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Get Certified as an Advanced SAS® Programmer in Six Months or Less!

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ABSTRACT

The SAS Certified Advanced Programmer credential is very prestigious worldwide. Getting this certificate requires passing two certification exams: SAS Base Programming Exam and SAS Advanced Programming Exam.

The author of this paper is a SAS Certified Advanced Programmer. He prepared for and passed both exams in four months, scoring 89% on both exams. This paper shares his experiences and strategies in preparing for these exams. With the strategies revealed in this paper, the author believes that the majority of SAS programmers who are beyond the beginning level are capable of passing both exams and becoming certified as SAS Certified Advanced Programmer within six months or less.

INTRODUCTION

SAS Certified Advanced Programmer[1] credential is very prestigious worldwide. There are many benefits of becoming a SAS Certified Advanced Programmer.

First of all, getting certified allows you to earn industry validation for your knowledge and it enhances your credibility as a SAS programmer. Secondly, being certified demonstrates that you have a highly portable skills set and thus increases your career opportunities and marketability. According to Support.SAS.com, a recent study showed that 83% of career professionals reported earning a SAS certification helped them get a promotion, and 66% reported earning a SAS certification helped them get a raise in salary.

Thirdly, the learning process to get certified can help you vastly deepen and broaden your SAS knowledge. SAS has so many different procedures, statements, functions, options, and so on, it is close to impossible to learn them all and it is not readily clear what set of SAS skills one should acquire if one wants to actively expand his/her SAS knowledge. Consequently, many programmers' choice is to learn only what is needed to get their job done. The Base and Advanced Programming Exams cover the knowledge base that SAS Institute believes a base or an advanced SAS programmer needs to possess. By preparing for the Programming Exams, one becomes a well-rounded programmer who is exposed to a broad range of SAS functionalities and has an in-depth grasp of knowledge that is required in everyday programming.

With so many advantages of becoming a SAS Certified Advanced Programmer, why there are only about 1,000 SAS Certified Advanced Programmers in the world? One of the reasons is that many SAS programmers do not have a realistic assessment of the difficulty of the exams, and how much time and effort it takes to pass the required exams. The results are usually an overestimation of the difficulty and cost (in terms of time and effort) of becoming certified. Sadly, this lack of knowledge deters potential candidates from embarking on the rewarding journey of getting certified, and deprives them of the opportunities of vastly improving their SAS skills through preparing for the certification exams.

This paper strives to demystify the certification exams by presenting realistic assessments of the time and effort needed to pass them. This paper also presents some easy-to-follow strategies to assist preparation for the certification exams.

COVERAGE OF THE CERTIFICATION EXAMS

Getting the SAS Certified Advanced Programmer credential is a two-step process. Normally, one would pass an exam to get certified as a SAS Certified Base Programmer first, and then pass another exam to get certified as a SAS Certified Advanced Programmer[2].

The SAS Base Programming Exam covers the following areas:

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[1] As of writing of this paper, SAS certified programmer credentials are version specific, e.g., SAS Certified Advanced Programmer for SAS® 9. However, the version number is removed from this paper for simplicity.

[2] It is possible to take the SAS Advanced Programming Exam first and then take the SAS Base Programming Exam, but this approach is unintuitive and not advisable.

- import and export raw data files
- manipulate and transform data
- combine SAS data sets
- create basic detail and summary reports using SAS procedures
- identify and correct data, syntax and programming logic errors.

The SAS Advanced Programming Exam covers the following areas:

- write and interpret SAS SQL code
- create and use the SAS MACRO facility
- use advanced DATA step programming statements
- use efficiency techniques to solve complex problems.

As you can see from the above lists, the SAS Certified Advanced Programmer credential will enable you to become skilled in data handling, SAS MACRO facility, basic and advanced programming techniques, and efficiency techniques. One will become an advanced SAS “programmer” with this skill set. However, the SAS Certified Advanced Programmer credential does not enable one to become a “specialist” with some very popular but specialized SAS products, such as SAS/STAT, SAS/GRAPH, SAS/ETS, etc.

