SAS ® Certification: What you need to know about how we did it!
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ABSTRACT
Are you interested in becoming a SAS Certified Professional? This presentation is a collection of practical tips and useful information gleaned from our varied experiences with several of the SAS certification exams. We will cover the “What”, “Why” and most importantly the “How” of the SAS Certification Process. The authors have differing histories with the SAS system; one passed his first exam after only 11 months of exposure to SAS and the other had 20 years as a SAS professional before succeeding with three exams. From these two vantage points, we’ll explain just what you need to know as you get ready to earn your first SAS Certified credential.

INTRODUCTION
SAS Professional Certification can enhance your career as a SAS programmer and provide a few additional benefits as well. The SAS Certified Professional Program currently includes five levels of globally recognized certifications for SAS software users. There are base and advanced programmer certifications as well as one for developers and two that indicate expertise in SAS Warehouse technologies. In every case, to earn a SAS Certified Professional, one must demonstrate an in-depth understanding of SAS software by successful completion of one or more exams. Whether you are a novice or a seasoned SAS programmer, preparation is a key element in obtaining this credential. A variety of options to suit individual needs are available to help you prepare for a qualifying exam, regardless of whether you consider yourself a “self-learner” or rely on formal training classes.

This paper provides an overview of the resources available to those wishing to pursue SAS Professional Certification. While much of the information was obtained directly from the SAS Support website, this is not meant to be a complete guide. Instead, we will highlight our individual experiences in achieving certification which we provide from two different perspectives, along with some subjective advice which will hopefully inspire and aid others in attaining SAS Professional Certification as well.

While we will focus primarily on the SAS Certified Base Programmer and SAS Certified Advanced Programmer tracks in this paper (as these are more relevant to our personal experience), much of the practical advice we offer is applicable to any of the exams you will encounter within the five currently available certification tracks.

WHY YOU SHOULD CONSIDER BECOMING CERTIFIED
The reasons as well as the benefits of pursuing SAS Professional Certification vary by individual. SAS believes that certification can provide benefits to both employees and employers. And considering our personal experience, we absolutely concur.

GENERAL BENEFITS TO EMPLOYEES
SAS advises that by gaining SAS Professional Certification, individuals may increase their career opportunities and marketability to potential employers, enhance their credibility as technical professionals, assess their knowledge of SAS software, and earn industry recognition for their knowledge. All of these are beneficial and enabling to career goals. Speaking from experience, for the self-employed SAS certification can serve as excellent impetus for keeping current with SAS technology. Both of the co-authors of this paper feel that they have realized several of the benefits listed above…more on this later!

GENERAL BENEFITS TO EMPLOYERS
SAS Certified Professionals can be a benefit to employers as one study by the well regarded industry analyst, International Data Corporation, (a study often cited by SAS Institute), found improved customer service, increased productivity, and reduced operating costs within companies that employ certified staff.

Certification provides a concrete measure of an employee’s knowledge of SAS software and a way to differentiate between the most qualified technical professionals. As we will comment in a later section, anyone in a managerial role, which includes evaluation of prospective personnel for SAS related employment, will recognize the need for a consistent method of ranking SAS knowledge. We feel that the SAS Certified Professional Program fills this need perfectly.

CERTIFIED DIRECTORY
The Certified Directory is a web listing, maintained directly by SAS, of SAS Certified Professionals along with the certifications each professional has earned. The list is found at http://support.sas.com/certify/directory.html#list. Your name will be added to the list once you return the Certification Information Release Form included in the SAS Certified Professional Welcome Package that is sent to everyone who passes a certification exam. Be assured that SAS sends a complete package every time you pass an exam, regardless of whether you have previously achieved a credential.

