SAS Institute Inc. (2001). *Step-By-Step Programming With Base SAS® Software*. Cary, NC: Author.

The author, SAS Institute Inc., is an American multinational company based in Cary, North Carolina that provides analytics, business intelligence, and data management software and services. This book from SAS Institute provides conceptual information about the basic SAS programming language to help customers use SAS software to its fullest potential. The book is developed and reviewed by technical experts. In addition to this book, which specifically talks about SAS software, a statistical analysis software, the company also published a book named *Step-by-Step Programming with Base SAS 9.4*, which talks about SAS 9.4, an analytics solution software. Readers should be able to choose the book according to the software they intended to learn.

This book has an extensive of coverage of SAS programming with basic yet not sophisticated contents. It is well organized and easy to navigate, and it is a good place for beginners to learn about SAS. The unique feature about this book is its step-by-step examples in illustrating the concepts. It mainly talks about DATA step programming and base SAS procedures which allows users to use SAS software for performing common tasks. DATA step is the building blocks of SAS programming as it shows readers how to create the data sets used for analysis and reporting procedures. Then the book introduces different ways of combining SAS Data Sets through Concatenating, Interleaving, Merging, Updating, Modifying, and Conditionally Processing Data Sets. The author also guides the readers to learn to use SAS log to produce basic detailed report, and at the same tells the readers that SAS log cannot be routed directly to an HTML, RTF, or PDF file since it is not an ODS destination. The right way is to use PROC PRINT options and statements to create a text file, and then replay its output to any OSD destination using IMPORT statement in PROC DOCUMENT. In the latter sections, the book includes plotting and charting of the relationship between variables, and also how to store and manage data in SAS files with SAS data libraries. The appendix includes the data sets used in each section of the book, which helps the reader to refer to while learning SAS programming and also to practice with. Even though the book teaches base SAS software, it is recommended to users who have an introductory level knowledge of SAS software and intermediate users who want to learn specific tasks.

SAS Institute Inc. (n.d.). *Big data analytics: What it is and why it matters.* Retrieved December 10, 2016, from

<http://www.sas.com/en_us/insights/analytics/big-data-analytics.html>

The author, SAS Institute Inc., is an American multinational company based in Cary, North Carolina that provides analytics, business intelligence, and data management software and services. The article starts with a concise introduction on the history and revolution of big data analytics, follows with an explanation of the importance of big data analytics, which is helping organization identify new opportunities by uncovering hidden patterns and correlations from their large set of data. From the article, we know that the value of using big data could benefit the company by bringing significant cost reduction, facilitating efficient and better quality decision-making, and creating new products and services that better meet customers’ needs.

The article then provides resources on how exactly big data and analytics could bring value to organizations. One of the resource talks about the many functions of combining the leading analytic strength of SAS with the low-cost distributed data storage of Hadoop, an open-source, Java-based programming framework for distributed computing and processing of large data sets. SAS/ACCESS software provides easy access to data stored in Hadoop via HiveQL, with which the user can analyze the data sets using SAS. SAS Data Loader for Hadoop helps to read, write and integrate data to and from Hadoop. SAS Visual Statistics provides an interactive and visual environment for uncovering patterns in Hadoop data, and SAS Visual Analytics helps visualize Hadoop data. The SAS In-Memory Statistics for Hadoop allows organization to not only collecting and sorting data in Hadoop but also able to explore the value and opportunities with the data.

In the next section, the article lists the types of businesses that are using big data analytics. This section provides real-word situations of where people could see and use big data. Business includes travel and hospitality, government, health care, and retail. It also uses the story of how Lenovo uses analytics to rethink its design on a new keyboard to illustrate the power of using big data analytics. Finally, the article highlights the key technologies that make big data analytics inclusive, which are data management, data mining, Hadoop, In-memory analytics, predictive analytics, and text mining.

SAS Institute Inc. (n.d.). *Machine Learning: What it is and why it matter.* Retrieved December 10, 2016, from

http://www.sas.com/en\_us/insights/analytics/machine-learning.html

The author, SAS Institute Inc., is an American multinational company based in Cary, North Carolina that provides analytics, business intelligence, and data management software and services. The article starts with a concise introduction on the revolution of machine learning, follows with a short video that explains what are SAS machine learning and it is popular. The article then emphasizes the importance of machine learning through the size and complexity of data it can handle and the cost and speed of the system. It also provides a question and answer section explaining the major components that create a good machine learning system, and also connects the concept of machine learning with the related concept in statistics.

