

SAS® Enterprise Guide or SAS® Studio: Which is Best for You?

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ABSTRACT

SAS® Studio (previous known as SAS Web Editor) was introduced in SAS 9.4 M1 as an alternative programming environment to Enterprise Guide (EG) and interactive SAS (DMS). SAS Studio is different in many ways to EG and DMS. As a programmer I currently use EG to help me code, test, maintain and organize my SAS programs. I have interactive SAS installed on my PC, but I still prefer to write my programs in EG, because I know it will save my log and output whenever I run a program, even if that program crashes and takes the SAS session with it! So should I now be using SAS Studio instead, and should you be using it too?

INTRODUCTION

In the early 1980's SAS offered users a “?” to prompt them to type in programming statements, then in the late 1980's the Display Manager (DMS) was introduced, where users could view their code, log and output together. It was not until the beginning of this century that Enterprise Guide was introduced and offered interactive access to remote SAS servers from a Windows PC. Finally, in 2014, SAS Studio was introduced for users on any platform that can be used to access a suitable web browser, because the interface to SAS was actually a web page.

This paper will discuss the options for a range of users: Windows, UNIX or Linux, Mac, Academic, non-programming data analysts, novice and intermediate programmers, power users, and interface and task developers.

PLATFORM-SPECIFIC USERS

The programming environments available will depend on the platform used, and so, when the options for particular types of users are discussed later, the environments here will need to be taken into account too.

Windows Users

As the SAS System and Enterprise Guide run on the Windows platform, the addition of SAS Studio running in a web browser means that all of the programming environments discussed in this paper are available to Windows PC users. This is not necessarily the case for the other platforms though.

Display Manager (DMS)

This is the standard interactive programming environment for SAS programmers who have the SAS System installed on their Windows PC. By default there are 5 areas with information about the SAS programming environment, as shown in Figure 1:

- Editor for viewing and editing SAS code.
- Log for viewing the progress and messages generated by running SAS programs.
- Output for viewing the text report output generated from SAS programs.
- Explorer for finding and viewing folders and files, including SAS libraries, data sets and external files.
- Results for finding and reviewing output from SAS programs in all file formats produced by SAS programs.

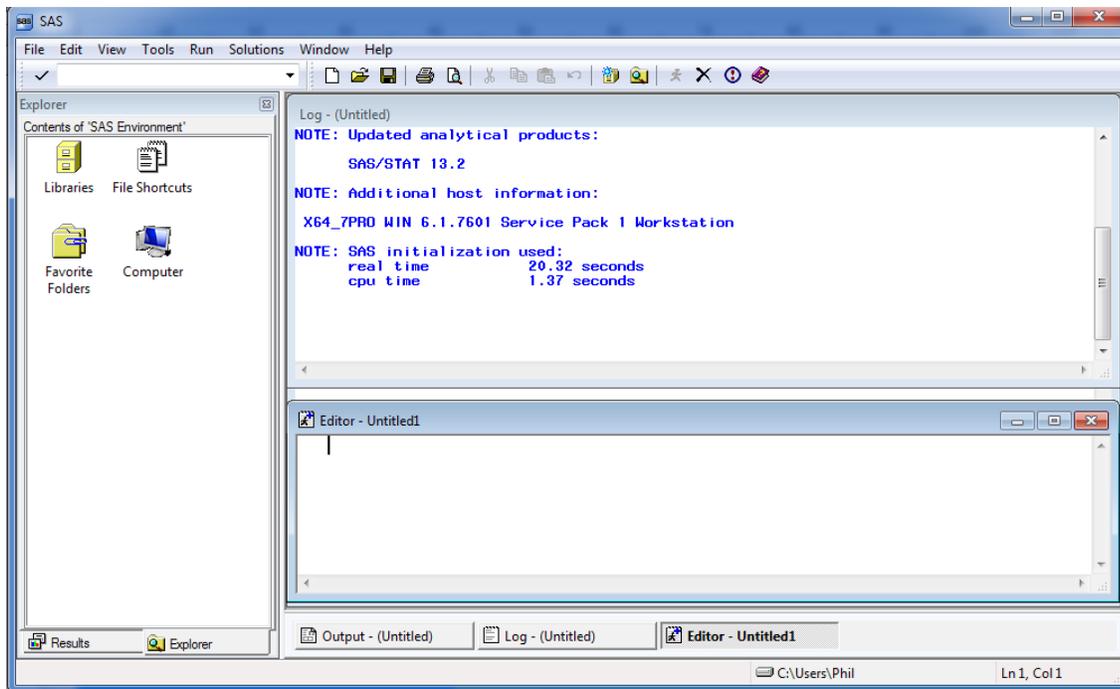


Figure 1. Opening screen for interactive SAS 9.4 on a Windows PC.

Enterprise Guide

The Enterprise Guide view of the programming environment is much more structured, and initially show 3 areas of information, as shown in Figure 2:

- Project Tree which lists the files associated with each Process Flow contained in the Enterprise Guide project. These files can be SAS programs and output files.
- Process Flow which displays the files associated with a Process Flow in the form of a flowchart.
- The third area is labeled “Servers” in the screen shot below, but, by clicking the 5 icons at the top of this area, can display the following information:
 - Tasks, which are screens and menus able to generate SAS code.
 - SAS Folders, which are data locations predefined by server administrators.
 - Servers, which are SAS servers your Enterprise Guide session is connected to, and the files and SAS libraries accessible of those servers.
 - Prompt Manager can be used to generate macro variable values to customize your SAS programs.
 - Data Exploration History allows the user to easily view and subset multiple SAS data sets without them being adding automatically to the project.

