CURRICULUM APPROACH TO SAS TRAINING
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Training for the first release of SAS (SAS72) was fairly straightforward. There was only one product, it was a batch processing system, and most applications were statistical. Therefore, a single course was sufficient to train new SAS users.

SAS in 1982 is no longer a statistical package with a single audience. SAS can be used in batch and interactively under different operating systems. It contains a high-level programming language with functions, data management and report writing capabilities, along with an extensive library of procedures. There is also the optional products SAS/GRAPH, SAS/ETS, SAS/FSP, and SAS/IMS.

SAS today is used by individuals in almost every profession, regardless of educational background or experience: computer professionals; scientists; econometricians; managers; secretaries; accountants; engineers; administrative assistants; and the list goes on and on. Training this mass of users is a real challenge, since some of them have no previous exposure to data processing, while others have ten or more years of experience.

It is necessary for the Education Division of SAS Institute to be as versatile and varied as the users themselves. For this reason, we are developing a curriculum approach to SAS training. Figure 1 outlines the ten courses which form the basis for a SAS course curriculum for 1982.

SAS Course Curriculum

[Diagram of course curriculum]

FIGURE 1
The **Introduction to Data Processing Using SAS Course** is designed for potential SAS users who have no experience in data processing. It is a four-day course which begins with turning on files. Each student will be able to invoke the terminal and builds to the construction of an appropriate system commands to build and edit files. Each student will be able to invoke the SAS processor to read this data, create a SAS data set, and invoke some of the more frequently used SAS procedures for processing the data.

The **SAS Basics Course** is designed for those who have working knowledge of data processing but little or no SAS experience. It is a two-day course which gives an overview of the data processing capabilities of SAS without getting into intensive programming or advanced statistical analysis. The course begins with an overview of the components of a typical SAS job then covers the logic of how SAS processes data and builds a SAS data set. It covers the SAS programming tools for managing SAS data sets, information retrieval, and report writing. SAS procedures covered are: PRINT, and CONTENTS to print information in a SAS data set; SORT to sort a SAS data set; MEANS to generate statistical analysis. The course begins with an overview of the SAS Basics Course then covers the logic of how SAS processes data and builds a SAS data set. It covers the SAS programming tools for managing SAS data sets, information retrieval, and report writing. SAS procedures covered are: PRINT, and CONTENTS to print information in a SAS data set; SORT to sort a SAS data set; MEANS to generate descriptive statistics; FREQ to generate frequency tables; FORMAT to recode data and format the printing of data values; and PLOT and CHART to graphically display data.

The **SAS Processing Course** is for those with equivalent knowledge of the SAS Basics Course but need to know more about using SAS as a programming language and as a data management tool. It is a two-day course that covers the command language and SAS statements needed to read non-rectangular file structures and a variety of record types, develop and maintain SAS data libraries and write tailored reports. It also includes discussions of data values, formats, format libraries, using options, macros, macro libraries, program development and testing, and general data processing concepts.

The **SAS Color Graphics Course** is designed to give the experienced SAS user an overview of SAS/GRAPH capabilities. It is a two-day course taught at the SAS Institute Training Center. The students learn through lecture and hands-on experience how to use SAS/GRAPH in conjunction with other SAS statements and procedures for graphically displaying your data. The course covers how to use SAS/GRAPH effectively for business presentations and research applications. Students learn how to plot and display text for slides, reports, and posters; produce colored and patterned charts, plots, and maps; and store the picture output from SAS/GRAPH in SAS data sets and display the output on a terminal or plotter.

The **Advanced Input/Output Course** is designed for those who need to use SAS to read and write non-rectangular or other complex files. It is a two-day course that starts out with a discussion on comparing SAS to an operating system and leads into the use of SAS as an application programming language. It covers reading sequential, hierarchical, indexed and direct access files. It also discusses: storing and accessing SAS data sets; using SAS as an information retrieval system; and outputting information from SAS.

The **Computer Performance Evaluation Course** is designed for those who want to use SAS for evaluating service, resources, and capacity using IBM's MVS and MVS/SE operating systems. This is a three-day course developed and taught by Dr. H.W. "Barry" Merrill, who is also the author of Merrill's Guide to CPE: Analysis of SMF/RMF Data with SAS. The book is not required, but the course expands on the tools provided in the text. The course looks at the sources of data that are useful in the analysis of computer system performance, and describes how to use the data. While the primary focus is on SMF and RMF data, the course also describes the use of GTF, SYSLOG, LOGREC, CICS Performance, Analyzer II, and IMS data from MVS systems. The course deals with practical solutions to manager's problems of service, resources, and costs of their computer systems.

The **Procedure Writing Course** is designed for PL/I and FORTRAN programmers who want to write their own extensions to SAS. It is a two-day course that teaches you how to write SAS procedures and functions.

We offer three statistics courses. These are applied courses that illustrate the power of SAS's statistical routines for data analysis. The courses cover the proper use and interpretation of the output produced by each statistical procedure. Most importantly, we emphasize the limitations, underlying assumptions, and inferences that can be drawn from the statistics printed.

The **Regression and ANOVA Course** is designed for those who want to use SAS to develop regression models and analyze data from experimental designs. It is a three-day course that covers: REG for least squares; PLOT for examining residuals; RSQUARE and STEPWISE for selecting the "best" regression model; ANOVA for analysis of variance of balanced designs; GLM for analysis of variance of unbalanced designs and analysis of covariance; and MATRIX for statistical computing.

The **Exploratory Multivariate Data Analysis Course** is designed for those who want to use SAS for cluster and factor analysis,
multidimensional scaling, and other multivariate procedures. It is a three-day course that introduces these multivariate concepts; shows how to use SAS procedures to perform the analyses; and explains how to interpret the output. The emphasis is on gaining a better understanding of your data, rather than on testing hypotheses. The course covers the use of the SAS procedures ALSCAL, PRINCOMP, FACTOR, FASTCLUS, VARCLUS, CLUSTER, CANCORR, and CANDISC.

The Applied Time Series Analysis and Forecasting Using SAS Course is designed to help practitioners understand many of the recent developments in time series analysis and forecasting techniques. Specific guidelines on how to make meaningful and appropriate applications of these techniques are given.

Using the SAS procedures: FORECAST, AUTOREG, ARIMA, SPECTRA, X11, and STATESPACE, a variety of methodologies are exemplified through annotated computer output. Attention is focused on the methods of formulating time series models, the underlying assumptions upon which these models are based, and the limitations associated with the models.

These ten courses form the basis for a SAS course curriculum for 1982. From Figure 1 you can see how these courses are logically related to one another. After acquiring the equivalent knowledge covered in the SAS Basics course, you can then specialize in the areas of your expertise. As new courses are developed, they will logically be fitted into curriculum design concept.