The article provides four papers on different aspects of how machine learning is used by organizations nowadays. Before reading the full paper, one can read the summary of each article as it provides a clear and short overall explanation on each topic. All the four examples well demonstrates how machine learning help organization make better decisions with no human intervention by using its algorithms to build models that uncover connections.

The topic then extends to the industries that recognize the value of machine learning technology and gain insights from the large set of data. Industries include financial services, government, health care, marketing and sales, oil and gas, and transportation. Another video shows one of the popular uses of machine learning, which is pattern recognition. In the short video, Patrick Hall, a research at SAS, shows a demo about pattern recognition by handwriting two numbers “4” and “9” and then use SAS® Enterprise Miner™ pattern recognition to recognize the images.

SAS Institute helps its readers to understand machine learning by giving an overview of the four most popular machine-learning methods. It explains each type by providing examples of inputs and the applications, and also highlights the situation when each method will be used.

The section I find most helpful and worth reading is the differences between data mining, machine learning, and deep learning. This is intended for those who have knowledge about either data mining or deep learning, and new to machine learning. The final section lists SAS machine learning algorithms and the tools and processes. This section will be helpful for those who want to build a machine-learning model and wants to be able to quickly get value from their big data.

SAS Institute Inc. (n.d.). *Data Visualization: What it is and why it matter.* Retrieved December 10, 2016, from

<http://www.sas.com/en_us/insights/big-data/data-visualization.html>

The author, SAS Institute Inc., is an American multinational company based in Cary, North Carolina that provides analytics, business intelligence, and data management software and services. The article starts with a concise introduction on the history of data visualization, follows with a two-minute video Q&A from Simon Samuel, past Head of Customer Value Modeling at Lloyds TSB in UK, and now the Associate Director at Deloitte, London. He talks about using data visualization to improve customer relationships and other big data issues that confront retail bankers. The article also briefly notes the importance of data visualization by comparing it with using spreadsheets or reports to read complex data.

Different the articles on big data analytics and machine learning, this article provides a paper outlining the five big data challenges and how data visualization is helping to overcome each one. The other three papers from experts add more on the techniques used in data visualization. One could connect these papers to big data analytics and researches on the SAS Visual Analytics that helps visualize Hadoop data, which is further discussed in the article. Under “How it Works” section, Mary Osborne from SAS demonstrates the use of SAS Virtual Analytics in the video.

Then the article discusses the four advantages for businesses to use data visualization to make the best use of their data. Instead of listing out the industries using data visualization, the author writes that all types of businesses are using data visualization regardless of industry or size.

The practical video that shows how to use SAS Visual Analytics is recommended for those who would like to learn about or intend to use the software. The article then discusses the steps before implementing data visualization in a conversational tone, which allows readers to relate the steps to their own intended use of data visualization. The next section is important for business users and all users of SAS Visual Analytics to read as it mentions one of the biggest challenges in data visualization, which is to decide the visual that can best represent the information.

Ricks, J. (2015, March 2). *SAS Programming Basics*. Retrieved from <http://www.ats.ucla.edu/stat/sas/seminars/sas_programming_basics/SAS%20Programming%20Basics.htm>

The author, Dr. Joni Ricks, statistical consultant at the Institute for Digital Research and Education (IDRE) of University of California Los Angeles (UCLA) provides a comprehensive guide for people to learn about the basics of SAS programming. Reading from the first paragraph of the article, one should learn that even though the article is about teaching how to write SAS programs basics, it is designed for people with some familiarity with SAS. Readers new to SAS could refer to the Introduction to SAS Seminar page for further information. The author also specifies the learning objectives for its readers and notes that the contents are developed in SAS 9.4.

Similar but different from the book *Step-By-Step Programming With Base SAS® Software* written by SAS Institute, this article talks more on navigating the SAS window environment and provides students hands-on experience of manipulating SAS data with SAS built-in functions, merging, appending, formatting and different options for modifying SAS output.

The first section SAS refresher starts with the SAS library and then briefly gives an overview of the SAS windowing environment. Then it transits to creating new SAS datasets as well as discussing the SAS options. In this section, students should pay attention to the syntax depends on the computing environment they use.