On the other hand, getting a SAS Certified Advanced Programmer credential lays a solid foundation in SAS programming and makes it easier to acquire additional SAS skills.

The certification exams are administered by Prometric™ and are conducted on computers. For both of the certification exams, one needs to finish 70 multiple-choice, single-answer questions within 2 hours. One must answer 46 questions correctly to pass. When taking the exam, one can scroll forward and backward through questions.

DIFFICULTY LEVEL OF THE CERTIFICATION EXAMS

SAS Institute Inc. provides some sample multiple-choice questions to illustrate some of the various types of questions that may appear on the SAS Global Certification Program exams at the following address: http://support.sas.com/certify/prep/samples.html. You can get a taste of the level of difficulty of the certification exams there. However, to more accurately gauge the certification exams' level of difficulty without taking the exams themselves, the best option is to purchase the practice exams produced by the SAS Institute Inc.

Generally, I have found the majority of the exam questions not very difficult if one has thoroughly studied the preparation materials published by SAS Institute Inc. An exam question might become difficult for an exam taker mainly for two reasons: 1.) the certification exams cover a very wide range of knowledge. If your memory is vague about a certain area, related questions might be difficult to answer; 2.) your understanding of the materials to be tested needs to be very thorough, rather than superficial, or you may be "tricked" by some questions. This latter point is illustrated by the following sample question taken from the practice exam for the SAS Base Programming Exam.

```
data test(drop=age);
   set sashelp.class(keep=name age gender height weight);
   drop=gender;
   newage=age+1;
run;
```

Question: Sashelp.Class contains 5 variables. What is the result?

- *a.* No variables are written to the data set Work.Test.
- *b.* 4 variables are written to the data set Work.Test.
- *c.* 5 variables are written to the data set Work.Test.
- *d.* 6 variables are written to the data set Work.Test.

One would be tempted to choose “a” as the correct answer because line 3 of the code, “`drop=gender;`”, doesn't seem right. `DROP=` is a data set option. If one wants to drop a variable by using a DROP statement, there should not be an equal sign after DROP. Thus, the “`drop=gender;`” portion the code seems to have wrong syntax.

However, this reasoning is incorrect because “drop=`gender;`” creates a new variable “`drop`”, and the syntax has no error. So the correct answer is “d” because the `Work.Test` data set will contains 6 variables: `Name`, `Gender`, `Height`, `Weight`, `Drop`, and `Newage`. The `KEEP=` option in the SET statement reads 5 variables from the input data set. The variable Age is read from the input data set, but it is dropped from the output data set by the `DROP=` data set option. There are also two new variables created in the DATA step.

To sum up, if your mastery of the materials to be tested is both comprehensive and in-depth, you should not find the exam questions exceedingly difficult, and you should be able to pass the certification exams with a comfortable margin.

THE AUTHOR’S OWN EXPERIENCE

Before deciding to pursue the SAS Certified Advanced Programmer credential, I had more than ten years of experience using SAS. However, this decade-long experience does not automatically make me an “advanced” SAS programmer. My job function requires me to use SAS for some research, but most of the time I use SAS for forecasting and routine data processing. As a result, my SAS skill set has been somewhat limited even though I have been using it for a long time. Before deciding to earn a SAS Certified Advanced Programmer credential, I would rate myself as an intermediate-level SAS programmer.

My decision to get certified by SAS Institute Inc. was triggered by my experience at the San Antonio SAS forum, where I found myself to be in the “Foundations and Fundamentals” sessions a lot. After several days of this, I found myself thinking: I have been using SAS for more than ten years, and have gone to four such conferences; shouldn’t I be in the “Beyond the Basics” sessions more than the “Foundations and Fundamentals” sessions? That is when I was struck by the revelation that my SAS skills have not been expanding much for the past several years, and I decided that if I do not institute some behavior change, I’ll continue to go to the “Foundations and Fundamentals” sessions year after year rather than the “Beyond the Basics” sessions. And the behavior change I decided on was to become a SAS certified programmer.

