What's Hot – Skills for SAS® Professionals

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Abstract

As a new generation of SAS® user emerges, current and prior generations of users have an extensive array of procedures, programming tools, approaches and techniques to choose from. This presentation identifies and explores the areas that are hot in the world of the professional SAS user. Topics include Enterprise Guide, PROC SQL, PROC REPORT, Output Delivery System (ODS), Macro Language, DATA step programming techniques such as arrays and hash objects, SAS University Edition software, technical support at support.sas.com, wiki-content on sasCommunity.org®, published "white" papers on LexJansen.com, and other venues.

Introduction

As defined in The Free Dictionary by Farlex, 'skill' is defined as "the proficiency, facility, or dexterity that is acquired or developed through training or experience." Essentially, a skill is developed or enhanced over time, with the help of training resources and/or experience. A skill is demonstrated by the ability to perform a task, or set of tasks, well. SAS professionals frequently need a broad range of skills in order to contribute in the workplace and particularly to succeed in the technological society of the 21st century.

Critical success factors include assessing what your current skills and skill levels are, determining what skills are hot (in demand), as well as what skills are not, and identifying where and how to access resources to acquire or learn the necessary skills. As a SAS® professional, the skills you acquire will, perhaps, enable you to embark on a more rewarding journey leading to exciting opportunities, projects and better way of life. To assist in getting started, a self-survey questionnaire appears at the end of this paper to help you assess where you are and the skills needed to achieve those goals.

Take Inventory of Your Skills

The Free Merriam-Webster Dictionary defines skill as, *"the ability to do something that comes from training, experience, or practice."* A skill must be developed – one isn't born with a set of skills. So, how does one go about determining if they already possess a useful skill? Begin by taking inventory of any, and all, skills you already possess. Taking inventory of your skills involves simply making a list. Your skills might look something like the list, below.

Inventory of Existing Skills
DATA/PROC Step Programming
Data Access
Data Transformation
Data Cleaning
Data Manipulation
ODS, Reporting and Specialized Output
Macro Programming
Statistical Analysis
Data-driven Application Development
User Interface Design
Database Design
Technical Writing

Now that you've taken inventory of your skills, assign a ranking to each skill using the following values.

Ranking of Existing Skills
0 = None
1 = Heard of it, but little or no experience
2 = Some working knowledge
3 = Proficient
4 = Expert

Once you've assessed and ranked your skill level, assign a ranking to your level of competence using the following values.

Identify Level of Competence
0 = None
1 = Out-of-date
2 = Competitive
3 = Cutting Edge

Finally, categorize your skills by functional discipline, as follows.

Categorize Skills by Functional Discipline
Requirements Analysis
Systems Analysis
Application Design
User Interface Design
Report, Table and Chart Design
Data Cleaning
SDLC
Programming
Statistical analysis
Teaching
Technical Writing
Technical Support
Debugging

Seek Your Level, But Don't be Afraid to Stray from Your "Comfort" Zone

Once you have determined the skills to pursue, consider the appropriate level and resource needed to succeed. Assess your skill level, including what your objective is, and what you like to do most. Your past experience doing similar things is critically important in this equation. You should also obtain the recommendations and advice of other professionals you know. One good way to gain the necessary experience is to collaborate with more experienced colleagues, presenters, authors and consultants.

Improve Skills/Expertise

Many professionals believe they have already mastered all the necessary skills to be successful. But as technology evolves, it becomes increasingly important to continue the process of learning, essentially evolving along with the areas you are pursuing. It may even involve splitting a large area of interest or endeavor into smaller pieces, a process known as specializing. Even if you consider yourself an expert at what you do with interests and abilities in several areas in the SAS software, specialization is becoming not only popular, but necessary. To assist with your skill building, consider additional training from the following sources:

1) **SAS-led courses (lecture / hands-on workshops)**

2) **Non-SAS Institute Instructor-led courses**

3) **Self-paced computer-based training (CBT)**

4) **Online SAS documentation in PDF and HTML format**

5) **User-written books from SAS Press, Books by Users (BBU)**

6) **"White" papers available from LexJansen.com, sasCommunity.org, support.sas.com, and other websites**

7) **User Group presentations and Hands-on workshops**

8) **Podcasts and webinars on sasCommunity.org and support.sas.com**

SAS professionals can improve or brush up on skills by attending instructor-led or hands-on workshop training courses. Training by experienced vendors is frequently available on a variety of topics and offered at local training centers and at conference events. For example, the SAS Global Forum (SGF), the annual regional SAS conferences (e.g., MWSUG, NESUG, PNWSUG, SCSUG, SESUG, and WUSS), and industry-specific SAS conferences (e.g., PharmaSUG) offer affordable half-day and full-day instructor-led training. Users can attend these cost-effective training sessions before and/or after the conference event. Also, many of the conferences offer "free" 80 – 120 minute hands-on workshop sessions for users to attend during the conference event. These can be very attractive ways to learn a topic of interest or brush up on the latest techniques from a leading expert in a hands-on environment.

