Reports, Spreadsheets, and Dashboards Made Easy Using SAS®

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Abstract

Organizations around the world develop business intelligence and analytics dashboards, sometimes referred to as enterprise dashboards, to display the status of "point-in-time" metrics and key performance indicators. Effectively designed dashboards extract real-time data from multiple sources for the purpose of highlighting important information, numbers, tables, statistics, metrics, performance scorecards and other essential content. This paper explores essential rules for "good" dashboard design, the metrics frequently used in dashboards, and the use of best practice programming techniques in the design of quick and easy dashboards using SAS® software. Learn essential programming techniques to create real-world dashboards using Base-SAS® software including PROC SQL, macro, Output Delivery System (ODS), ODS HTML, ODS Excel, ODS Layout, ODS Statistical Graphics, PROC SGPLOT, PROC SGPIE, and other technologies.

Introduction

In a world of big data where data repositories and the demand placed on them are growing at explosive levels, organizations are faced with a number of decisions related to their information requirements:

1) What are the best ways to handle large amounts of information?
2) How should analytical data be processed?
3) What are the choices for constructing the most effective information delivery mechanisms?
4) How should analytical data and results be displayed?

To help answer these and other questions, this paper explains what a dashboard is, the dashboard's elements, the do's and don'ts for constructing effective dashboards, dashboard design techniques, an investigation of the various types of dashboards, the merits and strengths of using the base-SAS® software to construct dashboards, and an illustration of a few dashboard examples along with the base-SAS code used in their construction.

Example Table

The dashboard examples displayed in this paper reference the dataset (or table), SASHELP.CARS. The SASHELP.CARS dataset consists of 428 observations and 15 variables and is illustrated below.

SASHELP.CARS Table

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

"Brief" History of Dashboards

In the world of information technology, a dashboard serves as a user interface to organize and display information visually in the simplest way possible. Dashboards originated in the 1970's as decision support tools and systems that served management, operations, and organizational planning. In the 1980's, dashboards came of age as executive information systems emphasizing graphical displays and simple user interfaces to assist with management decision making. In the 1990's, dashboards experienced a growing interest with the rise of the Internet. As information technology and the Internet entered the 2000's, vendors including SAS Institute, and others, offered high-end easy-to-use products for the development of comprehensive "custom" dashboards. The dashboards being built today offer users the ability to monitor key metrics, information summaries, and reports in a single easy-to-use user interface. As a result, dashboards are designed to alert users to key business issues that impact an organization's tactics and strategies by facilitating improved decision making activities.

So exactly what is a dashboard? In the paper, "Building Your First Dashboard Using the SAS® 9 Business Intelligence Platform: A Tutorial," by Gregory S. Nelson (2009), Nelson describes a dashboard as a visualization technique that provides an immediate view or snapshot of exactly where you are in a specific process relative to your stated goals and objectives. He adds that, Visual indicators, such as temperature gauges, traffic lights and speedometers, help give a real-world sense of present progress and assists in making decisions, adapting to current conditions or drilling into more detailed information. As a user interface, dashboards display performance indicators (PIs), key performance indicators (KPIs), and other relevant information.

Types of Dashboards

The first step in dashboard design is to understand the purpose and type of dashboard you will need. With three types of dashboard designs available, users are encouraged to select the dashboard type that best meets your needs. The following table describes the three types of enterprise dashboards and their purpose.

Dashboard Type	Purpose
Strategic Dashboards	Strategic dashboards provide executives and managers with visual information to determine and support goals and objectives within an organization. This type of dashboard facilitates monitoring an organization's health, progress, performance, and areas where improvement can be made. There is typically no need for interactive features with this type of dashboard. Strategic dashboard examples include: Sales, Human Resources, Manufacturing, and Services.
Analytical Dashboards	Analytical dashboards provide users with visual information to help gain a better understanding with historical, present and future data; understand trends; allow comparisons to be made; and determine the type of adjustments that are needed. Analytical dashboards should allow interactive features such as drill-down capabilities, as needed, to access more detailed information. Dashboard examples include: obtaining real-time data and information, determining why some things are working and others are not, identifying patterns and opportunities with your data, and aligning strategic objectives with performance initiatives.
Operational Dashboards	Operational dashboards provide users with visual information to concentrate on performance monitoring and measurements, monitor the efficiency and effectiveness of their organization. There is typically a need to update information displayed in an operational dashboard frequently to make it relevant to the users' needs. Dashboard examples include: improved understanding of performance, better focus and alignment, and faster and better decision making.

Dashboard Elements

In Malik Shadan's (2007) paper, Elements for an Enterprise Dashboard, he mentions that there are basic and advanced characteristics specific to an enterprise dashboard. The basic characteristics encompass the acronym, SMART, and the advanced characteristics of an enterprise dashboard encompass the acronym, IMPACT. The elements associated with each acronym appear in the following tables.

SMART Basic Elements	
Element	**Description**
Synergetic	Synergize information in a single screen view.
Monitor KPIs	Display critical KPIs for effective decision making.
Accurate	Dashboard must be well tested and validated, and information must be accurate.
Responsive	Respond to user alerts and visual content to draw immediate attention to critical matters.
Timely	Display information that is real-time and right-time for effective decision making.

IMPACT Advanced Elements	
Element	**Description**
Interactive	Allow user to drill-down and derive details, root causes and more.
More Data History	Allow users to review historical trends for any KPI.
Personalized	Display should be specific to each user's domain of responsibility, data restrictions, and privileges.
Analytical	Allow users to perform guided analysis, compare, contrast, and make analytical inferences.
Collaborative	Facilitate users' ability to exchange notes regarding observations on their dashboard.
Trackability	Allow each user to customize the metrics they would like to track.

13 Common Pitfalls to Avoid when Designing Dashboards

Successful dashboard design involves the transformation of quantitative data into meaningful and effective visual displays including graphs, maps, gauges and summary information. In his paper, "Common Pitfalls in Dashboard Design," Stephen Few (2006) proposes 13 common mistakes many make when designing dashboards. Instead of concentrating on what should be done when designing dashboards, Mr. Few's body of work espouses the most common mistakes along with detailed explanations to help educate current and future designers alike. I have listed the 13 common pitfalls from Mr. Few's seminal work, below, but readers are encouraged to read his entire paper, see the References section, for a complete perspective.

Stephen Few's 13 Common Pitfalls in Dashboard Design (cited from reference)

Pitfall	Description
Pitfall #1	Exceeding the Boundaries of a Single Screen
Pitfall #2	Supplying Inadequate Context for the Data
Pitfall #3	Displaying Excessive Detail or Precision
Pitfall #4	Expressing Measures Indirectly
Pitfall #5	Choosing Inappropriate Media of Display
Pitfall #6	Introducing Meaningless Variety
Pitfall #7	Using Poorly Designed Display Media
Pitfall #8	Encoding Quantitative Data Inaccurately
Pitfall #9	Arranging the Data Poorly
Pitfall #10	Ineffectively Highlighting What's Important
Pitfall #11	Cluttering the Screen with Useless Decoration
Pitfall #12	Misusing or Overusing Color
Pitfall #13	Designing an Unappealing Visual Display

Steps to Creating a Dashboard using Base-SAS® Software

Follow these basic steps to successfully construct a quick and easy dashboard using the SAS software.

1. Connect to desired data sources using Libname statement.
2. Specify an ODS HTML5 statement to produce dashboards that can be viewed with a web browser.
3. Specify an ODS LAYOUT statement to tell SAS how many row(s) and column(s) the dashboard should contain.
4. Specify an ODS REGION statement to control where output is to be placed on the dashboard.
5. Specify color settings, fonts, font attributes, and other "customizations".
6. Specify an ODS LAYOUT END statement to terminate the dashboard layout.
7. Specify an ODS HTML5 CLOSE statement to render the results to the dashboard file.

Several quick and easy dashboard examples are illustrated below.

Examples

Example #1 – (1x1) Dashboard Layout with Default Settings

PROC FREQ, PROC SGPLOT and PROC MEANS

Analytics Dashboard

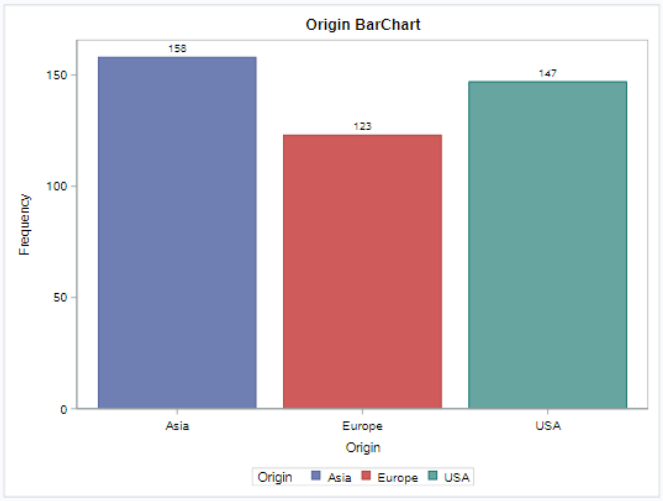
SASHELP.CARS Frequency Distribution for Origin and Type

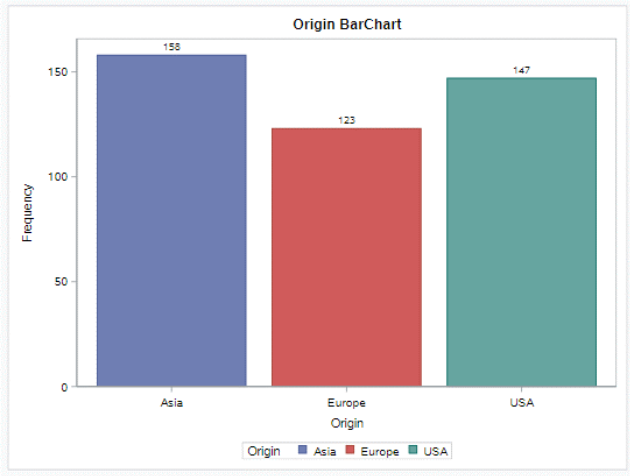
The FREQ Procedure

Number of Variable Levels	
Variable	Levels
Origin	3
Type	6

Origin	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Asia	158	36.92	158	36.92
Europe	123	28.74	281	65.65
USA	147	34.35	428	100.00

Type	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Hybrid	3	0.70	3	0.70
SUV	60	14.02	63	14.72
Sedan	262	61.21	325	75.93
Sports	49	11.45	374	87.38
Truck	24	5.61	398	92.99
Wagon	30	7.01	428	100.00





Key Points about Code

1. SAS software provides users with numerous procedures for creating dashboard output. The two procedures that are used to create the dashboard are: PROC FREQ and PROC REPORT.

2. An **ODS HTML5 PATH= FILE=** statement tells SAS the destination (or type of medium) to use in creating the dashboard including the destination path (or folder) and the name of the dashboard file.

3. An **ODS LAYOUT GRIDDED ROWS=1 COLUMNS=1** statement tells SAS to create a gridded layout consisting of one row and ONE column.

4. An **ODS REGION** statement tells SAS to produce the results using PROC FREQ, PROC SGPLOT and PROC MEANS.

5. An **ODS LAYOUT END** statement tells SAS to terminate the dashboard layout.

6. An **ODS HTML5 CLOSE** statement tells SAS to render the dashboard content to the dashboard file.

Base-SAS Code:

```
ods html5 path="/home/kirklafler/Dashboards/Results"
          body="Dashboard - Gridded HTML (1 x 1) Layout.html"
          (url=none) ;

title1 font=impact bold h=12 c=blue "Analytics Dashboard" ;

ODS LAYOUT GRIDDED ROWS=1 COLUMNS=1 ; /* Design HTML 1x1 Layout */

options center ; /* Center the Results */
ods region ;  /* Start of Output Results */
title1 "SASHELP.CARS Frequency Distribution for Origin and Type" ;
proc freq data=SASHELP.CARS NLEVELS ;
  table Origin Type ;
run ;

title1 "Origin BarChart" ;
proc sgplot data=SASHELP.CARS ;
  vbar Origin / group=Origin datalabel ;
run ;

title1 "Type BarChart" ;
proc sgplot data=SASHELP.CARS ;
  vbar Type / group=Type datalabel ;
run ;

title1 "Origin by Type Cluster BarChart" ;
proc sgplot data=SASHELP.CARS ;
  vbar Origin / group=Type response=MSRP stat=mean groupdisplay=cluster datalabel ;
run ;

title1 "Descriptive Statistics for MSRP and Invoice by Origin" ;
proc means data=SASHELP.CARS n nmiss min max range mean median mode std var ;
  class Origin Type ;
run ;
title ;

ods layout end ; /* Terminate the Layout of Output Results */
ods html5 close ;
```

Example #2 – (1x2) Dashboard Layout with Default Settings

PROC FREQ and PROC REPORT

Number of Distinct Variable Levels (Data Cardinality)
Variable Names Displayed in Alphabetical Order

The FREQ Procedure

Number of Variable Levels				
Variable	Label	Levels	Missing Levels	Nonmissing Levels
Cylinders		8	1	7
DriveTrain		3	0	3
EngineSize	Engine Size (L)	43	0	43
Horsepower		110	0	110
Invoice		425	0	425
Length	Length (IN)	67	0	67
MPG_City	MPG (City)	28	0	28
MPG_Highway	MPG (Highway)	33	0	33
MSRP		410	0	410
Make		38	0	38
Model		425	0	425
Origin		3	0	3
Type		6	0	6
Weight	Weight (LBS)	348	0	348
Wheelbase	Wheelbase (IN)	40	0	40

Origin Frequency Distribution

The FREQ Procedure

Origin	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Asia	158	36.92	158	36.92
Europe	123	28.74	281	65.65
USA	147	34.35	428	100.00

Cars by Origin

Type	Origin	Make	Model	MSRP
SUV	Asia	Honda	Pilot LX	$27,560
			CR-V LX	$19,860
			Element LX	$18,690
		Hyundai	Santa Fe GLS	$21,589
		Isuzu	Rodeo S	$20,449
		Kia	Sorento LX	$19,635
		Mazda	Tribute DX 2.0	$21,087
		Mitsubishi	Outlander LS	$18,892
		Nissan	Pathfinder SE	$27,339
			Xterra XE V6	$20,939
		Suzuki	XL-7 EX	$23,699
			Vitara LX	$17,163
		Toyota	4Runner SR5 V6	$27,710
			Highlander V6	$27,930
			RAV4	$20,290
	Europe	Land Rover	Freelander SE	$25,995
	USA	Buick	Rendezvous CX	$26,545
		Chevrolet	Tracker	$20,255
		Ford	Explorer XLT V6	$29,670
			Escape XLS	$22,515
		Jeep	Grand Cherokee Laredo	$27,905
			Liberty Sport	$20,130
			Wrangler Sahara convertible 2dr	$25,520
		Mercury	Mountaineer	$29,995
		Pontiac	Aztekt	$21,595
		Saturn	VUE	$20,585
Sports	Asia	Hyundai	Tiburon GT V6 2dr	$18,739
		Mazda	MX-5 Miata convertible 2dr	$22,388
			MX-5 Miata LS convertible 2dr	$25,193
			RX-8 4dr automatic	$25,700
			RX-8 4dr manual	$27,200
		Mitsubishi	Eclipse GTS 2dr	$25,092
			Eclipse Spyder GT convertible 2dr	$26,992
			Lancer Evolution 4dr	$29,562
		Nissan	350Z coupe 2dr	$26,910
		Subaru	Impreza WRX 4dr	$25,045
		Toyota	Celica GT-S 2dr	$22,570
			MR2 Spyder convertible 2dr	$25,130
	USA	Ford	Mustang 2dr (convertible)	$18,345
			Mustang GT Premium convertible 2dr	$29,380

Key Points about Code

7. SAS software provides users with numerous procedures for creating dashboard output. The two procedures that are used to create the dashboard are: PROC FREQ and PROC REPORT.

8. An **ODS HTML5 PATH= FILE=** statement tells SAS the destination (or type of medium) to use in creating the dashboard including the destination path (or folder) and the name of the dashboard file.

9. An **ODS LAYOUT GRIDDED ROWS=1 COLUMNS=2** statement tells SAS to create a gridded layout consisting of one row and two columns.

10. The first **ODS REGION** statement tells SAS to produce the first column of results using PROC FREQ.

11. The second **ODS REGION** statement tells SAS to produce the second column of results using PROC REPORT.

12. An **ODS LAYOUT END** statement tells SAS to terminate the dashboard layout.

13. An **ODS HTML5 CLOSE** statement tells SAS to render the dashboard content to the dashboard file.

Base-SAS Code:

```
ODS HTML5 PATH="/home/kirklafler/Results"
          FILE="Dashboard #1 - (1x2) Layout.html"
          (URL=NONE) ;

ODS LAYOUT GRIDDED ROWS=1 COLUMNS=2 ;

PROC SQL NOPRINT ;
  SELECT NAME
   INTO :mAlphabeticalVariable_List SEPARATED BY " "
    FROM SASHELP.VCOLUMN
     WHERE LIBNAME="SASHELP" AND MEMNAME="CARS"
      ORDER BY NAME ;
QUIT ;

ODS REGION ;  /* Row 1 Column 1 */
ODS SELECT NLEVELS ;
TITLE1 BOLD "Number of Distinct Variable Levels (Data Cardinality)" ;
TITLE2 BOLD "Variable Names Displayed in Alphabetical Order" ;
PROC FREQ DATA=SASHELP.Cars NLEVELS ;
  TABLES &mAlphabeticalVariable_List ;
RUN ;
TITLE1 BOLD "Origin Frequency Distribution" ;
PROC FREQ DATA=SASHELP.Cars ;
  TABLES Origin ;
RUN ;

ODS REGION ;  /* Row 1 Column 2 */
TITLE1 BOLD "Cars by Origin" ;
PROC REPORT DATA=SASHELP.Cars(KEEP=Type Make Model Origin MSRP) ;
  WHERE MSRP < 30000 AND Type IN ("SUV","Sports") ;
  COLUMNS Type Origin Make Model MSRP ;
  DEFINE Type   / ORDER          ;
  DEFINE Origin / ORDER          ;
  DEFINE Make   / ORDER   CENTER ;
  DEFINE Model  / DISPLAY        ;
  DEFINE MSRP   / DISPLAY        ;
RUN ;

ODS LAYOUT END ;

ODS HTML5 CLOSE ;
```

Example #3 – (2x2) Dashboard Layout with Default Settings

PROC FREQ, PROC SGPLOT, PROC MEANS, and PROC UNIVARIATE

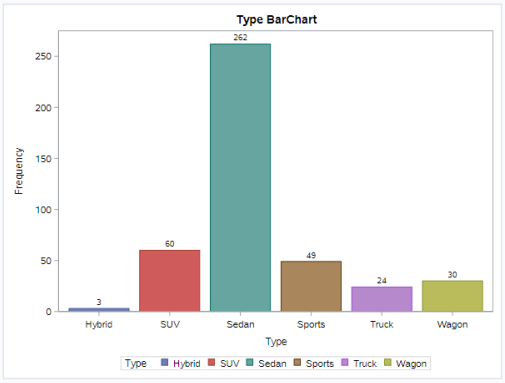
Analytics Dashboard

Region Frequency Distribution

The FREQ Procedure

Origin	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Asia	158	36.92	158	36.92
Europe	123	28.74	281	65.65
USA	147	34.35	428	100.00

Type	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Hybrid	3	0.70	3	0.70
SUV	60	14.02	63	14.72
Sedan	262	61.21	325	75.93
Sports	49	11.45	374	87.38
Truck	24	5.61	398	92.99
Wagon	30	7.01	428	100.00