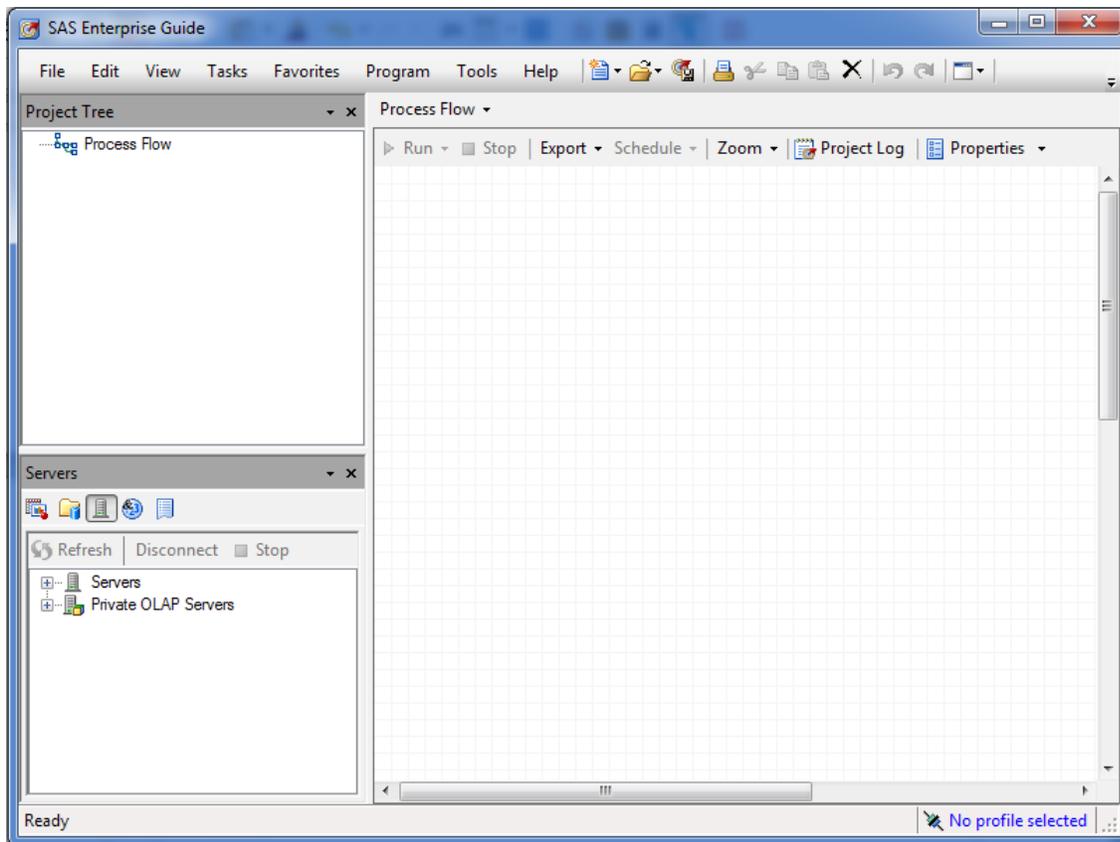


Figure 2. Opening screen for Enterprise Guide 7.1.

SAS Studio

SAS Studio gives a view of the programming environment which is somewhere between those of the Display Manager and Enterprise Guide, with 4 main areas of information, as shown in Figure 3:

- Code for viewing and editing SAS code.
- Log for viewing the progress and messages generated by running SAS programs.
- Results for viewing all of the report output generated from SAS programs.
- The left-hand area has 5 expanding sections:
 - Folders is a folder view of the connected SAS server, which could also be the user's own Windows PC, if it has SAS installed on it.
 - Tasks, which are screens and menus able to generate SAS code.
 - Snippets are generalized fragments of SAS code that can be pasted into the Code area.
 - Libraries lists the available SAS libraries and their contents.
 - File Shortcuts lists the available shortcuts to folders and files.