The directory lists accredited professionals alphabetically as well as by state and country. As of August 2004, there were at least 850 people who had achieved either the SAS Certified Base Programmer or the earlier version called the SAS Certified Professional V8 in the USA, with over 1200 certified worldwide. The SAS Certified Advanced Programmer is a much rarer credential as less than 200 people are listed worldwide. In the USA, even populous states like California (16) and New York (5) have only a relative few programmers who are listed with the advanced credential. Certainly any job candidate who has passed the two exams to earn the SAS Certified Advanced Programmer listing would benefit by drawing attention to the direc-
PROFESSIONAL LOGOS
A number of SAS Certified Professional Logos are made available to those who earn certification credentials. Logos are available in camera ready form in a variety of sizes and formats. These logos can be used in marketing and promotional materials, business cards, letterheads, and even within email signature files. Before using logo art, certified professionals must agree to abide by the guidelines that are included in the SAS Certified Professional Welcome Package. The guidelines are also listed at http://support.sas.com/certify/guidelines.pdf.

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REVIEW OF SAS CERTIFICATION TRACKS
Currently, there are five certification tracks available. Certification requires the successful completion of one or more exams, depending upon the track. (The SAS Warehouse Technology exam, required in two certification tracks, is under development at the time of this paper).

SAS CERTIFIED BASE PROGRAMMER
The SAS Base Programming Exam is required to obtain certification as a SAS Certified Base Programmer. This exam is also the starting point as a requirement in the advanced programming certification track.

SAS CERTIFIED ADVANCED PROGRAMMER
The SAS Base Programming and SAS Advanced Programming Exams are required to obtain certification as a SAS Certified Advanced Programmer.

In a later section we discuss the requirements for successful candidates as suggested by SAS, along with our own recommendations for each of the above tracks, both of which are of a more general nature and applicable to wide variety of SAS users.

Three tracks cover more specialized career skills in SAS technologies and while we provide only the follow summaries, much more detail can found within the SAS support web pages. The three tracks are:

SAS CERTIFIED WEBAF DEVELOPER: SERVER-SIDE
The SAS Advanced Programming and SAS webAF Server-side Application Development Exams are required to obtain certification as a SAS Certified webAF Developer: Server-side.

Successful candidates should have at least three years of experience in design and development of advanced applications using SAS systems such as SAS/AF technology, SAS OLAP Server, as well as a host of web developments tools such as DHTML, Java and the Java server-side environment.

SAS CERTIFIED WAREHOUSE DEVELOPMENT SPECIALIST
The SAS Advance Programming, SAS Warehouse Technology (in development), and SAS Warehouse Development Specialist Concepts Exams are required to obtain certification as a SAS Certified Warehouse Development Specialist.

For this certification you will need a minimum of three years of experience in data warehouse development and design using SAS. You must also have a working knowledge of data management programming skills, data quality, extract, transform, and load (ETL), and testing procedures. A detailed working knowledge of SAS data warehousing technologies along with the practical application in data warehousing projects is also suggested

SAS CERTIFIED WAREHOUSE ARCHITECT
The SAS Warehouse Technology (in development) and SAS Warehouse Architect Concepts Exams are required to obtain certification as a SAS Certified Warehouse Architect.

Successful candidates should have detailed knowledge in the development of the information architecture. Other required skills include communication of the design elements to the customer, design team, and other involved parties as well as developing strategy for gathering requirements, designing, implementing, testing, and deploying data warehouse solutions.

OUR EXPERIENCES
FROM A NEW USER
I decided to make a career change after working for the US Postal Service nearly fourteen years. Shortly after enrolling in a graduate program in applied statistics at the Rochester Institute of Technology (RIT), the program chair suggested I learn SAS to broaden my career opportunities. Upon realizing the existence of a SAS Certified Professional Program, I immediately set my goal on the SAS Professional Certification in Base Programming.

After dabbling around with SAS in RIT’s computer lab and reviewing the suggested requisites for the SAS Base Programming Exam, I realized there was much to learn. My spare time was limited and my current position did not involve the use of SAS software. It was summer at the time and I registered for a statistical computing course involving the use of SAS for the fall quarter at RIT. The SAS Learning Edition was under development; however, a site license was available at a modest cost through RIT.