Type Descriptive Statistics

The MEANS Procedure

Type	N Obs	Variable	Label	N	N Miss	Minimum	Maximum	Range	Mean	Median	Mode	Std Dev	Variance
Hybrid	3	MSRP		3	0	19110.00	20510.00	1400.00	19920.00	20140.00	.	725.4553879	526300.00
		Invoice		3	0	17911.00	18925.00	1015.00	18429.33	18451.00	.	507.8457817	257908.33
		EngineSize	Engine Size (L)	3	0	1.4000000	2.0000000	0.6000000	1.6333333	1.5000000	.	0.3214550	0.1033333
		Cylinders		3	0	3.0000000	4.0000000	1.0000000	3.6666667	4.0000000	4.0000000	0.5773503	0.3333333
		Horsepower		3	0	73.0000000	110.0000000	37.0000000	92.0000000	93.0000000	.	18.5202592	343.0000000
		MPG_City	MPG (City)	3	0	46.0000000	60.0000000	14.0000000	55.0000000	59.0000000	.	7.8102497	61.0000000
		MPG_Highway	MPG (Highway)	3	0	51.0000000	66.0000000	15.0000000	56.0000000	51.0000000	51.0000000	8.6602540	75.0000000
		Weight	Weight (LBS)	3	0	1850.00	2890.00	1040.00	2490.67	2732.00	.	560.4295971	314081.33
		Wheelbase	Wheelbase (IN)	3	0	95.0000000	106.0000000	11.0000000	101.3333333	103.0000000	.	5.6862407	32.3333333
		Length	Length (IN)	3	0	155.0000000	175.0000000	20.0000000	168.3333333	175.0000000	175.0000000	11.5470054	133.3333333
SUV	60	MSRP		60	0	17163.00	76670.00	59707.00	34790.25	32062.50	.	13598.63	184922749
		Invoice		60	0	16949.00	71540.00	54591.00	31625.35	29724.50	.	12082.39	145501198
		EngineSize	Engine Size (L)	60	0	2.0000000	6.8000000	4.8000000	3.9200000	4.0000000	2.4000000	1.0910732	1.1904407
		Cylinders		60	0	4.0000000	10.0000000	6.0000000	6.5666667	6.0000000	6.0000000	1.3822932	1.9107345
		Horsepower		60	0	130.0000000	340.0000000	210.0000000	235.8166667	231.0000000	275.0000000	56.2339217	3162.25
		MPG_City	MPG (City)	60	0	10.0000000	22.0000000	12.0000000	16.1000000	16.0000000	15.0000000	2.8206262	7.9559322
		MPG_Highway	MPG (Highway)	60	0	12.0000000	27.0000000	15.0000000	20.5000000	21.0000000	21.0000000	3.3370036	11.1355932
		Weight	Weight (LBS)	60	0	2886.00	7190.00	4324.00	4444.43	4438.00	.	889.2528184	790770.22
		Wheelbase	Wheelbase (IN)	60	0	93.0000000	137.0000000	44.0000000	111.0833333	110.5000000	112.0000000	8.7339037	76.2810734
		Length	Length (IN)	60	0	150.0000000	227.0000000	77.0000000	188.1333333	188.0000000	190.0000000	13.9411191	194.3548023
Sedan	262	MSRP		262	0	10280.00	128420.00	118140.00	29773.62	26432.50	13270.00	15584.59	242879498
		Invoice		262	0	9875.00	119600.00	109725.00	27389.80	24663.00	14207.00	14306.15	204837363
		EngineSize	Engine Size (L)	262	0	1.5000000	8.0000000	4.5000000	2.9709924	3.0000000	3.0000000	0.9263342	0.8582435
Truck	24	MSRP		24	0	12800.00	52975.00	40175.00	24941.38	22180.00	.	9871.97	97455778.42
		Invoice		24	0	11879.00	48541.00	36662.00	22515.75	19985.00	.	8852.13	78350239.85
		EngineSize	Engine Size (L)	24	0	2.3000000	8.0000000	5.7000000	4.0791667	3.8500000	3.7000000	1.2489923	1.5599819
		Cylinders		24	0	4.0000000	8.0000000	4.0000000	6.2500000	6.0000000	6.0000000	1.5048286	2.5434783
		Horsepower		24	0	142.0000000	345.0000000	203.0000000	224.8333333	208.5000000	300.0000000	51.8452955	3824.84
		MPG_City	MPG (City)	24	0	13.0000000	24.0000000	11.0000000	16.5000000	16.0000000	16.0000000	3.2302914	10.4347826
		MPG_Highway	MPG (Highway)	24	0	17.0000000	29.0000000	12.0000000	21.0000000	19.5000000	18.0000000	3.8735923	15.0434783
		Weight	Weight (LBS)	24	0	2750.00	5870.00	3120.00	4250.75	4112.50	.	888.8274794	789452.98
		Wheelbase	Wheelbase (IN)	24	0	103.0000000	144.0000000	41.0000000	123.0000000	124.5000000	111.0000000	11.7102705	137.1304348
		Length	Length (IN)	24	0	188.0000000	238.0000000	50.0000000	207.7083333	208.0000000	191.0000000	15.1613902	229.8577536
Wagon	30	MSRP		30	0	11905.00	50570.00	38665.00	28840.53	25545.00	.	11834.00	140043622
		Invoice		30	0	11410.00	48474.00	37064.00	26645.63	23721.00	.	10856.11	117855231
		EngineSize	Engine Size (L)	30	0	1.5000000	5.0000000	3.5000000	2.7700000	2.5000000	2.5000000	0.8910087	0.7938966
		Cylinders		30	0	4.0000000	8.0000000	4.0000000	5.3000000	5.5000000	4.0000000	1.4178863	2.0103448
		Horsepower		30	0	104.0000000	340.0000000	236.0000000	194.0000000	170.0000000	130.0000000	63.7922274	4069.45
		MPG_City	MPG (City)	30	0	15.0000000	31.0000000	16.0000000	21.1000000	20.0000000	19.0000000	4.2128703	17.7482759
		MPG_Highway	MPG (Highway)	30	0	19.0000000	36.0000000	17.0000000	27.9000000	27.5000000	25.0000000	4.4127558	19.4724138
		Weight	Weight (LBS)	30	0	2425.00	4575.00	2250.00	3438.80	3464.00	.	581.4517147	338088.10
		Wheelbase	Wheelbase (IN)	30	0	95.0000000	118.0000000	23.0000000	105.8000000	106.0000000	112.0000000	5.1888475	26.9241379
		Length	Length (IN)	30	0	155.0000000	199.0000000	44.0000000	182.4333333	184.0000000	190.0000000	10.1427172	102.8747126

Type Univariate Statistics

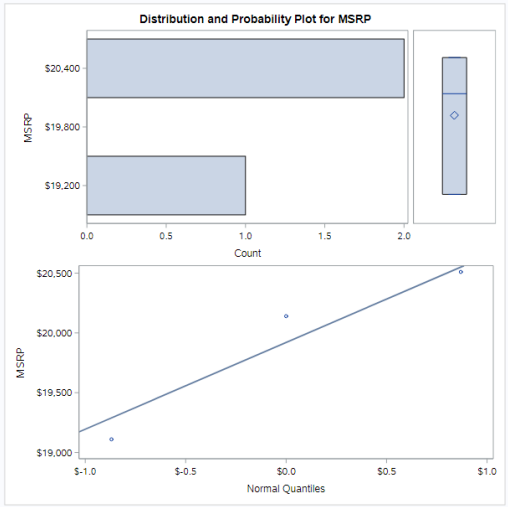
The UNIVARIATE Procedure
Variable: MSRP
Type = Hybrid

Moments			
N	3	Sum Weights	3
Mean	19920	Sum Observations	59760
Std Deviation	725.455388	Variance	526300
Skewness	-1.2391451	Kurtosis	.
Uncorrected SS	1191471800	Corrected SS	1052600
Coeff Variation	3.64189442	Std Error Mean	418.847825

Basic Statistical Measures			
Location		Variability	
Mean	19920.00	Std Deviation	725.45537
Median	20140.00	Variance	526300
Mode	.	Range	1400
		Interquartile Range	1400

Quantiles (Definition 5)	
90%	20510
75% Q3	20510
50% Median	20140
25% Q1	19110
10%	19110
5%	19110
1%	19110
0% Min	19110

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
19110	151	19110	151
20140	150	20140	150
20510	374	20510	374



Key Points about Code

1. SAS software provides users with numerous procedures for creating dashboard output. The four procedures that are used to create the dashboard are: PROC FREQ, PROC SGPLOT, PROC MEANS, and PROC UNIVARIATE.

2. An **ODS HTML5 PATH= FILE=** statement tells SAS the destination (or type of medium) to use in creating the dashboard including the destination path (or folder) and the name of the dashboard file.

3. An **ODS LAYOUT GRIDDED ROWS=2 COLUMNS=2** statement tells SAS to create a gridded layout consisting of one row and two columns.

4. Multiple **ODS REGION** statements to tell SAS to produce the row and column of results.

5. An **ODS LAYOUT END** statement tells SAS to terminate the dashboard layout.

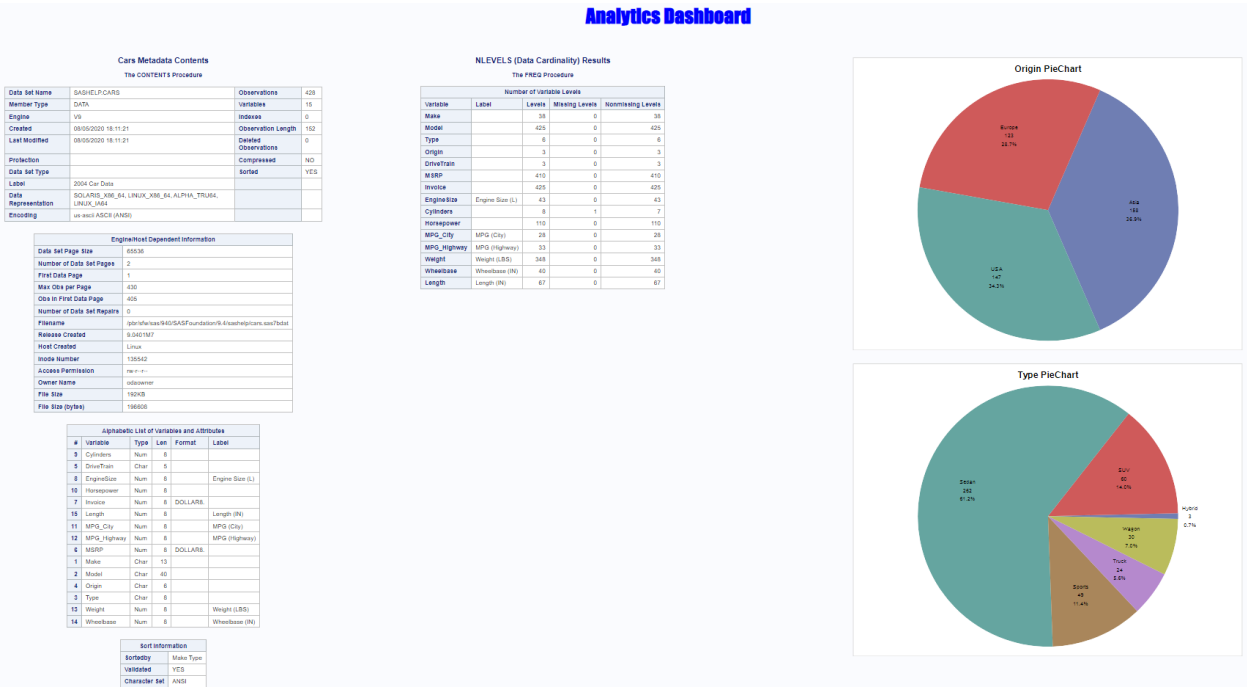
6. An **ODS HTML5 CLOSE** statement tells SAS to render the dashboard content to the dashboard file.

Base-SAS Code:

```
ODS HTML5 PATH="/home/kirklafler/Results"
          FILE="Dashboard #2 - (2x2) Layout.html"
          (URL=NONE) ;

title1 font=impact bold h=12 c=blue "Analytics Dashboard" ;
ods layout start rows=2 columns=2 ;

ods region ;  /* Row 1 Column 1 */
title1 "Region Frequency Distribution" ;
proc freq data=sashelp.cars ;
  tables Origin Type ;
run ;

ods region ;  /* Row 1 Column 2 */
title1 "Type BarChart" ;
proc sgplot data=sashelp.cars ;
  vbar Type / group=Type datalabel ;
run ;

ods region ;  /* Row 2 Column 1 */
title1 "Type Descriptive Statistics" ;
proc means data=sashelp.cars n nmiss min max range mean median mode std var ;
  class Type ;
run ;

ods region ;  /* Row 2 Column 2 */
title1 "Type Univariate Statistics" ;
proc univariate data=sashelp.cars plots ;
  class Type ;
run ;
title ;

ods layout end ;
ods html5 close ;
```

Example #4 – (3x3) Dashboard Layout with Default Settings

PROC CONTENTS, PROC FREQ, PROC SGPIE, PROC SGPLOT, PROC MEANS, PROC REPORT, and PROC UNIVARIATE



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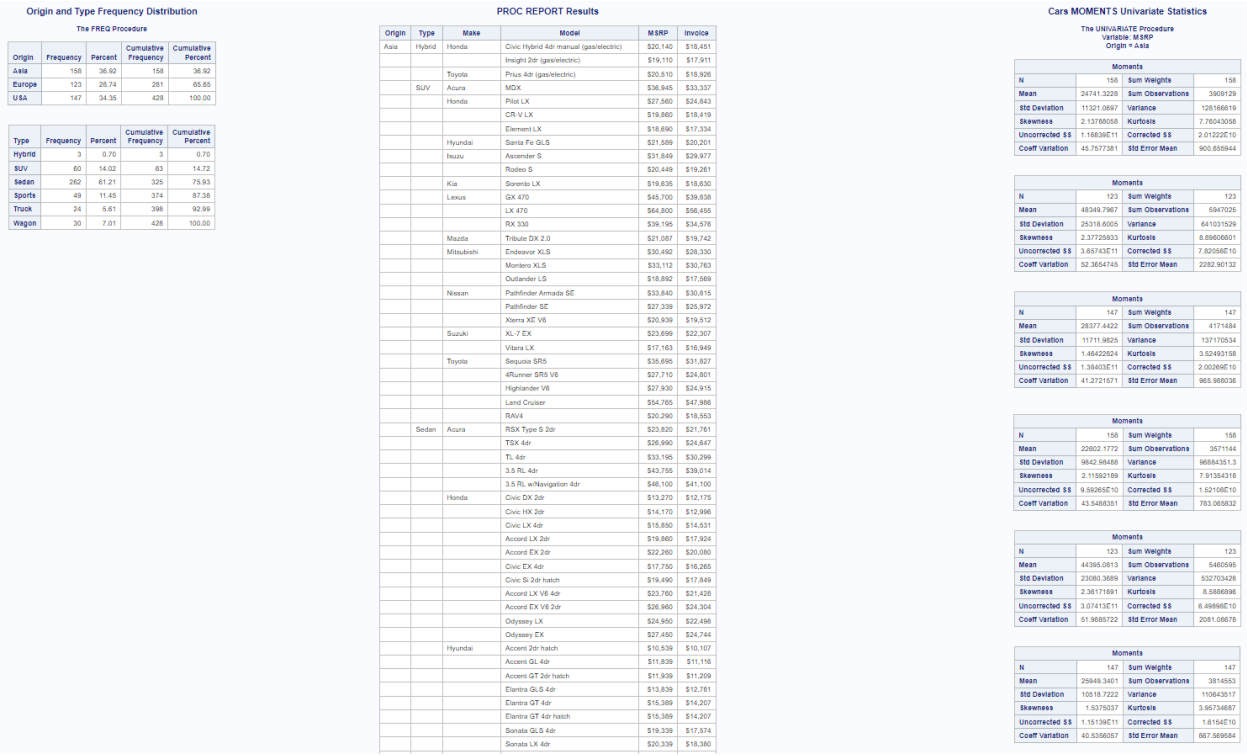
Dashboard #3, continued



Origin and Type Frequency Distribution

The FREQ Procedure

Origin	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Asia	158	36.92	158	36.92
Europe	123	28.74	281	65.65
USA	147	34.35	428	100.00

Type	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Hybrid	3	0.70	3	0.70
SUV	60	14.02	63	14.72
Sedan	262	61.21	325	75.93
Sports	49	11.45	374	87.38
Truck	24	5.61	398	92.99
Wagon	30	7.01	428	100.00

PROC REPORT Results

Origin	Type	Make	Model	MSRP	Invoice
Asia	Hybrid	Honda	Civic Hybrid 4dr manual (gas/electric)	$20,140	$18,451
			Insight 2dr (gas/electric)	$19,110	$17,911
		Toyota	Prius 4dr (gas/electric)	$20,510	$18,926
	SUV	Acura	MDX	$36,945	$33,337
		Honda	Pilot LX	$27,560	$24,843
			CR-V LX	$19,860	$18,419
			Element LX	$18,690	$17,334
		Hyundai	Santa Fe GLS	$21,589	$20,201
		Isuzu	Ascender S	$31,849	$29,977
			Rodeo S	$20,449	$19,261
		Kia	Sorento LX	$19,635	$18,630
		Lexus	GX 470	$45,700	$39,838
			LX 470	$64,800	$56,455
			RX 330	$39,195	$34,576
		Mazda	Tribute DX 2.0	$21,087	$19,742
		Mitsubishi	Endeavor XLS	$30,492	$28,330
			Montero XLS	$33,112	$30,763
			Outlander LS	$18,892	$17,569
		Nissan	Pathfinder Armada SE	$33,840	$30,815
			Pathfinder SE	$27,339	$25,972
			Xterra XE V6	$20,939	$19,512
		Suzuki	XL-7 EX	$23,699	$22,307
			Vitara LX	$17,163	$16,949
		Toyota	Sequoia SR5	$35,695	$31,827
			4Runner SR5 V6	$27,710	$24,801
			Highlander V6	$27,930	$24,915
			Land Cruiser	$54,765	$47,966
			RAV4	$20,290	$18,553
	Sedan	Acura	RSX Type S 2dr	$23,820	$21,761
			TSX 4dr	$26,990	$24,647
			TL 4dr	$33,195	$30,299
			3.5 RL 4dr	$43,755	$39,014
			3.5 RL w/Navigation 4dr	$46,100	$41,100
		Honda	Civic DX 2dr	$13,270	$12,175
			Civic HX 2dr	$14,170	$12,996
			Civic LX 4dr	$15,850	$14,531
			Accord LX 2dr	$19,860	$17,924
			Accord EX 2dr	$22,260	$20,080
			Civic EX 4dr	$17,750	$16,265
			Civic Si 2dr hatch	$19,490	$17,849
			Accord LX V6 4dr	$23,760	$21,428
			Accord EX V6 2dr	$26,960	$24,304
			Odyssey LX	$24,950	$22,498
			Odyssey EX	$27,450	$24,744
		Hyundai	Accent 2dr hatch	$10,539	$10,107
			Accent GL 4dr	$11,839	$11,116
			Accent GT 2dr hatch	$11,939	$11,209
			Elantra GLS 4dr	$13,839	$12,781
			Elantra GT 4dr	$15,389	$14,207
			Elantra GT 4dr hatch	$15,389	$14,207
			Sonata GLS 4dr	$19,339	$17,574
			Sonata LX 4dr	$20,339	$18,380

Cars MOMENTS Univariate Statistics

The UNIVARIATE Procedure
Variable: MSRP
Origin = Asia

Moments			
N	158	Sum Weights	158
Mean	24741.3228	Sum Observations	3909129
Std Deviation	11321.0697	Variance	128166819
Skewness	2.13788058	Kurtosis	7.76043058
Uncorrected SS	1.16839E11	Corrected SS	2.01222E10
Coeff Variation	45.7577381	Std Error Mean	900.655944

Moments			
N	123	Sum Weights	123
Mean	48349.7967	Sum Observations	5947025
Std Deviation	25318.6005	Variance	641031529
Skewness	2.37725933	Kurtosis	8.89606601
Uncorrected SS	3.65743E11	Corrected SS	7.82656E10
Coeff Variation	52.3654745	Std Error Mean	2282.90132

Moments			
N	147	Sum Weights	147
Mean	28377.4422	Sum Observations	4171484
Std Deviation	11711.9825	Variance	137170534
Skewness	1.46422824	Kurtosis	3.52493158
Uncorrected SS	1.38403E11	Corrected SS	2.00269E10
Coeff Variation	41.2721571	Std Error Mean	965.980036

Moments			
N	158	Sum Weights	158
Mean	22602.1772	Sum Observations	3571144
Std Deviation	9842.98488	Variance	96884351.3
Skewness	2.11592189	Kurtosis	7.91354318
Uncorrected SS	9.59265E10	Corrected SS	1.52108E10
Coeff Variation	43.5468351	Std Error Mean	783.065832

Moments			
N	123	Sum Weights	123
Mean	44395.0813	Sum Observations	5460595
Std Deviation	23080.3689	Variance	532703428
Skewness	2.36171691	Kurtosis	8.5886896
Uncorrected SS	3.07413E11	Corrected SS	6.49896E10
Coeff Variation	51.9685722	Std Error Mean	2081.08878

Moments			
N	147	Sum Weights	147
Mean	25949.3401	Sum Observations	3814553
Std Deviation	10518.7222	Variance	110643517
Skewness	1.5375037	Kurtosis	3.95734687
Uncorrected SS	1.15139E11	Corrected SS	1.6154E10
Coeff Variation	40.5356057	Std Error Mean	867.569584

Key Points about Code

1. SAS software provides users with numerous procedures for creating dashboard output. The procedures that are used to create the dashboard are: PROC FREQ, PROC SGPIE, PROC SGPLOT, PROC MEANS, PROC REPORT, and PROC UNIVARIATE.

2. An **ODS HTML5 PATH= FILE=** statement tells SAS the destination (or type of medium) to use in creating the dashboard including the destination path (or folder) and the name of the dashboard file.

1. An **ODS LAYOUT GRIDDED ROWS=3 COLUMNS=3** statement tells SAS to create a gridded layout consisting of one row and two columns.

