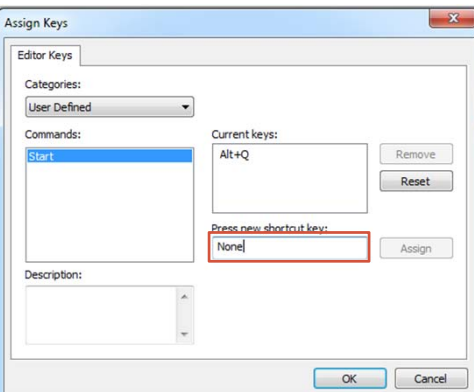
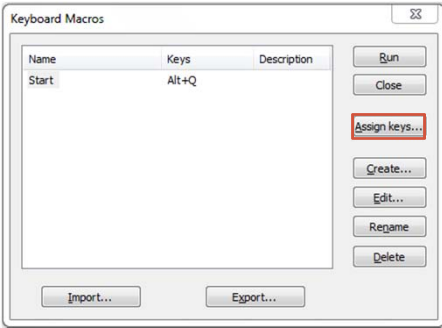
- Write the abbreviation → entire write-up will show up



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***** TIP # 1**

- Tools → Keyboard Macros → Macros → Assign keys



Listing output

- DATASET = SASHELP.CARS

```
ods html close;
ods listing;

proc print data=SASHELP.CARS (obs=10);
VAR make model type msrp;
run;

ods listing close;
ods html;
```



Listing output

The SAS System 14:59 Tuesday, February 21, 2012

Obs	Make	Model	Type	MSRP
1	Acura	MDX	SUV	\$36,945
2	Acura	RSX Type S 2dr	Sedan	\$23,820
3	Acura	TSX 4dr	Sedan	\$26,990
4	Acura	TL 4dr	Sedan	\$33,195
5	Acura	3.5 RL 4dr	Sedan	\$43,755
6	Acura	3.5 RL w/Navigation 4dr	Sedan	\$46,100
7	Acura	NSX coupe 2dr manual S	Sports	\$89,765
8	Audi	A4 1.8T 4dr	Sedan	\$25,940
9	Audi	A4 1.8T convertible 2dr	Sedan	\$35,940
10	Audi	A4 3.0 4dr	Sedan	\$31,840



HTML output

```
Proc print data=SAShelp.cars (obs=10);
VAR make model type msrp;
run;
```

The SAS System

Obs	Make	Model	Type	MSRP
1	Acura	MDX	SUV	\$36,945
2	Acura	RSX Type S 2dr	Sedan	\$23,820
3	Acura	TSX 4dr	Sedan	\$26,990
4	Acura	TL 4dr	Sedan	\$33,195
5	Acura	3.5 RL 4dr	Sedan	\$43,755
6	Acura	3.5 RL w/Navigation 4dr	Sedan	\$46,100
7	Acura	NSX coupe 2dr manual S	Sports	\$89,765
8	Audi	A4 1.8T 4dr	Sedan	\$25,940
9	Audi	A41.8T convertible 2dr	Sedan	\$35,940
10	Audi	A4 3.0 4dr	Sedan	\$31,840



PDF output

```
ods PDF FILE = "C:\Users\Hemal\Documents\Sas
output\cars.pdf";
proc print data=SAShelp.cars (obs=10);
VAR make model type msrp;
run;
ODS PDF CLOSE;
```



PDF output

The screenshot shows the SAS Results Viewer interface. The main window displays a table titled "The SAS System" with 10 observations. The table columns are Obs, Make, Model, Type, and MSRP. The data is as follows:

Obs	Make	Model	Type	MSRP
1	Acura	MDX	SUV	\$36,945
2	Acura	RSX Type S 2dr	Sedan	\$23,820
3	Acura	TSX 4dr	Sedan	\$26,990
4	Acura	TL 4dr	Sedan	\$33,195
5	Acura	3.5 RL 4dr	Sedan	\$43,755
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7	Acura	NSX coupe 2dr manual S	Sports	\$89,765
8	Audi	A4 1.8T 4dr	Sedan	\$25,940
9	Audi	A4 1.8T convertible 2dr	Sedan	\$35,940
10	Audi	A4 3.0 4dr	Sedan	\$31,840