As an alternative to attending a training class in person, self-paced computer-based training (CBT) modules are available for purchase or through subscription. From time to time, "free" limited trial access is available for evaluation purposes. All you need to access this treasure-trove of information and learning is a computer and Web browser (e.g., Internet Explorer, Netscape Navigator, Safari or Mozilla FireFox). SAS Institute, for example, offers topics that can be accessed and studied for a 90-day period on the Web.

sasCommunity.org

sasCommunity.org is an exciting collaborative online community for SAS users worldwide. This virtual online community supports technology for SAS users to collaborate with other users anywhere in the world; access SAS-based content including blogs, presentations, and code examples; learn about upcoming events, forums and user group conferences; and discuss anything and everything that is related to SAS software, from SAS users to SAS users. As organizations experience declining travel budgets, improved broadband and Internet technological advances, and a need for greater productivity, sasCommunity.org expands its presence among SAS professionals.

SAS Certified Professional Exams

To give your career a significant boost and to improve your prospects for success, the SAS Institute offers certification testing for users in three key areas: 1) SAS Programming, 2) Predictive Modeling and 3) Data Warehousing among others. These globally recognized certification tests are administered in more than 140 countries by a global leader in testing services in the IT industry, and are taken in a controlled environment.

Two credentials are offered by SAS Institute for SAS programmers to consider:
1)   SAS Certified Base Programmer Credential for SAS 9
     a.   SAS Base Programming Exam for SAS 9

2)   SAS Certified Advanced Programmer Credential for SAS 9
     a.   SAS Base Programming Exam for SAS 9
     b.   SAS Advanced Programming Exam for SAS 9

SAS Institute offers users a credential for predictive modelers to consider:
1)   Predictive Modeling Using SAS Enterprise Miner 5.2 Credential
     a.   Predictive Modeling Using SAS Enterprise Miner 5.2 Exam

Two credentials are offered by SAS Institute for SAS data warehouse professionals to consider:
1)   SAS Certified Warehouse Development Specialist Credential
     a.   SAS Advanced Programming Exam for SAS 9
     b.   SAS Warehouse Technology Exam
     c.   SAS Warehouse Development Specialist Concepts Exam

2)   SAS Certified Warehouse Architect Credential
     a.   SAS Warehouse Technology Exam
     b.   SAS Warehouse Architect Concepts Exam

SAS Alliance Partner Program

SAS professionals may want to consider applying to become a SAS Alliance Partner. Five core programs are available to choose from: 1) Technology Program, 2) Consulting Program, 3) Application Program, 4) Outsourcing Program, and 5) Reseller Program. Each program has three levels: 1) Platinum, 2) Gold and 3) Silver. For more information about Alliance partnership opportunities, prospective candidates should access and review the SAS Alliance Program Guide on the SAS Institute web site at http://www.sas.com/partners/programs/index.html.

What Skills, Techniques and Websites are Hot?

The following table illustrates many of the skills, techniques and/or websites, but not all, that the author has found to be popular and in demand by SAS professionals.

- **Enterprise Guide – GUI point-and-click front-end application**
- **Hash Programming Techniques to produce "Fast" table lookups, sorts, merges, and joins**
- **Output Delivery System (ODS) to create RTF, PDF, HTML, XML, and Excel output**
- **ODS Statistical Graphics to produce high-quality plots, bar charts, histograms, maps, and other graphics**
- **PROC SQL to construct Queries, Tables, Views, Case Expression Logic, inner and outer Joins**
- **PROC REPORT to create Detail and Summary Reporting**
- **Macro Language to construct Reusable Code and Tools**
- **Dictionary Tables and SASHELP Views – Access SAS Environmental / Metadata**
- **Business Intelligence**
- **SAS® University Edition software – Base-SAS, SAS/STAT, SAS/IML, SAS/ACCESS for Windows and Studio**
- **Resource for Published SAS Papers – http://www.LexJansen.com**
- **SAS/XML – Share Structured Data as meta-data**
- **Technical Support, Online Documentation – http://support.sas.com**
- **Social Networking, Blogs, Tech Support – http://www.sasCommunity.org**
- **List Serve of archived Technical Support – SAS-L – http://www.listserv.uga.edu/archives/sas-l.html**
- **SAS Certification – SAS Certified Professional Exams**
- **JMP software to produce Statistical and Data Visualization**
- **JMP and JMP Genomics**

What Skills are Not so Hot?

The table below shows a few skills that the authors have found to be not as popular, or as they once were, by SAS professionals.