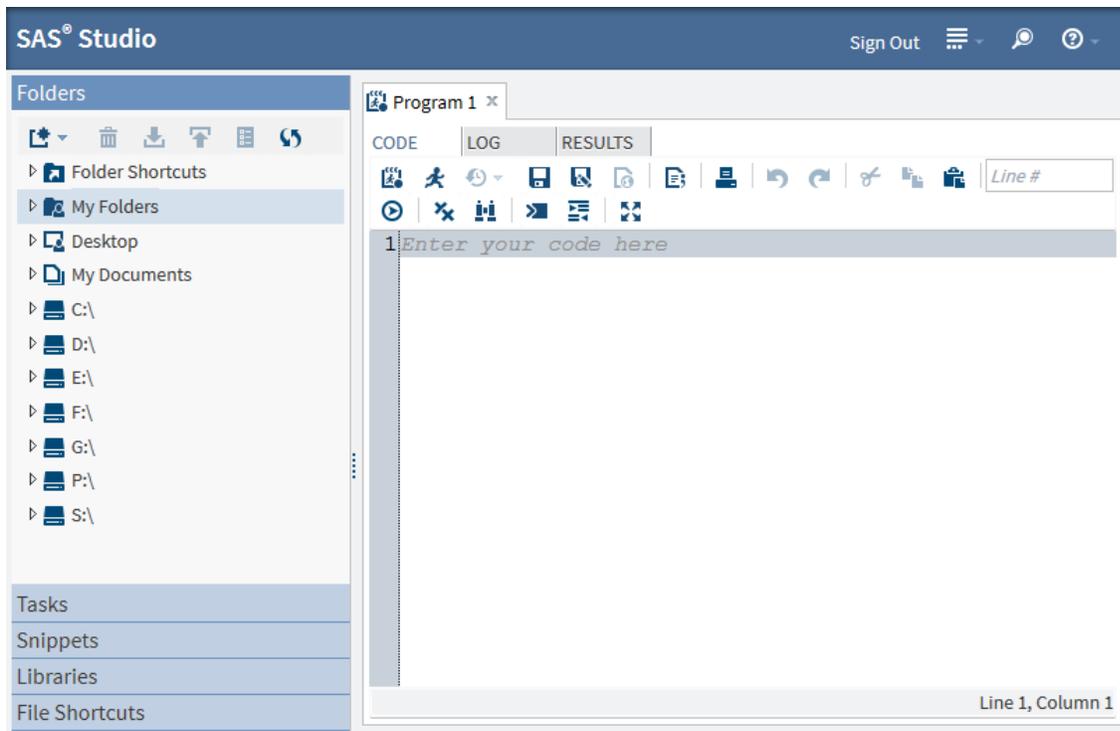


Figure 3. Opening screen for SAS Studio connected to a Windows PC.

UNIX or Linux Users

The SAS System will run on most varieties of UNIX and Linux, and web browsers are also included in UNIX and Linux installations, so users with access to these platforms have the choice of the Display Manager or SAS Studio to use for developing SAS programs.

Display Manager (DMS)

This is the standard interactive programming environment for SAS programmers who have access to the SAS System installed on UNIX or Linux. As in Windows there are 5 areas with information about the SAS programming environment, but in UNIX and Linux they are displayed as separate floating windows, as shown in Figure 4:

- Program Editor for viewing and editing SAS code.
- Log for viewing the progress and messages generated by running SAS programs.
- Output for viewing the text report output generated from SAS programs.
- Explorer for finding and viewing folders and files, including SAS libraries, data sets and external files.
- Results for finding and reviewing output from SAS programs in all file formats produced by SAS programs.

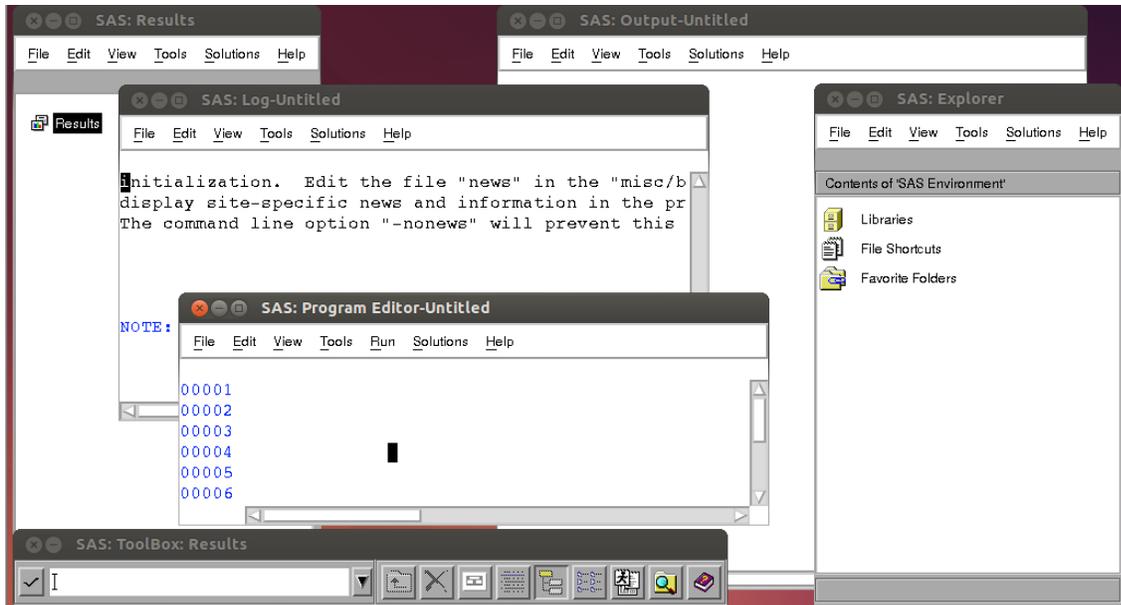


Figure 4. Opening screen for interactive SAS 9.3 on Ubuntu Linux.

SAS Studio

The screen displayed by SAS Studio on a UNIX or Linux platform will depend completely on the type of SAS server it is connected to, but will broadly look like the screen displayed on a Windows platform. The differences will only be seen in the Folders area, where a Windows server will show Windows-specific file naming with “\” as separators, whereas UNIX and Linux servers will show UNIX-specific file naming with “/” as separators.

MAC Users

The SAS System can no longer be installed on Mac computers, so the only remaining available option is to use SAS Studio in a web browser.