RTF output

```
ods RTF FILE = "C:\Users\Hemal\Documents\Sas
output\cars.rtf";
proc print data=SASHELP.CARS (obs=10);
VAR make model type msrp;
run;
ODS RTF CLOSE;
```



RTF output

12:15 Wednesday, February 22, 2012 1

The SAS System

Obs	Make	Model	Type	MSRP
1	Acura	MDX	SUV	\$36,945
2	Acura	RSX Type S 2dr	Sedan	\$23,820
3	Acura	TSX 4dr	Sedan	\$26,990
4	Acura	TL 4dr	Sedan	\$33,195
5	Acura	3.5 RL 4dr	Sedan	\$43,755
6	Acura	3.5 RL w/Navigation 4dr	Sedan	\$46,100
7	Acura	NSX coupe 2dr manual S	Sports	\$89,765
8	Audi	A4 1.8T 4dr	Sedan	\$25,940
9	Audi	A4 1.8T convertible 2dr	Sedan	\$35,940
10	Audi	A4 3.0 4dr	Sedan	\$31,840



RTF output

- Headers = Titles & Footers = Footnotes
 - `ODS RTF FILE='filename' BODYTITLE;`
 - `BODYTITLE` – puts it in the main document
- Orientation
 - `OPTIONS ORIENTATION=LANDSCAPE;`
 - `OPTIONS ORIENTATION=PORTRAIT;`
- Controlling page breaks
 - `ODS RTF FILE='filename.rtf' STARTPAGE=NO;`
- Page X OF Y
 - `OPTIONS NUMBER;`

RTF output

- Table of Contents – Cool !!!

```
ods RTF FILE = "C:\Users\Hemal\Documents\Sas
output\carscool.rtf" startpage = no
bodytitle CONTENTS=yes TOC_DATA;
```

- Open Word document → CTRL+A → F9
 - ToC is ready



RTF output

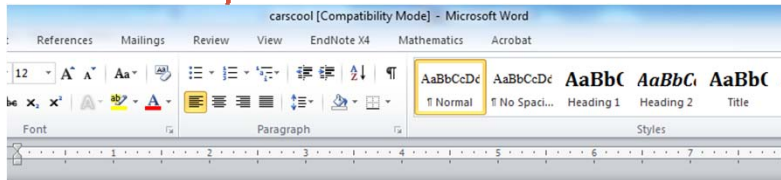


Table of Contents

The Print Procedure.....	1
Data Set SASHELP.CARS.....	1
The Means Procedure.....	1
Summary statistics.....	1
The Freq Procedure.....	1
Table Type * Origin.....	1
Cross-Tabular Freq Table.....	1
The Univariate Procedure.....	2
MSRP.....	2
Moments.....	2
Basic Measures of Location and Variability.....	2
Tests For Location.....	3
Quantiles.....	3
Extreme Observations.....	3



EXCEL output

```
ods tagsets.excelxp
file='C:\Users\Hemal\Documents\Sas
output\cars.xml' options (doc='help');

proc print data=SAShelp.cars (obs=10);
VAR make model type msrp;
run;

ODS tagsets.excelxp CLOSE;
```



EXCEL output

	A	B	C	D	E	F
	Obs	Make	Model	Type	MSRP	
2	1	Acura	MDX	SUV	\$36,945.00	
3	2	Acura	RSX Type S 2dr	Sedan	\$23,820.00	
4	3	Acura	TSX 4dr	Sedan	\$26,990.00	
5	4	Acura	TL 4dr	Sedan	\$33,195.00	
6	5	Acura	3.5 RL 4dr	Sedan	\$43,755.00	
7	6	Acura	3.5 RL w/Navigation 4dr	Sedan	\$46,100.00	
8	7	Acura	NSX coupe 2dr manual S	Sports	\$89,765.00	
9	8	Audi	A4 1.8T 4dr	Sedan	\$25,940.00	
10	9	Audi	A41.8T convertible 2dr	Sedan	\$35,940.00	
11	10	Audi	A4 3.0 4dr	Sedan	\$31,840.00	