To my surprise, I discovered the license included a component called the SAS Online Tutor – a collection of interactive lessons aimed towards novice to intermediate SAS users. It has practice sessions, provides feedback throughout, and quizzes at the end of each lesson.

I would like to point out that the SAS Certification Base Programming and Advanced Programming courses were not available at the time. While they are similar in structure to the Online Tutor, the content of these course are geared towards preparing for the respective exams.

It wasn’t long before I was ‘bitten by the SAS bug.’ Throughout the entire summer, I spent much of my spare time going through lessons from the Online Tutor. It was a small price to pay for helping achieve my long-term goal of changing careers.

The statistical computing class strengthened the knowledge I acquired over the summer. The instructor was a SAS veteran from whom I learned a lot. It was extremely helpful to have someone answer questions, provide feed-
back, point out weaknesses, enforce my strengths, and test my skills.

Through the course, I was introduced to the SAS Books by Users (BBU), the Base SAS Procedures Guide, and the SAS/STAT User’s Guide; tools I found invaluable in my SAS education. I started out with The Little SAS Book by Lora D. Delwiche and Susan J. Slaughter, but since then, my library of BBUs has grown extensively.

After spending the summer going through the SAS Online Tutor and completing the statistical computing course in the fall, I found that I had a firm educational foundation of SAS. However, I realized that I would need much more experience in order to pass the certifying exam in base programming.

I began to use SAS to do much of my coursework in addition to volunteering for several fairly large projects at RIT. Along the way, I also joined a local SAS User Group that was reforming. After nearly a year of experience using the SAS system, I passed the SAS Certified Base Programmer exam. In fact, my certification credential was one of the key elements that recently allowed me to achieving my goal of changing careers.

FROM AN EXPERIENCED USER

Just about twenty years after I wrote my first data step code, I took my initial certification exam. I had used SAS products starting with SAS version 79.5 and over the course of my career I had gained extensive experience in BASE SAS, SAS/AF, SAS Macro Programming, SAS/Graph, SAS/STAT, and the use of PROC SQL along with SAS/Access.

I have passed three of these exams to-date: The SAS Core Concepts V8 and V6 exams, as well as the SAS Data management V6 exam. In addition, I am preparing for the SAS advanced programmer exam as part of this paper and will report direct experience during the live presentation.

I took my first exam expecting to do well. Using the website topics list as a guide, I actually studied only a few hours, mainly by reviewing the book SAS® Language and Procedures: Usage 2. Fortunately, this book was a good blueprint for the exact range of topics covered and I would still recommend the book as a valuable overview of essential base SAS skills. (Of course, you would want to augment this training with information regarding features added to SAS in Versions 8 and 9)

One of the primary reasons, I took the first exam was to evaluate the worth of the exam itself as a barometer of SAS experience. Over my long SAS career, I have occasionally had to interview and recommend SAS programmers for positions within my organization or for a client. Many of us in this position had often struggled with coming up with an effective measure of SAS expertise that could be used to delineate the “power” SAS user from the individual who has only nominal SAS experience through course work or rudimentary data analysis. In fact, one can find SUGI papers that stretch back into the early 80s that described the process of coming up with SAS evaluation questionnaires or other similar methods.

Many of us become familiar with using simple SAS questions such as

“What is the difference between these SAS statements?”

A = B + C;

vs

A = SUM(B, C);

or

“Explain the use of the SYMGET and SYMPUT functions.”

But the use of such simple measures lacked the quality assurance and the scope required by those of us who need to reliably evaluate candidates for SAS positions.

Since the SAS Certified Professional program began, I am happy to report that, using my own experience as a guide, I have been pleasantly surprised by the breadth and quality of the SAS certification exams.