- **SAS/ASSIST® software**
- **SAS/FSP® software**
- **SAS/AF® software**
- **Screen Component Language® (SCL)**
- **DATA _NULL_ –> Monospace "Custom" Reporting**

SAS University Edition Software

The SAS® University Edition is "free" to anyone. It falls under the SAS Analytics U umbrella and includes e-Learning modules to help SAS learners grow their analytics, technical and programming skills using powerful SAS software. Available for PC, Mac, or Linux Workstations, the SAS University Edition includes Base SAS®, SAS/STAT®, SAS/IML®, SAS/ACCESS® for Windows, and SAS Studio. It works through Virtualization Software in standalone mode and your Browser to access to SAS software.

Base SAS Features

The Base SAS software contains a built in DATA step programming language, the ability to access a wide-range of data sources, comprehensive set of functions to handle data manipulation, an assortment of "canned" and ready-to-use procedures, a comprehensive SQL language, reporting and customization feature for reports and results using Output Delivery System (ODS), data display informats and output formats, comprehensive data visualization features known as ODS Statistical Graphics, data management capabilities, and much more.

SAS/STAT® Features

The SAS/STAT software supports the application of the latest statistical techniques. It supports the following statistical routines: Analysis of Variance, Bayesian Analysis, Categorical Data Analysis, Cluster Analysis, Mixed Models, Multivariate Analysis, Nonparametric Analysis, Regression Analysis, Survey Sampling and Analysis, Statistical Graphics, and much more.

SAS/IML® Features
The SAS/IML software is an interactive matrix programming language and supports the ability to conduct Exploratory Analysis, the integration with the R programming language, dynamically linked graphics, and much more.

SAS/ACCESS® Features
The SAS/ACCESS software supports the ability to read, write, and update data sources; provides a flexible query language; supports the access to a variety of data sources including text files, dat files, CSV files, Excel spreadsheets, Microsoft SQL Server, and ODBC; and much more.

SAS Studio
The SAS Studio software serves as the user interface; supports Web applications; the access to data files, libraries and programs; the ability to recover files; dynamically link graphics; and much more.
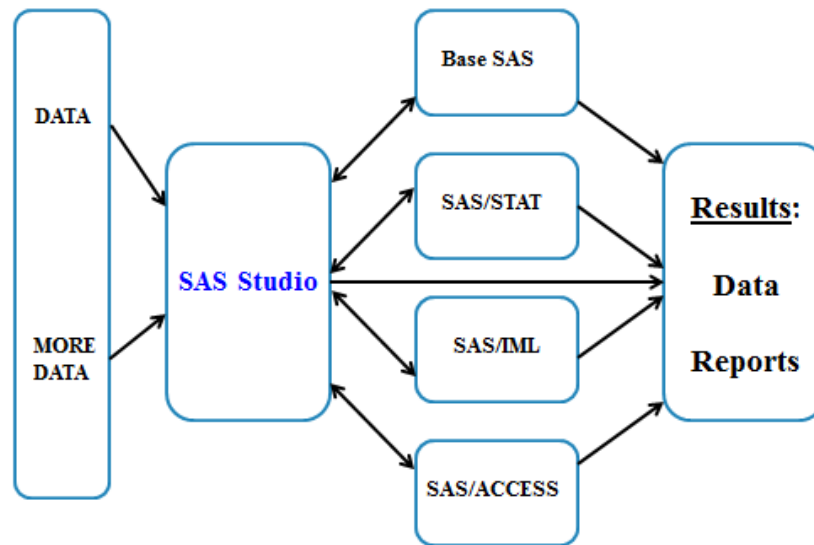
SAS University Edition Processing

Figure 22. SAS Studio Control Flow

SAS University Edition Coding Examples
In this section, SAS learners are provided with a sampling of essential SAS coding techniques to begin their knowledge acquisition.

Displaying table attributes with PROC CONTENTS

```
libname mydata '/folders/myfolders/' ;
proc contents lib=mydata.movies ;
 title ;
run ;
```

Sorting data with PROC SORT

```
libname mydata '/folders/myfolders/' ;
proc sort data=mydata.movies
          out=sorted_movies ;
 by rating title ;
run ;
```

Printing data with PROC PRINT

```
libname mydata '/folders/myfolders/' ;
proc print data=sorted_movies ;
 var title category length ;
 by rating ;
run ;
```

Transposing data with PROC TRANSPOSE

```
libname mydata '/folders/myfolders/' ;
proc transpose data=mydata.movies
                out=transposed_movies ;
 var title ;
 by rating ;
run ;
```

DATA Step Match-Merge

```
libname mydata '/folders/myfolders/' ;
data match_merge ;
 merge mydata.movies(in=m)
       mydata.actors(in=a) ;
 if m and a ;
run ;
```

Conventional Matching Join with PROC SQL

```
libname mydata '/folders/myfolders/' ;
proc sql ;
 select m.title, rating, length,
        actor_leading
   from mydata.movies  m,
        mydata.actors a
    where m.title = a.title ;
quit ;
```

Using PROC REPORT

SAS users often need to create and deliver quality custom reports and specialized output for management, end users, and customers. The SAS System provides users with the REPORT PROCedure, a "canned" Base-SAS procedure, for producing quick and formatted detail and summary results; compute subtotals and totals at the end of a report using a COMPUTE Block; calculate percentages; produce statistics for an analysis variable; and apply conditional logic to control summary output rows.

