MWSUG 2017 - Paper SA14

The Battle of the Titans (Part II): PROC TABULATE versus PROC REPORT

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Abstract

Should I use PROC REPORT or PROC TABULATE to produce that report? Which one will give me the control and flexibility to produce the report exactly the way I want it to look? Which one is easier to use? Which one is more powerful? WHICH ONE IS BETTER?

If you have these and other questions about the pros and cons of the REPORT and TABULATE procedures, this presentation is for you. We will discuss, using real-life report scenarios, the strengths (and even a few weaknesses) of the two most powerful reporting procedures in SAS® (as we see it). We will provide you with the wisdom you need to make that sometimes difficult decision about which procedure to use to get the report you really want and need.

Introduction

Well, here we go again "Titans" fans – due to the incredible persuasion of one of the "ORIGINAL" Titan champions, Ray Pass, two new warriors, Kirk and Ben, have united to do battle again using the Titans: PROC TABULATE and PROC REPORT. NOT to replicate the "battle" as was waged at previous SAS® Users Group International (SUGIs), but rather to turn our knowledge of these two incredibly simple and powerful procedures into a "fun", and engaging presentation.

We will basically be using some basic code to help you discover the power of these two "titan" procedures. We will walk through several scenarios using one procedure to produce a report then produce the same report with the other procedure. Then we will take the same code and expand upon it in the next scenario. Hopefully you will be enlightened as to where each procedure's strengths lie. So you can reproduce and experiment with the examples, we chose to use the CARS dataset from the SASHELP library. We chose this dataset because we felt it possessed many of the same attributes of some typical datasets/database tables most reports are generated from (categorical values and actual/summarized values).

Data Set Used in Examples

The examples used throughout this paper and presentation utilize the dataset, SASHELP.CARS. The SASHELP.CARS dataset consists of 428 observations and 15 variables, illustrated below.