2. Multiple **ODS REGION** statements to tell SAS to produce the row and column of results.

3. An **ODS LAYOUT END** statement tells SAS to terminate the dashboard layout.

4. An **ODS HTML5 CLOSE** statement tells SAS to render the dashboard content to the dashboard file.

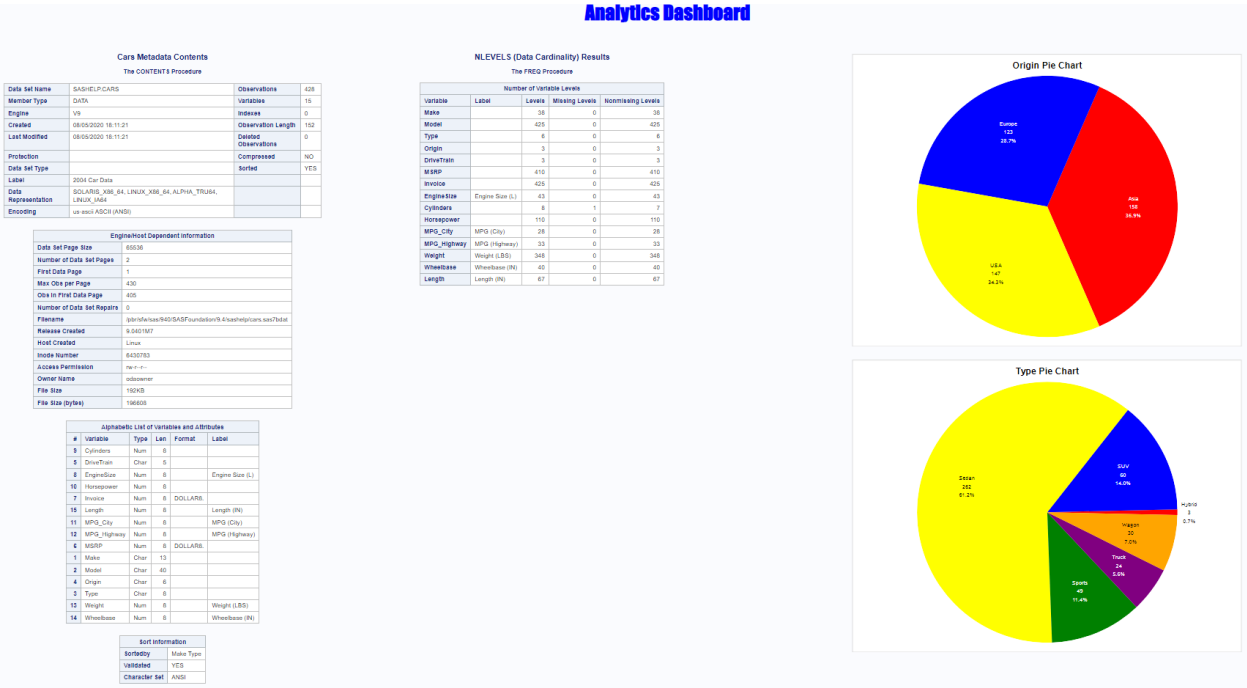
Base-SAS Code:

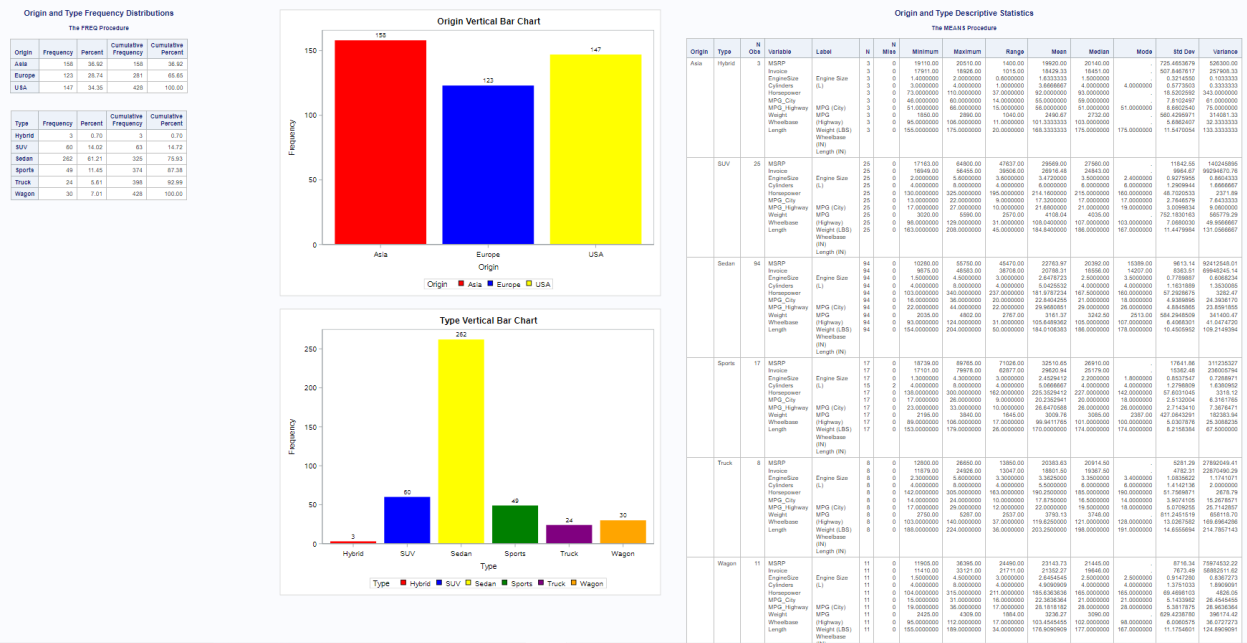
```
ODS HTML5 PATH="/home/kirklafler/Results"
          body="Dashboard #3 - (3x3) Layout.html"
          (url=none) ;

title1 font=impact bold h=12 c=blue "Analytics Dashboard" ;
ods layout start rows=3 columns=3 ;

ods region ;  /* Row 1 Column 1 */
title1 "Cars Metadata Contents" ;
proc contents data=sashelp.cars nods ;
run ;

ods region ;  /* Row 1 Column 2 */
ods select nlevels ;
title1 "NLEVELS (Data Cardinality) Results" ;
proc freq data=sashelp.cars NLEVELS ;
```

```
run ;

ods region ;  /* Row 1 Column 3 */
title1 "Origin PieChart" ;
proc sgpie data=sashelp.cars ;
  pie Origin / datalabeldisplay=all ;
run ;
title1 "Type PieChart" ;
proc sgpie data=sashelp.cars ;
  pie Type / datalabeldisplay=all ;
run ;
title ;

ods region ;  /* Row 2 Column 1 */
title1 "Origin and Type Frequency Distributions" ;
proc freq data=sashelp.cars ;
  tables Origin Type ;
run ;

ods region ;  /* Row 2 Column 2 */
title1 "Origin Vertical BarChart" ;
proc sgplot data=sashelp.cars ;
  vbar Origin / group=Origin datalabel ;
run ;
title1 "Type Vertical BarChart" ;
proc sgplot data=sashelp.cars ;
  vbar Type   / group=Type datalabel ;
run ;

ods region ;  /* Row 2 Column 3 */
title1 "Origin and Type Descriptive Statistics" ;
proc means data=sashelp.cars n nmiss min max range mean median mode std var ;
  class Origin Type ;
run ;

ods region ;  /* Row 3 Column 1 */
title1 "Origin and Type Frequency Distribution" ;
proc freq data=sashelp.cars ;
  tables Origin Type ;
run ;

ods region ;  /* Row 3 Column 2 */
title1 "PROC REPORT Results" ;
proc report data=sashelp.cars ;
  columns Origin Type Make Model MSRP Invoice ;
  define Origin  / order ;
  define Type    / order ;
  define Make    / order ;
  define Model   / display ;
  define MSRP    / display format=dollar10. ;
  define Invoice / display format=dollar10. ;
run ;

ods region ;  /* Row 3 Column 3 */
ods select moments ;
title1 "Cars MOMENTS Univariate Statistics" ;
proc univariate data=sashelp.cars ;
  class Origin ;
run ;

ods layout end ;
ods html5 close ;
```

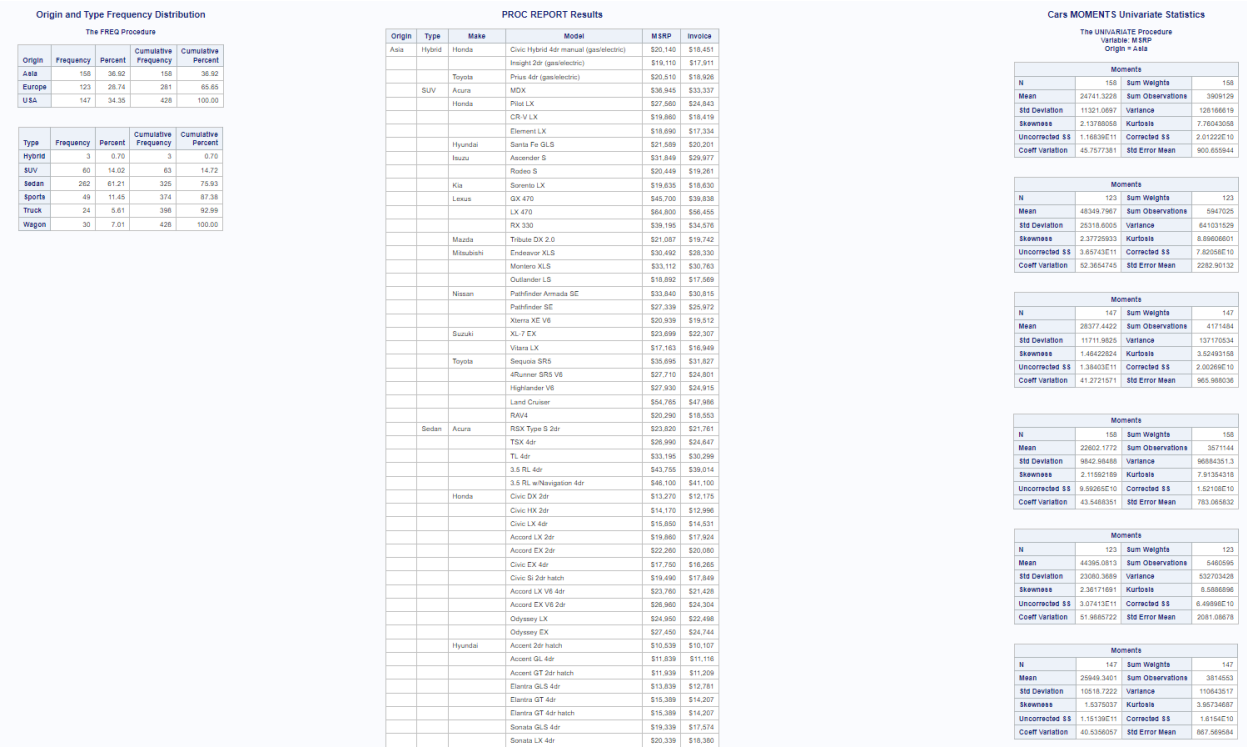
Example #5 – (3x3) Dashboard Layout with Custom Colors

PROC CONTENTS, PROC FREQ, PROC SGPIE, PROC SGPLOT, PROC MEANS, PROC REPORT, and PROC UNIVARIATE





Dashboard #4, continued



Key Points about Code

1. SAS software provides users with numerous procedures for creating dashboard output. The procedures that are used to create the dashboard are: PROC FREQ, PROC SGPIE, PROC SGPLOT, PROC MEANS, PROC REPORT, and PROC UNIVARIATE.

2. An **ODS HTML5 PATH= FILE=** statement tells SAS the destination (or type of medium) to use in creating the dashboard including the destination path (or folder) and the name of the dashboard file.

3. An **ODS LAYOUT GRIDDED ROWS=3 COLUMNS=3** statement tells SAS to create a gridded layout consisting of one row and two columns.

4. Multiple **ODS REGION** statements to tell SAS to produce the row and column of results.

5. When producing graphics (e.g., bar charts, pie charts, etc.) the statement **styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan)** tells SAS to display the bars and/or pie slices using the specified colors.

6. An **ODS LAYOUT END** statement tells SAS to terminate the dashboard layout.

7. An **ODS HTML5 CLOSE** statement tells SAS to render the dashboard content to the dashboard file.

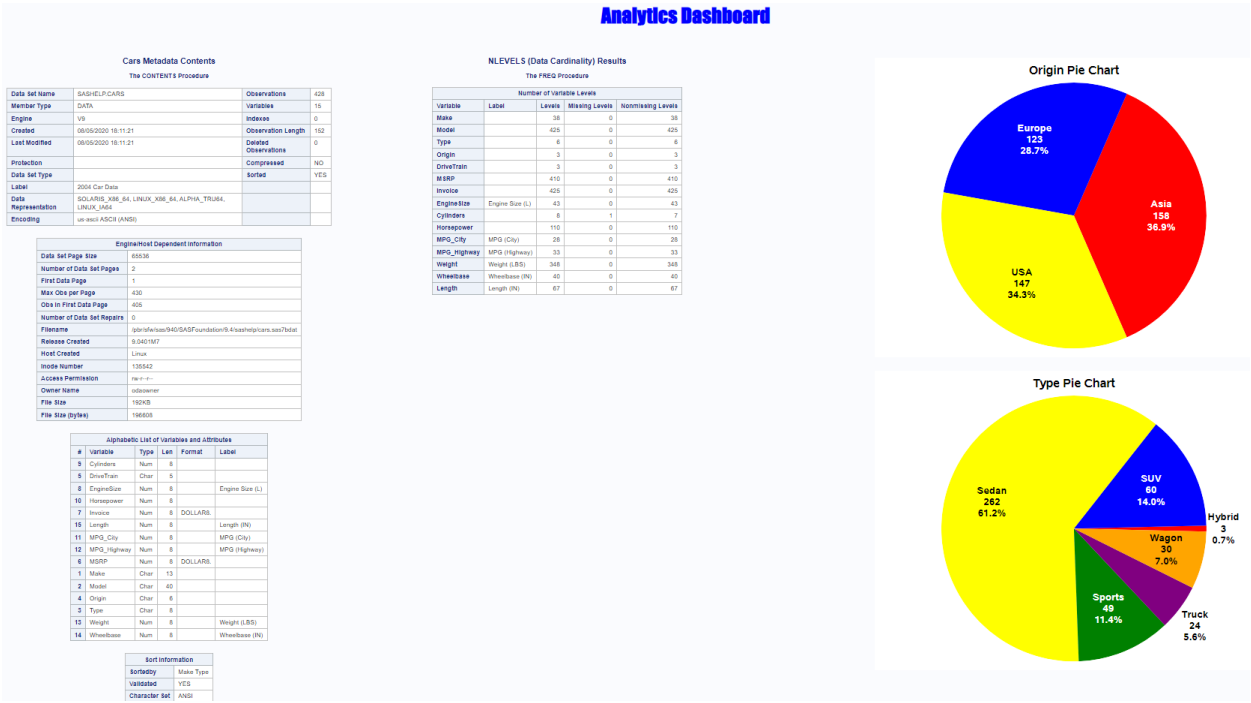
Base-SAS Code:

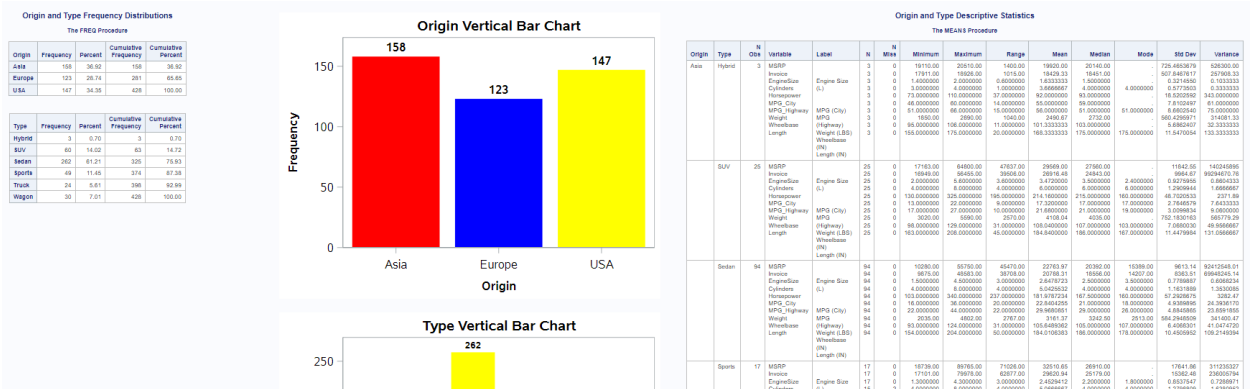
```
ODS HTML5 PATH="/home/kirklafler/Dashboards/Results"
          body="Dashboard #4 - (3x3) Layout with Custom Colors.html"
          (url=none) ;

title1 font=impact bold h=12 c=blue "Analytics Dashboard" ;
ods layout start rows=3 columns=3 ;

ods region ;  /* Row 1 Column 1 */
title1 "Cars Metadata Contents" ;
proc contents data=sashelp.cars nods ;
run ;
ods region ;  /* Row 1 Column 2 */
ods select nlevels ;
```

```
title1 "NLEVELS (Data Cardinality) Results" ;
proc freq data=sashelp.cars NLEVELS ;
run ;

ods region ;  /* Row 1 Column 3 */
title1 "Origin Pie Chart" ;
proc sgpie data=sashelp.cars ;
  styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan) ;
  pie Origin / datalabeldisplay=all ;
run ;
title1 "Type Pie Chart" ;
proc sgpie data=sashelp.cars ;
  styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan) ;
  pie Type / datalabeldisplay=all ;
run ;
title ;

ods region ;  /* Row 2 Column 1 */
title1 "Origin and Type Frequency Distributions" ;
proc freq data=sashelp.cars ;
  tables Origin Type ;
run ;

ods region ;  /* Row 2 Column 2 */
title1 "Origin Vertical Bar Chart" ;
proc sgplot data=sashelp.cars ;
  styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan) ;
  vbar Origin / group=Origin datalabel nooutline ;
run ;
title1 "Type Vertical Bar Chart" ;
proc sgplot data=sashelp.cars ;
  styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan) ;
  vbar Type   / group=Type datalabel nooutline ;
run ;

ods region ;  /* Row 2 Column 3 */
title1 "Origin and Type Descriptive Statistics" ;
proc means data=sashelp.cars n nmiss min max range mean median mode std var ;
  class Origin Type ;
run ;

ods region ;  /* Row 3 Column 1 */
title1 "Origin and Type Frequency Distribution" ;
proc freq data=sashelp.cars ;
  tables Origin Type ;
run ;

ods region ;  /* Row 3 Column 2 */
title1 "PROC REPORT Results" ;
proc report data=sashelp.cars ;
  columns Origin Type Make Model MSRP Invoice ;
  define Origin  / order ;
  define Type    / order ;
  define Make    / order ;
  define Model   / display ;
  define MSRP    / display format=dollar10. ;
  define Invoice / display format=dollar10. ;
run ;

ods region ;  /* Row 3 Column 3 */
ods select moments ;
title1 "Cars MOMENTS Univariate Statistics" ;
proc univariate data=sashelp.cars ;
  class Origin ;
run ;

ods layout end ;
ods html5 close ;
```

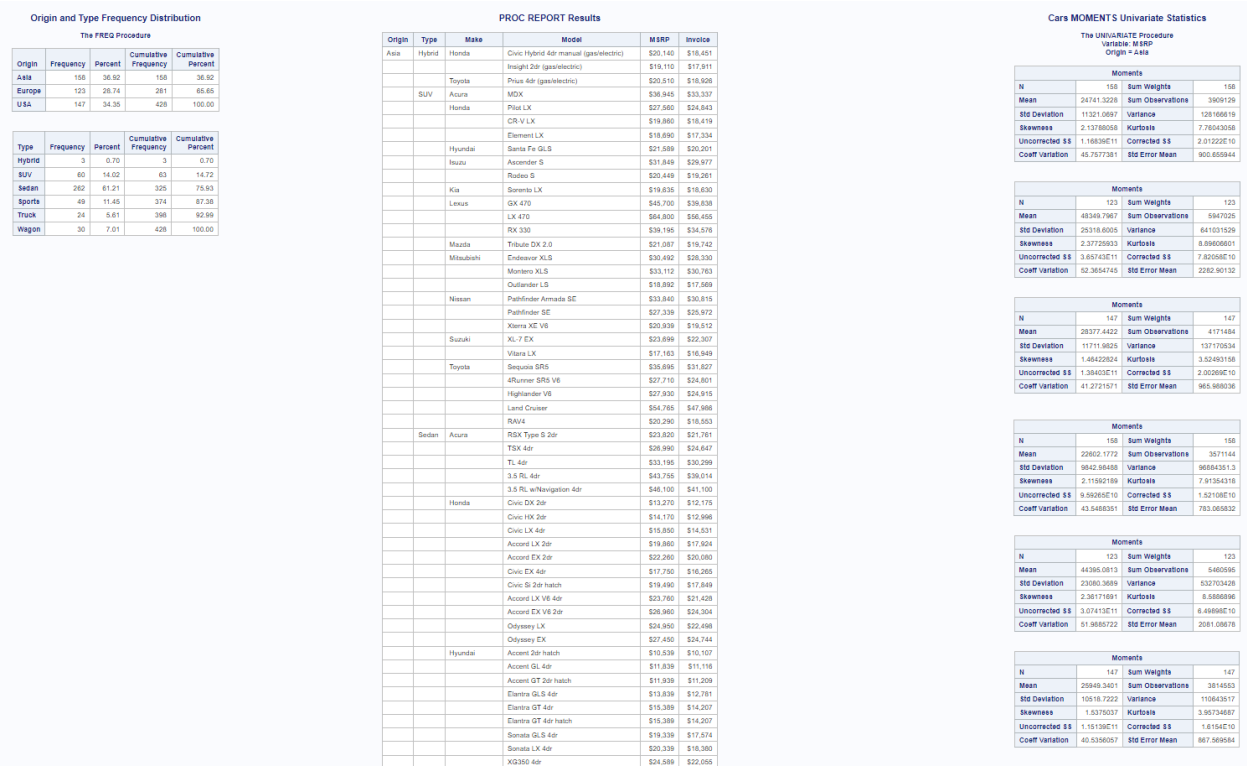
Example #6 – (3x3) Dashboard Layout with Custom Colors and Enlarged Fonts