From my own experience and my observation of others, there are two common factors that hinder SAS programmers to commit to getting certified by SAS.

The first factor is a lack of knowledge of the level of difficulty of the exams, and how much time and effort is needed to prepare and pass the certification exams. This usually leads to an overestimation of the difficulty of getting certified. In my case, I initially feared that it might take me two hours a day for up to six months to prepare and pass the SAS Base Programming Exam. The reality is that it only took me four weeks to pass the SAS Base Programming Exam.

After the experience of getting my SAS Certified Base Programmer certificate, I had a much more realistic estimate of the time needed to prepare for the SAS Advanced Programming Exam. I figured that it should not take more than four or five months. In the end, it took me less than three months to pass the exam. Hopefully, this will give an intermediate-level SAS programmer a realistic estimate of the time and effort needed for preparing for these exams.

The other common factor that hinders SAS programmers to commit to getting certified by SAS is fear of failure. In an organization setting, it is usually difficult to prevent others from knowing your failure to pass a certification exam if you do unfortunately fail. At least your boss, who bankrolls your ambition, will know. I myself had this fear of failure and public humiliation and I observed others having it as well. This is normal human psychology and it can be mitigated by knowing more about the exams and by having more realistic assessments of one’s own ability.

It helps to realize that: 1.) if you are currently a SAS programmer, you have already demonstrated that you are intelligent enough to master additional SAS programming skills; 2.) the certification exams are designed to assess your ability, not to fail you; and finally, 3.) if you spend beyond a certain amount of time and effort, you will become almost failure-proof.

Below are some strategies that hopefully will both reduce the time needed for preparing for the exams, and boost one’s chances of passing.

STRATEGIES OF PREPARATION

1. CHOOSE A METHOD OF PREPARATION

There are three options in preparing for the certification exams: Instructor-led training (if one resides within the U.S.), Self-paced e-learning, and self-study of exam preparation books published by SAS Institute Inc. Greater details about these different options can be found at http://support.sas.com/certify/prep/preptable.html.

Unless one is a SAS novice and one lacks the confidence of learning SAS by reading books, I'll recommend preparing for the certification exams by reading the two books published by SAS Institute Inc.: "*SAS® Certification Prep Guide: Base Programming for SAS® 9*" and "*SAS® Certification Prep Guide: Advanced Programming for SAS® 9*". These two books are well written and have a very generous number of examples and sample programs. New and experienced SAS users who want to prepare for the certification exams will find these two books to be convenient and comprehensive resources. These two books cover all the topics and objectives tested on the exams. However, they do not completely cover everything that could appear in the exams. For instance, the exams can test a function or option that does not appear anywhere in the two books. Fortunately, this occurs rarely and the aforementioned two books should be more than enough to enable one to pass both certification exams.

For the SAS Advanced Programming Exam only, I recommend you to read the first seven chapters of "Carpenter's Complete Guide to SAS Macro Language" (second edition) by Art Carpenter as well. It complements "SAS® Certification Prep Guide: Advanced Programming for SAS® 9"well and will expedite your mastering of the SAS Macro language. Consequently, reading these extra seven chapters will shorten, rather than lengthen, the time needed to prepare for the SAS Advanced Programming Exam.

A main disadvantages associated with preparing for the certification exams with the two preparation books published by SAS is that one cannot readily get his/her questions answered should there be any questions. Luckily, these two books were written in such a detailed and easy-to-understand way, the chances of confusion are minimized. Additionally, it is usually not very difficult to find answers by using SAS software's online documentation. As a final resort, one can contact SAS technical support, which usually provides satisfactory support in my experience.