Make	Model	Type	Origin	DriveTrain	MSRP	Invoice	EngineSize	Cylinders	Horsepower	MPG_City	MPG_Highway	Weight	Wheelbase	Length
Acura	MDX	SUV	Asia	All	$36,945	$33,337	3.5	6	265	17	23	4451	106	189
Acura	RSX Type S 2dr	Sedan	Asia	Front	$23,820	$21,761	2.0	4	200	24	31	2778	101	172
Acura	TSX 4dr	Sedan	Asia	Front	$26,990	$24,647	2.4	4	200	22	29	3230	105	183
Acura	TL 4dr	Sedan	Asia	Front	$33,195	$30,299	3.2	6	270	20	28	3575	108	186
Acura	3.5 RL 4dr	Sedan	Asia	Front	$43,755	$39,014	3.5	6	225	18	24	3880	115	197
Acura	3.5 RL w/Navigation 4dr	Sedan	Asia	Front	$46,100	$41,100	3.5	6	225	18	24	3893	115	197
Acura	NSX coupe 2dr manual S	Sports	Asia	Rear	$89,765	$79,978	3.2	6	290	17	24	3153	100	174
Audi	A4 1.8T 4dr	Sedan	Europe	Front	$25,940	$23,508	1.8	4	170	22	31	3252	104	179
Audi	A41.8T convertible 2dr	Sedan	Europe	Front	$35,940	$32,506	1.8	4	170	23	30	3638	105	180
Audi	A4 3.0 4dr	Sedan	Europe	Front	$31,840	$28,846	3.0	6	220	20	28	3462	104	179
Audi	A4 3.0 Quattro 4dr manual	Sedan	Europe	All	$33,430	$30,366	3.0	6	220	17	26	3583	104	179
Audi	A4 3.0 Quattro 4dr auto	Sedan	Europe	All	$34,480	$31,388	3.0	6	220	18	25	3627	104	179
Audi	A6 3.0 4dr	Sedan	Europe	Front	$36,640	$33,129	3.0	6	220	20	27	3561	109	192
Audi	A6 3.0 Quattro 4dr	Sedan	Europe	All	$39,640	$35,992	3.0	6	220	18	25	3880	109	192
Audi	A4 3.0 convertible 2dr	Sedan	Europe	Front	$42,490	$38,325	3.0	6	220	20	27	3814	105	180
Audi	A4 3.0 Quattro convertible 2dr	Sedan	Europe	All	$44,240	$40,075	3.0	6	220	18	25	4013	105	180
Audi	A6 2.7 Turbo Quattro 4dr	Sedan	Europe	All	$42,840	$38,840	2.7	6	250	18	25	3836	109	192
Audi	A6 4.2 Quattro 4dr	Sedan	Europe	All	$49,690	$44,936	4.2	8	300	17	24	4024	109	193
Audi	A8 L Quattro 4dr	Sedan	Europe	All	$69,190	$64,740	4.2	8	330	17	24	4399	121	204
Audi	S4 Quattro 4dr	Sedan	Europe	All	$48,040	$43,556	4.2	8	340	14	20	3825	104	179
Audi	RS 6 4dr	Sports	Europe	Front	$84,600	$76,417	4.2	8	450	15	22	4024	109	191
Audi	TT 1.8 convertible 2dr (coupe)	Sports	Europe	Front	$35,940	$32,512	1.8	4	180	20	28	3131	95	159
Audi	TT 1.8 Quattro 2dr (convertible)	Sports	Europe	All	$37,390	$33,891	1.8	4	225	20	28	2921	96	159
Audi	TT 3.2 coupe 2dr (convertible)	Sports	Europe	All	$40,590	$36,739	3.2	6	250	21	29	3351	96	159
Audi	A6 3.0 Avant Quattro	Wagon	Europe	All	$40,840	$37,060	3.0	6	220	18	25	4035	109	192
Audi	S4 Avant Quattro	Wagon	Europe	All	$49,090	$44,446	4.2	8	340	15	21	3936	104	179
BMW	X3 3.0i	SUV	Europe	All	$37,000	$33,873	3.0	6	225	16	23	4023	110	180
BMW	X5 4.4i	SUV	Europe	All	$52,195	$47,720	4.4	8	325	16	22	4824	111	184
BMW	325i 4dr	Sedan	Europe	Rear	$28,495	$26,155	2.5	6	184	20	29	3219	107	176
BMW	325Ci 2dr	Sedan	Europe	Rear	$30,795	$28,245	2.5	6	184	20	29	3197	107	177
BMW	325Ci convertible 2dr	Sedan	Europe	Rear	$37,995	$34,800	2.5	6	184	19	27	3560	107	177

Our focus for this paper and presentation is to explore an assortment of scenarios describing general concepts that users will most likely encounter while using PROC TABULATE and PROC REPORT. For users who may not know the underlying design premise for these two procedures, we have included the following excerpt from earlier papers that were written by Dan Bruns, Ray Pass and Alan Eaton of SAS Institute, the original developer of both the TABULATE and REPORT procedures.

The TABULATE Procedure

Hierarchies Are Good. The primary goals for PROC TABULATE were to form and present hierarchical tables of summary statistics using the data values of classification variables to define hierarchies. An important model for TABULATE was TPL, a table producing language developed at the Department of Labor. TPL did a wonderful job of defining, building, and presenting complex hierarchical tables. However, TPL required users to predefine a significant amount of structural information in codebooks and could require as many as 15 JCL steps to execute. Our goal was to make the table building process entirely data driven and to simplify the task to writing a few lines of SAS code rather than many lines of complex code.

Give Me the Summary Version. PROC SUMMARY already computed summary statistics. TABULATE's job was to organize these summary statistics for presentation. Other SAS procedures were available in the early days for detailed listings, PROC PRINT, and row and column computations, PROC COMPUTAB. TABULATE made no attempt to offer these kinds of features.

Generality in All Dimensions. PROC TABULATE supports three-dimensional tables, tables with pages, rows, and columns. TABULATE was designed to support arbitrarily complex nestings and concatenations of table elements in each dimension. So TABULATE provides a lot of flexibility but at the cost of seeming overly complex and difficult to master at times.

The REPORT Procedure

Hierarchies Are Not So Good. The syntax for TABULATE is a challenge for a lot of users. Some form of simplification was in order. The approach taken in PROC REPORT was to limit the number of dimensions and to support a simpler COLUMN statement. Even that COLUMN statement had to be complex enough to support nestings of ACROSS variables and other elements.