The REPORT procedure is a powerful tool for creating detail and summary reports and output. As with all powerful procedures, users have a number of statements and options to choose from. In its simplest form, below, PROC REPORT with the DATA= option displays all variables for all observations in the specified SAS data set. SAS determines the best way to format the output, so you don't necessarily need to worry about these types of issues. It should be noted that the order of the displayed variables on the output report is not alphabetical, but the order the variables were created in the data set. It should also be noted that when a Title statement is not specified, the default title displayed on output is, "The SAS System." The basic syntax of PROC REPORT with the DATA= option and the corresponding output is shown below.

PROC REPORT Code

```
PROC REPORT DATA=mydata.movies  ;
RUN ;
```

Output

The SAS System					
Title	**Length**	**Category**	**Year**	**Studio**	**Rating**
Brave Heart	177	Action Adventure	1995	Paramount Pictures	R
Casablanca	103	Drama	1942	MGM / UA	PG
Christmas Vacation	97	Comedy	1989	Warner Brothers	PG-13
Coming to America	116	Comedy	1988	Paramount Pictures	R
Dracula	130	Horror	1993	Columbia TriStar	R
Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R
Forrest Gump	142	Drama	1994	Paramount Pictures	PG-13
Ghost	127	Drama Romance	1990	Paramount Pictures	PG-13
Jaws	125	Action Adventure	1975	Universal Studios	PG
Jurassic Park	127	Action	1993	Universal Pictures	PG-13
Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R
Michael	106	Drama	1997	Warner Brothers	PG-13
National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG-13
Poltergeist	115	Horror	1982	MGM / UA	PG
Rocky	120	Action Adventure	1976	MGM / UA	PG
Scarface	170	Action Cops & Robber	1983	Universal Studios	R
Silence of the Lambs	118	Drama Suspense	1991	Orion	R
Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG
The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG
The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R
The Wizard of Oz	101	Adventure	1939	MGM / UA	G
Titanic	194	Drama Romance	1997	Paramount Pictures	PG-13

Selecting Variables to Display with a KEEP= Data Set Option
PROC REPORT output can also be produced with a KEEP= data set option. In lieu of all the variables being read from the input SAS data set, a KEEP= data set option gives users a controlled way to select the variable(s) needed from an input data set. This not only prevents all variables from being read and processed, it reduces CPU and I/O performance demands on the system. As was presented in the previous example, the order of the displayed variables for the generated output is in the order the variables were created in the data set. The following example shows the syntax and corresponding output of a KEEP= data set and the NOWINDOWS option.

PROC REPORT Code

```
PROC REPORT DATA=mydata.movies(KEEP=title rating category length) NOWINDOWS ;
RUN ;
```

Output

Title	Length	Category	Rating
Brave Heart	177	Action Adventure	R
Casablanca	103	Drama	PG
Christmas Vacation	97	Comedy	PG-13
Coming to America	116	Comedy	R
Dracula	130	Horror	R
Dressed to Kill	105	Drama Mysteries	R
Forrest Gump	142	Drama	PG-13
Ghost	127	Drama Romance	PG-13
Jaws	125	Action Adventure	PG
Jurassic Park	127	Action	PG-13
Lethal Weapon	110	Action Cops & Robber	R
Michael	106	Drama	PG-13
National Lampoon's Vacation	98	Comedy	PG-13
Poltergeist	115	Horror	PG
Rocky	120	Action Adventure	PG
Scarface	170	Action Cops & Robber	R
Silence of the Lambs	118	Drama Suspense	R
Star Wars	124	Action Sci-Fi	PG
The Hunt for Red October	135	Action Adventure	PG
The Terminator	108	Action Sci-Fi	R
The Wizard of Oz	101	Adventure	G
Titanic	194	Drama Romance	PG-13

The SAS System

Selecting Variables to Display with a COLUMNS Statement

PROC REPORT output can also be produced with an optional COLUMNS statement. The COLUMNS statement tells SAS what variable(s) to display in the report. Unlike the previous examples, the variables specified with the COLUMNS statement are displayed in the exact order specified and not in the order the variables were created in the data set. The following example shows the syntax and corresponding output of the COLUMNS statement.