Like many certification exams, the base test may be overly reliant on questions that center on BASE SAS language syntax. This is expected: For in the world of the professional programmer, long before syntax checking technology grew into IntelliSense® as well as color coding editors, when throughput of jobs was measured in hours, detailed knowledge of syntax was perhaps more important. With on-line help guides and the vast array of options and statements, even professional programmers relegate some syntax checking to an “on-the-fly” experience. That said, syntax remains one of the easiest things to test as well as to cram for. For this reason, many people remain skeptical of multiple choice tests as true indicator of programming experience. But SAS Certified exams have been designed to challenge more than the user’s memories of syntax. In fact, this is the real strength of the design of these exams. I feel that that the SAS Institute has hit upon the style of questions that truly demand that the user knowledge is acquire from experience and not by studying a reference book.

Many questions rely on individual perceptions of how the processing of SAS code actually works. Some questions expect you to match a given result, in the form of printed output or data structure to one of several possible choices of SAS code that generated it. Others reverse the process; by giving the several choices of output from a given snippet of SAS statements. Often, the possible answers are distinguished subtly, in a manner that will be evident to a person with many hours of experience devoted to submitting SAS code and perusing SAS logs and output for feedback, but not to the user whose time with SAS has been spent only in rote exercises.

After seeing the content and being tested by the Certification at both a base and advanced level, I would feel confident hiring programmers who have achieved SAS certification. In fact, personally I would demand SAS certification as a requirement in all advanced programming positions!

OUR SUGGESTIONS ON HOW TO EVALUATE WHETHER YOU ARE READY FOR A SAS CERTIFICATION EXAM

First we reiterate and validate the suggestion that one cannot achieve success without SAS programming experience:

For the SAS Base Programming exam, which is the entry point in the certification process, we expect that the successful candidate needs at least eight months, but pref-
erably one year, of intensive use of the base SAS system. For the advanced programming exam, SAS’s suggested yardstick of three years experience is probably just about right, although the superior programmer with intense daily experience in writing SAS code may be ready in only two years or so.

SO IF YOU THINK YOU ARE READY...

Start with the Sample Questions that SAS lists here: http://support.sas.com/certify/samples.html. If you cannot answer almost all of these correctly for the exam you wish to take, be prepared to seek more training immediately!

Now move to on the topics list given here http://support.sas.com/certify/testbp.html or the base exam and here http://support.sas.com/certify/testap.html for the advanced exams (Topic lists are available on the SAS Website for all exams). Note that for the base exam, 25 subtopics are given within these five categories

- Accessing Data
- Creating Data Structures
- Managing Data
- Generating Reports
- Handling Errors.

In addition, according to SAS, a successful candidate “should be able to import and export raw data files, manipulate and transform data, combine SAS data sets, create basic detail and summary reports using SAS procedures, and identify and correct data syntax and programming logic errors.”

The advanced exam lists 18 separate topics under these three headings...

- Accessing Data Using SQL
- Macro Processing
- Advanced Programming Techniques

...while the SAS web site goes on to suggest that an advanced programmer “will be knowledgeable in using advanced DATA step programming statements and efficiency techniques to solve complex problems, writing and interpreting SAS SQL code, and creating and using the SAS MACRO facility”

Our experience regarding the topic subjects is this: Each of these should be self-evident and you should recognize relevant items within your own experience that match each and every topic listed. In other words, you shouldn’t need to guess what the topic refers to; you should already understand a good deal of SAS specific to the item. For example, if you are thinking of taking the Advanced Programming exam and the topics listing “SQL subqueries”, “SAS dictionary tables” or “automatic macro variables” do not immediately register, DO NOT proceed to the exam without a thorough review and understanding of the topics. It is important to accept that you will most likely find more than one question which directly tests your knowledge on every topic and sub-topic listed on the web site.

If you have many years of experience, you might just use the topics listed to determine what gaps you need to fill and you may already know where information to do this resides. But if you are fairly new to the SAS programming system or have not acquired all the necessary skills for these exams, consider the many options offered by SAS Institute for training and preparation.

