<http://support.sas.com/certify/creds/ct.html>

**SAS Global Certification program**

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|  | **SAS Certified Clinical Trials Programmer Using SAS 9**  **Validates a candidates' ability to apply SAS programming skills to clinical trials data**  Successful candidates should have experience in   * clinical trials process * accessing, managing, and transforming clinical trials data * statistical procedures and macro programming * reporting clinical trials results * validating clinical trial data reporting. |

**Required Exam**

Candidates who earn this credential will have earned a passing score on the Clinical Trials Programming Using SAS 9 exam. This exam is administered by SAS and Pearson VUE.

* 71 multiple-choice and short-answer questions (must achieve score of 70% correct to pass)
* 2 hours to complete exam
* Use exam ID **A00-281**; required when registering with Pearson VUE.
* Candidate must hold the SAS Certified Base Programmer for SAS 9 credential to take this exam. Otherwise, candidate should take the A00-280 exam.

**Exam topics include:**  
The following exam objectives are subject to change during the development process and will be updated prior to exam registration.

* Clinical Trials Process
  + Describe the clinical research process (phases, key roles, key organizations).
  + Interpret a Statistical Analysis Plan.
  + Derive programming requirements from an SAP and an annotated Case Report Form.
  + Describe regulatory requirements (principles of 21 CFR Part 11, International Conference on Harmonization, Good Clinical Practices).
* Clinical Trials Data Structures
  + Identify the classes of clinical trials data (demographic, lab, baseline, concomitant medication, etc.).
  + Identify key CDISC principals and terms.
  + Describe the structure and purpose of the CDISC SDTM data model.
  + Describe the structure and purpose of the CDISC ADaM data model.
  + Describe the contents and purpose of define.xml.
* Import and Export Clinical Trials Data
  + Apply regulatory requirements to exported SAS data sets (SAS V5 requirements).
* Manage Clinical Trials Data
  + Access DICTIONARY Tables using the SQL procedure.
  + Examine and explore clinical trials input data (find outliers, missing vs. zero values, etc).
* Transform Clinical Trials Data
  + Apply categorization and windowing techniques to clinical trials data.
  + Transpose SAS data sets.
  + Apply 'observation carry forward' techniques to clinical trials data (LOCF, BOCF, WOCF).
  + Calculate 'change from baseline' results.
  + Obtain counts of events in clinical trials.
* Apply Statistical Procedures for Clinical Trials
  + Use SAS procedures to obtain descriptive statistics for clinical trials data (FREQ, UNIVARIATE, MEANS, SUMMARY).
  + Use PROC FREQ to obtain p-values for categorical data (2x2 and NxP test for association).
  + Use PROC TTEST to obtain p-values for continuous data (one-sample, paired and two-sample t-tests).
  + Create output data sets from statistical procedures.
* Macro Programming for Clinical Trials
  + Create and use user-defined and automatic macro variables.
  + Automate programs by defining and calling macros.
  + Use system options to debug macros and display values of macro variables in the SAS log (MPRINT, SYMBOLGEN, MLOGIC, MACROGEN).
* Report Clinical Trials Results
  + Use PROC REPORT to produce tables and listings for clinical trials reports.
  + Use ODS and global statements to produce and augment clinical trials reports.
* Validate Clinical Trial Data Reporting
  + Explain the principles of programming validation in the clinical trial industry.
  + Utilize the log file to validate clinical trial data reporting.
  + Use programming techniques to validate clinical trial data reporting (PROC COMPARE, MSGLEVEL).
  + Identify and Resolve data, syntax and logic errors.
  + The recommended preparation for the Clinical Trials Programming Using SAS 9 exam is compiled from multiple sources: SAS Training courses\*, pharmaceutical industry publications, white papers and candidate experience. While no exam questions are drawn verbatim from the preparation sources, these materials provide a foundation from which to apply the knowledge and skill necessary for the exam.
  + The preparation materials listed below assume the candidate has little familiarity with SAS programming and the clinical trials industry. Depending on your level of experience, you may not require all preparation components. For example, a SAS Certified Base Programmer would not require the Programming 1 and 2 classes. Please review the exam objectives and then determine which materials will complete your preparation.
  + \* This credential is related to clinical trials programming. If your work is more related to clinical data integration, please see the [SAS Clinical Data Integration: Essentials](https://support.sas.com/edu/schedules.html?ctry=us&id=1051)course.
  + **Publications**
  + [SAS Programming in the Pharmaceutical Industry, Second Edition](http://www.sas.com/store/books/categories/usage-and-reference/sas-programming-in-the-pharmaceutical-industry-second-edition/prodBK_64408_en.html), Jack Shostak
  + [Clinical Trials: A Practical Guide to Design, Analysis, and Reporting](http://books.google.com/books?id=zgx_YTHny5sC&printsec=frontcover&source=gbs_slider_thumb#v=onepage&q&f=false), Duolao Wang, Ameet Bakhai
  + [Introducing the CDISC Standards: New Efficiencies for Medical Research](http://www.cdisc.org/primer), Amanda J. de Montjoie
  + [Validating Clinical Trial Data Reporting with SAS](https://support.sas.com/pubscat/bookdetails.jsp?pc=59404), Carol Matthews & Brian Shilling
  + **White Papers, Proceedings, Standards**
  + [CDISC SDTM and ADaM Standards Documentation](http://www.cdisc.org/standards)
  + [PharmaSUG 2008 Proceedings: SQL or not SQL When Performing Many-to-Many Merge](http://www.lexjansen.com/pharmasug/2008/cc/cc07.pdf) (.pdf)
  + [SUGI 30 Paper: Exploring DICTIONARY Tables and Views](http://www2.sas.com/proceedings/sugi30/070-30.pdf) (.pdf)

Bottom of Form