PROC REPORT Code

```
PROC REPORT DATA=mydata.movies NOWINDOWS ;
   COLUMNS title rating category length ;
RUN ;
```

Output

The SAS System

Title	Rating	Category	Length
Brave Heart	R	Action Adventure	177
Casablanca	PG	Drama	103
Christmas Vacation	PG-13	Comedy	97
Coming to America	R	Comedy	116
Dracula	R	Horror	130
Dressed to Kill	R	Drama Mysteries	105
Forrest Gump	PG-13	Drama	142
Ghost	PG-13	Drama Romance	127
Jaws	PG	Action Adventure	125
Jurassic Park	PG-13	Action	127
Lethal Weapon	R	Action Cops & Robber	110
Michael	PG-13	Drama	106
National Lampoon's Vacation	PG-13	Comedy	98
Poltergeist	PG	Horror	115
Rocky	PG	Action Adventure	120
Scarface	R	Action Cops & Robber	170
Silence of the Lambs	R	Drama Suspense	118
Star Wars	PG	Action Sci-Fi	124
The Hunt for Red October	PG	Action Adventure	135
The Terminator	R	Action Sci-Fi	108
The Wizard of Oz	G	Adventure	101
Titanic	PG-13	Drama Romance	194

In the next example, the DEFINE statement specifies the DISPLAY option with a character string to use as the variable heading for each variable. Each DEFINE statement also tells PROC REPORT the width to display each column's content using the WIDTH= option. Unlike the COLUMNS statement specified in the previous example, the DEFINE statement's purpose is to tell PROC REPORT how each variable is to be used and displayed in the report. The resulting report output displays all variables in the order they were created in the data set, shown below.

PROC REPORT Code

```
PROC REPORT DATA=mydata.movies NOWINDOWS ;
  DEFINE title    / DISPLAY 'Movie Title'  WIDTH=30 ;
  DEFINE rating   / DISPLAY 'Movie Rating' WIDTH=5  ;
  DEFINE category / DISPLAY 'Category'     WIDTH=20 ;
  DEFINE length   / DISPLAY 'Movie Length' WIDTH=3  ;
RUN ;
```

Output

Movie Title	Movie Length	Category	Year	Studio	Movie Rating
Brave Heart	177	Action Adventure	1995	Paramount Pictures	R
Casablanca	103	Drama	1942	MGM / UA	PG
Christmas Vacation	97	Comedy	1989	Warner Brothers	PG-13
Coming to America	116	Comedy	1988	Paramount Pictures	R
Dracula	130	Horror	1993	Columbia TriStar	R
Dressed to Kill	105	Drama Mysteries	1980	Filmways Pictures	R
Forrest Gump	142	Drama	1994	Paramount Pictures	PG-13
Ghost	127	Drama Romance	1990	Paramount Pictures	PG-13
Jaws	125	Action Adventure	1975	Universal Studios	PG
Jurassic Park	127	Action	1993	Universal Pictures	PG-13
Lethal Weapon	110	Action Cops & Robber	1987	Warner Brothers	R
Michael	106	Drama	1997	Warner Brothers	PG-13
National Lampoon's Vacation	98	Comedy	1983	Warner Brothers	PG-13
Poltergeist	115	Horror	1982	MGM / UA	PG
Rocky	120	Action Adventure	1976	MGM / UA	PG
Scarface	170	Action Cops & Robber	1983	Universal Studios	R
Silence of the Lambs	118	Drama Suspense	1991	Orion	R
Star Wars	124	Action Sci-Fi	1977	Lucas Film Ltd	PG
The Hunt for Red October	135	Action Adventure	1989	Paramount Pictures	PG
The Terminator	108	Action Sci-Fi	1984	Live Entertainment	R
The Wizard of Oz	101	Adventure	1939	MGM / UA	G
Titanic	194	Drama Romance	1997	Paramount Pictures	PG-13

The SAS System

Creating PROC REPORT Output with a COLUMNS and DEFINE Statement

The COLUMNS and DEFINE statements can also be combined in PROC REPORT to create an output report. The COLUMNS statement tells SAS what variable(s) to display in the report. It is also worth noting that the COLUMNS statement limits the display to only those columns specified. The DEFINE statement tells PROC REPORT how each variable will be used in the generated report output. The following example illustrates using a COLUMNS and DEFINE statement along with various display options.

PROC REPORT Code

```
PROC REPORT DATA=mydata.movies NOWINDOWS ;
   COLUMNS title rating category length ;
   DEFINE title    / DISPLAY 'Movie Title'  WIDTH=30 ;
   DEFINE rating   / DISPLAY 'Movie Rating' WIDTH=5  ;
   DEFINE category / DISPLAY 'Category'     WIDTH=20 ;
   DEFINE length   / DISPLAY 'Movie Length' WIDTH=3  ;
   RUN ;
```

Output

The SAS System

Movie Title	Movie Rating	Category	Movie Length
Brave Heart	R	Action Adventure	177
Casablanca	PG	Drama	103
Christmas Vacation	PG-13	Comedy	97
Coming to America	R	Comedy	116
Dracula	R	Horror	130
Dressed to Kill	R	Drama Mysteries	105
Forrest Gump	PG-13	Drama	142
Ghost	PG-13	Drama Romance	127
Jaws	PG	Action Adventure	125
Jurassic Park	PG-13	Action	127
Lethal Weapon	R	Action Cops & Robber	110
Michael	PG-13	Drama	106
National Lampoon's Vacation	PG-13	Comedy	98
Poltergeist	PG	Horror	115
Rocky	PG	Action Adventure	120
Scarface	R	Action Cops & Robber	170
Silence of the Lambs	R	Drama Suspense	118
Star Wars	PG	Action Sci-Fi	124
The Hunt for Red October	PG	Action Adventure	135
The Terminator	R	Action Sci-Fi	108
The Wizard of Oz	G	Adventure	101
Titanic	PG-13	Drama Romance	194