TRAINING AND PREPARATION

On top of the aforementioned SAS programming experience, every use should consider SAS training courses as a definitive method of getting ready for these tests. SAS training is accepted within the industry as a standard of excellence in computer training.

While options vary by country, these include instructor-based training, web-based training, and recommended books for each exam. All of these can be obtained by selecting your location on the website at http://support.sas.com/certify/prep.html.

SAS offers specifically designed packages of instructor lead courses (at a discount) that are tailored to the requirements of individual certification tracks. But if these excellent training resources are beyond your budget, there are still other options...

E-LEARNING AND PRACTICE EXAMS

Web-based learning certainly has its advantages; an individual can study when and where it is convenient at a comfortable pace. However, one must be quite self-motivated and there is no instructor who can answer any questions that may arise.

For those who wish to try web based self training, SAS now offers two reasonably priced self paced e-learning courses available for the first two levels of SAS certification entitled:

- SAS Certification: Base Programming
- SAS Certification: Advanced Programming

We can personally vouch for the first course as being an excellent and well designed learning tool and because of our experience, we expect the advanced course is similarly designed. Both courses include a 50-question practice exam identical to the format of the questions on the Certification Exam. In addition, these same practice exams are available as stand-alone products for experienced SAS users wishing to assess their readiness for the exams.

If you do not have continuous access to the SAS system while taking either of these courses, the SAS Learning Edition is available and is highly recommended (as well as being an incredible bargain when compared to licensing SAS product directly!).

Once your training is completed and you feel prepared, it is now time for the exam. Here we have practical advice about the experience and the process,
TAKING THE CERTIFICATION EXAM

WHERE TO TAKE IT
SAS Certified Professional exams are administered by Prometric® a Thomson learning company that offers a variety of computer based certification exams at over 2400 locations worldwide. You may contact them either by phone ((888) 895-5819) or at www.prometric.com. In either case, you can schedule exams well in advance at a time and date of your choosing. If you use the web, Prometric offers detailed instructions on locating a nearby testing center. There is a 24 hour waiting period when you first signup with Prometric before you can schedule an exam.

In the past, SAS has also offered SAS Certified Professional Testing Events at SUGI conferences, often with substantial “early bird” discounts for pre-registering. For example, at SUGI 29, two sessions were available on the Saturday prior to the conference at up to 35% savings off of the regular exam fees. So If you already planning to attend SUGI, this may an attractive manner to acquire the SAS certification credentials.

At the time of this writing, production exams cost $150 per test while “beta” exams cost only $75. Prior to releasing an exam into production, SAS often offers beta exams with a slightly different testing process. Beta exams tend to be longer both in time required and number of questions. In addition, immediate feedback regarding your results is not available for beta exams. Once SAS chooses which questions in the beta exam are to be used in the production release, you will be then be scored. This selection process can take 10-12 weeks.

No matter where you decide to take the exam, you should take time prior to the test to download and examine the SAS Institute Inc. Certification Program Candidate Agreement at http://support.sas.com/certify/cand_agmt.pdf. To receive the SAS Certified Professional benefits, you will enter into an agreement with SAS Institute to respect SAS’s numerous trademarks and also agree to advertise your credentials in an appropriate and accurate manner, among other conditions. As you must accept the agreement before continuing with an exam, it is a good use of your time to read over the complete agreement before arriving at the test location.

SAS advises that you should plan on arriving at least 15 minutes prior to the exam starting time. Be sure you know exactly where the testing center is located because if you arrive later than 15 minutes after your scheduled time, you may not be able to take the test or even get a refund. Bring along two forms of identification, with at least one photo id. Of course, you will want to bring printed copies of the exam title and registration information from the Prometric Web Site (or the e-mail confirmation) if you used the internet to schedule the exam.

