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So You Want to be SAS Certified

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ABSTRACT

Several years ago, SAS Institute, Inc. started a Certification program to give SAS users a chance to tell the SAS world the level of their SAS skills. Since those early days, this Certification program has grown tremendously. This paper looks at this certification process. The purpose of this paper is to trace this process and in so doing, is divided into three parts: (1.) an Introduction, (2.) exam content, and (3.) exam preparation.

INTRODUCTION

The SAS Certification program has grown through the years to include eight different exams in five major areas:

A. SAS Foundation:

1. SAS Certified **Base Programmer** for SAS9
2. SAS Certified **Advanced Programmer** for SAS9.
3. SAS Certified Clinical Trials Programmer Using SAS9

B. SAS Advanced Analytics:

4. SAS Certified Predictive Modeler Using SAS Enterprise Miner 7.
5. SAS Certified Statistical Business Analyst Using SAS9 Regression & Modeling

C. SAS Business Intelligence:

6. SAS Certified BI Content Developer for SAS9.

D. SAS Data Management (Information Management):

7. SAS Certified Data Integration Developer for SAS9.

E. SAS Administration:

8. SAS Certified Platform Administrator for SAS9.

A. SAS Foundation: the major knowledge areas for each **SAS Foundation** exam are:

1. SAS Certified Base Programmer for SAS9:

- Import and export raw data files**.**
- Manipulate and transform data**.**
- Combine SAS data sets**.**
- Create basic detail and summary reports using Base SAS procedures**.**
- Identify and correct data syntax and programming logic errors**.**

2. SAS Certified Advanced Programmer for SAS9:

- Write efficient SAS code to solve complex problems, while minimizing the use of computer resources**.**
- Use advanced DATA step programming and efficiency techniques**.**
- Write and interpret SAS SQL code**.**
- Use the SAS Macro facility**.**

3. SAS Certified Clinical Trials Programmer for SAS9:

- Clinical trials process.
- Accessing, managing and transforming clinical trials data.
- Statistical procedures and macro programming.
- Reporting clinical trials results.
- Validating clinical trials data reporting.

B. SAS Advanced Analytics: the major knowledge areas for each **SAS Advanced Analytics** exam are:

4. SAS Certified Statistical Business Analyst Using SAS9: Regression and Modeling:

- Analysis of variance.
- Linear and logistic regression.
- Preparing inputs for predictive models.
- Measuring model performance.

5. SAS Certified Predictive Modeler Using Enterprise Miner:

- Prepare data.
- Build predictive models.
- Assess models.
- Implement models.

C. SAS Certified Business Intelligence Content Developer for SAS9: the major knowledge areas for the one exam in this are :

6. SAS Certified BI Content Developer:

- Business user reporting applications.
- Advanced reporting techniques and roles.
- Information Maps.
- SAS BI Dashboard applications.
- Stored Processes.
- Advanced techniques with SAS Reports.
- Multidimensional (OLAP) data sources.
- Environment metadata.

D. Data Management / Information Management: the major knowledge areas for the one exam in this are :

7. SAS Certified Data Integration Developer:

- Define the **platform** for SAS Business Analytics architecture.
- Create metadata for the source data, target data and jobs.
- Work with transformations.
- Work with slowly changing dimensions.
- Define generated transformation.
- Deploy jobs.

E. SAS Administration: the major knowledge areas for the one exam in this are :

8. SAS Certified Platform Administrator for SAS9:

- Secure the SAS configuration on each server machine.
- Check status and operate servers.
- Monitor server activity and administer logging.
- Establish formal, regularly scheduled backup processes.
- Add users and manage their access.
- Establish connectivity to data sources.
- Set up and secure metadata folder structures.
- Administer repositories and move metadata.

EXAM CONTENT

A. SAS Foundation:

1. SAS Certified Base Programmer for SAS9:

A. Description:

- Exam is administered by SAS and Pearson VUE.
- **64** multiple-choice and short answer questions.
- Must achieve a score of 70% or higher to pass.
- **110** minutes to complete exam.
- Use exam ID A00-211 (required when registering with Pearson VUE).