Centering Data in a Column of PROC REPORT Output

The data displayed in each column of output can be centered. By default, PROC REPORT left justifies character-defined data and right justifies numeric-defined data. As in the previous example, the TITLE, COLUMNS and DEFINE statements were specified in PROC REPORT to create a "custom" output report. The next example illustrates using the DEFINE statement CENTER option to center the data for the RATING column on the report output.

PROC REPORT Code

```
TITLE Detailed Movies Listing ;
PROC REPORT DATA=mydata.movies NOWINDOWS ;
  COLUMNS title rating category length ;
  DEFINE title    / DISPLAY 'Movie Title'  WIDTH=30 ;
  DEFINE rating   / DISPLAY 'Movie Rating' WIDTH=5
                    CENTER ;
  DEFINE category / DISPLAY 'Category'     WIDTH=20 ;
  DEFINE length   / DISPLAY 'Movie Length' WIDTH=3  ;
RUN ;
```

Output

Detailed Movies Listing

Movie Title	Movie Rating	Category	Movie Length
Brave Heart	R	Action Adventure	177
Casablanca	PG	Drama	103
Christmas Vacation	PG-13	Comedy	97
Coming to America	R	Comedy	116
Dracula	R	Horror	130
Dressed to Kill	R	Drama Mysteries	105
Forrest Gump	PG-13	Drama	142
Ghost	PG-13	Drama Romance	127
Jaws	PG	Action Adventure	125
Jurassic Park	PG-13	Action	127
Lethal Weapon	R	Action Cops & Robber	110
Michael	PG-13	Drama	106
National Lampoon's Vacation	PG-13	Comedy	98
Poltergeist	PG	Horror	115
Rocky	PG	Action Adventure	120
Scarface	R	Action Cops & Robber	170
Silence of the Lambs	R	Drama Suspense	118
Star Wars	PG	Action Sci-Fi	124
The Hunt for Red October	PG	Action Adventure	135
The Terminator	R	Action Sci-Fi	108
The Wizard of Oz	G	Adventure	101
Titanic	PG-13	Drama Romance	194

Creating a Grouped PROC REPORT Output

A "grouped" type of output can be created with PROC REPORT where analysis variables can be summarized based on a grouping variable. The next example illustrates a COLUMNS statement containing the desired variables to display on the report output. Notice that the order of the TITLE and RATING variables specified in the COLUMNS statement have been switched where now the categorical variable, RATING, is specified first. The DEFINE statement for the RATING variable specifies a GROUP option to create a "grouped" type of output where all the observations in the GROUP variable are consolidated together.

PROC REPORT Code

```
TITLE Detailed Movies Listing ;
TITLE2 Sorted by Rating ;
PROC REPORT DATA=mydata.movies NOWINDOWS ;
  COLUMNS rating title category length ;
  DEFINE title    / DISPLAY 'Movie Title'  WIDTH=30 ;
  DEFINE rating   / ORDER   'Movie Rating' WIDTH=5
                    CENTER ;
  DEFINE category / DISPLAY 'Category'     WIDTH=20 ;
  DEFINE length   / DISPLAY 'Movie Length' WIDTH=3  ;
RUN ;
```

Output

Detailed Movies Listing
Sorted by Rating

Movie Rating	Movie Title	Category	Movie Length
G	The Wizard of Oz	Adventure	101
PG	Casablanca	Drama	103
	Jaws	Action Adventure	125
	Poltergeist	Horror	115
	Rocky	Action Adventure	120
	Star Wars	Action Sci-Fi	124
	The Hunt for Red October	Action Adventure	135
PG-13	Christmas Vacation	Comedy	97
	Forrest Gump	Drama	142
	Ghost	Drama Romance	127
	Jurassic Park	Action	127
	Michael	Drama	106
	National Lampoon's Vacation	Comedy	98
	Titanic	Drama Romance	194
R	Brave Heart	Action Adventure	177
	Coming to America	Comedy	116
	Dracula	Horror	130
	Dressed to Kill	Drama Mysteries	105
	Lethal Weapon	Action Cops & Robber	110
	Scarface	Action Cops & Robber	170
	Silence of the Lambs	Drama Suspense	118
	The Terminator	Action Sci-Fi	108

Applying Conditional Logic in PROC REPORT Code

The next example illustrates how conditional logic can be optionally applied in PROC REPORT code to control the display of information on report output and, specifically the display of computed values for the variable, LENGTH2.