SAS Studio

Like the SAS Studio screen on Windows, UNIX and Linux platforms, the only differences will be seen because of the SAS server platform, not where the web browser is being used.

ROLE-SPECIFIC USERS

The options available to all the roles given below will depend on the platform used.

Academic Users

Academic access to SAS is available through 2 specific products:

- OnDemand for Academics uses the web-based SAS Studio interface to access a remote SAS server, where course files are stored and submitted.
- SAS University Edition is supplied a free virtual machine for the Oracle VirtualBox or VMware Player virtualisation software packages, both of which can also be installed for free. The virtual Linux SAS 9.4 server runs on the user's 64-bit Windows, Linux or Mac computer, but can only be accessed through a web browser by using the IP address supplied by the running virtual machine, which starts a SAS Studio session. The web page that starts SAS Studio also includes web links to discussion communities, installation documentation and frequently asked questions, as shown in Figure 5.

Welcome



NOTIFICATIONS

Checking for updates...

RESOURCES

[Communities \(collaborate and share best practices\)](#)
[Installation Documentation](#)
[Frequently Asked Questions \(FAQ\)](#)

Figure 5. Opening screen for SAS University Edition.

Once SAS Studio has been started, then all the functionality described in Figure 3 are available to the user. The users could be Non-programming Data Analysts, Novice and Intermediate Programmers or Power Users, and each of these sections will explain the relevant features of SAS Studio.

Non-programming Data Analysts

Because of the in-built Tasks available in Enterprise Guide and SAS Studio, and the fact that these can generate and run SAS code without the user having even to be aware that they are doing so, non-programming data analysts can use either of these products to investigate SAS data by using menus, variable lists and drag-and-drop operations.

SAS Studio

Taking the Distribution Analysis as an example, this can be found in the Statistics-related tasks, as shown in Figure 6.

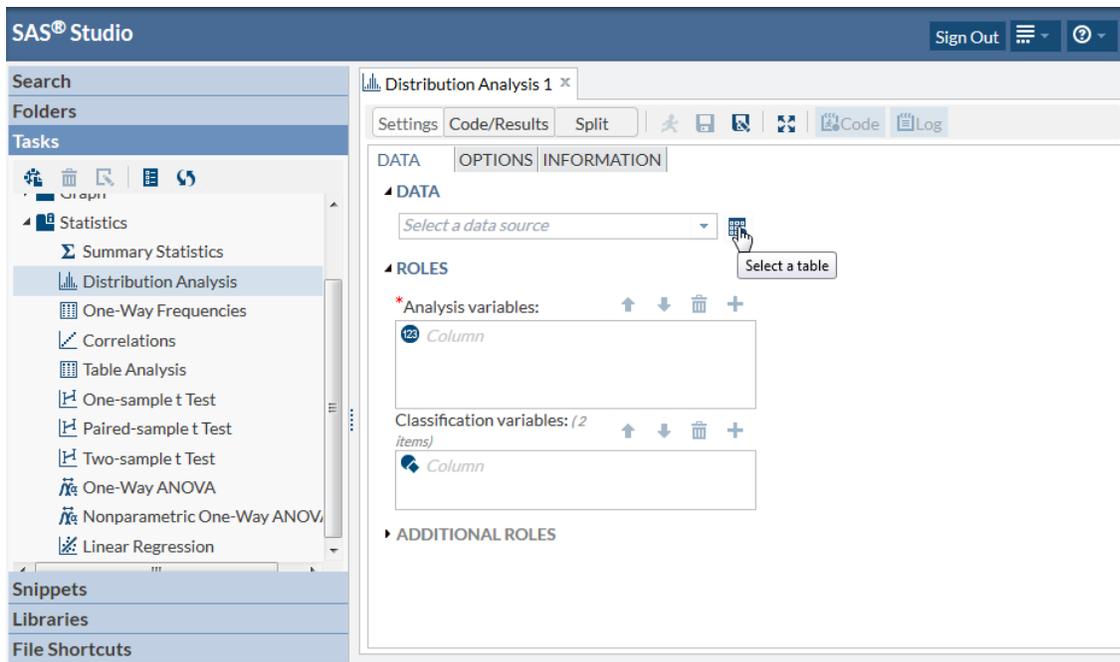


Figure 6. Settings for the Distribution Analysis task in SAS Studio.

The Settings menu requires Data, which can be selected by clicking the icon at the right-hand end of the box, as shown in Figure 6.

Having selected SASHELP.BASEBALL from the pop-up list, the Roles can be selected can be selected from similar pop-up lists to complete the information about the data for the analysis, as shown in Figure 7.

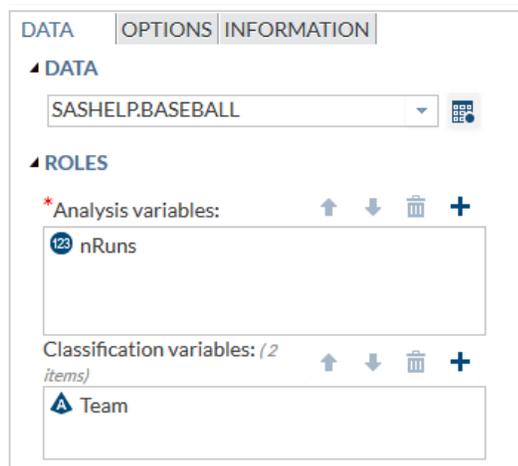


Figure 7. Completed Data for the Distribution Analysis task in SAS Studio.