*** TIP # 2

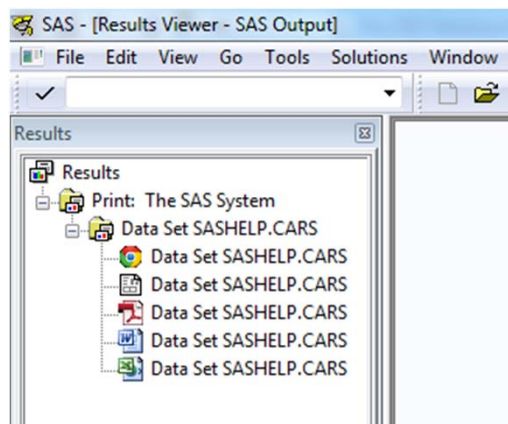
- Producing multiple outputs simultaneously

```
ods listing;  
ods pdf file='path name';  
ods rtf file='path name';  
ods tagsets.excelxp file= `path name';  
  
proc print data=SAShelp.cars (obs=10);  
VAR make model type msrp;  
run;  
  
ods _all_ close;  
  
*Closes all outputs;  
ods HTML;
```



*** TIP # 2

- Producing multiple outputs simultaneously



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Tracing Procedure Output

```
ODS TRACE ON;
```

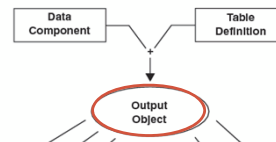
```
Proc means data = SAShelp.cars;
var MSRP;
run;
```

```
ODS TRACE OFF;
```

Output Added:

```
-----
Name:      Summary
Label:     Summary statistics
Template:  base.summary
Path:     Means.Summary
-----
```

ODS Processing: What Goes In and What Comes Out



Tracing Procedure Output

```
ODS TRACE ON;
```

```
Proc univariate data = SAShelp.cars;
var MSRP;
run;
```

```
ODS TRACE OFF;
```



Tracing Procedure Output

```
Output Added:
-----
Name:      Moments
Label:     Moments
Template:  base.univariate.Moments
Path:     Univariate.MSRP.Moments
-----

Output Added:
-----
Name:      BasicMeasures
Label:     Basic Measures of Location and Variability
Template:  base.univariate.Measures
Path:     Univariate.MSRP.BasicMeasures
-----

Output Added:
-----
Name:      TestsForLocation
Label:     Tests For Location
Template:  base.univariate.Location
Path:     Univariate.MSRP.TestsForLocation
-----

Output Added:
-----
Name:      Quantiles
Label:     Quantiles
Template:  base.univariate.Quantiles
Path:     Univariate.MSRP.Quantiles
-----

Output Added:
-----
Name:      ExtremeObs
Label:     Extreme Observations
Template:  base.univariate.ExtObs
Path:     Univariate.MSRP.ExtremeObs
-----
```



Selecting Procedure Output


```
*ODS SELECT  Univariate.MSRP.BasicMeasures;
ODS SELECT  Univariate.MSRP.ExtremeObs;
```

```
Proc univariate data = SAShelp.cars;
var MSRP;
run;
```

The SAS System

The UNIVARIATE Procedure
Variable: MSRP

Basic Statistical Measures		
Location		Variability
Mean	32774.86	Std Deviation 19432
Median	27635.00	Variance 377591613
Mode	13270.00	Range 182185
		Interquartile Range 18886

Note: The mode displayed is the smallest of 18 modes with a count of 

*** TIP # 3

- Trace and select for output
- Logistic regression / linear regression / MLM
 - Print what you need

*** TIP # 3

Output Added:

```
-----
Name:      NObs
Label:     Number of Observations
Template:  Stat.Reg.NObs
Path:     Reg.MODEL1.Fit.MSRP.NObs
-----
```