B. Accessing Data:

- Use Formatted and LIST input to read raw data files.
- Use INFILE statement options to control processing when reading raw data files.
- Use various components of an INPUT statement to process raw data files including column and line pointer controls and trailing @ controls.
- Combine SAS data sets.
- Access data in an Excel spreadsheet.

C. Creating Data Structures:

- Create temporary and permanent SAS data sets.
- Create and manipulate SAS date values.
- Export data to create standard and comma-delimeted raw data files.
- Control which observations and variables in a SAS data are processed and output.

D. Managing Data:

- Investigate SAS data libraries using base SAS utility procedures.
- Sort observations in a SAS data set.
- Conditionally execute SAS statements.
- Use assignment statements in the DATA step.
- Modify variable attributes using DATA step options and statements.
- Accumulate sub-totals and totals using DATA step statements.
- Use SAS functions to manipulate character data, numeric data and SAS date values.
- Use SAS functions to convert character data to numeric and vice versa.
- Process data using DO LOOPS.
- Process data using SAS arrays.
- Validate and clean data.

E. Generating Reports:

- Generating **list** reports using the PRINT procedure.
- Generate **summary** reports and Frequency tables using base SAS procedures.
- Enhance reports through the use of user-defined formats, titles, footnotes, and SAS system reporting options.
- Generate reports using **ODS** statements.

F. Handling Errors:

- Identify and resolve programming logic errors.
- Recognize and correct syntax errors.
- Examine and resolve data errors.

2. SAS Certified Advanced Programmer for SAS9:

A. Description:

- Must have passed the Base Certification Exam as well as this exam (65% or higher) to be a certified Advanced SAS Programmer. This exam is also administered by SAS and Pearson VUE.
- 60-65 multiple-choice and short answer questions; 2 hours to complete.
- Use exam ID A00-212 (required when registering with Pearson VUE).

B. Accessing Data Using SQL:

- Generate detail reports by working with a single table, joining tables, or using set operators in the SQL procedure.
- Generate summary reports by working with a single table, joining tables, or using set operators in the SQL procedure.
- Construct sub-queries and in-line views within an SQL procedure step**.**
- Compare solving a problem using the SQL procedure versus using traditional SAS programming techniques, like the DATA step.
- Access Dictionary Tables using the SQL procedure.

C. Macro Processing:

- Create and use user-defined and automatic macro variables within the SAS Macro Language.
- Automate programs by defining and calling macros using the SAS Macro Language.
- Understand the use of macro functions.
- Use various options that are available for macro debugging and displaying values of user-defined and automatic macro variables in the SAS log.
- Create data-driven programs using SAS Macro Language.

D. Advanced Programming Techniques:

- Demonstrate the use of advanced data look-up techniques such as array processing, hash objects, formats, and combining/merging data.
- Reduce computing resource requirements by controlling the **space** required to store SAS data sets using compression techniques, LENGTH statements, or eliminating variables and observations.
- Reduce programming **time** by developing reusable SAS programs which incorporate DATA step views, DATA steps that write SAS programs and the **FCMP** procedure.
- Perform effective benchmarking by using the appropriate SAS System options and interpreting the resulting resource utilization statistics.
- Identify appropriate applications for using indexes and create them using the DATA step, the DATASETS procedure, or the SQL procedure.
- Compare techniques to eliminate duplicate data using the DATA step, the SORT procedure and the SQL procedure.

For the purposes of this paper, only two exams are covered. It is the intent of the author to cover the two most common types of SAS certification. Those tests/exams that are not covered in this paper can be found on the SAS Institute web site where volumes of information can be found.