PROC CONTENTS, PROC FREQ, PROC SGPIE, PROC SGPLOT, PROC MEANS, PROC REPORT, and PROC UNIVARIATE





Dashboard #5, continued



Origin and Type Frequency Distribution

The FREQ Procedure

Origin	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Asia	158	36.92	158	36.92
Europe	123	28.74	281	65.65
USA	147	34.35	428	100.00

Type	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Hybrid	3	0.70	3	0.70
SUV	60	14.02	63	14.72
Sedan	262	61.21	325	75.93
Sports	49	11.45	374	87.38
Truck	24	5.61	398	92.99
Wagon	30	7.01	428	100.00

PROC REPORT Results

Origin	Type	Make	Model	MSRP	Invoice
Asia	Hybrid	Honda	Civic Hybrid 4dr manual (gas/electric)	$20,140	$18,451
			Insight 2dr (gas/electric)	$19,110	$17,911
		Toyota	Prius 4dr (gas/electric)	$20,510	$18,926
	SUV	Acura	MDX	$36,945	$33,337
		Honda	Pilot LX	$27,560	$24,843
			CR-V LX	$19,860	$18,419
			Element LX	$18,690	$17,334
		Hyundai	Santa Fe GLS	$21,589	$20,201
		Isuzu	Ascender S	$31,849	$29,977
			Rodeo S	$20,449	$19,261
		Kia	Sorento LX	$19,835	$18,630
		Lexus	GX 470	$45,700	$39,838
			LX 470	$64,800	$56,455
			RX 330	$39,195	$34,576
		Mazda	Tribute DX 2.0	$21,087	$19,742
		Mitsubishi	Endeavor XLS	$30,492	$28,330
			Montero XLS	$33,112	$30,763
			Outlander LS	$18,892	$17,569
		Nissan	Pathfinder Armada SE	$33,840	$30,615
			Pathfinder SE	$27,339	$25,972
			Xterra XE V6	$20,939	$19,512
		Suzuki	XL-7 EX	$23,699	$22,307
			Vitara LX	$17,163	$16,949
		Toyota	Sequoia SR5	$35,895	$31,827
			4Runner SR5 V6	$27,710	$24,801
			Highlander V6	$27,930	$24,915
			Land Cruiser	$54,765	$47,986
			RAV4	$20,290	$18,553
	Sedan	Acura	RSX Type S 2dr	$23,820	$21,761
			TSX 4dr	$26,990	$24,647
			TL 4dr	$33,195	$30,299
			3.5 RL 4dr	$43,755	$39,014
			3.5 RL w/Navigation 4dr	$46,100	$41,100
		Honda	Civic DX 2dr	$13,270	$12,175
			Civic HX 2dr	$14,170	$12,996
			Civic LX 4dr	$15,850	$14,531
			Accord LX 2dr	$19,860	$17,924
			Accord EX 2dr	$22,260	$20,080
			Civic EX 4dr	$17,750	$16,265
			Civic Si 2dr hatch	$19,490	$17,849
			Accord LX V6 4dr	$23,760	$21,428
			Accord EX V6 2dr	$26,960	$24,304
			Odyssey LX	$24,950	$22,498
			Odyssey EX	$27,450	$24,744
		Hyundai	Accent 2dr hatch	$10,539	$10,107
			Accent GL 4dr	$11,839	$11,116
			Accent GT 2dr hatch	$11,939	$11,209
			Elantra GLS 4dr	$13,839	$12,781
			Elantra GT 4dr	$15,389	$14,207
			Elantra GT 4dr hatch	$15,389	$14,207
			Sonata GLS 4dr	$19,339	$17,574
			Sonata LX 4dr	$20,339	$18,380
			XG350 4dr	$24,589	$22,055

Cars MOMENTS Univariate Statistics

The UNIVARIATE Procedure
Variable: MSRP
Origin = Asia

Moments			
N	158	Sum Weights	158
Mean	24741.3228	Sum Observations	3909129
Std Deviation	11321.0697	Variance	128166619
Skewness	2.13788058	Kurtosis	7.78043058
Uncorrected SS	1.16839E11	Corrected SS	2.01222E10
Coeff Variation	45.7577381	Std Error Mean	900.658944

Moments			
N	123	Sum Weights	123
Mean	48349.7967	Sum Observations	5947025
Std Deviation	25318.6005	Variance	641031529
Skewness	2.37725933	Kurtosis	8.89606601
Uncorrected SS	3.65743E11	Corrected SS	7.82058E10
Coeff Variation	52.3654745	Std Error Mean	2282.90132

Moments			
N	147	Sum Weights	147
Mean	28377.4422	Sum Observations	4171484
Std Deviation	11711.9825	Variance	137170534
Skewness	1.46422824	Kurtosis	3.52493158
Uncorrected SS	1.38403E11	Corrected SS	2.00269E10
Coeff Variation	41.2721571	Std Error Mean	965.988036

Moments			
N	158	Sum Weights	158
Mean	22602.1772	Sum Observations	3571144
Std Deviation	9842.98488	Variance	96884351.3
Skewness	2.11592189	Kurtosis	7.91354318
Uncorrected SS	9.59265E10	Corrected SS	1.52108E10
Coeff Variation	43.5486351	Std Error Mean	783.065832

Moments			
N	123	Sum Weights	123
Mean	44395.0813	Sum Observations	5460595
Std Deviation	23080.3689	Variance	532703428
Skewness	2.36171691	Kurtosis	8.5886896
Uncorrected SS	3.07413E11	Corrected SS	6.49896E10
Coeff Variation	51.9685722	Std Error Mean	2081.08678

Moments			
N	147	Sum Weights	147
Mean	25949.3401	Sum Observations	3814553
Std Deviation	10518.7222	Variance	110643517
Skewness	1.5375037	Kurtosis	3.95734687
Uncorrected SS	1.15139E11	Corrected SS	1.6154E10
Coeff Variation	40.5356057	Std Error Mean	867.569584

Key Points about Code

1. SAS software provides users with numerous procedures for creating dashboard output. The procedures that are used to create the dashboard are: PROC FREQ, PROC SGPIE, PROC SGPLOT, PROC MEANS, PROC REPORT, and PROC UNIVARIATE.

2. An **ODS HTML5 PATH= FILE=** statement tells SAS the destination (or type of medium) to use in creating the dashboard including the destination path (or folder) and the name of the dashboard file.

3. An **ODS LAYOUT GRIDDED ROWS=3 COLUMNS=3** statement tells SAS to create a gridded layout consisting of one row and two columns.

4. Multiple **ODS REGION** statements to tell SAS to produce the row and column of results.

5. When producing enlarged titles and fonts (e.g., titles, footnotes, charts, etc.) the **datalabeldisplay=all** and **datalabelattrs=** options tell SAS to display the text associated with bars and/or pie slices using a larger size font.

6. An **ODS LAYOUT END** statement tells SAS to terminate the dashboard layout.

7. An **ODS HTML5 CLOSE** statement tells SAS to render the dashboard content to the dashboard file.

Base-SAS Code:

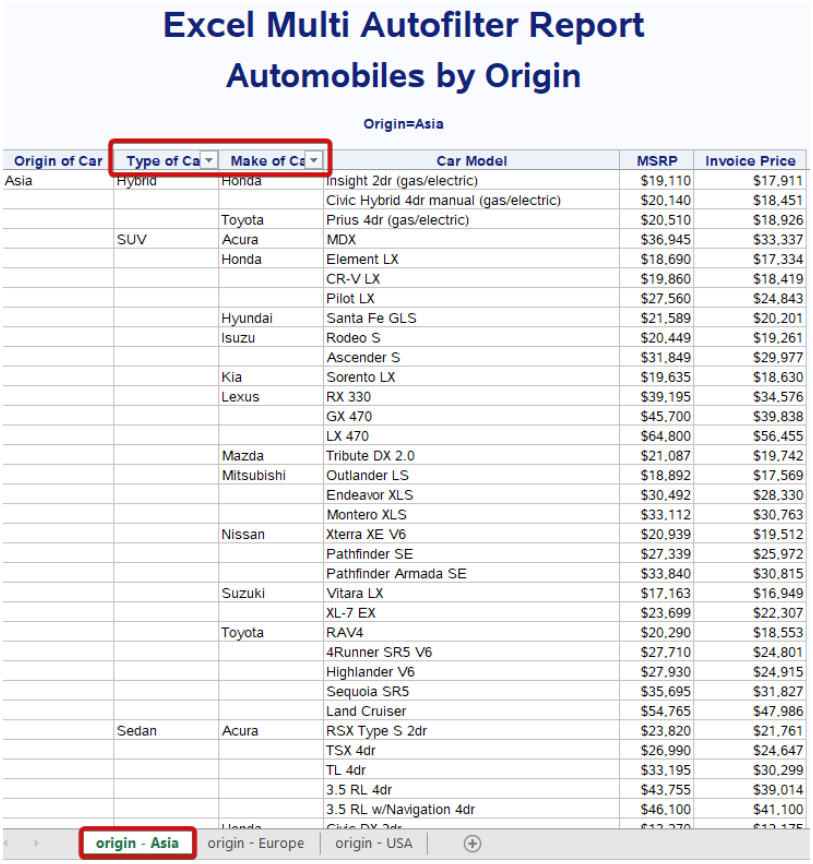
```
ODS HTML5 PATH="/home/kirklafler/Dashboards/Results"
      body="Dashboard #5 - (3x3) Layout with Custom Colors and Enlarged Fonts.html"
         (url=none) ;

title1 font=impact bold h=12 c=blue "Analytics Dashboard" ;
ods layout start rows=3 columns=3 ;

ods region ;  /* Row 1 Column 1 */
title1 "Cars Metadata Contents" ;
proc contents data=sashelp.cars nods ;
run ;
ods region ;  /* Row 1 Column 2 */
```

```
ods select nlevels ;
title1 "NLEVELS (Data Cardinality) Results" ;
proc freq data=sashelp.cars NLEVELS ;
run ;

ods region ;  /* Row 1 Column 3 */
title1 bold height=14pt "Origin Pie Chart" ;
proc sgpie data=sashelp.cars ;
  styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan) ;
  pie Origin / datalabeldisplay=all
               datalabelattrs=(Family="Arial" Size=12 Weight=Bold)  ;
run ;
title1 bold height=14pt "Type Pie Chart" ;
proc sgpie data=sashelp.cars ;
  styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan) ;
  pie Type / datalabeldisplay=all
             datalabelattrs=(Family="Arial" Size=12 Weight=Bold)  ;
run ;
title ;

ods region ;  /* Row 2 Column 1 */
title1 "Origin and Type Frequency Distributions" ;
proc freq data=sashelp.cars ;
  tables Origin Type ;
run ;

ods region ;  /* Row 2 Column 2 */
ods graphics on / reset=all border=off ;
title1 bold height=16pt "Origin Vertical Bar Chart" ;
proc sgplot data=sashelp.cars ;
  styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan) ;
  vbar Origin / group=Origin datalabel nooutline
                datalabelattrs=(Family="Arial" Size=14 Weight=Bold) ;
  xaxis fitpolicy=rotatealways labelattrs=(family='Arial Black') ;
  xaxis valueattrs=(size=14) labelattrs=(size=14 weight=bold) ;
  yaxis valueattrs=(size=14) labelattrs=(size=14 weight=bold) ;
  keylegend 'bar' 'vline' / title='Origin Legend'
                        titleattrs=(color=blue size=14pt)
                        valueattrs=(size=14pt) noborder ;
run ;
title1 bold height=16pt "Type Vertical Bar Chart" ;
proc sgplot data=sashelp.cars ;
  styleattrs DATACOLORS=(red blue yellow green purple orange goldenrod cyan) ;
  vbar Type   / group=Type datalabel nooutline
                datalabelattrs=(Family="Arial" Size=12 Weight=Bold)  ;
  xaxis fitpolicy=rotatealways labelattrs=(family='Arial Black') ;
  xaxis valueattrs=(size=14) labelattrs=(size=14 weight=bold) ;
  yaxis valueattrs=(size=14) labelattrs=(size=14 weight=bold) ;
  keylegend 'bar' 'vline' / title='Type Legend'
                        titleattrs=(color=blue size=14pt)
                        valueattrs=(size=12pt) noborder ;
run ;

ods region ;  /* Row 2 Column 3 */
title1 "Origin and Type Descriptive Statistics" ;
proc means data=sashelp.cars n nmiss min max range mean median mode std var ;
  class Origin Type ;
run ;

ods region ;  /* Row 3 Column 1 */
title1 "Origin and Type Frequency Distribution" ;
proc freq data=sashelp.cars ;
  tables Origin Type ;
run ;

ods region ;  /* Row 3 Column 2 */
title1 "PROC REPORT Results" ;
proc report data=sashelp.cars ;
  columns Origin Type Make Model MSRP Invoice ;
  define Origin  / order ;
  define Type    / order ;
  define Make    / order ;
  define Model   / display ;
```

```
  define MSRP    / display format=dollar10. ;
  define Invoice / display format=dollar10. ;
run ;

ods region ;  /* Row 3 Column 3 */
ods select moments ;
title1 "Cars MOMENTS Univariate Statistics" ;
proc univariate data=sashelp.cars ;
  class Origin ;
run ;

ods graphics reset ;
ods layout end ;
ods html5 close ;
```

Example #7 – Excel Multi Autofilter Dashboard Report

PROC SORT and PROC REPORT



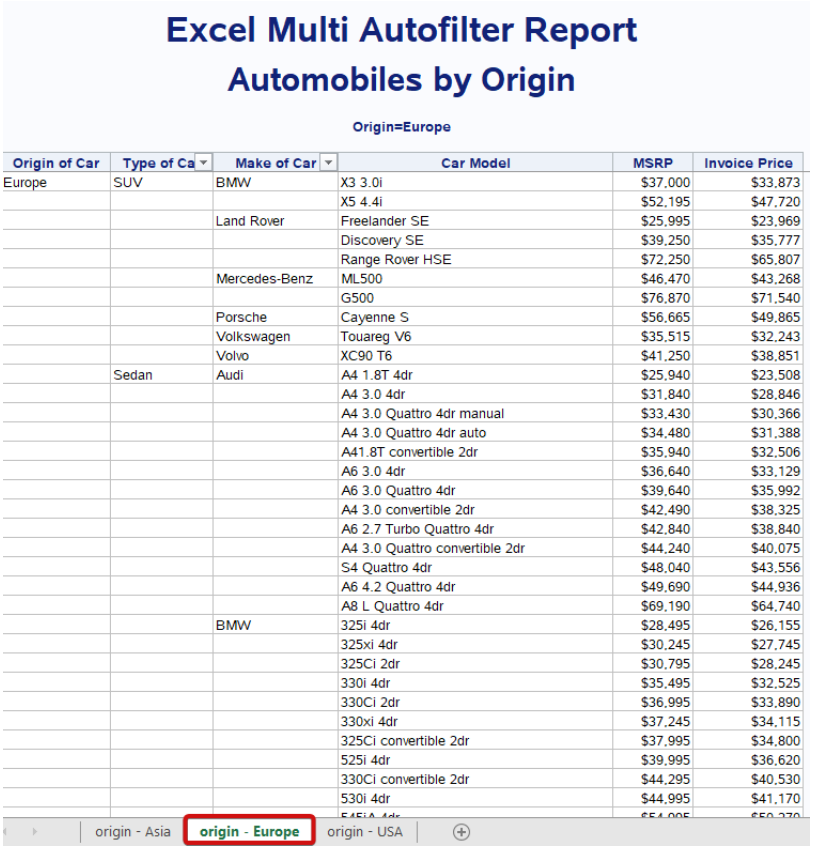
Excel Multi Autofilter Report

Automobiles by Origin

Origin=Asia

Origin of Car	Type of Ca	Make of Ca	Car Model	MSRP	Invoice Price
Asia	Hybrid	Honda	Insight 2dr (gas/electric)	$19,110	$17,911
			Civic Hybrid 4dr manual (gas/electric)	$20,140	$18,451
		Toyota	Prius 4dr (gas/electric)	$20,510	$18,926
	SUV	Acura	MDX	$36,945	$33,337
		Honda	Element LX	$18,690	$17,334
			CR-V LX	$19,860	$18,419
			Pilot LX	$27,560	$24,843
		Hyundai	Santa Fe GLS	$21,589	$20,201
		Isuzu	Rodeo S	$20,449	$19,261
			Ascender S	$31,849	$29,977
		Kia	Sorento LX	$19,635	$18,630
		Lexus	RX 330	$39,195	$34,576
			GX 470	$45,700	$39,838
			LX 470	$64,800	$56,455
		Mazda	Tribute DX 2.0	$21,087	$19,742
		Mitsubishi	Outlander LS	$18,892	$17,569
			Endeavor XLS	$30,492	$28,330
			Montero XLS	$33,112	$30,763
		Nissan	Xterra XE V6	$20,939	$19,512
			Pathfinder SE	$27,339	$25,972
			Pathfinder Armada SE	$33,840	$30,815
		Suzuki	Vitara LX	$17,163	$16,949
			XL-7 EX	$23,699	$22,307
		Toyota	RAV4	$20,290	$18,553
			4Runner SR5 V6	$27,710	$24,801
			Highlander V6	$27,930	$24,915
			Sequoia SR5	$35,695	$31,827
			Land Cruiser	$54,765	$47,986
	Sedan	Acura	RSX Type S 2dr	$23,820	$21,761
			TSX 4dr	$26,990	$24,647
			TL 4dr	$33,195	$30,299
			3.5 RL 4dr	$43,755	$39,014
			3.5 RL w/Navigation 4dr	$46,100	$41,100

origin - Asia | origin - Europe | origin - USA



Excel Multi Autofilter Report

Automobiles by Origin

Origin=Europe

Origin of Car	Type of Ca	Make of Car	Car Model	MSRP	Invoice Price
Europe	SUV	BMW	X3 3.0i	$37,000	$33,873
			X5 4.4i	$52,195	$47,720
		Land Rover	Freelander SE	$25,995	$23,969
			Discovery SE	$39,250	$35,777
			Range Rover HSE	$72,250	$65,807
		Mercedes-Benz	ML500	$46,470	$43,268
			G500	$76,870	$71,540
		Porsche	Cayenne S	$56,665	$49,865
		Volkswagen	Touareg V6	$35,515	$32,243
		Volvo	XC90 T6	$41,250	$38,851
	Sedan	Audi	A4 1.8T 4dr	$25,940	$23,508
			A4 3.0 4dr	$31,840	$28,846
			A4 3.0 Quattro 4dr manual	$33,430	$30,366
			A4 3.0 Quattro 4dr auto	$34,480	$31,388
			A41.8T convertible 2dr	$35,940	$32,506
			A6 3.0 4dr	$36,640	$33,129
			A6 3.0 Quattro 4dr	$39,640	$35,992
			A4 3.0 convertible 2dr	$42,490	$38,325
			A6 2.7 Turbo Quattro 4dr	$42,840	$38,840
			A4 3.0 Quattro convertible 2dr	$44,240	$40,075
			S4 Quattro 4dr	$48,040	$43,556
			A6 4.2 Quattro 4dr	$49,690	$44,936
			A8 L Quattro 4dr	$69,190	$64,740
		BMW	325i 4dr	$28,495	$26,155
			325xi 4dr	$30,245	$27,745
			325Ci 2dr	$30,795	$28,245
			330i 4dr	$35,495	$32,525
			330Ci 2dr	$36,995	$33,890
			330xi 4dr	$37,245	$34,115
			325Ci convertible 2dr	$37,995	$34,800
			525i 4dr	$39,995	$36,620
			330Ci convertible 2dr	$44,295	$40,530
			530i 4dr	$44,995	$41,170

origin - Asia | origin - Europe | origin - USA

Excel Multi Autofilter Report

Automobiles by Origin

Origin=USA

Origin of Car	Type of Ca	Make of Ca	Car Model	MSRP	Invoice Price
USA	SUV	Buick	Rendezvous CX	$26,545	$24,085
			Rainier	$37,895	$34,357
		Cadillac	SRX V8	$46,995	$43,523
			Escalade	$52,795	$48,377
		Chevrolet	Tracker	$20,255	$19,108
			TrailBlazer LT	$30,295	$27,479
			Tahoe LT	$41,465	$36,287
			Suburban 1500 LT	$42,735	$37,422
		Dodge	Durango SLT	$32,235	$29,472
		Ford	Escape XLS	$22,515	$20,907
			Explorer XLT V6	$29,670	$26,983
			Expedition 4.6 XLT	$34,560	$30,468
			Excursion 6.8 XLT	$41,475	$36,494
		GMC	Envoy XUV SLE	$31,890	$28,922
			Yukon 1500 SLE	$35,725	$31,361
			Yukon XL 2500 SLT	$46,265	$40,534
		Hummer	H2	$49,995	$45,815
		Jeep	Liberty Sport	$20,130	$18,973
			Wrangler Sahara convertible 2dr	$25,520	$23,275
			Grand Cherokee Laredo	$27,905	$25,686
		Lincoln	Aviator Ultimate	$42,915	$39,443
			Navigator Luxury	$52,775	$46,360
		Mercury	Mountaineer	$29,995	$27,317
		Pontiac	Aztekt	$21,595	$19,810
		Saturn	VUE	$20,585	$19,238
	Sedan	Buick	Century Custom 4dr	$22,180	$20,351
			Regal LS 4dr	$24,895	$22,835
			LeSabre Custom 4dr	$26,470	$24,282
			Regal GS 4dr	$28,345	$26,047
			LeSabre Limited 4dr	$32,245	$29,566
			Park Avenue 4dr	$35,545	$32,244
			Park Avenue Ultra 4dr	$40,720	$36,927
		Cadillac	CTS VVT 4dr	$30,835	$28,575

origin - Asia | origin - Europe | origin - USA

Key Points about Code

1. SAS Output Delivery System (ODS) provides users with the ability to create Excel dashboards, reports, and spreadsheet results using the ODS Excel destination. Any procedure output, such as PROC REPORT, PROC FREQ, PROC MEANS, PROC SGPLOT, and countless others, can be automatically written to an open Excel spreadsheet.