USE THE SAMPLE TEST
Once you arrive at the testing site and have been situated at the testing machine, you will have an opportunity to take a sample test before going on to the actual SAS exam. You should use this sample exam to your advantage as taking the time will not count against the allotted time for the main event.

The sample test allows you to explore the mechanics of the user interface. We feel that this is valuable even if it is not your first experience with electronic testing or even SAS certification exams. So you should use the sample test to:

- Recognize when a question is multiple choice with only one correct answer
- Recognize when a question allows choice of multiple correct answers
- Practice simple scrolling through the answer selections. Infrequently, questions have lengthy answer selections that take more than one screen. On several occasions, we have seen page breaks occur right after three choices are shown, where the fourth choice occurs on another page. When this happens, you will want to recognize it immediately.
- Learn how to bring up “examples” or “exhibits” which are essentially pop up windows with relevant information about the current question. Often these additional popups might include the SAS output, code or tabular data structure referred to within the question.
- Learn how to navigate through the list of test questions and how to mark and return to a question that was left unanswered. While a very simple task, this will be important when you start the actual exam as you will need to be able to return to questions for which you do not find the answers self evident. When this happens, you do not want to waste time figuring out the user interface.

HINTS FOR THE ACTUAL EXAM
Once, you have become comfortable with the sample test, it’s time to start the actual exam. You will have two hours to complete the 50 to 70 questions presented to you. With only a couple of minutes per question, it is important to watch the clock and monitor your progress as you go. We suggest that on a first pass, you should answer all questions in which you feel confident of the answer and be sure to mark any questions that you are unsure of. Save time by leaving the harder questions for the second pass. This is to your benefit for several reasons. First, you will be assured of having enough time to finish all questions that you do know. Second, especially for matters of syntax, the context or even the exhibit of a later question may actually provide a hint to one of the question that stumped you on the first pass. If you have time, use a third pass to review all the questions along with your answers one more time. Remember there is no credit given for completing the test early! The testing interface also allows you to give feed back on the questions to SAS institute, but we suggest you wait until the final pass after you answered all questions before adding these comments.

GETTING YOUR RESULTS
As soon you complete a production exam, you will receive instant feedback on your score in the form of a printed document. This is where you will find the passing grade as well as your score and grade. Details will include a section analysis where the section titles loosely parallel the main topics listed under the exam on the SAS website. This document may include a seal administered by the
local Prometric testing personnel. But if you pass your exam, SAS will send you a welcome package that contains:

- An official certificate for the credential that you have earned
- Guidelines on the usage of the SAS Professional Logo
- A password or coupon for downloading logo art
- A release form for inclusion of your name and earned credential on the SAS professional website
- And, sometimes, a small gift (such as a pin with the SAS Certified Professional logo on it)

**IF YOU NEED TO RETAKE AN EXAM…**

You are permitted to take a SAS production exam up to three times within the same 12 month period, but you must wait at least two months between exams. This restriction does not apply to beta exams; however you may take a particular beta exam only once. If you don’t pass the beta exam, you can then take the production version as soon as it becomes available. No monetary credit is given for exams previously taken. Be sure to follow these guidelines for production exam retests, for while you may convince Prometric to administer an exam even if you have not waited two months for a retake, SAS Institute will NOT give you credit towards a credential if you pass.

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**CONCLUSIONS**

SAS Certification can play an important role in developing the career of a SAS user. While we have summarized some of the practical elements of our own experience as a guide to attaining this goal, we must end by emphasizing the following: SAS programming experience is the key ingredient for all users and the constant requirement for a successful testing experience. Add some training along with a few other simple methods of preparation and you too can enjoy the benefits of the SAS Certified Professional program!

**REFERENCES:**

Please refer to the SAS Support Web site for related information on SAS Certification: http://support.sas.com/certify/

Other references include:


**ACKNOWLEDGMENTS**

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The authors would like to thank the members of the Gene-see Valley SAS User’s Group for the suggestions along the way.

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