Output Added:

```
-----
Name:      ANOVA
Label:     Analysis of Variance
Template:  Stat.REG.ANOVA
Path:     Reg.MODEL1.Fit.MSRP.ANOVA
-----
```

Output Added:

```
-----
Name:      FitStatistics
Label:     Fit Statistics
Template:  Stat.REG.FitStatistics
Path:     Reg.MODEL1.Fit.MSRP.FitStatistics
-----
```

Output Added:

```
-----
Name:      ParameterEstimates
Label:     Parameter Estimates
Template:  Stat.REG.ParameterEstimates
Path:     Reg.MODEL1.Fit.MSRP.ParameterEstimates
-----
```

Output Added:

```
-----
Name:      DiagnosticsPanel
Label:     Fit Diagnostics
Template:  Stat.REG.Graphics.DiagnosticsPanel
Path:     Reg.MODEL1.ObswiseStats.MSRP.DiagnosticPic
-----
```

Output Added:

```
-----
Name:      ResidualPlot
Label:     MPG_Highway
Template:  Stat.REG.Graphics.ResidualPlot
Path:     Reg.MODEL1.ObswiseStats.MSRP.ResidualPlots
-----
```

Output Added:

```
-----
Name:      FitPlot
Label:     Fit Plot
Template:  Stat.REG.Graphics.Fit
Path:     Reg.MODEL1.ObswiseStats.MSRP.FitPlot
-----
```



*** TIP - 4

- Multiple outputs
 - Keep full for your reference and give other to your boss

```
ods rtf(1) file="C:\Users\Hemal\Documents\Sas
output\carscool3.rtf" ;
```

```
ods rtf(2) file="C:\Users\Hemal\Documents\Sas
output\carscool4.rtf" ;
ods rtf(2) select univariate.msrp.moments;
```

```
      Title "Proc Univariate for MSRP";
      Proc Univariate data = sashelp.cars;
      var msrp ;
      run;
```

```
ods _all_ close;
```

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Creating SAS dataset from ODS

```
*ods output BasicMeasures = work.BM;  
ods output ExtremeObs = work.EO;  
  
Proc univariate data = SAShelp.cars;  
var MSRP;  
run;  
  
ods output close;
```

Creating SAS dataset from ODS

```

19 ods output ExtremeObs = work.EO;
20 Proc univariate data = SAShelp.cars;
21 var MSRP;
22 run;

```

NOTE: The data set WORK.EO has 5 observations and 5 variables.

NOTE: PROCEDURE UNIVARIATE used (Total process time):

real time	0.13 seconds
cpu time	0.04 seconds

```

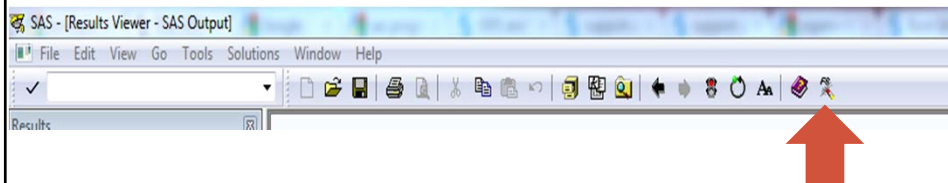
23 ods output close;

```



*** TIP # 5

- How to clear results from HTML windows browser
 - Annoying...
 - ONE WAY: ods html close; ods html;
 - SECOND WAY:



- <http://kenkleinman.net/home/index.php/sas-and-r-code/sas-tricks/77-clear-the-results-viewer-in-sas-93.html>

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Styles

```
ODS pdf FILE = "path name" STYLE=JOURNAL ;  
TITLE "Different types of styles";
```

```
Proc Univariate data = SAShelp.cars;  
var MSRP;  
run;
```

```
ODS pdf close;
```



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Styles

15:03 Wednesday, February 22, 2012 1

Different types of styles
Variable: MSRP

Moments			
N	428	Sum Weights	428
Mean	32774.8551	Sum Observations	14027638
Std Deviation	19431.7167	Variance	377591613
Skewness	2.79809927	Kurtosis	13.8792055
Uncorrected SS	6.20985E11	Corrected SS	1.61232E11
Coeff Variation	59.2884899	Std Error Mean	939.267478