Give Me the Facts. It was also necessary to offer detail reports with more formatting options than PROC PRINT afforded. PROC REPORT supports both GROUP and ORDER variables to generate both summary and detail reports.

Hierarchies Are Not So Good. Users frequently requested that TABULATE support a "post compute" feature to allow new rows or columns to be calculated from the rows and columns of summary statistics already computed from the data. How to specify symbols for use in expressions was a major stumbling block in TABULATE. The expression terms could be very complicated specifications of a sub-dimension of the TABLE statement. So the generality of TABULATE worked against this opportunity for enhancement. Supporting computed columns was a requirement of REPORT from the beginning. The simpler COLUMN statement made it easier to identify symbols to use in column expressions. With symbols available for parsing it became possible to build an interface between PROC REPORT and the DATA step so that PROC REPORT users can compute new columns using DATA step language and functions.

Scenario #1

Many users produce detail output and reports on their data, we will begin here. (We will examine how a summary report can be produced in Scenario #2). In this scenario, we will examine the TABULATE and REPORT procedures to produce detail output / reports. Several statements and options are available to users of PROC TABULATE and PROC REPORT for the production of detail output / reports. For the TABULATE procedure, the CLASS, VAR, and TABLE statements can be specified; and for the REPORT procedure, the COLUMN(S) and DEFINE statements can be specified, see below.

PROC TABULATE Code:

```
TITLE1 Detailed Cars Report <= $13,000 ;
TITLE2 Arranged by Origin ;
TITLE3 Produced by PROC TABULATE ;
PROC TABULATE DATA=sashelp.cars FORMAT=DOLLAR8. ;
 CLASS origin type make model ;
 TABLE origin * type *
       make * model,
       MSRP ;
 VAR MSRP ;
 WHERE MSRP LE 13000 ;
RUN ;
```

Results:

Detailed Cars Report <= $13,000
Arranged by Origin
Produced by PROC TABULATE

				MSRP
				Sum
Origin	Type	Make	Model	
Asia	Sedan	Hyundai	Accent 2dr hatch	$10,539
			Accent GL 4dr	$11,839
			Accent GT 2dr hatch	$11,939
		Kia	Rio 4dr auto	$11,155
			Rio 4dr manual	$10,280
			Spectra 4dr	$12,360
		Nissan	Sentra 1.8 4dr	$12,740
		Scion	xA 4dr hatch	$12,965
		Suzuki	Aeno S 4dr	$12,884
			Forenza S 4dr	$12,269
		Toyota	Echo 2dr auto	$11,560
			Echo 2dr manual	$10,760
			Echo 4dr	$11,290
	Truck	Toyota	Tacoma	$12,800
	Wagon	Kia	Rio Cinco	$11,905
USA	Sedan	Chevrolet	Aveo 4dr	$11,690
			Aveo LS 4dr hatch	$12,585
		Saturn	Ion1 4dr	$10,995

PROC REPORT Code:

```
TITLE1 Detailed Cars Report <= $13,000 ;
TITLE2 Arranged by Origin ;
TITLE3 Produced by PROC REPORT ;
PROC REPORT DATA=sashelp.cars NOWINDOWS ;
 COLUMNS origin type make model MSRP ;
 DEFINE origin / ORDER 'Origin of Car' WIDTH=6 ;
 DEFINE type  / ORDER 'Type of Car' WIDTH=8 CENTER ;
 DEFINE make  / ORDER 'Make of Car' WIDTH=13 ;
 DEFINE model / DISPLAY 'Model of Car' WIDTH=40 ;
 DEFINE MSRP  / DISPLAY WIDTH=8 FORMAT=Dollar8. ;
 WHERE MSRP LE 13000 ;
RUN ;
```

Results:

Detailed Cars Report <= $13,000
Arranged by Origin
Produced by PROC REPORT

Origin of Car	Type of Car	Make of Car	Model of Car	MSRP
Asia	Sedan	Hyundai	Accent 2dr hatch	$10,539
			Accent GL 4dr	$11,839
			Accent GT 2dr hatch	$11,939
		Kia	Rio 4dr manual	$10,280
			Rio 4dr auto	$11,155
			Spectra 4dr	$12,360
		Nissan	Sentra 1.8 4dr	$12,740
		Scion	xA 4dr hatch	$12,965
		Suzuki	Aeno S 4dr	$12,884
			Forenza S 4dr	$12,269
		Toyota	Echo 2dr manual	$10,760
			Echo 2dr auto	$11,560
			Echo 4dr	$11,290
	Truck	Toyota	Tacoma	$12,800
	Wagon	Kia	Rio Cinco	$11,905
USA	Sedan	Chevrolet	Aveo 4dr	$11,690
			Aveo LS 4dr hatch	$12,585
		Saturn	Ion1 4dr	$10,995

Scenario #2

In this second scenario we will turn our attention from the production of detail output / reports to summary output / reports. In other words, we will describe and illustrate the specific statements and options to produce summary-level output / reports that display a number of descriptive statistics (i.e., SUM, N, MEAN, MIN, and MAX); using PROC TABULATE and PROC REPORT.

PROC TABULATE Code:

```
TITLE1 MSRP Summary Statistics Report ;
TITLE2 Cars <= $18,000 ;
TITLE3 Produced by PROC TABULATE ;
PROC TABULATE DATA=sashelp.cars ;
 CLASS type make ;
 TABLE type * make,
       MSRP * (SUM N MEAN MIN MAX) ;
 VAR MSRP ;
 WHERE MSRP LE 18000 ;
RUN ;
```

Results:

MSRP Summary Statistics Report
Cars <= $18,000
Produced by PROC TABULATE

		MSRP				
		Sum	N	Mean	Min	Max
Type	Make					
SUV	Suzuki	17163.00	1	17163.00	17163.00	17163.00
Sedan	Chevrolet	70080.00	5	14016.00	11690.00	16385.00
	Chrysler	17985.00	1	17985.00	17985.00	17985.00
	Dodge	28710.00	2	14355.00	13670.00	15040.00
	Ford	58040.00	4	14510.00	13270.00	15580.00
	Honda	61040.00	4	15260.00	13270.00	17750.00
	Hyundai	78934.00	6	13155.67	10539.00	15389.00
	Kia	78045.00	6	13007.50	10280.00	16040.00
	MINI	16999.00	1	16999.00	16999.00	16999.00
	Mazda	32700.00	2	16350.00	15500.00	17200.00
	Mitsubishi	48576.00	3	16192.00	14622.00	17232.00
	Nissan	45120.00	3	15040.00	12740.00	17640.00
	Pontiac	33230.00	2	16615.00	15495.00	17735.00
	Saturn	72320.00	5	14464.00	10995.00	16350.00
	Scion	12965.00	1	12965.00	12965.00	12965.00
	Suzuki	72483.00	5	14496.60	12269.00	17262.00
	Toyota	78020.00	6	13003.33	10760.00	15295.00
Truck	Dodge	17630.00	1	17630.00	17630.00	17630.00
	Ford	14385.00	1	14385.00	14385.00	14385.00
	GMC	16530.00	1	16530.00	16530.00	16530.00
	Mazda	14840.00	1	14840.00	14840.00	14840.00
	Toyota	29295.00	2	14647.50	12800.00	16495.00
Wagon	Ford	17475.00	1	17475.00	17475.00	17475.00
	Kia	11905.00	1	11905.00	11905.00	11905.00
	Mitsubishi	17495.00	1	17495.00	17495.00	17495.00
	Pontiac	17045.00	1	17045.00	17045.00	17045.00
	Scion	14165.00	1	14165.00	14165.00	14165.00
	Suzuki	16497.00	1	16497.00	16497.00	16497.00
	Toyota	16695.00	1	16695.00	16695.00	16695.00