PROC REPORT Code

```
TITLE  Detailed Movies Listing ;
TITLE2 Using Conditional Logic ;
PROC REPORT DATA=mydata.movies NOWINDOWS ;
  COLUMNS rating title studio length length2 ;
  DEFINE title    / DISPLAY  'Movie Title'  WIDTH=30 ;
  DEFINE rating   / ORDER    'Movie Rating' WIDTH=5 CENTER ;
  DEFINE studio   / DISPLAY  'Movie Studio' WIDTH=20 ;
  DEFINE length   / ANALYSIS 'Movie Length' WIDTH=3 ;
  DEFINE length2  / COMPUTED 'Trailer Length' ;
  COMPUTE length2 ;
    if UPCASE(studio)='PARAMOUNT PICTURES' then
            length2 = 1 + length.sum ;
  ENDCOMP ;
RUN ;
```

Output

Detailed Movies Listing Using Conditional Logic

Movie Rating	Movie Title	Movie Studio	Movie Length	Trailer Length
G	The Wizard of Oz	MGM / UA	101	.
PG	Casablanca	MGM / UA	103	.
	Jaws	Universal Studios	125	.
	Poltergeist	MGM / UA	115	.
	Rocky	MGM / UA	120	.
	Star Wars	Lucas Film Ltd	124	.
	The Hunt for Red October	Paramount Pictures	135	136
PG-13	Christmas Vacation	Warner Brothers	97	.
	Forrest Gump	Paramount Pictures	142	143
	Ghost	Paramount Pictures	127	128
	Jurassic Park	Universal Pictures	127	.
	Michael	Warner Brothers	106	.
	National Lampoon's Vacation	Warner Brothers	98	.
	Titanic	Paramount Pictures	194	195
R	Brave Heart	Paramount Pictures	177	178
	Coming to America	Paramount Pictures	116	117
	Dracula	Columbia TriStar	130	.
	Dressed to Kill	Filmways Pictures	105	.
	Lethal Weapon	Warner Brothers	110	.
	Scarface	Universal Studios	170	.
	Silence of the Lambs	Orion	118	.
	The Terminator	Live Entertainment	108	.

SAS Metadata DICTIONARY Tables and SASHELP Views

SAS users can quickly and conveniently obtain useful information about their SAS session with a number of read-only SAS system tables called DICTIONARY tables. At any time during a SAS session, DICTIONARY tables can be accessed using the libref DICTIONARY in the FROM clause of a PROC SQL SELECT statement to capture information related to currently defined libnames, table names, column names and attributes, formats, and much more. SASHELP views can be accessed using any of your favorite procedures or in the DATA step. SAS 9.1 software supported 22 Dictionary tables and SASHELP views, SAS 9.2 supported 29 Dictionary tables and SASHELP views, SAS 9.3 supported 30 DICTIONARY tables and SASHELP views, and SAS 9.4 supports 32 DICTIONARY tables and SASHELP views.

Accessing and Displaying the Number of Rows in a Table
The DICTIONARY table, TABLES, can be accessed to capture and display each table name and the number of observations in the user-assigned MYDATA libref. The following PROC SQL code provides a handy way to quickly determine the number of rows in one or all tables in a libref without having to execute multiple PROC CONTENTS by using the stored information in the Dictionary table TABLES.

PROC SQL Code

```
PROC SQL ;
  SELECT LIBNAME, MEMNAME, NOBS
    FROM DICTIONARY.TABLES
      WHERE UPCASE(LIBNAME)="MYDATA" AND
            UPCASE(MEMTYPE)="DATA" ;
QUIT ;
```

Output

Library Name	Member Name	Number of Physical Observations
MYDATA	ACTORS	13
MYDATA	CUSTOMERS	3
MYDATA	MOVIES	22
MYDATA	PG_RATED_MOVIES	13

Accessing and Displaying the Column Definitions for a "Key" Variable in All Tables

The DICTIONARY table, COLUMNS, is accessed to display all table names (data sets) that contain the variable TITLE in the user-assigned MYDATA libref as a cross-reference listing. To retrieve the needed type of information, you could execute multiple PROC CONTENTS against selected tables. Or in a more efficient method, you could retrieve the information directly from the read-only Dictionary table COLUMNS with the selected columns LIBNAME, MEMNAME, NAME, TYPE and LENGTH, as shown. For more information about Dictionary tables, readers may want to view the "free" SAS Press Webinar by Kirk Paul Lafler at http://support.sas.com/publishing/bbu/webinar.html#lafler2 or the published paper by Kirk Paul Lafler, Exploring Dictionary Tables and SASHELP Views.