The Options tab will give you choices about how to display the data, so that the Run icon becomes click-able, as shown in Figure 8.

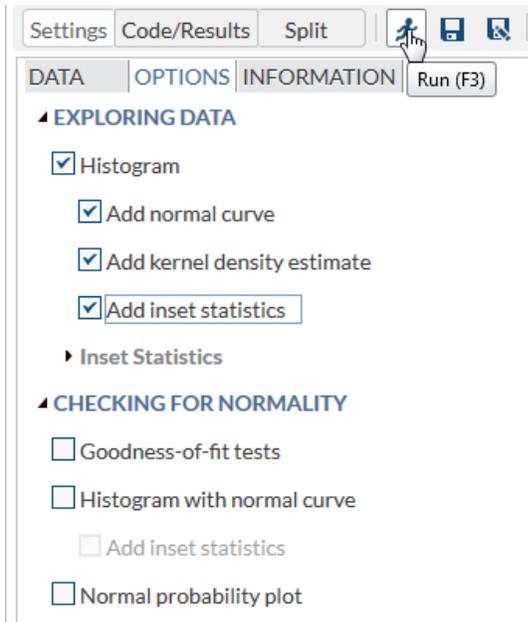


Figure 8. Completed Options for the Distribution Analysis task in SAS Studio.

This starts a SAS program running, which will, hopefully, generate the results you were looking for, as shown in Figure 9, but without any SAS programming skills required.

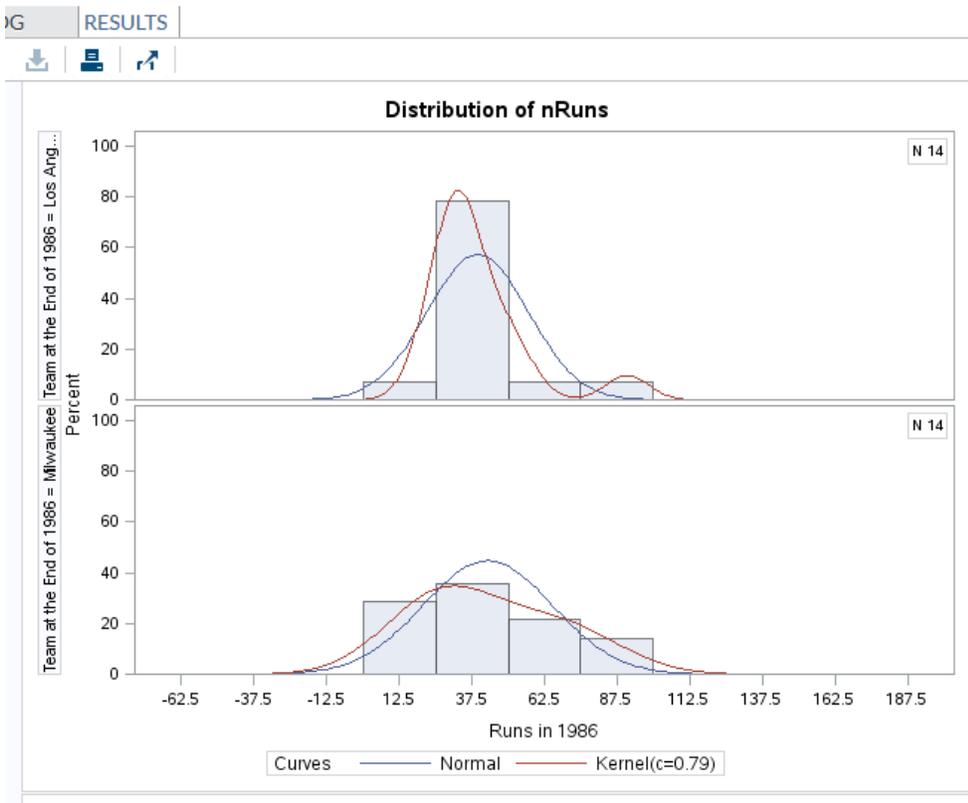


Figure 9. Graphical Results for the Distribution Analysis task in SAS Studio.

Enterprise Guide

Taking the Distribution Analysis again as an example, this can be found in the Tasks > Describe drop-down menu, but also in the Task list which shares the area with the Servers, as shown in Figure 10.