The next section one could find it helpful is diagnosing and correcting syntax errors. Many articles and books walk through step-by-step of basic SAS programming, but not many of them discuss how to identify and address coding errors which is quite common and a main issue for new learns.

Dr. Ricks spends most part of this article on showing students how to manipulate datasets in detail. She started with the basic SAS operators and provides detail examples for each. Then she moves on to IF-THEN statement and SAS built-in functions. She ends the manipulating datasets section by discussing merging, appending, formatting and many other different options for modifying SAS output. In addition to the format and label options in section 5.0 modifying SAS output, one should pay attention to 5.4 about the Output Delivery System (ODS) basics.

Cody, R. P. (2012). *Cody's Collection of Popular SAS Programming Tasks and How to Tackle Them*. SAS Institute.

The author, Ron Cody, EdF, a retired professor from the Robert Wood Johnson Medial School who now works as a private consultant and a national instructor for SAS writes this book for all levels of SAS programmers to find solutions of common programming tasks people face on a daily basis. When readers are browsing the table contents of this book, it is worth noticing that this book is different from all the above books and articles I cited as it is a task based guidebook for SAS users.

Because the content of this book is task-based, the author includes an index section at the end of the book to help readers navigate the book according to a specific SAS concept and function they are looking for. At the last section of the book, the author has a link to the author’s page for readers to download free chapter and access example code and data.

The content of this book includes many programming tasks of manipulating data and data sets. In each chapter, the author provides four or five different methods for one to accomplish a talk. Readers could choose the method they prefer as well as exploring other programming techniques.

Similar to the article Dr. Ricks writes on SAS programming basics, Dr. Cody includes valuable SAS programming tricks and tips for SAS users to read. Also, he provides example and explanations that are clear and concise. New SAS learners will be able find practical solutions for most common tasks, and SAS professionals could also use this book to discover insights on using the software.

Since Dr. Cody has experience in medical fields, this book from him could help SAS users to learn how to solve a technical problem with affordable answers. It is recommended for busy professional who encounters a SAS programming problem and in need to find a simple solution, but also be able to explain the programming constructs.

Rey, T., Kordon, A., & Wells, C. (2012). *Applied data mining for forecasting using SAS.* Cary, NC: SAS Institute.

The authors of this book, Tim Rey is the director of advanced analytics at the Dow Chemical Company, Arthur Kordon is Advanced Analytics Leader at the Dow Chemical Company, and Chip Wells is Statistical Services Specialist at SAS Institute.

This book is well organized and it walks through the complete forecasting process. This book is highly recommended for people who have already have enough knowledge of the basic SAS programming skills, and is using or intend to do forecasting with variables in SAS. The book uses software like SAS/ETS and SAS Forecast Server.

The book begins with the importance of using data mining in forecasting and its advantages. Then it explains the entire forecasting work process by identifying the key SAS tools used in it. The next chapter discusses data mining for forecasting based on different infrastructure – Hardware, Software, Data, and Organizational. Enterprise users could find this section useful to read based on the infrastructure.

As the book continues, it introduces various models for users to identify the correlation structure between selected input variables and the forecast variables. The chapter “Issues with Data Mining for Forecasting Application” could be instructional for forecasting practitioners, engineers, and statisticians to find solutions and insights on dealing with both technical and nontechnical issues.

I find this book requires a lot of knowledge on modeling techniques even though it covers from simple to complex modeling through out the book. This is not many mathematical detail and explanation for the modeling sections. Also, this book provides scenario-based forecasts for people to learn how data mining for forecasting is used in a real-world setting. It could be also used as a instructional book for advanced course in data forecasting.

Brookstein, E., Glaser, A., & Koch, L. (2010). *Getting that New SAS® Programming Job - A Management Perspective*. Retrieved from <http://www.lexjansen.com/pharmasug/2010/MA/MA01.pdf>

This article is written by Ellen Brookstein, who was the founder and director of SAS Certificate program for the Pharmaceutical industry, cooperates with Allan Glaser and Laurie Koch from Octagon Research Solutions, Inc. The article is intended for programmers to find insightful information about how to succeed in finding a SAS programming job.