2. APPLY MEMORIZATION TECHNIQUES

To pass the certification exams, a large amount of information needs to be understood, encoded in one's memory, and retained for subsequent retrieval. "SAS® Certification Prep Guide: Base Programming for SAS® 9"has 848 pages, and "SAS® Certification Prep Guide: Advanced Programming for SAS® 9"has 992 pages. To memorize this amount of information, it is essential to comprehend the logic, reasoning, and connection underlying the information. On the other hand, for information that does not seem to have any logic behind it, applying some memorization techniques will be helpful.

Human's memory is an associative function of the brain. An associative function is one in which one object is associated with another by a relationship. Because of this, our memory works at its best when the information to be memorized can be associated with other information already stored in our brains, or, the information to be remembered is "meaningful" to us. Thus, for a piece of information that has no meaning to us, utilizing creative imaginations to transform that information from meaningless to meaningful will help us retain it longer.

For instance, SAS has a "sound like" operator "=*", as used in:

```
Where lastname =* 'smith';
```

The above WHERE statement will cause a data step to keep only those observations where the variable `lastname` sounds like "Smith". It is not immediately clear why a "sound like" operator should take the form "=*". With no sensible connection between "=*" and its meaning – "sound like", one's memory of this operator is more difficult to retain.

A creatively imagined connection between "=*" and its meaning can be the following: "*" means "star", a pop star. And what does a pop star do? He/she sings—making sounds. So, "=*" is associated with "sounds like".

Imaginations like this will help you transform a piece of information from meaningless to meaningful and thus prolong memory retention. The more absurd, more vivid you can imagine, the longer you will retain that imagination and the easier you will be able to retrieve the information that is associated with it.

Another example is the SYSPBUFF automatic macro variable. Just by looking at this macro variable's name by itself, it is not immediately clear what it means and what it does. However, by considering that SYSPBUFF resolves to the text supplied as parameter values in the invocation of a macro that is defined with the PARMBUFF option, one can reason that SYSPBUFF is possibly abbreviated from SYStem Paramerter Buffer. Even though one cannot be sure about this reasoning, it does help one remember this keyword and its function better.

3. RUN SAMPLE PROGRAMS IN PREPARATION MATERIALS

The certification exams cover a wide range of functions, statements, options, etc. One will run into new things one had not encountered before. In these situations, it helps to try out these new functions, statements, options, etc. with the SAS software. You can run the sample code provided in the books, or even better, you can write your own code to incorporate the new materials you just learned. These hands-on experiences will enhance your understanding of the new materials.

4. STUDY THE PREPARATION MATERIALS WITH INTENSIVE REPETITION

Thorough comprehension, memorization techniques, and hands-on experiences are all beneficial in exam preparation. However, when learning and assimilating such a large amount of information as required in the SAS certification exams, it can be a challenge to keep learning new materials without forgetting materials that have already been learned. To fight against forgetfulness, intensive repetition is an effective strategy.

To memorize information in the long run, the human brain usually needs a two-stage process: stage one is the initial learning and memorization; stage two involves subsequent reinforcement of the memory and repair of any forgotten information. It saves time to reinforce the memory before it completely fades way, because once it is forgotten, you will need to go back to stage one and spend time to relearn the forgotten information.

While you go through the certification exam preparation materials chapter by chapter, the strategy of intensive repetition requires you to proactively go back and review the materials you have studied, well before you would have forgotten much of the materials. Using this strategy, you can go through the exam preparation materials at a very aggressive rate (i.e., learn more than one or two chapter(s) per day) and not have to worry about not being to remember it all, because you will soon come back to reinforce what you just learned.

In my own case, when studying “SAS® Certification Prep Guide: Base Programming for SAS® 9”, it took me two weeks to go through the entire book (22 chapters) the first time while frequently reviewing the chapters I'd gone through. I spent another two weeks reviewing the book several more times. Before I took the Certification exam, I read each chapter about five times. By doing just that and taking the practice exam, I scored 89% on my Base SAS Programmer Certification Exam.