PROC REPORT Code:

```
TITLE1 MSRP Summary Statistics Report ;
TITLE2 Cars <= $18,000 ;
TITLE3 Produced by PROC REPORT ;
PROC REPORT DATA=sashelp.cars NOWINDOWS ;
 COLUMNS type make MSRP MSRP=MSRP_Sum MSRP=MSRP_N
         MSRP=MSRP_Mean MSRP=MSRP_Min MSRP=MSRP_Max ;
 DEFINE type / GROUP 'Type of Car'  WIDTH=8 ;
 DEFINE make / GROUP 'Make of Car'  WIDTH=13 ;
 DEFINE MSRP / ANALYSIS NOPRINT FORMAT=Dollar12. ;
 DEFINE MSRP_SUM  / ANALYSIS SUM FORMAT=Dollar12. "Sum" ;
 DEFINE MSRP_N    / ANALYSIS N "N" FORMAT=COMMA7. ;
 DEFINE MSRP_MEAN / ANALYSIS MEAN "Mean" ;
 DEFINE MSRP_MIN  / ANALYSIS MIN  "Min" ;
 DEFINE MSRP_MAX  / ANALYSIS MAX  "Max" ;
 WHERE MSRP LE 18000 ;
RUN ;
```

Results:

MSRP Summary Statistics Report
Cars <= $18,000
Produced by PROC REPORT

Type of Car	Make of Car	Sum	N	Mean	Min	Max
SUV	Suzuki	$17,163	1	$17,163	$17,163	$17,163
Sedan	Chevrolet	$70,080	5	$14,016	$11,690	$16,385
	Chrysler	$17,985	1	$17,985	$17,985	$17,985
	Dodge	$28,710	2	$14,355	$13,670	$15,040
	Ford	$58,040	4	$14,510	$13,270	$15,580
	Honda	$61,040	4	$15,260	$13,270	$17,750
	Hyundai	$78,934	6	$13,156	$10,539	$15,389
	Kia	$78,045	6	$13,008	$10,280	$16,040
	MINI	$16,999	1	$16,999	$16,999	$16,999
	Mazda	$32,700	2	$16,350	$15,500	$17,200
	Mitsubishi	$48,576	3	$16,192	$14,622	$17,232
	Nissan	$45,120	3	$15,040	$12,740	$17,640
	Pontiac	$33,230	2	$16,615	$15,495	$17,735
	Saturn	$72,320	5	$14,464	$10,995	$16,350
	Scion	$12,965	1	$12,965	$12,965	$12,965
	Suzuki	$72,483	5	$14,497	$12,269	$17,262
	Toyota	$78,020	6	$13,003	$10,760	$15,295
Truck	Dodge	$17,630	1	$17,630	$17,630	$17,630
	Ford	$14,385	1	$14,385	$14,385	$14,385
	GMC	$16,530	1	$16,530	$16,530	$16,530
	Mazda	$14,840	1	$14,840	$14,840	$14,840
	Toyota	$29,295	2	$14,648	$12,800	$16,495
Wagon	Ford	$17,475	1	$17,475	$17,475	$17,475
	Kia	$11,905	1	$11,905	$11,905	$11,905
	Mitsubishi	$17,495	1	$17,495	$17,495	$17,495
	Pontiac	$17,045	1	$17,045	$17,045	$17,045
	Scion	$14,165	1	$14,165	$14,165	$14,165
	Suzuki	$16,497	1	$16,497	$16,497	$16,497
	Toyota	$16,695	1	$16,695	$16,695	$16,695

Scenario #3

In this third scenario we will use PROC TABULATE and PROC REPORT, along with the Output Delivery System (ODS) Excel destination, to send output / reports to a Microsoft® Excel spreadsheet. We describe and illustrate the SAS-supplied style templates, the ODS Excel destination, and options, below.

PROC TEMPLATE List Styles Code:

```
PROC TEMPLATE;
  LIST STYLES;
RUN;
```

The results produced from the PROC TEMPLATE LIST STYLES statement produces the following styles, see below.