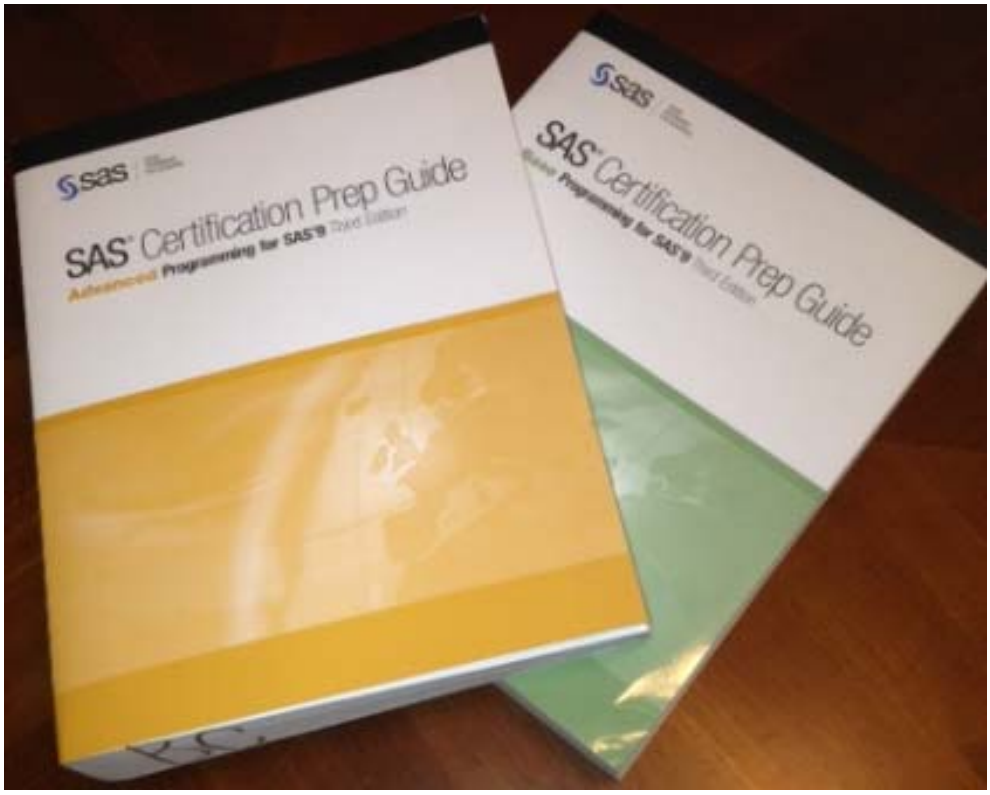
EXAM PREPARATION

SAS Foundation Preparation Courses from SAS Institute:

1. SAS Certified **Base** Programmer for SAS9
   - ❑ SAS Programming I – Essentials
   - ❑ SAS Programming II – Data Manipulation Techniques

2. SAS Certified **Advanced** Programmer for SAS9.
   - ❑ SAS Programming III
   - ❑ SAS SQL
   - ❑ SAS Macro Language

SAS Foundation Preparation Guides from SAS Institute:



These publications are sold through SAS Institute for $149.00 each. They are Great coverage of all the topics covered on the exams. There are hundreds of sample questions at the end of each book.

EXAM PREPARATION: SAMPLE QUESTIONS

Base SAS Certification Questions:

Question B1: Which values are stored in the output data set?

```
data WORK.TEST;
    input Name $ Age ;
    datalines;
John  +32
;
run;
```

	Name	Age
A.	John	32
B.	John	(missing value)
C.	(missing value)	32
D.	The DATA step failed.	

Question B2: What's the **first observation** in the data set WORK.BOTH?

Work.ONE

Id	Char_1
182	M
190	N
250	O
720	P

Work.TWO

Id	Char_2
182	Q
623	R
720	S

```
data WORK.BOTH;
   merge WORK.ONE  WORK.TWO;
   by Id;
run;
```

	Id	Char_1	Char_2
A.	182	M	
B.	182		Q
C.	182	M	Q
D.	720	P	S

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Question B3:

What will the dataset WORK.COLORS look like ?