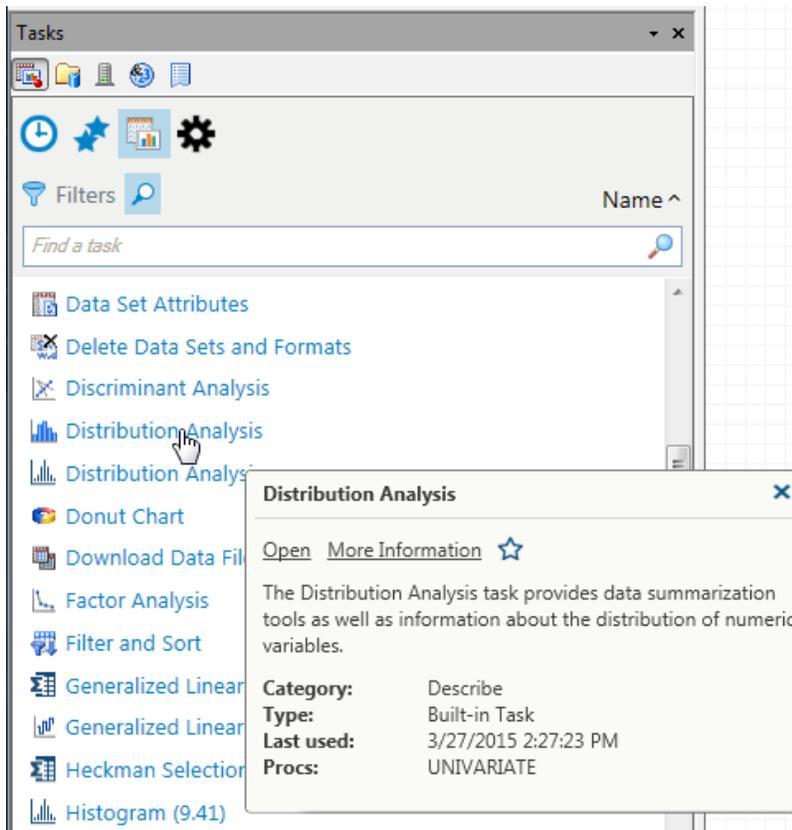


Figure 10. Finding the Distribution Analysis task in Enterprise Guide 7.1.

Clicking on the Task opens up a window where data and settings can be selected. Having selected SASHELP.BASEBALL from the pop-up list, the Roles can be selected from similar pop-up lists to complete the information about the data for the analysis, as shown in Figure 11.

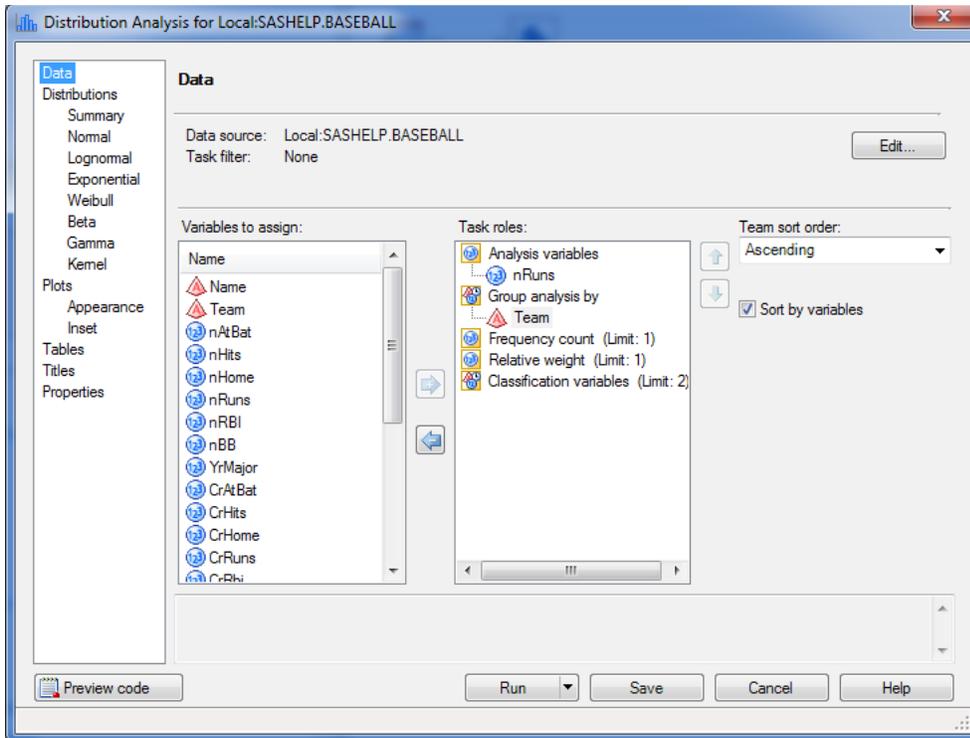


Figure 11. Completed Data for the Distribution Analysis task in Enterprise Guide 7.1.

The Appearance tab under Plots will give you choices about how to display the data, as shown in Figure 12.