Results:

Listing of: SASHELP.TMPLMST
Path Filter is: Styles
Sort by: PATH/ASCENDING

Obs	Path	Type
1	Styles	Dir
2	Styles.Analysis	Style
3	Styles.BarrettsBlue	Style
4	Styles.BlockPrint	Style
5	Styles.DTree	Style
6	Styles.Daisy	Style
7	Styles.Default	Style
8	Styles.Dove	Style
9	Styles.EGDefault	Style
10	Styles.Excel	Style
11	Styles.FancyPrinter	Style
12	Styles.Festival	Style
13	Styles.FestivalPrinter	Style
14	Styles.Gantt	Style
15	Styles.GrayscalePrinter	Style
16	Styles.HTMLBlue	Style
17	Styles.Harvest	Style
18	Styles.HighContrast	Style
19	Styles.HighContrastLarge	Style
20	Styles.Journal	Style
21	Styles.Journal1a	Style
22	Styles.Journal2	Style
23	Styles.Journal2a	Style
24	Styles.Journal3	Style
25	Styles.Journal3a	Style
26	Styles.Listing	Style
27	Styles.Meadow	Style
28	Styles.MeadowPrinter	Style
29	Styles.Minimal	Style
30	Styles.MonochromePrinter	Style
31	Styles.Monospace	Style
32	Styles.Moonflower	Style
33	Styles.Netdraw	Style
34	Styles.NoFontDefault	Style
35	Styles.Normal	Style
36	Styles.NormalPrinter	Style
37	Styles.Ocean	Style
38	Styles.Pearl	Style
39	Styles.PearlJ	Style
40	Styles.Plateau	Style
41	Styles.PowerPointDark	Style
42	Styles.PowerPointLight	Style
43	Styles.Printer	Style
44	Styles.Raven	Style
45	Styles.Rtf	Style
46	Styles.Sapphire	Style
47	Styles.SasDocPrinter	Style
48	Styles.SasWeb	Style
49	Styles.Seaside	Style
50	Styles.SeasidePrinter	Style
51	Styles.Snow	Style
52	Styles.StatDoc	Style
53	Styles.Statistical	Style
54	Styles.Word	Style
55	Styles.vaDark	Style
56	Styles.vaHighContrast	Style
57	Styles.vaLight	Style

The next example illustrates the creation of an Excel spreadsheet by specifying the ODS Excel destination with PROC TABULATE.

PROC TABULATE Code:

```
ODS Excel FILE='TABULATE-to-Excel.XLSX'
          STYLE=BarrettsBlue ;
TITLE1 Detailed Cars Report <= $13,000 ;
TITLE2 Arranged by Origin ;
TITLE3 Produced by PROC TABULATE ;
PROC TABULATE DATA=sashelp.cars FORMAT=DOLLAR8. ;
 CLASS origin type make model ;
 TABLE origin * type *
       make * model,
       MSRP ;
 VAR MSRP ;
 WHERE MSRP LE 13000 ;
RUN ;
ODS Excel CLOSE ;
```

Results:

	A	B	C	D	E
1					MSRP
2					Sum
3	Origin	Type	Make	Model	
4	Asia	Sedan	Hyundai	Accent 2dr hatch	$10,539
5				Accent GL 4dr	$11,839
6				Accent GT 2dr hatch	$11,939
7			Kia	Rio 4dr auto	$11,155
8				Rio 4dr manual	$10,280
9				Spectra 4dr	$12,360
10			Nissan	Sentra 1.8 4dr	$12,740
11			Scion	xA 4dr hatch	$12,965
12			Suzuki	Aeno S 4dr	$12,884
13				Forenza S 4dr	$12,269
14			Toyota	Echo 2dr auto	$11,560
15				Echo 2dr manual	$10,760
16				Echo 4dr	$11,290
17		Truck	Toyota	Tacoma	$12,800
18		Wagon	Kia	Rio Cinco	$11,905
19	USA	Sedan	Chevrolet	Aveo 4dr	$11,690
20				Aveo LS 4dr hatch	$12,585
21			Saturn	Ion1 4dr	$10,995

The next example illustrates the creation of an Excel spreadsheet by specifying the ODS Excel destination with PROC REPORT.