Written from the perspective of management team, the authors first discuss the background information during the recruiting process. The authors point our that a resume and a CV is important in applying a job thus should be paid a lot of attention on detail. However, this article will teach the reader who to revise the resume based on the needs of the new organization. It also clarifies the definition on an applicant and a candidate.

One of the sections that worth reading is the section talks about dealing with automated systems, in which the authors emphasizes that many organizations use automated systems to filter and select applicants in the first process. Thus, the applicants should carefully read the job posting and instructions, and also take enough time to check the spelling, punctuation, and grammar in order to get through the automated system. In addition, black response is not a good choice while applying a job since it makes hiring manager thinks that you are not interested enough to apply the job.

In addition, the authors stress the importance of technical skills in applying for jobs that require SAS programming skills. Ones should learn the SAS skill that is required in the industry that they are interested to apply for since different industries has diverse needs for skills. The programming skill that is commonplace in one organization may not be used at all in another.

The authors also provide detail information on what to include and what not to include in a resume. Another section that the article offers which can be helpful for readers is the sample code section. It tells the applicants how to include sample code in their application, which should not be attached to the resume. The article is quite worthy to read as it provides much insightful information for college graduates who want to score a programmer job.

Elliott, A. C., & Woodward, W. A. (2016). *SAS essentials: Mastering SAS for data analytics*. Hoboken, NJ: John Wiley and Sons.

The authors, Alan C. Elliott, MBA, the Director of the Statistical Consulting Center at Southern Methodist University, and Wayne A. Woodward, PhD, the Chair and Professor of the Department of Statistical Science at Southern Methodist University (SMU) writes the book to provide its readers a step-by-step introduction on the use of SAS statistical software. The authors highlight that this book is intended for SAS beginners who want to use SAS software as a foundational approach to data analysis and interpretation.

It the contents of the book, it includes the programming approaches for the most up-to-date version of the SAS software and also includes detailed information on how to use the SAS University Edition, which is quite helpful for college students to use a guide. It also includes many real-world example and useful techniques for users to perform data manipulation of the SAS programming languages. In addition to basic programming techniques, there are also SAS advanced programming topics for people who are familiar with SAS to read.

In the second part of the book, the authors break down the statistical analysis using SAS procedures from the initial evaluating quantitative data to creating custom graphs and reports. For example, there are updated ANOVA and regression examples, as well as statistical methods of using T-tests to compare the means.

The book is not recommended for people who are new to SAS with no statistical background knowledge. It is more an ideal book for upper-undergraduate and graduate students to learn statistics by applying SAS programming and statistical computer software as supplement materials to study. There is also a companion website with the data sets, codes, and PowerPoint slides discussed in the book for users to refer to in the process of reading. It is also a helpful resource for people who are preparing for basic Certification exams.

Ottesen, R. A., Delwiche, L. D., & Slaughter, S. J. (2015). *Exercises and projects for the Little SAS Book*. Cary, NC: SAS Institute.

The author, Rebecca A. Ottesen teaches at the Statistics Department SAS at California Polytechnic State University, San Luis Obispo. As a Biostatistician, she incorporates her research and programming experience into the coursework for her students and also in her book for readers to learn. The original authors, Lora D. Delwiche spends most of her professional life teaching at University of California, Davis with using SAS as a teaching and research tool. Susan J. Slaughter now works as a consultant for Avocet Solutions. This book is intended to use as the practice book for *The Little SAS Book: A Primer, Fifth Edition*, and readers are recommended to read both books to reach a better understanding and practice of SAS programming skills.

This book contains quite interesting and helpful exercises for readers to practice on SAS programming. However, there are only selected solutions provided in this book so one has to be an instructor to request the solution. I would recommend this book for instructors to use it as an instructional tool to construct practice or quiz for students.

In each chapter of the book, there are three types of practice - multiple choice, short answers, and programming exercise. It covers practice of basic knowledge of SAS, and includes comprehensive topics. The book is helpful for people new to SAS to test their general knowledge of SAS as it starts the practice with using SAS software, but may not be helpful for users with in-depth or extensive knowledge of SAS.

In addition to the exercises in this book, the projects are the end of the book also provides readers a good opportunity to practice real-world coding by synthesizing the information they learn from case studies. This book is also recommended since it is student-oriented book that could use a manual for preparing SAS Certification exams.