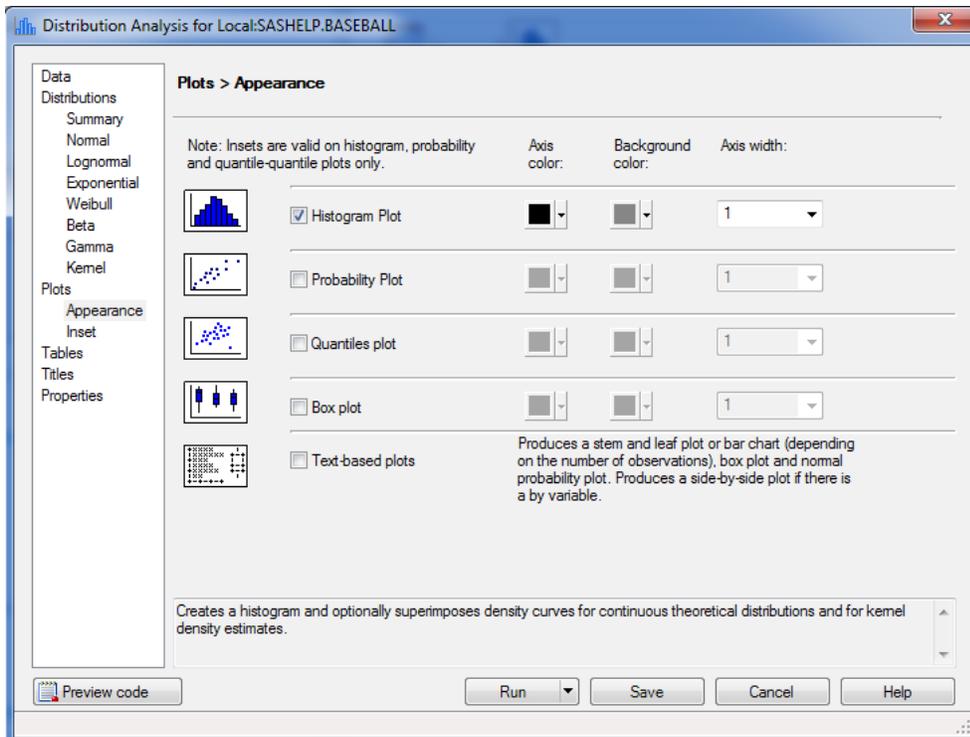


Figure 12. Completed Appearance for the Distribution Analysis task in Enterprise Guide 7.1.

Clicking the [Run] button will start a SAS program running, which will, hopefully, generate the results you were looking for, as shown in Figure 13, but again without any SAS programming skills required.

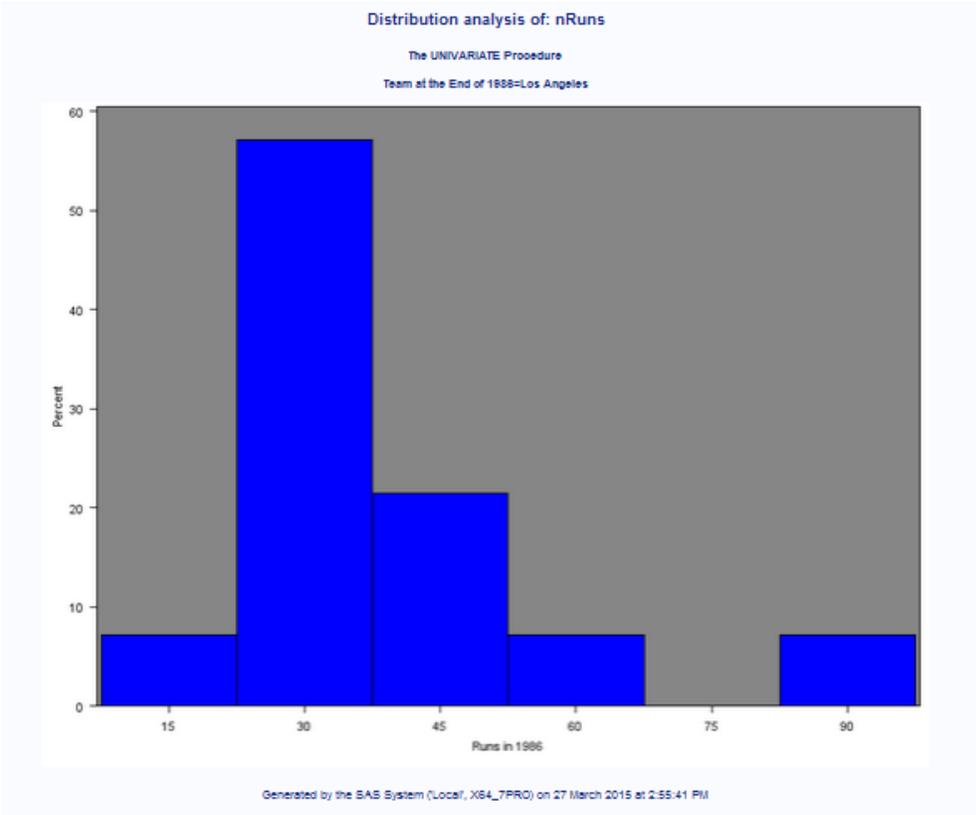


Figure 13. Graphical Results for the Distribution Analysis task in Enterprise Guide 7.1.

Enterprise Guide and SAS Studio together

At first sight it would appear that SAS Studio is the obvious choice, at least for Distribution Analysis, as the graphical output is much easier to view and is also easier to customize. SAS Studio uses ODS Graphics, whereas Enterprise Guide mostly creates traditional SAS/GRAPH plots. However, if Enterprise Guide and SAS Studio are installed on the same Windows PC, and a suitable web browser is also installed, Enterprise Guide 7.1 can make use of the Tasks from SAS Studio, as shown in Figure 14, where the two Distribution Analysis Tasks have different icons, but can only be distinguished precisely by hovering the mouse over the link. It should also be noted that it is only possible to find both these Tasks in the Tasks list, as only the Enterprise Guide Tasks are shown in the Tasks menu.