PROC SQL Code

```
PROC SQL ;
  SELECT LIBNAME, MEMNAME, NAME, TYPE, LENGTH
    FROM DICTIONARY.COLUMNS
      WHERE UPCASE(LIBNAME)="MYDATA" AND
          UPCASE(NAME)="TITLE" AND
          UPCASE(MEMTYPE)="DATA" ;
QUIT ;
```

Output

Library Name	Member Name	Column Name	Column Type	Column Length
MYDATA	ACTORS	Title	char	30
MYDATA	MOVIES	Title	char	30
MYDATA	PG_MOVIES	Title	char	30
MYDATA	PG_RATED_MOVIES	Title	char	30
MYDATA	RENTAL_INFO	Title	char	30

Conclusion

There are many avenues to help determine what skills are hot and what are not in the world of the SAS professional. Follow the main websites www.SAS.com, the forums and blogs within http://support.SAS.com and the user interchange on www.sasCommunity.org to keep abreast of advancing technologies. Education and a desire to acquire new skills and experience are very important. Careful planning, preparation, organization, the ability to handle multiple tasks, and diligence are important factors for any SAS professional to possess and/or develop.

It's also important to identify and acquire specific techniques from others, along with their successes and failures, to improve the likelihood for greater success while enhancing your skills. Other professionals may be able to share their own expertise to help you acquire, or brush up on, specific skills, including resources like SAS-L, sasCommunity.org, and various web sites designed for SAS professionals. These resources include instructor-led and hands-on workshop training available at SAS user conferences, self-paced computer based training (CBT) or e-Learning applications, self-study web resources including "white" papers, published programming tips and techniques, and certification. Also, a good SAS programming and/or user-written technical book, or two, can provide a wealth of knowledge for the inquisitive, and self-starting, professional.

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Acknowledgments

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Kirk Paul Lafler is an entrepreneur, consultant and founder of Software Intelligence Corporation, and has been using SAS since 1979. Kirk is a SAS Certified Professional, provider of IT consulting services, advisor and professor at UC San Diego Extension and educator to SAS users around the world, mentor, and emeritus sasCommunity.org Advisory Board member. As the author of six books including Google® Search Complete (Odyssey Press. 2014) and PROC SQL: Beyond the Basics Using SAS, Second Edition (SAS Press. 2013); Kirk has written hundreds of papers and articles; been an Invited speaker and trainer at hundreds of SAS International, regional, special-interest, local, and in-house user group conferences and meetings; and is the recipient of 23 "Best" contributed paper, hands-on workshop (HOW), and poster awards.

Comments and suggestions can be sent to:

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SAS® Professional Skills Survey

SAS Professional: _____

E-mail/LinkedIn: _____

1. How long have you been using SAS?   ____ < 1 Year   ____ 1 – 5 Years   ____ 6 – 10 Years   ____ > 10 Years

2. How would you rate the level of your SAS expertise?   ____ None   ____ Novice   ____ Intermediate   ____ Advanced (Expert)

3. Have you been certified as a SAS Professional by passing the certification exam?   ____ Yes   ____ No

4. Are you a SAS Alliance Partner?   ____ Yes   ____ No   If you answered 'Yes' to previous question, how long? _____ Years

5. What method(s) do you use to improve your SAS skills?   ____ CBT   ____ Instructor-led Training   ____ Podcasts

        ____ Hands-on Workshops   ____ User Group Presentations   ____ Webinars   ____ YouTube Videos

        ____ Computer Based Training (CBT)   ____ support.sas.com   ____ SAS Press Books/eBooks

        ____ SAS Online Documentation   ____ www.lexjansen.com   ____ MOOCs   ____ Other

6. Rate your SAS programming/skills in the following areas (0=None, 1=Novice, 2=Some Knowledge, 3=Very Good, 4=Expert):

	Currently	1-Year from Now	2-Years from Now
- Base SAS®	_____	_____	_____
- SAS Programming	_____	_____	_____
- SQL Programming	_____	_____	_____
- Macro Programming	_____	_____	_____
- DATA Step Hash Programming	_____	_____	_____
- Output Delivery System (ODS)	_____	_____	_____
- ODS Statistical Graphics	_____	_____	_____
- SAS/FSP®, SAS/AF® and SCL	_____	_____	_____
- SAS Enterprise Guide® (EG)	_____	_____	_____
- SAS Debugging Techniques	_____	_____	_____
- Business Intelligence	_____	_____	_____
- Statistical Consulting	_____	_____	_____
- SAS/IntrNet®	_____	_____	_____
- SAS/PC®	_____	_____	_____
- SAS/Connect®	_____	_____	_____
- SAS/ETS®	_____	_____	_____
- SAS/OR®	_____	_____	_____
- SAS/Graph®	_____	_____	_____
- SAS/XML®	_____	_____	_____
- Data Mining	_____	_____	_____
- Data Cleaning	_____	_____	_____
- Other _____	_____	_____	_____
- Other _____	_____	_____	_____

7. What makes your skills unique and/or successful? _____
_____

8. What are your goals, directions, and future plans? _____
_____
_____
_____
_____

Please feel free to use this form to assess and manage your own SAS Skills.

Figure 1.   Professional SAS Skills Survey