The preparation book for the Advanced SAS Programmer Certification Exam, “SAS® Certification Prep Guide: Advanced Programming for SAS® 9”, is markedly more concise, comprehensive, and more difficult than the book for the SAS Base Programming Exam. It is also printed in such a format that although it is only about 150 more pages, its content probably at least doubles. It took me about six weeks to go through the entire book (24 chapters) the first time while systematically reviewing the chapters I'd read. I spent another three weeks reviewing the book and before I took the certification exam, again, I read each chapter about five times. On the SAS Advanced Programming Exam, just as in the Base SAS Programmer Certification Exam, I scored 89% correct.

One bonus of this intensively repeated memorization is that you are left with memories that last more accurately and much longer than if you just encounter the material once. How many times do you have to refer to SAS documentations for the exact spelling of a SAS keyword or the exact syntax of a SAS procedure? Probably more often than you'd prefer. Intensively repeated memorization will help alleviate this aggravation.

5. TAKE PRACTICE EXAMS OFFERED BY SAS

SAS Institute provides practice exams for the both of the certification tests.

The practice exams are constructed to test the same knowledge and skills as the SAS certification exams, and all topics are proportionally weighted to match the certification exams. In addition, all test items on both exams are multiple-choice, single-answer questions.

However, instead of containing 70 test questions as in the actual certification exams, the practice exam contains only 50 questions. The certification exam has a time limit of 120 minutes, and a timer is provided on each screen to help you track your exam time. There is no timer in the practice exam. To best simulate the actual time allowed for the Certification exams, one should allow 85 minutes for the practice exams.

There are two good times to take the practice exams. One is before you start working on the preparation materials. Taking a practice exam at this point will allow you to assess the knowledge gap between what you possess now and what you need to possess to comfortably pass the certification exam. Taking a practice exam at this point will also familiarize you with the format and the level of difficulty of the certification exam.

The other good time to take the practice exam is after you have reviewed the exam preparation materials several times and feel you are about ready to take the certification exam. Taking a practice exam at this point helps you assess if you are indeed ready for the actual certification exam. If you do very well in the practice exam, it will also boost your confidence level and ease your nervousness when taking the actual certification exam.

Even though successful performance on the practice exams does not guarantee successful performance on the certification exams, I have found the difficulty level between the two exams to be very close, although the actual exams appeared to be slightly more difficult. If you can pass the practice exam with a score of 80% or above, you should feel confident that you can probably pass the actual certification exam.

6. AIM TO PASS THE CERTIFICATION EXAMS QUICKLY

There are two diametrically different approaches to exam preparation. You can either choose to devote every hour available to you to preparing the exams and then take the exams as soon as you feel ready, or you can study the materials at your leisure halfheartedly in a prolonged preparation process. The more drawn-out the process is, the more time you will have to spend to reinforce fading memories. In the end, you spend a lot more total hours on exam preparation if you adopt the second approach rather than completely immersing yourself in the exam preparation.

Thus, it is not only possible to become a SAS Certified Advanced Programmer in six months or less if you employ the strategies outlined in this paper, for many programmers, it can actually be easier to get certified in six months than in a year or two years!

Preparing for exams is certainly more “painful” than taking a stroll in the park, or watching you favorite TV show on the couch. If you would like to reduce the amount of “pain” you have to endure and increase your odds of passing the exams, then completely commit yourself to a single-minded, all-out assault on the exams.

CONCLUSION

Like anything in this world that is of true value, a SAS Certified Advanced Programmer certificate comes only with your labor and determination. Hopefully this paper demystifies the process of getting certified and gives you a more accurate estimate of how much sweat you will have to shed.

For a SAS programmer who is beyond a beginning level, if you apply the strategies suggested in this paper, it is a very realistic goal to become certified as an Advanced Programmer within six month or less. In fact, this is the preferred way because the sooner you get certified, the less you will have to sweat, and the faster you will enjoy you newly-acquired programming skills!

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