2. The SASHELP.CARS dataset is sorted using **PROC SORT** in ascending order by the ORIGIN and MSRP variables.

3. An **ODS EXCEL FILE=** statement tells SAS the path / folder where the spreadsheet is to be written along with the assignment of its physical name.

4. A few **ODS options are specified to t**ell SAS to create and name multiple sheets with the **sheet_interval="bygroup"** option, assign the Origin variable's value to each sheet with the **sheet_label="origin"** option, embed titles into the spreadsheet with the **embedded_titles="yes"** option, freeze six (6) rows at the top of the spreadsheet with the **frozen_headers="6"** option so these rows remain fixed in-place during vertical scrolling, and assign automatic filtering (or subsetting) to the second and third variables (or columns) with the **autofilter="2-3"** option.

5. Produce detailed results using **PROC REPORT** and **TITLE** statements.

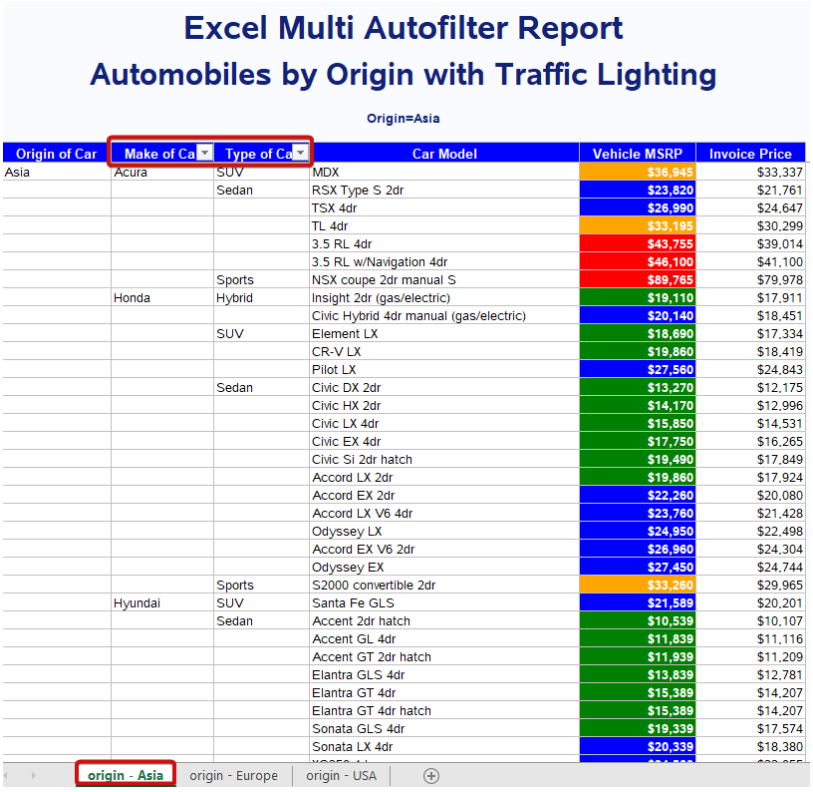
6. An **ODS Excel CLOSE** statement tells SAS to render the PROC REPORT results representing the dashboard contents to the Excel spreadsheet file.

Base-SAS Code:

```
PROC SORT DATA=SASHELP.CARS
          OUT=WORK.Cars_Sorted ;
  BY ORIGIN MSRP ;
RUN ;

ODS Excel FILE="/Dashboards/Results/Dashboard #6 - Excel Autofilter Report.xlsx"
          OPTIONS(sheet_interval="bygroup"
                  sheet_label="origin"
                embedded_titles="yes"
                 frozen_headers="6"
                     autofilter="2-3") ;

TITLE1 BOLD HEIGHT=12 "Excel Multi Autofilter Report" ;
TITLE2 BOLD HEIGHT=11 "Automobiles by Origin" ;
PROC REPORT DATA=WORK.Cars_Sorted(KEEP=Origin Type Make Model MSRP Invoice) ;
  BY Origin ;
  COLUMNS Origin Type Make Model MSRP Invoice ;
  DEFINE Origin  / ORDER   "Origin of Car" ;
  DEFINE Type    / ORDER   "Type of Car"   ;
  DEFINE Make    / ORDER   "Make of Car"   ;
  DEFINE Model   / DISPLAY "Car Model"     ;
  DEFINE MSRP    / DISPLAY "MSRP"          ;
  DEFINE Invoice / DISPLAY "Invoice Price" ;
RUN ;
TITLE ;

ODS Excel CLOSE ;
```

Example #8 – Excel Multi Autofilter Dashboard Report with Traffic Lighting

PROC FORMAT, PROC SORT, and PROC REPORT



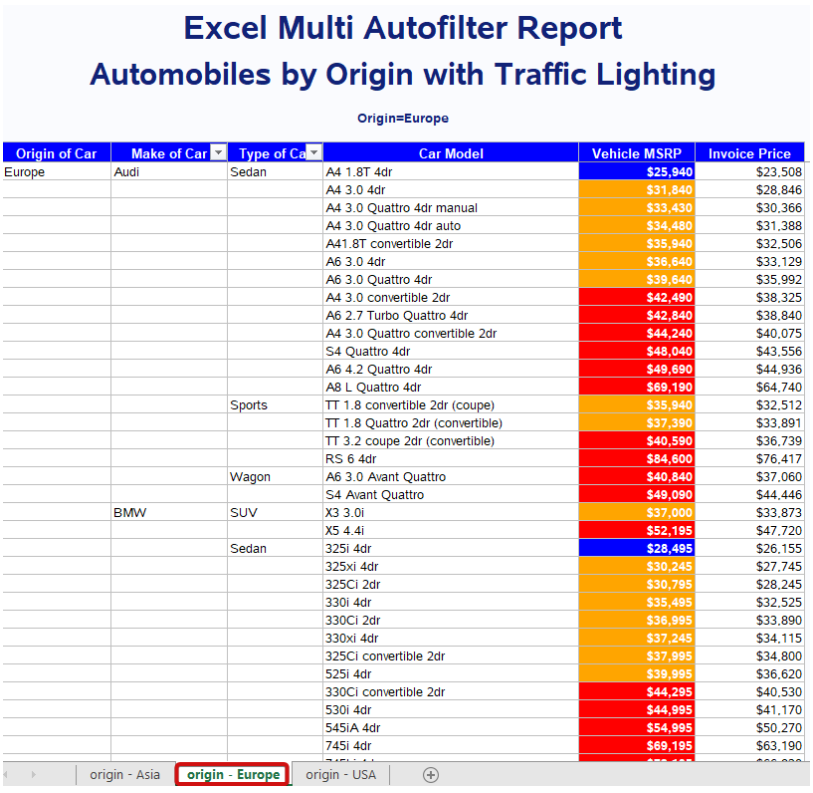
Excel Multi Autofilter Report

Automobiles by Origin with Traffic Lighting

Origin=Asia

Origin of Car	Make of Ca	Type of Ca	Car Model	Vehicle MSRP	Invoice Price
Asia	Acura	SUV	MDX	$36,945	$33,337
		Sedan	RSX Type S 2dr	$23,820	$21,761
			TSX 4dr	$26,990	$24,647
			TL 4dr	$33,195	$30,299
			3.5 RL 4dr	$43,755	$39,014
			3.5 RL w/Navigation 4dr	$46,100	$41,100
		Sports	NSX coupe 2dr manual S	$89,765	$79,978
	Honda	Hybrid	Insight 2dr (gas/electric)	$19,110	$17,911
			Civic Hybrid 4dr manual (gas/electric)	$20,140	$18,451
		SUV	Element LX	$18,690	$17,334
			CR-V LX	$19,860	$18,419
			Pilot LX	$27,560	$24,843
		Sedan	Civic DX 2dr	$13,270	$12,175
			Civic HX 2dr	$14,170	$12,996
			Civic LX 4dr	$15,850	$14,531
			Civic EX 4dr	$17,750	$16,265
			Civic Si 2dr hatch	$19,490	$17,849
			Accord LX 2dr	$19,860	$17,924
			Accord EX 2dr	$22,260	$20,080
			Accord LX V6 4dr	$23,760	$21,428
			Odyssey LX	$24,950	$22,498
			Accord EX V6 2dr	$26,960	$24,304
			Odyssey EX	$27,450	$24,744
		Sports	S2000 convertible 2dr	$33,260	$29,965
	Hyundai	SUV	Santa Fe GLS	$21,589	$20,201
		Sedan	Accent 2dr hatch	$10,539	$10,107
			Accent GL 4dr	$11,839	$11,116
			Accent GT 2dr hatch	$11,939	$11,209
			Elantra GLS 4dr	$13,839	$12,781
			Elantra GT 4dr	$15,389	$14,207
			Elantra GT 4dr hatch	$15,389	$14,207
			Sonata GLS 4dr	$19,339	$17,574
			Sonata LX 4dr	$20,339	$18,380

origin - Asia | origin - Europe | origin - USA



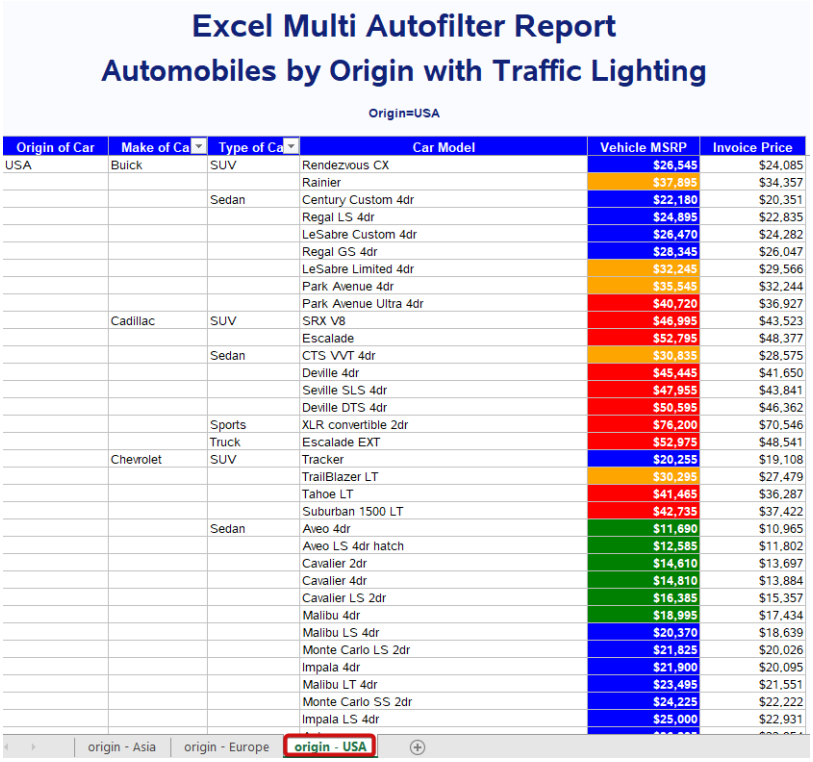
Excel Multi Autofilter Report

Automobiles by Origin with Traffic Lighting

Origin=Europe

Origin of Car	Make of Car	Type of Ca	Car Model	Vehicle MSRP	Invoice Price
Europe	Audi	Sedan	A4 1.8T 4dr	$25,940	$23,508
			A4 3.0 4dr	$31,840	$28,846
			A4 3.0 Quattro 4dr manual	$33,430	$30,366
			A4 3.0 Quattro 4dr auto	$34,480	$31,388
			A41.8T convertible 2dr	$35,940	$32,506
			A6 3.0 4dr	$36,640	$33,129
			A6 3.0 Quattro 4dr	$39,640	$35,992
			A4 3.0 convertible 2dr	$42,490	$38,325
			A6 2.7 Turbo Quattro 4dr	$42,840	$38,840
			A4 3.0 Quattro convertible 2dr	$44,240	$40,075
			S4 Quattro 4dr	$48,040	$43,556
			A6 4.2 Quattro 4dr	$49,690	$44,936
			A8 L Quattro 4dr	$69,190	$64,740
		Sports	TT 1.8 convertible 2dr (coupe)	$35,940	$32,512
			TT 1.8 Quattro 2dr (convertible)	$37,390	$33,891
			TT 3.2 coupe 2dr (convertible)	$40,590	$36,739
			RS 6 4dr	$84,600	$76,417
		Wagon	A6 3.0 Avant Quattro	$40,840	$37,060
			S4 Avant Quattro	$49,090	$44,446
	BMW	SUV	X3 3.0i	$37,000	$33,873
			X5 4.4i	$52,195	$47,720
		Sedan	325i 4dr	$28,495	$26,155
			325xi 4dr	$30,245	$27,745
			325Ci 2dr	$30,795	$28,245
			330i 4dr	$35,495	$32,525
			330Ci 2dr	$36,995	$33,890
			330xi 4dr	$37,245	$34,115
			325Ci convertible 2dr	$37,995	$34,800
			525i 4dr	$39,995	$36,620
			330Ci convertible 2dr	$44,295	$40,530
			530i 4dr	$44,995	$41,170
			545iA 4dr	$54,995	$50,270
			745i 4dr	$69,195	$63,190

origin - Asia | origin - Europe | origin - USA



Excel Multi Autofilter Report

Automobiles by Origin with Traffic Lighting

Origin=USA

Origin of Car	Make of Ca	Type of Ca	Car Model	Vehicle MSRP	Invoice Price
USA	Buick	SUV	Rendezvous CX	$26,545	$24,085
			Rainier	$37,895	$34,357
		Sedan	Century Custom 4dr	$22,180	$20,351
			Regal LS 4dr	$24,895	$22,835
			LeSabre Custom 4dr	$26,470	$24,282
			Regal GS 4dr	$28,345	$26,047
			LeSabre Limited 4dr	$32,245	$29,566
			Park Avenue 4dr	$35,545	$32,244
			Park Avenue Ultra 4dr	$40,720	$36,927
	Cadillac	SUV	SRX V8	$46,995	$43,523
			Escalade	$52,795	$48,377
		Sedan	CTS VVT 4dr	$30,835	$28,575
			Deville 4dr	$45,445	$41,650
			Seville SLS 4dr	$47,955	$43,841
			Deville DTS 4dr	$50,595	$46,362
		Sports	XLR convertible 2dr	$76,200	$70,546
		Truck	Escalade EXT	$52,975	$48,541
	Chevrolet	SUV	Tracker	$20,255	$19,108
			TrailBlazer LT	$30,295	$27,479
			Tahoe LT	$41,465	$36,287
			Suburban 1500 LT	$42,735	$37,422
		Sedan	Aveo 4dr	$11,690	$10,965
			Aveo LS 4dr hatch	$12,585	$11,802
			Cavalier 2dr	$14,610	$13,697
			Cavalier 4dr	$14,810	$13,884
			Cavalier LS 2dr	$16,385	$15,357
			Malibu 4dr	$18,995	$17,434
			Malibu LS 4dr	$20,370	$18,639
			Monte Carlo LS 2dr	$21,825	$20,026
			Impala 4dr	$21,900	$20,095
			Malibu LT 4dr	$23,495	$21,551
			Monte Carlo SS 2dr	$24,225	$22,222
			Impala LS 4dr	$25,000	$22,931

origin - Asia | origin - Europe | origin - USA

Key Points about Code

1. PROC FORMAT provides users with the ability to create and assign user-defined formats for the application of data standardization, color assignment, and many other valuable coding techniques. In this example, the assignment of colors (i.e., “Green”, “Blue”, “Orange”, and “Red”) are applied to the background in the Excel spreadsheet.

2. The SASHELP.CARS dataset is sorted using **PROC SORT** in ascending order by the ORIGIN and MSRP variables.

3. An **ODS EXCEL FILE=** statement tells SAS the path / folder where the spreadsheet is to be written along with the assignment of its physical name.

4. A few **ODS options are specified to t**ell SAS to create and name multiple sheets with the **sheet_interval=”bygroup”** option, assign the Origin variable’s value to each sheet with the **sheet_label=”origin”** option, embed titles into the spreadsheet with the **embedded_titles="yes"** option, freeze six (6) rows at the top of the spreadsheet with the **frozen_headers=”6”** option so these rows remain fixed in-place during vertical scrolling, and assign automatic filtering (or subsetting) to the second and third variables (or columns) with the **autofilter="2-3"** option.

5. Produce detailed results using **PROC REPORT** and **TITLE** statements.

6. Define MSRP as an “ANALYSIS” variable so it can be used in a COMPUTE block, along with the assignment of the background colors based on the MSRP value.

7. An **ODS Excel CLOSE** statement tells SAS to render the PROC REPORT results representing the dashboard contents to the Excel spreadsheet file.

Base-SAS Code:

```
PROC FORMAT ;
  Value MSRPFmt LOW - < 20000 = 'Green'
                20000 - < 30000 = 'Blue'
                30000 - < 40000 = 'Orange'
                40000 - HIGH    = 'Red' ;
RUN ;

PROC SORT DATA=SASHELP.CARS
          OUT=WORK.Cars_Sorted ;
  BY Origin MSRP ;
```

```
RUN ;

ODS Excel FILE="/Dashboards/Results/Dashboard #7 - Excel Autofilter Report with Traffic
Lighting.xlsx"
          OPTIONS(sheet_interval="bygroup"
                     sheet_label="origin"
                  embedded_titles="yes"
                   frozen_headers="6"
                       autofilter="2-3") ;

TITLE1 BOLD HEIGHT=12 "Excel Multi Autofilter Report" ;
TITLE2 BOLD HEIGHT=11 "Automobiles by Origin with Traffic Lighting" ;
PROC REPORT DATA=WORK.Cars_Sorted(KEEP=Origin Type Make Model MSRP Invoice)
   STYLE(Header)={BackGround=Blue ForeGround=White Font=(Arial, 10pt, Bold)} ;
  BY Origin ;
  COLUMNS Origin Make Type Model MSRP Invoice ;
  DEFINE Origin  / ORDER    "Origin of Car" ;
  DEFINE Type    / ORDER    "Type of Car"   ;
  DEFINE Make    / ORDER    "Make of Car"   ;
  DEFINE Model   / DISPLAY  "Car Model"     ;
  DEFINE MSRP    / ANALYSIS "Vehicle MSRP"
                   STYLE(Column)=[FontWeight=bold BackGround=MSRPFmt.] ;
  DEFINE Invoice / DISPLAY  "Invoice Price" ;
  COMPUTE MSRP ;
    CALL DEFINE (_COL_,"STYLE","STYLE={ForeGround=White}") ;
  ENDCOMP ;
RUN ;

ODS Excel close ;
```

Example #9 – Traffic Lighting to Rows (Background)

PROC SORT, ODS EXCEL, and PROC REPORT COMPUTE Block

Detailed Vehicle Listing

Country of Origin	Make of Vehicle	Vehicle Type	Vehicle Model	Vehicle MSRP
Asia	Acura	SUV	MDX	$36,945
		Sedan	RSX Type S 2dr	$23,820
			TSX 4dr	$26,990
			TL 4dr	$33,195
			3.5 RL 4dr	$43,755
			3.5 RL w/Navigation 4dr	$46,100
		Sports	NSX coupe 2dr manual S	$89,765
	Honda	Hybrid	Insight 2dr (gas/electric)	$19,110
			Civic Hybrid 4dr manual (gas/electric)	$20,140
		SUV	Element LX	$18,690
			CR-V LX	$19,860
			Pilot LX	$27,560
		Sedan	Civic DX 2dr	$13,270
			Civic HX 2dr	$14,170
			Civic LX 4dr	$15,850
			Civic EX 4dr	$17,750
			Civic Si 2dr hatch	$19,490
			Accord LX 2dr	$19,860
			Accord EX 2dr	$22,260
			Accord LX V6 4dr	$23,760
			Odyssey LX	$24,950
			Accord EX V6 2dr	$26,960
			Odyssey EX	$27,450
		Sports	S2000 convertible 2dr	$33,260
	Hyundai	SUV	Santa Fe GLS	$21,589
		Sedan	Accent 2dr hatch	$10,539
			Accent GL 4dr	$11,839
			Accent GT 2dr hatch	$11,939
			Elantra GLS 4dr	$13,839
			Elantra GT 4dr	$15,389

Key Points about Code

1. **PROC SORT** to order the SASHELP.CARS dataset in ascending order by the ORIGIN, MAKE, TYPE, MODEL, and MSRP variables.