PROC REPORT Code:

```
ODS Excel FILE='REPORT-to-Excel.XLSX'
          STYLE=BarrettsBlue ;
TITLE1 Detailed Cars Report <= $13,000 ;
TITLE2 Arranged by Origin ;
TITLE3 Produced by PROC REPORT ;
PROC REPORT DATA=sashelp.cars NOWINDOWS ;
 COLUMNS origin type make model MSRP ;
 DEFINE origin / ORDER 'Origin of Car'  WIDTH=6 ;
 DEFINE type   / ORDER 'Type of Car' WIDTH=8 CENTER ;
 DEFINE make   / ORDER 'Make of Car'  WIDTH=13 ;
 DEFINE model  / DISPLAY 'Model of Car' WIDTH=40 ;
 DEFINE MSRP   / DISPLAY WIDTH=8 FORMAT=Dollar8. ;
 WHERE MSRP LE 13000 ;
RUN ;
ODS Excel CLOSE ;
```

Results:

	A	B	C	D	E
1	Origin of Car	Type of Car	Make of Car	Model of Car	MSRP
2	Asia	Sedan	Hyundai	Accent 2dr hatch	$10,539
3				Accent GL 4dr	$11,839
4				Accent GT 2dr hatch	$11,939
5			Kia	Rio 4dr manual	$10,280
6				Rio 4dr auto	$11,155
7				Spectra 4dr	$12,360
8			Nissan	Sentra 1.8 4dr	$12,740
9			Scion	xA 4dr hatch	$12,965
10			Suzuki	Aeno S 4dr	$12,884
11				Forenza S 4dr	$12,269
12			Toyota	Echo 2dr manual	$10,760
13				Echo 2dr auto	$11,560
14				Echo 4dr	$11,290
15		Truck	Toyota	Tacoma	$12,800
16		Wagon	Kia	Rio Cinco	$11,905
17	USA	Sedan	Chevrolet	Aveo 4dr	$11,690
18				Aveo LS 4dr hatch	$12,585
19			Saturn	Ion1 4dr	$10,995

Scenario #4

In this fourth scenario we will illustrate various style options with PROC TABULATE and PROC REPORT code to enhance the look of the output / report. What and how would you change to the code to make it more presentable? What statements, options and features could be specified to improve the appearance of the output / report? In the following table a number of style components available with PROC TABULATE and PROC REPORT are illustrated, see below.

Component	Description
Report	**Affects the report and the table structure.**
Header (HDR)	**Affects color header cells.**
Column	**Affects data cells.**
Summary	**Affects summary lines generated by BREAK or RBREAK statements.**
Lines	**Affects lines generated by LINE statements.**

Specific style attributes available to PROC TABULATE and PROC REPORT are illustrated, see below.

Style Attribute	Description
Background=	Changes background color (e.g., Red, Blue, Green, Orange, Yellow).
Bordercolor=	Changes border color (e.g., Red, Blue, Green, Orange, Yellow).
Borderwidth=	Changes border width (e.g., 0, 3, 7, in, cm, pt).
Cellspacing=	Changes cell spacing (e.g., 0, 3, 7, in, cm, pt).
Foreground=	Changes foreground color (e.g., Red, Blue, Green, Orange, Yellow).
Frame=	Changes frame style (e.g., ABOVE, BELOW, BOX, HSIDES, LHS, RHS, VOID and VSIDES).
Rules=	Changes rules (e.g., ALL, COLS, GROUPS, NONE, and ROWS).

In the following PROC TABULATE code we examine how labels, titles, formats, and the style= option can be specified to enhance the output / report aesthetics.

PROC TABULATE Code:

```
TITLE1 Customized Cars Report <= $13,000 ;
TITLE2 with Style ;
TITLE3 Produced by PROC TABULATE ;
PROC TABULATE DATA=sashelp.cars FORMAT=DOLLAR8. ;
 CLASS origin type make model ;
 TABLE origin * type *
       make * model,
       MSRP * {style={Background=red
                      Foreground=White}} ;
 VAR MSRP ;
 WHERE MSRP LE 13000 ;
RUN ;
```

Results:

Customized Cars Report <= $13,000
with Style
Produced by PROC TABULATE

				MSRP
				Sum
Origin	Type	Make	Model	
Asia	Sedan	Hyundai	Accent 2dr hatch	$10,539
			Accent GL 4dr	$11,839
			Accent GT 2dr hatch	$11,939
		Kia	Rio 4dr auto	$11,155
			Rio 4dr manual	$10,280
			Spectra 4dr	$12,360
		Nissan	Sentra 1.8 4dr	$12,740
		Scion	xA 4dr hatch	$12,965
		Suzuki	Aeno S 4dr	$12,884
			Forenza S 4dr	$12,269
		Toyota	Echo 2dr auto	$11,560
			Echo 2dr manual	$10,760
			Echo 4dr	$11,290
	Truck	Toyota	Tacoma	$12,800
	Wagon	Kia	Rio Cinco	$11,905
USA	Sedan	Chevrolet	Aveo 4dr	$11,690
			Aveo LS 4dr hatch	$12,585
		Saturn	Ion1 4dr	$10,995

In the next PROC REPORT code we examine how labels, titles, formats, and the style= option can be specified to enhance the output / report aesthetics.

PROC REPORT Code:

```
TITLE1 Customized Cars Report <= $13,000 ;
TITLE2 with Style ;
TITLE3 Produced by PROC REPORT ;
PROC REPORT DATA=sashelp.cars NOWINDOWS ;
 COLUMNS origin type make model MSRP ;
 DEFINE origin / ORDER 'Origin of Car'  WIDTH=6 ;
 DEFINE type  / ORDER 'Type of Car' WIDTH=8 CENTER ;
 DEFINE make  / ORDER 'Make of Car'  WIDTH=13 ;
 DEFINE model / DISPLAY 'Model of Car' WIDTH=40 ;
 DEFINE MSRP  / DISPLAY WIDTH=8 FORMAT=Dollar8.
                STYLE(Column)={Background=Red
                               Foreground=White} ;
 WHERE MSRP LE 13000 ;
RUN ;
```

Results:

Customized Cars Report <= $13,000 with Style Produced by PROC REPORT

Origin of Car	Type of Car	Make of Car	Model of Car	MSRP
Asia	Sedan	Hyundai	Accent 2dr hatch	$10,539
			Accent GL 4dr	$11,839
			Accent GT 2dr hatch	$11,939
		Kia	Rio 4dr manual	$10,280
			Rio 4dr auto	$11,155
			Spectra 4dr	$12,360
		Nissan	Sentra 1.8 4dr	$12,740
		Scion	xA 4dr hatch	$12,965
		Suzuki	Aeno S 4dr	$12,884
			Forenza S 4dr	$12,269
		Toyota	Echo 2dr manual	$10,760
			Echo 2dr auto	$11,560
			Echo 4dr	$11,290
	Truck	Toyota	Tacoma	$12,800
	Wagon	Kia	Rio Cinco	$11,905
USA	Sedan	Chevrolet	Aveo 4dr	$11,690
			Aveo LS 4dr hatch	$12,585
		Saturn	Ion1 4dr	$10,995

Conclusion

So, "Which is better?", you might ask. Well, our task was not to declare a winner and a loser, but rather to show that either procedure could be used to solve your report problem. This paper and presentation is not intended to be a cure for all your TABULATE and REPORT problems. Every use is unique in some way. All we have attempted to do is give you a head start, and perhaps coax you to further discover the power that these two SAS "TITANS" possess (to be clear, we're talking about the procedures here, not the authors). It is also worth mentioning that each procedure has a definite set of strengths over the other depending on the desired result. The tools are there and they are powerful foundations to valuable and productive report generation.

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Acknowledgments

The authors thank Andrea Frazier and Ray Pass, MWSUG 2017 SAS 101 Section Chairs, for accepting our abstract and paper; Misty Johnson, MWSUG 2017 Academic Chair; John Xu, MWSUG 2017 Operations Chair; the MWSUG Executive Board; the Conference Sponsors; and SAS Institute for organizing and supporting a great conference!

Trademark Citations

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After 35 years or so, Ray Pass retired last year (June 1, 2016 to be exact, but who cares) from full-time SASing. He now spends his time living, thinking, reading, cooking, eating, walking, biking, shopping, erranding and as much flaneuring as he can. He has no idea how he ever found time to "work" as his current schedule is so full. He recommends retirement very highly and has adopted a new life motto: **"Every day is Saturday!"**

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