CRAYONS.TXT

```
----+----1----+----2----+----
RED    ORANGE  YELLOW  GREEN
BLUE   INDIGO  PURPLE  VIOLET
CYAN   WHITE   FUCSIA  BLACK
GRAY   BROWN   PINK    MAGENTA
```

```
data work.colors;
    infile 'CRAYONS.TXT';
    input @1 Var1 $  @8 Var2 $ @;
    input @1 Var3 $  @8 Var4 $ @;
run;
```

A.

Var1	Var2	Var3	Var4
RED	ORANGE	RED	ORANGE
BLUE	INDIGO	BLUE	INDIGO
CYAN	WHITE	CYAN	WHITE
GRAY	BROWN	GRAY	BROWN

B.

Var1	Var2	Var3	Var4
RED	ORANGE	BLUE	INDIGO
CYAN	WHITE	GRAY	BROWN

C.

Var1	Var2	Var3	Var4
RED	ORANGE	YELLOW	GREEN
BLUE	INDIGO	PURPLE	VIOLET

D.

Var1	Var2	Var3	Var4
RED	ORANGE	YELLOW	GREEN
BLUE	INDIGO	PURPLE	VIOLET
CYAN	WHITE	FUCSIA	BLACK
GRAY	BROWN	PINK	MAGENTA

Question B4:

```
data work.one  work.two;
   set work.input;
   if Var1 = 'A' then output work.one;
   output;
run;
```

Work.INPUT

Var1	Var2
A	one
A	two
B	three
C	four
A	five

B4a. How many observations will be in dataset work.one?

B4b. How many observations will be in dataset work.two?

The correct Answer to B4a. is 8

The correct Answer to B4b. is 5

EXAM PREPARATION: SAMPLE QUESTIONS

Advanced Programming Certification Questions:

Question A1:

```
proc sql;
   select one.*, sales
   from one right join two
   on one.year = two.year ;
quit ;
```

Which one of the following reports is generated?

Work.ONE

Year	Qtr	Budget
2001	3	500
2001	4	400
2002	1	700

Work.TWO

Year	Qtr	Sales
2001	4	300
2002	1	600

	Year	Qtr	Budget	Sales
A.	2001	3	500	.
B.	2001	4	400	300
	2002	1	700	600
C.	2001	3	500	.
	2001	4	400	300
	2002	1	700	600
D.	2001	3	500	300
	2001	4	400	300
	2002	1	700	600

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Question A2:

The following DATA step was submitted to create WORK.THREE.

```
data work.three;
    merge  work.one (in = a)
           work.two (in = b);
    by num ;
run;
```

Which one of the SQL programs on the next page creates an equivalent SAS data set THREE?

Work.ONE

Num	Char_1
1	A
2	B
4	C

Work.TWO

Num	Char_2
2	X
3	Y
5	Z

Work.THREE

Num	Char_1	Char_2
1	A	
2	B	X
3		Y
4	D	
5		Z

Q A2:

Work.ONE

Num	Char_1
1	A
2	B
4	C

Work.TWO

Num	Char_2
2	X
3	Y
5	Z

Work.THREE

Num	Char_1	Char_2
1	A	
2	B	X
3		Y
4	C	
5		Z

```
*A; proc sql;
      create table three as
      select *
      from one full join two
      where one.num = two.num;
    quit ;

*B; proc sql;
      create table three as
      select coalesce (one.num, two.num)
            as Num,  char_1, char_2
      from one full join two
      where one.num = two.num;
    quit ;
```

```
*C; proc sql;
      create table three as
       select one.num, char_1, char_2
       from one full join two
       on  one.num = two.num;
    quit ;

*D; proc sql;
      create table three as
      select coalesce (one.num, two.num)
            as Num,  char_1, char_2
      from one full join two
      on one.num = two.num;
    quit ;
```

CONCLUSION

SAS Certification is a worthy pursuit. It attests to the SAS skills of the certified. It can enhance one's marketability. .

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CONTACT INFORMATION

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