2. An **ODS EXCEL FILE=** statement tells SAS the path / folder where the spreadsheet is to be written along with the assignment of its physical name, and a style definition, STYLES.MINIMAL, with the **STYLE=** parameter.

3. Produce detailed results using **PROC REPORT** and **TITLE** statements.

4. Define MSRP so it can be used in a **COMPUTE block**, along with the assignment of the background colors based on the MSRP value used in the COMPUTE block logic. In this example, the assignment of colors (i.e., "Green", "Blue", "Orange", and "Red") are applied to the background in the Excel spreadsheet.

5. An **ODS Excel CLOSE** statement tells SAS to render the PROC REPORT results representing the dashboard contents to the Excel spreadsheet file.

Base-SAS Code:

```
PROC SORT DATA=SASHELP.CARS
          OUT=WORK.CARS_SORTED ;
  BY Origin Make Type Model MSRP ;
RUN ;

ODS Excel FILE = 'c:\Custom Row Traffic Lighting.xlsx'
        STYLE = styles.minimal ;

TITLE "Detailed Vehicle Listing" ;
PROC REPORT DATA=WORK.Cars_Sorted ;
  COLUMNS Origin Make Type Model MSRP ;
  DEFINE Origin / ORDER    'Country of Origin'  ;
  DEFINE Make   / ORDER    'Make of Vehicle'    ;
  DEFINE Type   / ORDER    'Vehicle Type'       ;
  DEFINE Model  / DISPLAY  'Vehicle Model'      ;
  DEFINE MSRP   / ORDER    'Vehicle MSRP'       ;
  DEFINE MSRP   / ORDER                         ;
  COMPUTE MSRP ;
    IF MSRP < 20000 THEN
      CALL DEFINE (_ROW_,'STYLE','STYLE=[BACKGROUND=GREEN FOREGROUND=WHITE FONT_WEIGHT=BOLD]') ;
    ELSE IF MSRP IN (20000:29999) THEN
      CALL DEFINE (_ROW_,'STYLE','STYLE=[BACKGROUND=BLUE FOREGROUND=WHITE FONT_WEIGHT=BOLD]') ;
    ELSE IF MSRP IN (30000:39999) THEN
      CALL DEFINE (_ROW_,'STYLE','STYLE=[BACKGROUND=YELLOW FOREGROUND=BLACK FONT_WEIGHT=BOLD]') ;
    ELSE IF MSRP >= 40000 THEN
      CALL DEFINE (_ROW_,'STYLE','STYLE=[BACKGROUND=RED FOREGROUND=WHITE FONT_WEIGHT=BOLD]') ;
  ENDCOMP ;
RUN ;

ODS Excel close ;
```

Example #10 – Traffic Lighting to Column (Foreground Text)

PROC FORMAT, ODS EXCEL, and PROC REPORT

Origin	Make	Type	Model	Vehicle MSRP
Asia	Kia	Wagon	Rio Cinco	$11,905
Asia	Toyota	Truck	Tacoma	$12,800
Asia	Scion	Wagon	xB	$14,165
Asia	Mazda	Truck	B2300 SX Regular Cab	$14,840
Asia	Toyota	Truck	Tundra Regular Cab V6	$16,495
Asia	Suzuki	Wagon	Aerio SX	$16,497
Asia	Toyota	Wagon	Matrix XR	$16,695
Asia	Mitsubishi	Wagon	Lancer Sportback LS	$17,495
Asia	Nissan	Truck	Frontier King Cab XE V6	$19,479
Asia	Subaru	Wagon	Forester X	$21,445
Asia	Mazda	Truck	B4000 SE Cab Plus	$22,350
Asia	Subaru	Wagon	Outback	$23,895
Asia	Subaru	Truck	Baja	$24,520
Asia	Toyota	Truck	Tundra Access Cab V6 SR5	$25,935
Asia	Nissan	Truck	Titan King Cab XE	$26,650
Asia	Nissan	Wagon	Murano SL	$28,739
Asia	Lexus	Wagon	IS 300 SportCross	$32,455
Asia	Infiniti	Wagon	FX35	$34,895
Asia	Infiniti	Wagon	FX45	$36,395
Europe	Volkswagen	Wagon	Jetta GL	$19,005
Europe	Volkswagen	Wagon	Passat GLS 1.8T	$24,955
Europe	Volvo	Wagon	V40	$26,135
Europe	BMW	Wagon	325xi Sport	$32,845
Europe	Mercedes-Benz	Wagon	C240	$33,780
Europe	Volvo	Wagon	XC70	$35,145
Europe	Volkswagen	Wagon	Passat W8	$40,235
Europe	Audi	Wagon	A6 3.0 Avant Quattro	$40,840
Europe	Saab	Wagon	9-5 Aero	$40,845
Europe	Audi	Wagon	S4 Avant Quattro	$49,090
Europe	Mercedes-Benz	Wagon	E320	$50,670
Europe	Mercedes-Benz	Wagon	E500	$60,670
USA	Ford	Truck	Ranger 2.3 XL Regular Cab	$14,385
USA	GMC	Truck	Canyon Z85 SL Regular Cab	$16,530
USA	Pontiac	Wagon	Vibe	$17,045
USA	Ford	Wagon	Focus ZTW	$17,475
USA	Dodge	Truck	Dakota Regular Cab	$17,630
USA	Chevrolet	Truck	Colorado Z85	$18,760
USA	Dodge	Truck	Ram 1500 Regular Cab ST	$20,215
USA	Dodge	Truck	Dakota Club Cab	$20,300
USA	Chevrolet	Truck	Silverado 1500 Regular Cab	$20,310
USA	Ford	Truck	F-150 Regular Cab XL	$22,010
USA	Chevrolet	Wagon	Malibu Maxx LS	$22,225
USA	Ford	Wagon	Taurus SE	$22,290
USA	Mercury	Wagon	Sable GS	$22,595
USA	Saturn	Wagon	L300 2	$23,560
USA	GMC	Truck	Sonoma Crew Cab	$25,395
USA	GMC	Truck	Sierra Extended Cab 1500	$25,717
USA	GMC	Truck	Sierra HD 2500	$29,322
USA	Chrysler	Wagon	Pacifica	$31,230
USA	Ford	Truck	F-150 Supercab Lariat	$33,540
USA	Chevrolet	Truck	Avalanche 1500	$36,100
USA	Chevrolet	Truck	Silverado SS	$40,340
USA	Chevrolet	Truck	SSR	$41,995
USA	Cadillac	Truck	Escalade EXT	$52,975

Key Points about Code

1. **PROC SORT** to order the SASHELP.CARS dataset in ascending order by the ORIGIN and MSRP variables.

2. **PROC FORMAT** to assign "custom" colors to a user-defined format.

3. An **ODS EXCEL FILE=** statement tells SAS the path / folder where the spreadsheet is to be written along with the assignment of its physical name.

4. Produce detailed results using **PROC REPORT** and **TITLE** statements. A style definition for the **HEADER component** of PROC REPORT is specified (Background, Foreground, and Font) with the **STYLE=** parameter.

5. A **DEFINE statement** as an ANALYSIS variable with the user-defined format name, MSRPFmt., to assign the foreground colors based on the MSRP value specified in the PROC FORMAT. In this example, the assignment of colors (i.e., "Green", "Blue", "Orange", and "Red") are applied to the foreground column in the Excel spreadsheet.

6. An **ODS Excel CLOSE** statement tells SAS to render the PROC REPORT results representing the dashboard contents to the Excel spreadsheet file.

Base-SAS Code:

```
PROC SORT DATA=SASHELP.CARS
          OUT=WORK.CARS_SORTED ;
  BY Origin MSRP ;
RUN ;

PROC FORMAT ;
  Value MSRPFmt LOW - < 20000 = 'Green'
                20000 - < 35000 = 'Blue'
                35000 - < 50000 = 'Orange'
                50000 - HIGH    = 'Red' ;
RUN ;

ODS Excel file=':\Column Traffic Lighting Foreground.xlsx'
        style=styles.minimal ;

PROC REPORT DATA=WORK.CARS_SORTED
            STYLE(Header)={BackGround=Blue ForeGround=White
                                  Font=(Arial, 10pt, Bold)} ;
 WHERE UPCASE(Type) IN ("TRUCK","WAGON") ;
 COLUMNS Origin Make Type Model MSRP ;
 DEFINE MSRP / ANALYSIS 'Vehicle MSRP'
       STYLE(Column)=[FontWeight=bold ForeGround=MSRPFmt.] ;
RUN ;

ODS Excel close ;
```

Example #11 – Traffic Lighting to Column (Background)

PROC FORMAT, ODS EXCEL, and PROC REPORT

Origin	Make	Type	Model	Vehicle MSRP
Asia	Kia	Wagon	Rio Cinco	$11,905
Asia	Toyota	Truck	Tacoma	$12,800
Asia	Scion	Wagon	xB	$14,165
Asia	Mazda	Truck	B2300 SX Regular Cab	$14,840
Asia	Toyota	Truck	Tundra Regular Cab V6	$16,495
Asia	Suzuki	Wagon	Aerio SX	$16,497
Asia	Toyota	Wagon	Matrix XR	$16,695
Asia	Mitsubishi	Wagon	Lancer Sportback LS	$17,495
Asia	Nissan	Truck	Frontier King Cab XE V6	$19,479
Asia	Subaru	Wagon	Forester X	$21,445
Asia	Mazda	Truck	B4000 SE Cab Plus	$22,350
Asia	Subaru	Wagon	Outback	$23,895
Asia	Subaru	Truck	Baja	$24,520
Asia	Toyota	Truck	Tundra Access Cab V6 SR5	$25,935
Asia	Nissan	Truck	Titan King Cab XE	$26,650
Asia	Nissan	Wagon	Murano SL	$28,739
Asia	Lexus	Wagon	IS 300 SportCross	$32,455
Asia	Infiniti	Wagon	FX35	$34,895
Asia	Infiniti	Wagon	FX45	$36,395
Europe	Volkswagen	Wagon	Jetta GL	$19,005
Europe	Volkswagen	Wagon	Passat GLS 1.8T	$24,955
Europe	Volvo	Wagon	V40	$26,135
Europe	BMW	Wagon	325xi Sport	$32,845
Europe	Mercedes-Benz	Wagon	C240	$33,780
Europe	Volvo	Wagon	XC70	$35,145
Europe	Volkswagen	Wagon	Passat W8	$40,235
Europe	Audi	Wagon	A6 3.0 Avant Quattro	$40,840
Europe	Saab	Wagon	9-5 Aero	$40,845
Europe	Audi	Wagon	S4 Avant Quattro	$49,090
Europe	Mercedes-Benz	Wagon	E320	$50,670
Europe	Mercedes-Benz	Wagon	E500	$60,670
USA	Ford	Truck	Ranger 2.3 XL Regular Cab	$14,385
USA	GMC	Truck	Canyon Z85 SL Regular Cab	$16,530
USA	Pontiac	Wagon	Vibe	$17,045
USA	Ford	Wagon	Focus ZTW	$17,475
USA	Dodge	Truck	Dakota Regular Cab	$17,630
USA	Chevrolet	Truck	Colorado Z85	$18,760
USA	Dodge	Truck	Ram 1500 Regular Cab ST	$20,215
USA	Dodge	Truck	Dakota Club Cab	$20,300
USA	Chevrolet	Truck	Silverado 1500 Regular Cab	$20,310
USA	Ford	Truck	F-150 Regular Cab XL	$22,010
USA	Chevrolet	Wagon	Malibu Maxx LS	$22,225
USA	Ford	Wagon	Taurus SE	$22,290
USA	Mercury	Wagon	Sable GS	$22,595
USA	Saturn	Wagon	L300 2	$23,560
USA	GMC	Truck	Sonoma Crew Cab	$25,395
USA	GMC	Truck	Sierra Extended Cab 1500	$25,717
USA	GMC	Truck	Sierra HD 2500	$29,322
USA	Chrysler	Wagon	Pacifica	$31,230
USA	Ford	Truck	F-150 Supercab Lariat	$33,540
USA	Chevrolet	Truck	Avalanche 1500	$36,100
USA	Chevrolet	Truck	Silverado SS	$40,340
USA	Chevrolet	Truck	SSR	$41,995
USA	Cadillac	Truck	Escalade EXT	$52,975

Key Points about Code

1. **PROC SORT** to order the SASHELP.CARS dataset in ascending order by the ORIGIN and MSRP variables.

2. **PROC FORMAT** to assign "custom" colors to a user-defined format.

3. An **ODS EXCEL FILE=** statement tells SAS the path / folder where the spreadsheet is to be written along with the assignment of its physical name.

4. Produce detailed results using **PROC REPORT** and **TITLE** statements. A style definition for the **HEADER component** of PROC REPORT is specified (Background, Foreground, and Font) with the **STYLE=** parameter.

5. A **DEFINE statement** as an ANALYSIS variable with the user-defined format name, MSRPFmt., to assign the foreground colors based on the MSRP value specified in the PROC FORMAT. In this example, the assignment of colors (i.e., "Green", "Blue", "Orange", and "Red") are applied to the foreground column in the Excel spreadsheet.

6. A **COMPUTE block** to assign the **ForeGround=White** color to the data in the column.

7. An **ODS Excel CLOSE** statement tells SAS to render the PROC REPORT results representing the dashboard contents to the Excel spreadsheet file.

Base-SAS Code:

```
PROC SORT DATA=SASHELP.CARS
          OUT=WORK.CARS_SORTED ;
  BY Origin MSRP ;
RUN ;

PROC FORMAT ;
  Value MSRPFmt LOW - < 20000 = 'Green'
                20000 - < 35000 = 'Blue'
                35000 - < 50000 = 'Orange'
                50000 - HIGH    = 'Red' ;
RUN ;

ODS Excel file='c:\Column Traffic Lighting Background.xlsx'
         style=styles.minimal ;

PROC REPORT DATA=WORK.CARS_SORTED
            STYLE(Header)={BackGround=Blue ForeGround=White
                                    Font=(Arial, 10pt, Bold)} ;
 WHERE UPCASE(Type) IN ("TRUCK","WAGON") ;
 COLUMNS Origin Make Type Model MSRP ;
 DEFINE MSRP / ANALYSIS 'Vehicle MSRP'
        STYLE(Column)=[FontWeight=bold BackGround=MSRPFmt.] ;
 COMPUTE MSRP ;
   CALL DEFINE (_COL_,"STYLE","STYLE={ForeGround=White}") ;
 ENDCOMP ;
RUN ;

ODS Excel close ;
```

Example #12 – Listing of SAS-supplied Style Templates

PROC TEMPLATE with LIST STYLES Statement

Base-SAS Code:

```
proc template ;
  list styles ;
run ;
```

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.DTree	Style
5	Styles.Daisy	Style
6	Styles.Default	Style
7	Styles.Dove	Style
8	Styles.EGDefault	Style
9	Styles.Excel	Style
10	Styles.FancyPrinter	Style
11	Styles.Festival	Style
12	Styles.FestivalPrinter	Style
13	Styles.Gantt	Style
14	Styles.GrayscalePrinter	Style
15	Styles.HTMLBlue	Style
16	Styles.HTMLEncore	Style
17	Styles.Harvest	Style
18	Styles.HighContrast	Style
19	Styles.HighContrastLarge	Style
20	Styles.Ignite	Style

21	Styles.Illuminate	Style
22	Styles.Journal	Style
23	Styles.Journal1a	Style
24	Styles.Journal2	Style
25	Styles.Journal2a	Style
26	Styles.Journal3	Style
27	Styles.Journal3a	Style
28	Styles.Listing	Style
29	Styles.Meadow	Style
30	Styles.MeadowPrinter	Style
31	Styles.Minimal	Style
32	Styles.MonochromePrinter	Style
33	Styles.Monospace	Style
34	Styles.Moonflower	Style
35	Styles.Netdraw	Style
36	Styles.NoFontDefault	Style
37	Styles.Normal	Style
38	Styles.NormalPrinter	Style
39	Styles.Ocean	Style
40	Styles.Pearl	Style
41	Styles.PearlJ	Style
42	Styles.Plateau	Style
43	Styles.PowerPointDark	Style
44	Styles.PowerPointLight	Style
45	Styles.Printer	Style
46	Styles.Raven	Style
47	Styles.Rtf	Style
48	Styles.Sapphire	Style
49	Styles.SasDocPrinter	Style
50	Styles.SasWeb	Style
51	Styles.Seaside	Style
52	Styles.SeasidePrinter	Style
53	Styles.Snow	Style
54	Styles.StatDoc	Style
55	Styles.Statistical	Style
56	Styles.Word	Style
57	Styles.vaDark	Style
58	Styles.vaHighContrast	Style
59	Styles.vaLight	Style

Example #13 – Styles.SasWeb Style Definition

PROC TEMPLATE with SOURCE STYLES.SasWeb Statement

Base-SAS Code:

```
proc template ;
  source styles.SasWeb ;
run ;
```

Log Results:

```
77         proc template ;
78           source styles.SasWeb ;
 define style Styles.SasWeb;
    style fonts /
       'TitleFont2' = ("<sans-serif>, Helvetica, sans-serif",2,bold italic)
       'TitleFont' = ("<sans-serif>, Helvetica, sans-serif",4,bold)
       'StrongFont' = ("<sans-serif>, Helvetica, sans-serif",2,bold)
       'EmphasisFont' = ("<sans-serif>, Helvetica, sans-serif",2,italic)
       'FixedEmphasisFont' = ("<monospace>, Courier, monospace",2,italic)
       'FixedStrongFont' = ("<monospace>, Courier, monospace",2,bold)
       'FixedHeadingFont' = ("<monospace>, Courier, monospace",2)
       'BatchFixedFont' = ("SAS Monospace, <monospace>, Courier, monospace",2)
```

```
      'FixedFont' = ("<monospace>, Courier, monospace",2)
      'headingEmphasisFont' = ("<sans-serif>, Helvetica, sans-serif",2,bold italic)
      'headingFont' = ("<sans-serif>, Helvetica, sans-serif",2,bold)
      'docFont' = ("<sans-serif>, Helvetica, sans-serif",2);
   class GraphFonts /
      'GraphDataFont' = ("<sans-serif>, <MTsans-serif>",7pt)
      'GraphUnicodeFont' = ("<MTsans-serif-unicode>",9pt)
      'GraphValueFont' = ("<sans-serif>, <MTsans-serif>",9pt)
      'GraphLabel2Font' = ("<sans-serif>, <MTsans-serif>",10pt)
      'GraphLabelFont' = ("<sans-serif>, <MTsans-serif>",10pt,bold)
      'GraphFootnoteFont' = ("<sans-serif>, <MTsans-serif>",10pt,bold)
      'GraphTitleFont' = ("<sans-serif>, <MTsans-serif>",11pt,bold)
      'GraphTitle1Font' = ("<sans-serif>, <MTsans-serif>",14pt,bold)
      'GraphAnnoFont' = ("<sans-serif>, <MTsans-serif>",10pt);
   style color_list
      "Colors used in the default style" /
      'fgD1' = cx666666    /* Gray            */
      'fgC1' = cxCCCCCC    /* Light Gray      */
      'fgB1' = cx000000    /* Black           */
      'bgA1' = cx6495ED    /* CornFlower Blue */
      'fgA'  = cx003399    /* Blue            */
      'bgA'  = cxffffff;   /* White           */
   style colors
      "Abstract colors used in the default style" /
      'headerfgemph' = color_list('bgA')
      'headerbgemph' = color_list('bgA1')
      'headerfgstrong' = color_list('bgA')
      'headerbgstrong' = color_list('bgA1')
      'headerfg' = color_list('bgA')
      'headerbg' = color_list('bgA1')
      'datafgemph' = color_list('fgB1')
      'databgemph' = color_list('bgA')
      'datafgstrong' = color_list('fgB1')
      'databgstrong' = color_list('bgA')
      'datafg' = color_list('fgB1')
      'databg' = color_list('bgA')
      'batchfg' = color_list('fgA')
      'batchbg' = color_list('bgA')
      'tableborder' = color_list('fgD1')
      'tablebg' = cxcccccc
      'notefg' = color_list('fgA')
      'notebg' = color_list('bgA')
      'bylinefg' = color_list('fgA')
      'bylinebg' = color_list('bgA')
      'captionfg' = color_list('fgA')
      'captionbg' = color_list('bgA')
      'proctitlefg' = color_list('fgA')
      'proctitlebg' = color_list('bgA')
      'titlefg' = color_list('fgA')
      'titlebg' = color_list('bgA')
      'systitlefg' = color_list('fgA')
      'systitlebg' = color_list('bgA')
      'contentfg' = color_list('fgA')
      'contentbg' = color_list('bgA')
      'docfg' = color_list('fgA')
      'docbg' = color_list('bgA');

      .  .  .       .  .  .       .  .  .

end;
 NOTE: Path 'Styles.SasWeb' is in: SASHELP.TMPL_EN (via SASHELP.TMPLMST).
 79         run ;
```