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Titles, Footnotes

- General form of title & footnote

`TITLE` options 'text-string-1' options 'text-string-2' ... options 'text-string-n';

`TITLE1` options 'text-string-1';

`TITLE2` options 'text-string-1';

C	COLOR=	specifies a color for the text
BC	BCOLOR=	specifies a color for the background of the text
H	HEIGHT=	specifies the height of the text
J	JUSTIFY=	requests justification
F	FONT=	specifies a font for the text
	BOLD	makes text bold
	ITALIC	makes text italic

*** TIP # 6

- Use “automatic macro” variable cleverly in title and footnotes
 - `%PUT _ALL_;` - To see all automatic macro variable
- Footnote "Prepared by Hemal Mehta on &sysdate, &sysday at &systemtime";

Prepared by Hemal Mehta on 22FEB12, Wednesday at 15:03

Web / Hyperlink in SAS

- `TITLE5 link="http://www.sas.com" "Click to go to SAS website";`
- `ODS RTF TEXT='^S={URL="http://www.myweb.com"}Source: www.myweb.com';`



Superscript, Subscript

```
ods escapechar = "~";

title 'This value is superscripted~{super 1}';
title3 'This value is subscripted~{sub 2}';

Proc print data = sashelp.heart (obs = 10);
Var height weight;
run;

footnote2 "Look ~{sub UNDER} and ~{super OVER}
everything.";
```



Superscript, Subscript

This value is superscripted¹

This value is subscripted₂

Look _{UNDER} and ^{OVER} everything.



Page X of Y

RTF / PDF

```
OPTIONS NONUMBER;
ODS ESCAPECHAR='~';
```

```
title justify=center 'ABC'
justify=right 'Page ~{pageof}';
```

RTF only

```
title justify=center 'ABC'
justify=right 'Page ~{thispage} of
~{lastpage}';
```

RTF & PDF
both

Inserting symbols

```
title 'Greek symbol Alpha ~{unicode alpha}';
title2 'Copyright symbol ~{unicode 00A9}';
title3 'White Chess Rook is ~{unicode
2656}';
proc print data=sashelp.class(obs=1); run;
```

Greek symbol Alpha α
Copyright symbol ©
White Chess Rook is ♖

Obs	Name	Sex	Age	Height	Weight
1	Alfred	M	14	69	112.5



Inserting LOGO

- You can add University/Company logo in all outputs

ODS ESCAPECHAR = “~”;

- TITLE
- FOOTNOTE
- BACKGROUND

Prepared by Hemal Mehta on 22FEB12, Wednesday at 15:03

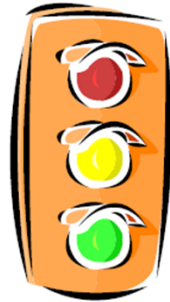
UNIVERSITY of **HOUSTON**
YOU ARE THE PRIDE

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Traffic-lighting

- Traffic lighting is highlighting individual cells based on the cell's value.



Example:

Red for bad results.

Yellow for neutral results.

Green for good results.

Proc Print, Report, Tabulate

Traffic-lighting

- Two steps
 1. Create a format referencing the style attribute values with PROC FORMAT
 2. Then set the style attribute equal to the format you defined in the STYLE option

Traffic-lighting

```

PROC FORMAT;
VALUE weightf
    0 - < 150 = 'light green'
    150 - < 170 = 'light yellow'
    170 - HIGH = 'light red';

run;

Proc print data = sashelp.heart (obs = 20);
var status sex height;
var weight / STYLE={BACKGROUND=weightf.};
    *This will assign label;

run;