Example #14 – Single Column Black & White Dashboard

PROC FORMAT, PROC SORT, and PROC REPORT

Analytics Dashboard

SASHELP.CARS Frequency Distribution for Origin and Type

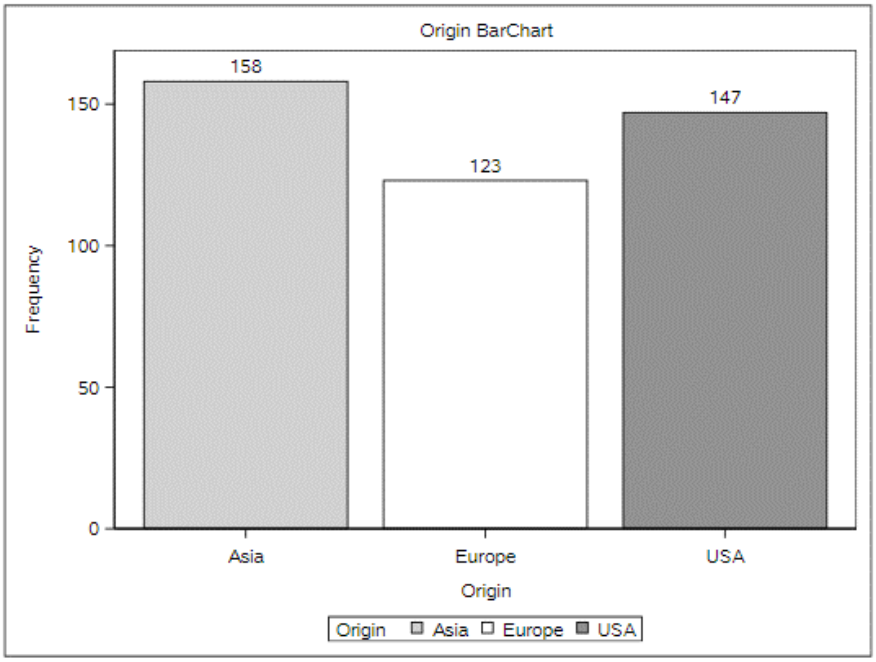
The FREQ Procedure

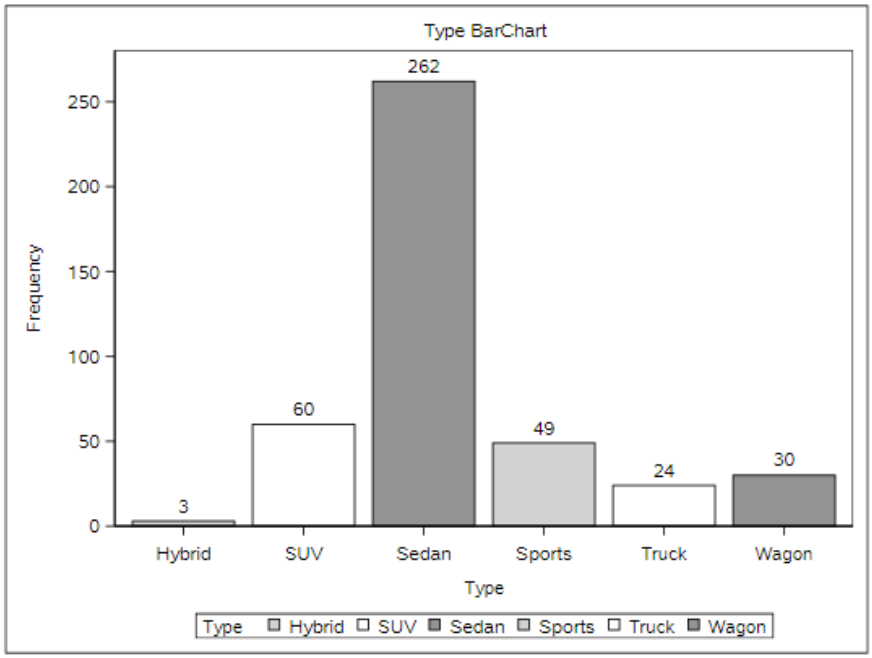
Number of Variable Levels

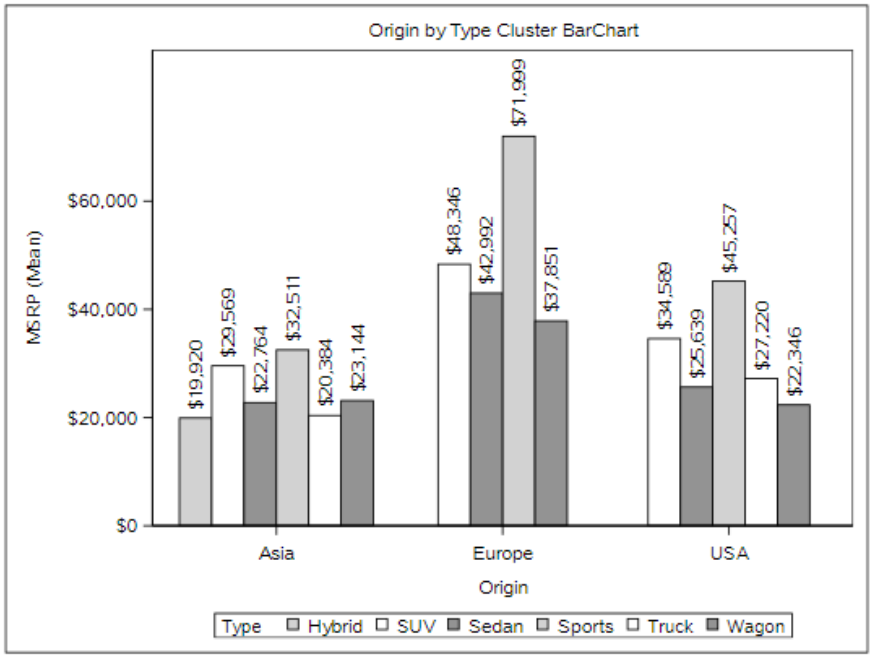
Variable	Levels
Origin	3
Type	6

Origin	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Asia	158	36.92	158	36.92
Europe	123	28.74	281	65.65
USA	147	34.35	428	100.00

Type	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Hybrid	3	0.70	3	0.70
SUV	60	14.02	63	14.72
Sedan	262	61.21	325	75.93
Sports	49	11.45	374	87.38
Truck	24	5.61	398	92.99
Wagon	30	7.01	428	100.00




Type BarChart
Frequency
0
50
100
150
200
250
3
60
262
49
24
30
Hybrid
SUV
Sedan
Sports
Truck
Wagon
Type
Type Hybrid SUV Sedan Sports Truck Wagon


Origin by Type Cluster BarChart
MSRP (Mean)
$0
$20,000
$40,000
$60,000
$19,920
$29,569
$22,764
$32,511
$20,384
$23,144
$48,346
$42,992
$71,999
$37,851
$34,589
$25,639
$45,257
$27,220
$22,346
Asia
Europe
USA
Origin
Type Hybrid SUV Sedan Sports Truck Wagon

Descriptive Statistics for MSRP and Invoice by Origin

The MEANS Procedure

Origin	Type	N Obs	Variable	Label	N	N Miss	Minimum	Maximum	Range	Mean	Median	Mode	Std Dev	Variance
Asia	Hybrid	3	MSRP		3	0	19110.00	20510.00	1400.00	19920.00	20140.00	.	725.4653679	526300.00
			Invoice		3	0	17911.00	18926.00	1015.00	18429.33	18451.00	.	507.8467617	257908.33
			EngineSize	Engine Size (L)	3	0	1.4000000	2.0000000	0.6000000	1.6333333	1.5000000	.	0.3214550	0.1033333
			Cylinders		3	0	3.0000000	4.0000000	1.0000000	3.6666667	4.0000000	4.0000000	0.5773503	0.3333333
			Horsepower		3	0	73.0000000	110.0000000	37.0000000	92.0000000	93.0000000	.	18.5202592	343.0000000
			MPG_City	MPG (City)	3	0	46.0000000	60.0000000	14.0000000	55.0000000	59.0000000	.	7.8102497	61.0000000
			MPG_Highway	MPG (Highway)	3	0	51.0000000	66.0000000	15.0000000	56.0000000	51.0000000	51.0000000	8.6602540	75.0000000
			Weight	Weight (LBS)	3	0	1850.00	2890.00	1040.00	2490.67	2732.00	.	560.4295971	314081.33
			Wheelbase	Wheelbase (IN)	3	0	95.0000000	106.0000000	11.0000000	101.3333333	103.0000000	.	5.6862407	32.3333333
			Length	Length (IN)	3	0	155.0000000	175.0000000	20.0000000	168.3333333	175.0000000	175.0000000	11.5470054	133.3333333
	SUV	25	MSRP		25	0	17163.00	64800.00	47637.00	29569.00	27560.00	.	11842.55	140245895
			Invoice		25	0	16949.00	56455.00	39506.00	26916.48	24843.00	.	9964.67	99294670.76
			EngineSize	Engine Size (L)	25	0	2.0000000	5.6000000	3.6000000	3.4720000	3.5000000	2.4000000	0.9275955	0.8604333
			Cylinders		25	0	4.0000000	8.0000000	4.0000000	6.0000000	6.0000000	6.0000000	1.2909944	1.6666667
			Horsepower		25	0	130.0000000	325.0000000	195.0000000	214.1600000	215.0000000	160.0000000	48.7020533	2371.89
			MPG_City	MPG (City)	25	0	13.0000000	22.0000000	9.0000000	17.3200000	17.0000000	17.0000000	2.7646579	7.6433333
			MPG_Highway	MPG (Highway)	25	0	17.0000000	27.0000000	10.0000000	21.6800000	21.0000000	19.0000000	3.0099834	9.0600000
			Weight	Weight (LBS)	25	0	3020.00	5590.00	2570.00	4108.04	4035.00	.	752.1830163	565779.29
			Wheelbase	Wheelbase (IN)	25	0	98.0000000	129.0000000	31.0000000	108.0400000	107.0000000	103.0000000	7.0680030	49.9566667
			Length	Length (IN)	25	0	163.0000000	208.0000000	45.0000000	184.8400000	186.0000000	167.0000000	11.4479984	131.0566667
	Sedan	94	MSRP		94	0	10280.00	55750.00	45470.00	22763.97	20392.00	15389.00	9613.14	92412548.01
			Invoice		94	0	9875.00	48583.00	38708.00	20788.31	18556.00	14207.00	8363.51	69948245.14
			EngineSize	Engine Size (L)	94	0	1.5000000	4.5000000	3.0000000	2.6478723	2.5000000	3.5000000	0.7789887	0.6068234
			Cylinders		94	0	4.0000000	8.0000000	4.0000000	5.0425532	4.0000000	4.0000000	1.1631889	1.3530085
			Horsepower		94	0	103.0000000	340.0000000	237.0000000	181.9787234	167.5000000	160.0000000	57.2928675	3282.47
			MPG_City	MPG (City)	94	0	16.0000000	36.0000000	20.0000000	22.8404255	21.0000000	18.0000000	4.9389895	24.3936170
			MPG_Highway	MPG (Highway)	94	0	22.0000000	44.0000000	22.0000000	29.9680851	29.0000000	26.0000000	4.8845865	23.8591855
			Weight	Weight (LBS)	94	0	2035.00	4802.00	2767.00	3161.37	3242.50	2513.00	584.2948509	341400.47
			Wheelbase	Wheelbase (IN)	94	0	93.0000000	124.0000000	31.0000000	105.6489362	105.0000000	107.0000000	6.4068301	41.0474720
			Length	Length (IN)	94	0	154.0000000	204.0000000	50.0000000	184.0106383	186.0000000	178.0000000	10.4505952	109.2149394
	Sports	17	MSRP		17	0	18739.00	89765.00	71026.00	32510.65	26910.00	.	17641.86	311235327
			Invoice		17	0	17101.00	79978.00	62877.00	29620.94	25179.00	.	15362.48	236005794
			EngineSize	Engine Size (L)	17	0	1.3000000	4.3000000	3.0000000	2.4529412	2.2000000	1.8000000	0.8537547	0.7288971
			Cylinders		15	2	4.0000000	8.0000000	4.0000000	5.0666667	4.0000000	4.0000000	1.2798809	1.6380952
			Horsepower		17	0	138.0000000	300.0000000	162.0000000	225.3529412	227.0000000	142.0000000	57.6031045	3318.12
			MPG_City	MPG (City)	17	0	17.0000000	26.0000000	9.0000000	20.2352941	20.0000000	18.0000000	2.5132004	6.3161765
			MPG_Highway	MPG (Highway)	17	0	23.0000000	33.0000000	10.0000000	26.6470588	26.0000000	26.0000000	2.7143410	7.3676471
			Weight	Weight (LBS)	17	0	2195.00	3840.00	1645.00	3009.76	3085.00	2387.00	427.0643291	182383.94
			Wheelbase	Wheelbase (IN)	17	0	89.0000000	106.0000000	17.0000000	99.9411765	101.0000000	100.0000000	5.0307876	25.3088235
			Length	Length (IN)	17	0	153.0000000	179.0000000	26.0000000	170.0000000	174.0000000	174.0000000	8.2158384	67.5000000
	Truck	8	MSRP		8	0	12800.00	26650.00	13850.00	20383.63	20914.50	.	5281.29	27892049.41
			Invoice		8	0	11879.00	24926.00	13047.00	18801.50	19367.50	.	4782.31	22870490.29
			EngineSize	Engine Size (L)	8	0	2.3000000	5.6000000	3.3000000	3.3625000	3.3500000	3.4000000	1.0835622	1.1741071
			Cylinders		8	0	4.0000000	8.0000000	4.0000000	5.5000000	6.0000000	6.0000000	1.4142136	2.0000000
			Horsepower		8	0	142.0000000	305.0000000	163.0000000	190.2500000	185.0000000	190.0000000	51.7569871	2678.79
			MPG_City	MPG (City)	8	0	14.0000000	24.0000000	10.0000000	17.8750000	16.5000000	14.0000000	3.9074105	15.2678571
			MPG_Highway	MPG (Highway)	8	0	17.0000000	29.0000000	12.0000000	22.0000000	19.5000000	18.0000000	5.0709255	25.7142857
			Weight	Weight (LBS)	8	0	2750.00	5287.00	2537.00	3793.13	3748.00	.	811.2451519	658118.70
			Wheelbase	Wheelbase (IN)	8	0	103.0000000	140.0000000	37.0000000	119.6250000	121.0000000	128.0000000	13.0267582	169.6964286
			Length	Length (IN)	8	0	188.0000000	224.0000000	36.0000000	203.2500000	198.0000000	191.0000000	14.6555694	214.7857143
	Wagon	11	MSRP		11	0	11905.00	36395.00	24490.00	23143.73	21445.00	.	8716.34	75974532.22
			Invoice		11	0	11410.00	33121.00	21711.00	21352.27	19646.00	.	7673.49	58882511.62
			EngineSize	Engine Size (L)	11	0	1.5000000	4.5000000	3.0000000	2.6454545	2.5000000	2.5000000	0.9147280	0.8367273
			Cylinders		11	0	4.0000000	8.0000000	4.0000000	4.9090909	4.0000000	4.0000000	1.3751033	1.8909091
			Horsepower		11	0	104.0000000	315.0000000	211.0000000	185.6363636	165.0000000	165.0000000	69.4698103	4826.05
			MPG_City	MPG (City)	11	0	15.0000000	31.0000000	16.0000000	22.3636364	21.0000000	21.0000000	5.1433982	26.4545455
			MPG_Highway	MPG (Highway)	11	0	19.0000000	36.0000000	17.0000000	28.1818182	28.0000000	28.0000000	5.3817875	28.9636364
			Weight	Weight (LBS)	11	0	2425.00	4309.00	1884.00	3236.27	3090.00	.	629.4238780	396174.42
			Wheelbase	Wheelbase (IN)	11	0	95.0000000	112.0000000	17.0000000	103.4545455	102.0000000	98.0000000	6.0060575	36.0727273
			Length	Length (IN)	11	0	155.0000000	189.0000000	34.0000000	176.9090909	177.0000000	167.0000000	11.1754601	124.8909091

Key Points about Code

1. PROC TEMPLATE provides users with the ability to create and/or customize the appearance of tabular SAS output. A new styles.SasWeb_White_Black template using PROC TEMPLATE is created by modifying two parameters ('fgB1' and 'bgA') in the style color_list section.

2. An **ODS HTML5 FILE=** statement tells SAS the path / folder where the output is to be written along with the assignment of its physical name.

3. A **TITLE** statement is specified to display the name of the dashboard.

4. An **ODS LAYOUT** statement is specified to tell SAS to define a 1 row x 1 column layout.

5. An **ODS REGION** statement is specified to indicate the beginning of output results.

6. A PROC FREQ, three PROC SGPLOTs, and a PROC MEANS is specified.

7. An **ODS LAYOUT CLOSE** statement is specified to terminate the layout of output results.

8. An **ODS HTML5 CLOSE** statement tells SAS to render the output results representing the dashboard contents to the HTML5 file.

Base-SAS Code:

```
proc template ;
  define style Styles.Sasweb_White_Black ;
    style color_list
    "Colors used in the default style" /
      'fgD1'     = cx666666 /* Gray             */
      'fgC1'     = cxCCCCCC /* Light Gray       */
      'fgB1'     = cxFFFFFF /* White            */
      'bgA1'     = cx6495ED /* CornFlower Blue  */
      'fgA'      = cx003399 /* Dark Blue        */
      'bgA'      = cx000000 /* Black            */ ;
  end ;
run ;

ods html5 style=styles.Sasweb_White_Black
          path="/home/kirklafler/Dashboards/Results"
          body="Dashboard - Color (White-Black).html"
          (url=none) ;

title1 font=impact bold j=c h=12 c=black "Analytics Dashboard" ;

ODS LAYOUT GRIDDED ROWS=1 COLUMNS=1 ; /* Design HTML 1x1 Layout */

options center ; /* Center the Results */
ods region ;  /* Start of Output Results */
title1 "SASHELP.CARS Frequency Distribution for Origin and Type" ;
proc freq data=SASHELP.CARS NLEVELS ;
  table Origin Type ;
run ;

title1 "Origin BarChart" ;
proc sgplot data=SASHELP.CARS ;
  vbar Origin / group=Origin datalabel ;
run ;

title1 "Type BarChart" ;
proc sgplot data=SASHELP.CARS ;
  vbar Type / group=Type datalabel ;
run ;

title1 "Origin by Type Cluster BarChart" ;
proc sgplot data=SASHELP.CARS ;
  vbar Origin / group=Type response=MSRP stat=mean groupdisplay=cluster datalabel ;
run ;

title1 "Descriptive Statistics for MSRP and Invoice by Origin" ;
footnote1 j=l "Layout: HTML-fgB1-CXFFFFFF-bgA-CX000000 (White/Black)" ;
proc means data=SASHELP.CARS n nmiss min max range mean median mode std var ;
  class Origin Type ;
run ;
title ;

ods layout end ; /* Terminate the Layout of Output Results */
ods html5 close ;
```

Example #15 – Single Column Black & Burgundy Dashboard

PROC FORMAT, PROC SORT, and PROC REPORT

Analytics Dashboard

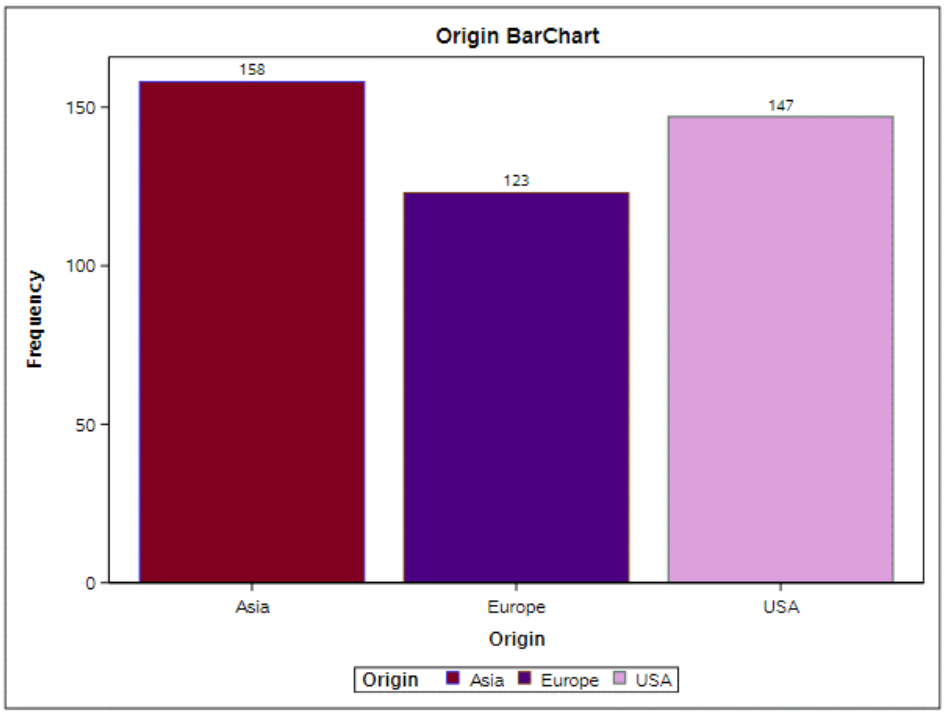
SASHELP.CARS Frequency Distribution for Origin and Type

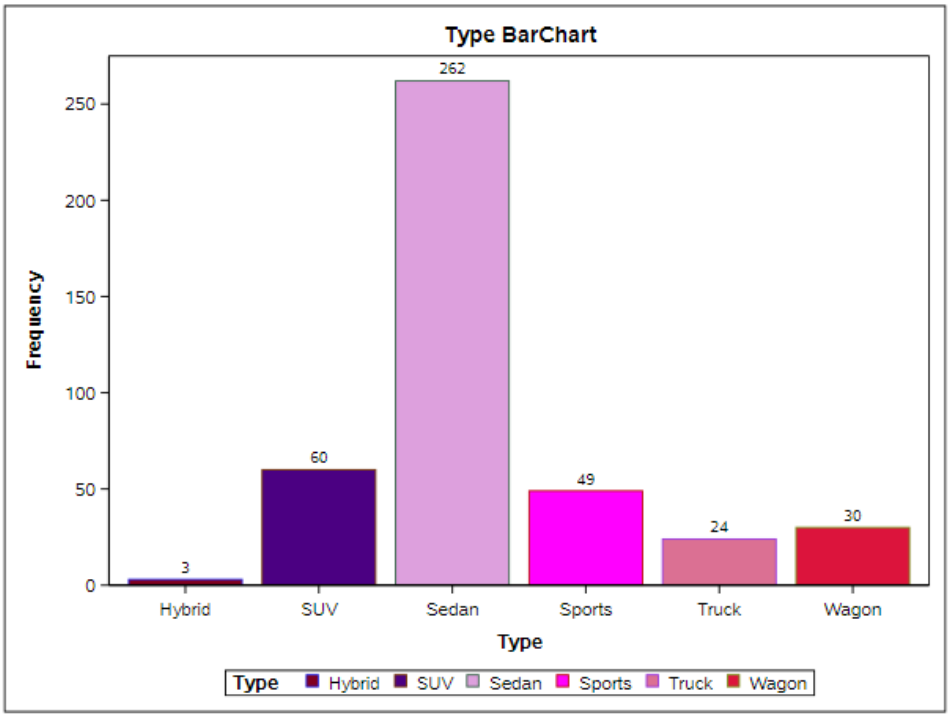
The FREQ Procedure

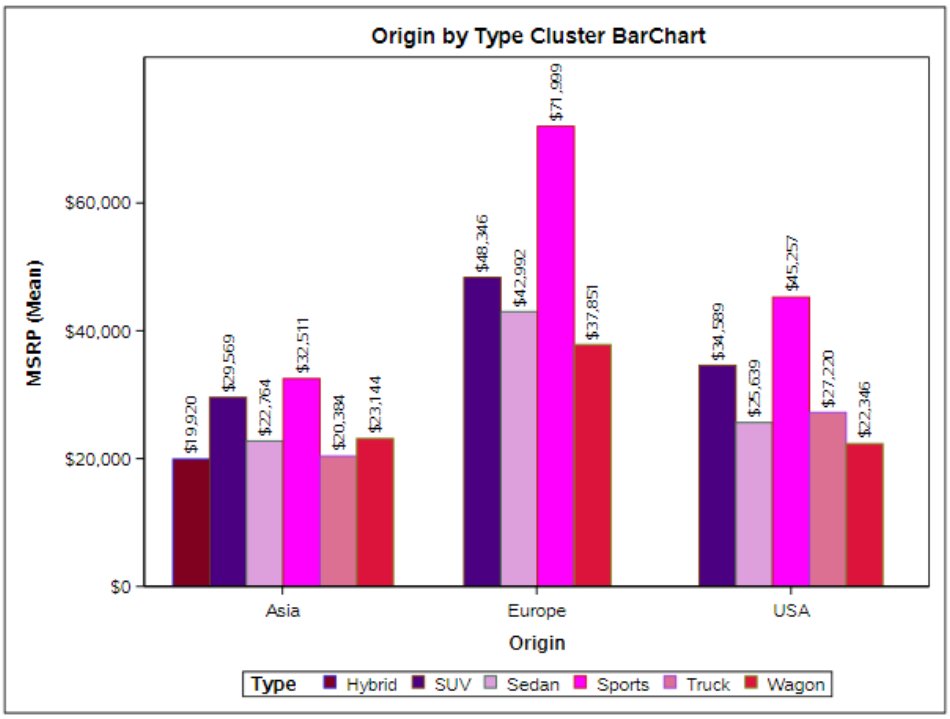
Number of Variable Levels	
Variable	Levels
Origin	3
Type	6

Origin	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Asia	158	36.92	158	36.92
Europe	123	28.74	281	65.65
USA	147	34.35	428	100.00

Type	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Hybrid	3	0.70	3	0.70
SUV	60	14.02	63	14.72
Sedan	262	61.21	325	75.93
Sports	49	11.45	374	87.38
Truck	24	5.61	398	92.99
Wagon	30	7.01	428	100.00




Type BarChart
Frequency
0
50
100
150
200
250
3
60
262
49
24
30
Hybrid
SUV
Sedan
Sports
Truck
Wagon
Type
Type Hybrid SUV Sedan Sports Truck Wagon


Origin by Type Cluster BarChart
MSRP (Mean)
$0
$20,000
$40,000
$60,000
$19,920
$29,569
$22,764
$32,511
$20,384
$23,144
$48,346
$42,992
$71,999
$37,851
$34,589
$25,639
$45,257
$27,220
$22,346
Asia
Europe
USA
Origin
Type Hybrid SUV Sedan Sports Truck Wagon

Descriptive Statistics for MSRP and Invoice by Origin

The MEANS Procedure

Origin	Type	N Obs	Variable	Label	N	N Miss	Minimum	Maximum	Range	Mean	Median	Mode	Std Dev	Variance
Asia	Hybrid	3	MSRP		3	0	19110.00	20510.00	1400.00	19920.00	20140.00	.	725.4653679	526300.00
			Invoice		3	0	17911.00	18926.00	1015.00	18429.33	18451.00	.	507.8467617	257908.33
			EngineSize	Engine Size (L)	3	0	1.4000000	2.0000000	0.6000000	1.6333333	1.5000000	.	0.3214550	0.1033333
			Cylinders		3	0	3.0000000	4.0000000	1.0000000	3.6666667	4.0000000	4.0000000	0.5773503	0.3333333
			Horsepower		3	0	73.0000000	110.0000000	37.0000000	92.0000000	93.0000000	.	18.5202592	343.0000000
			MPG_City	MPG (City)	3	0	46.0000000	60.0000000	14.0000000	56.0000000	59.0000000	.	7.8102497	61.0000000
			MPG_Highway	MPG (Highway)	3	0	51.0000000	66.0000000	15.0000000	56.0000000	51.0000000	51.0000000	8.6602540	75.0000000
			Weight	Weight (LBS)	3	0	1850.00	2890.00	1040.00	2490.67	2732.00	.	560.4295971	314081.33
			Wheelbase	Wheelbase (IN)	3	0	95.0000000	106.0000000	11.0000000	101.3333333	103.0000000	.	5.6862407	32.3333333
			Length	Length (IN)	3	0	155.0000000	175.0000000	20.0000000	168.3333333	175.0000000	175.0000000	11.5470054	133.3333333
	SUV	25	MSRP		25	0	17163.00	64800.00	47637.00	29569.00	27560.00	.	11842.55	140245895
			Invoice		25	0	16949.00	56455.00	39506.00	26916.48	24843.00	.	9964.67	99294670.76
			EngineSize	Engine Size (L)	25	0	2.0000000	5.6000000	3.6000000	3.4720000	3.5000000	2.4000000	0.9275955	0.8604333
			Cylinders		25	0	4.0000000	8.0000000	4.0000000	6.0000000	6.0000000	6.0000000	1.2909944	1.6666667
			Horsepower		25	0	130.0000000	325.0000000	195.0000000	214.1600000	215.0000000	160.0000000	48.7020533	2371.89
			MPG_City	MPG (City)	25	0	13.0000000	22.0000000	9.0000000	17.3200000	17.0000000	17.0000000	2.7646579	7.6433333
			MPG_Highway	MPG (Highway)	25	0	17.0000000	27.0000000	10.0000000	21.6800000	21.0000000	19.0000000	3.0099834	9.0600000
			Weight	Weight (LBS)	25	0	3020.00	5590.00	2570.00	4108.04	4035.00	.	752.1830163	565779.29
			Wheelbase	Wheelbase (IN)	25	0	98.0000000	129.0000000	31.0000000	108.0400000	107.0000000	103.0000000	7.0680030	49.9566667
			Length	Length (IN)	25	0	163.0000000	208.0000000	45.0000000	184.8400000	186.0000000	167.0000000	11.4479984	131.0566667
	Sedan	94	MSRP		94	0	10280.00	55750.00	45470.00	22763.97	20392.00	15389.00	9613.14	92412548.01
			Invoice		94	0	9875.00	48583.00	38708.00	20788.31	18556.00	14207.00	8363.51	69948245.14
			EngineSize	Engine Size (L)	94	0	1.5000000	4.5000000	3.0000000	2.6478723	2.5000000	3.5000000	0.7789887	0.6068234
			Cylinders		94	0	4.0000000	8.0000000	4.0000000	5.0425532	4.0000000	4.0000000	1.1631889	1.3530085
			Horsepower		94	0	103.0000000	340.0000000	237.0000000	181.9787234	167.5000000	160.0000000	57.2928675	3282.47
			MPG_City	MPG (City)	94	0	16.0000000	36.0000000	20.0000000	22.8404255	21.0000000	18.0000000	4.9389895	24.3936170
			MPG_Highway	MPG (Highway)	94	0	22.0000000	44.0000000	22.0000000	29.9680851	29.0000000	26.0000000	4.8845865	23.8591855
			Weight	Weight (LBS)	94	0	2035.00	4802.00	2767.00	3161.37	3242.50	2513.00	584.2948509	341400.47
			Wheelbase	Wheelbase (IN)	94	0	93.0000000	124.0000000	31.0000000	105.6489362	105.0000000	107.0000000	6.4068301	41.0474720
			Length	Length (IN)	94	0	154.0000000	204.0000000	50.0000000	184.0106383	186.0000000	178.0000000	10.4505952	109.2149394
	Sports	17	MSRP		17	0	18739.00	89765.00	71026.00	32510.65	26910.00	.	17641.86	311235327
			Invoice		17	0	17101.00	79978.00	62877.00	29620.94	25179.00	.	15362.48	236005794
			EngineSize	Engine Size (L)	17	0	1.3000000	4.3000000	3.0000000	2.4529412	2.2000000	1.8000000	0.8537547	0.7288971
			Cylinders		15	2	4.0000000	8.0000000	4.0000000	5.0666667	4.0000000	4.0000000	1.2798809	1.6380952
			Horsepower		17	0	138.0000000	300.0000000	162.0000000	225.3529412	227.0000000	142.0000000	57.6031045	3318.12
			MPG_City	MPG (City)	17	0	17.0000000	26.0000000	9.0000000	20.2352941	20.0000000	18.0000000	2.5132004	6.3161765
			MPG_Highway	MPG (Highway)	17	0	23.0000000	33.0000000	10.0000000	26.6470588	26.0000000	26.0000000	2.7143410	7.3676471
			Weight	Weight (LBS)	17	0	2195.00	3840.00	1645.00	3009.76	3085.00	2387.00	427.0643291	182383.94
			Wheelbase	Wheelbase (IN)	17	0	89.0000000	106.0000000	17.0000000	99.9411765	101.0000000	100.0000000	5.0307876	25.3088235
			Length	Length (IN)	17	0	153.0000000	179.0000000	26.0000000	170.0000000	174.0000000	174.0000000	8.2168384	67.5000000
	Truck	8	MSRP		8	0	12800.00	26650.00	13850.00	20383.63	20914.50	.	5281.29	27892049.41
			Invoice		8	0	11879.00	24926.00	13047.00	18801.50	19367.50	.	4782.31	22870490.29
			EngineSize	Engine Size (L)	8	0	2.3000000	5.6000000	3.3000000	3.3625000	3.3500000	3.4000000	1.0835622	1.1741071
			Cylinders		8	0	4.0000000	8.0000000	4.0000000	5.5000000	6.0000000	6.0000000	1.4142136	2.0000000
			Horsepower		8	0	142.0000000	305.0000000	163.0000000	190.2500000	185.0000000	190.0000000	51.7569871	2678.79
			MPG_City	MPG (City)	8	0	14.0000000	24.0000000	10.0000000	17.8750000	16.5000000	14.0000000	3.9074105	15.2678571
			MPG_Highway	MPG (Highway)	8	0	17.0000000	29.0000000	12.0000000	22.0000000	19.5000000	18.0000000	5.0709255	25.7142857
			Weight	Weight (LBS)	8	0	2750.00	5287.00	2537.00	3793.13	3748.00	.	811.2451519	658118.70
			Wheelbase	Wheelbase (IN)	8	0	103.0000000	140.0000000	37.0000000	119.6250000	121.0000000	128.0000000	13.0267582	169.6964286
			Length	Length (IN)	8	0	188.0000000	224.0000000	36.0000000	203.2500000	198.0000000	191.0000000	14.6555694	214.7857143
	Wagon	11	MSRP		11	0	11905.00	36395.00	24490.00	23143.73	21445.00	.	8716.34	75974532.22
			Invoice		11	0	11410.00	33121.00	21711.00	21352.27	19846.00	.	7673.49	58882511.62
			EngineSize	Engine Size (L)	11	0	1.5000000	4.5000000	3.0000000	2.6454545	2.5000000	2.5000000	0.9147280	0.8367273
			Cylinders		11	0	4.0000000	8.0000000	4.0000000	4.9090909	4.0000000	4.0000000	1.3751033	1.8909091
			Horsepower		11	0	104.0000000	315.0000000	211.0000000	185.6363636	165.0000000	165.0000000	69.4698103	4826.05
			MPG_City	MPG (City)	11	0	15.0000000	31.0000000	16.0000000	22.3636364	21.0000000	21.0000000	5.1433982	26.4545455
			MPG_Highway	MPG (Highway)	11	0	19.0000000	36.0000000	17.0000000	28.1818182	28.0000000	28.0000000	5.3817875	28.9636364
			Weight	Weight (LBS)	11	0	2425.00	4309.00	1884.00	3236.27	3090.00	.	629.4238780	396174.42
			Wheelbase	Wheelbase (IN)	11	0	95.0000000	112.0000000	17.0000000	103.4545455	102.0000000	98.0000000	6.0060575	36.0727273
			Length	Length (IN)	11	0	155.0000000	189.0000000	34.0000000	176.9090909	177.0000000	167.0000000	11.1754601	124.8909091
Europe	SUV	10	MSRP		10	0	25995.00	76870.00	50875.00	48346.00	43860.00	.	16325.11	266509293
			Invoice		10	0	23969.00	71540.00	47571.00	44291.30	41059.50	.	14974.33	224230534
			EngineSize	Engine Size (L)	10	0	2.5000000	5.0000000	2.5000000	3.9500000	4.4000000	4.4000000	0.9431036	0.8894444
			Cylinders		10	0	6.0000000	8.0000000	2.0000000	7.2000000	8.0000000	8.0000000	1.0327956	1.0666667
			Horsepower		10	0	174.0000000	340.0000000	166.0000000	263.1000000	275.0000000	.	52.6570666	2772.77
			MPG_City	MPG (City)	10	0	12.0000000	18.0000000	6.0000000	14.5000000	14.5000000	12.0000000	1.9002924	3.6111111
			MPG_Highway	MPG (Highway)	10	0	14.0000000	23.0000000	9.0000000	18.7000000	19.0000000	16.0000000	2.9458068	8.6777778
			Weight	Weight (LBS)	10	0	3577.00	5423.00	1846.00	4735.00	4849.00	.	574.1995395	329705.11
			Wheelbase	Wheelbase (IN)	10	0	100.0000000	113.0000000	13.0000000	109.5000000	111.5000000	112.0000000	4.8362060	23.3888889
			Length	Length (IN)	10	0	175.0000000	195.0000000	20.0000000	185.2000000	185.5000000	.	5.3707024	28.8444444

Key Points about Code

1. A new style template, Styles.Sasweb_Black_Burgundy, is created with PROC TEMPLATE that inherits the attributes of its parent template, Styles.SASWEB. The new template replaces two parameters ('fgB1' and 'bgA1') in the style color_list section.

2. An **ODS HTML5 FILE=** statement tells SAS the path / folder where the output is to be written along with the assignment of its physical name.

3. A **TITLE** statement is specified to display the name of the dashboard.

4. An **ODS LAYOUT** statement is specified to tell SAS to define a 1 row x 1 column layout.

5. An **ODS REGION** statement is specified to indicate the beginning of output results.

6. A PROC FREQ, three PROC SGPLOTs, and a PROC MEANS is specified.

7. An **ODS LAYOUT CLOSE** statement is specified to terminate the layout of output results.

8. An **ODS HTML5 CLOSE** statement tells SAS to render the output results representing the dashboard contents to the HTML5 file.

Base-SAS Code:

```
proc template ;
  define style Styles.Sasweb_Black_Burgundy ;
    parent = Styles.SASWEB ;
      replace color_list /
        'fgD1' = cx666666 /* Gray             */
        'fgC1' = cxCCCCCC /* Light Gray       */
        'fgB1' = CX000000 /* Black            */
        'bgA1' = CX800020 /* Burgundy         */
        'fgA'  = CX000000 /* Black            */
        'bgA'  = CXFFFFFF /* White            */ ;
  end ;
run ;

ods html5 style=styles.Sasweb_Black_Burgundy
          path="/home/kirklafler/Dashboards/Results"
          body="Dashboard - Color (Black-Burgundy) with STYLEATTRS.html"
          (url=none) ;

title1 font=impact bold j=c h=12 c=Black "Analytics Dashboard" ;

ODS LAYOUT GRIDDED ROWS=1 COLUMNS=1 ; /* Design HTML 1x1 Layout */

options center ; /* Center the Results */
ods region ;  /* Start of Output Results */
title1 "SASHELP.CARS Frequency Distribution for Origin and Type" ;
proc freq data=SASHELP.CARS NLEVELS ;
  table Origin Type ;
run ;

title1 "Origin BarChart" ;
proc sgplot data=SASHELP.CARS ;
  styleattrs DATACOLORS=(CX800020 Indigo Plum Magenta PaleVioletRed Crimson) ;
  vbar Origin / group=Origin datalabel ;
run ;

title1 "Type BarChart" ;
proc sgplot data=SASHELP.CARS ;
  styleattrs DATACOLORS=(CX800020 Indigo Plum Magenta PaleVioletRed Crimson) ;
  vbar Type / group=Type datalabel ;
run ;

title1 "Origin by Type Cluster BarChart" ;
proc sgplot data=SASHELP.CARS ;
  styleattrs DATACOLORS=(CX800020 Indigo Plum Magenta PaleVioletRed Crimson) ;
  vbar Origin / group=Type response=MSRP stat=mean groupdisplay=cluster datalabel ;
run ;

title1 "Descriptive Statistics for MSRP and Invoice by Origin" ;
footnote1 j=l "Layout: HTML-bgA1-CX800020-fgA-CX000000 (Black-Burgundy) with STYLEATTRS" ;
proc means data=SASHELP.CARS n nmiss min max range mean median mode std var ;
  class Origin Type ;
run ;
title ;

ods layout end ; /* Terminate the Layout of Output Results */
ods html5 close ;
```

Conclusion

Organizations around the globe develop business intelligence and analytics dashboards to display the status of "point-in-time" metrics and key performance indicators. An effectively designed dashboard extracts real-time data from multiple sources for the purpose of highlighting important information, numbers, tables, statistics, metrics, performance scorecards and other essential content. This paper explored essential rules for "good" dashboard design, the metrics frequently used in dashboards, and the use of best practice programming techniques in the design of aesthetically pleasing dashboards using SAS® software. Readers were shown programming techniques to create quick and easy dashboards using Base-SAS® software including PROC SQL, macro, Output Delivery System (ODS), ODS HTML, ODS Excel, ODS Layout, ODS Statistical Graphics, PROC SGPLOT, and PROC SGPIE.

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Trademarks Citations

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Kirk Paul Lafler is a consultant, developer, programmer, educator, and data scientist; and teaches SAS Programming and Data Management in the Statistics Department at San Diego State University. Kirk also provides project-based consulting and programming services to client organizations in a variety of industries including healthcare, life sciences, and business; and teaches "virtual" and "live" SAS, SQL, Python, Database Management Systems (DBMS) technologies (e.g., Oracle, SQL-Server, Teradata, MySQL, MongoDB, PostgreSQL, AWS), Excel, R, cloud-based technologies as well as other software and tools. Currently, Kirk serves as the Western Users of SAS Software (WUSS) Executive Committee (EC) Open-Source Advocate and Coordinator and is actively involved with several proprietary and open-source software, DBMS, machine learning, cloud-computing user groups and conference committees. Kirk is the author of several books including the popular PROC SQL: Beyond the Basics Using SAS, Third Edition (SAS Press. 2019), along with other technical books and publications. He is also an Invited speaker, educator, keynote, and leader; and is the recipient of 28 "Best" contributed paper, hands-on workshop (HOW), and poster awards.

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