```



Traffic-lig

Obs	Status	Sex	Height	Weight
1	Dead	Female	62.50	140
2	Dead	Female	59.75	194
3	Alive	Female	62.25	132
4	Alive	Female	65.75	158
5	Alive	Male	66.00	156
6	Alive	Female	61.75	131
7	Alive	Female	64.75	136
8	Dead	Male	65.50	130
9	Alive	Male	71.00	194
10	Dead	Male	62.50	129
11	Alive	Male	66.25	179
12	Alive	Male	64.25	151
13	Alive	Male	70.00	174



*** TIP # 7

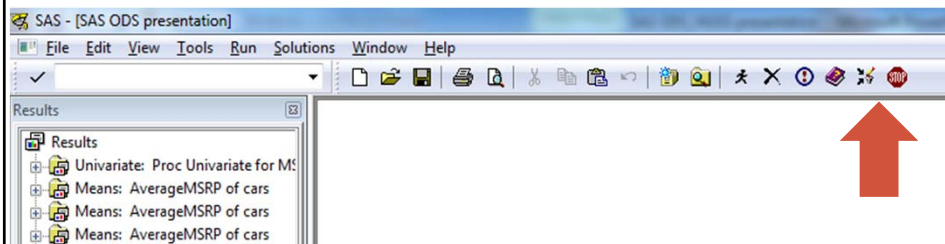
- You are on OUTPUT or LOG window
 - Want to go back to EDITOR window

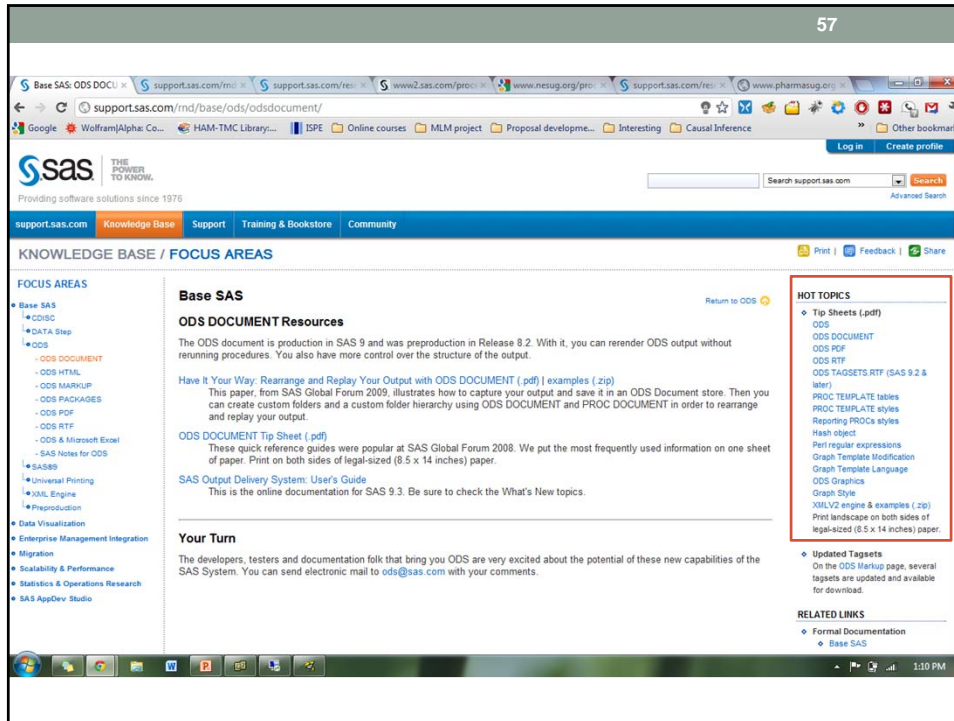
- Just hit



*** TIP # 8

- Two more buttons
 - Clear TITLE and FOOTNOTE
 - Clear clutter (HTML and png files) in you folder





References

- SAS Help and Documentation
- The little SAS book
- SAS Abbreviations are your friends, use the template method to code! [\[Link\]](#)
- Practically perfect presentations [\[Link\]](#)
- ODS RTF: the Basics and Beyond [\[Link\]](#)

Contact Information

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University of Houston

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mehtahemal318@gmail.com

Phone: 718-607-4967



Thank you !