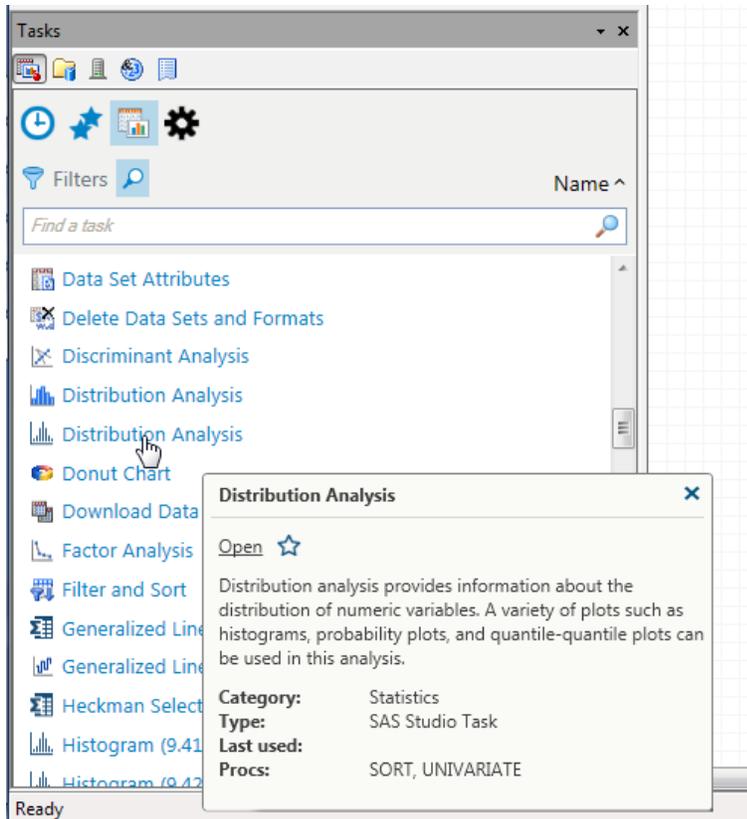


Figure 14. Finding the SAS Studio Distribution Analysis task in Enterprise Guide 7.1.

Novice and Intermediate Programmers

The definitions of Novice and Intermediate Programmers are those programmers who have limited SAS programming experience, but wish to improve their programming skills. They also have a need to make use of SAS software to investigate data, without necessarily the SAS skills required to write code to a sufficient standard to do this unaided. Both SAS Studio and Enterprise Guide include functionality to give a helping hand.

SAS Studio

SAS Studio includes a small, but growing, list of Tasks, which can be used to generate SAS code to perform generic data manipulation and reporting actions. Figure 15 shows the Data-related Tasks available to users in SAS Studio. Each one opens a series of menus where data, report content and appearance can be specified.

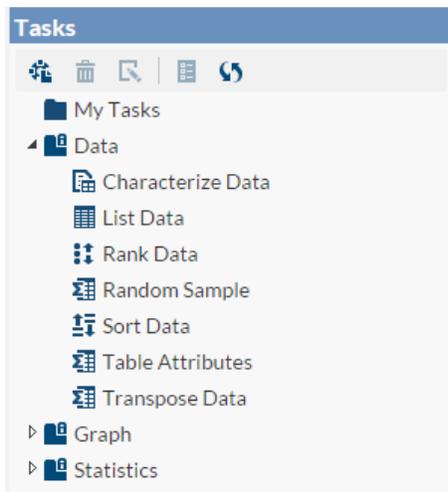


Figure 15. Data-related Tasks in SAS Studio.

Figure 16 shows the Graph-related Tasks available to users in SAS Studio, where ODS Graphics code will be generated for the user, based on the choices made in the menus.

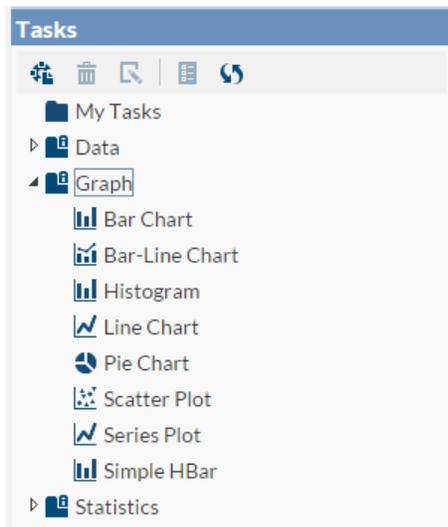


Figure 16. Graph-related Tasks in SAS Studio.

Figure 17 shows the Statistics-related Tasks available to users in SAS Studio

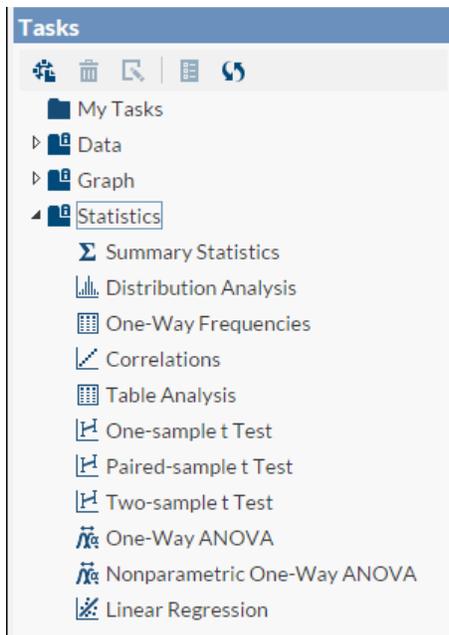


Figure 17. Statistics-related Tasks in SAS Studio.

As a Novice and Intermediate Programmer you may be interested in learning more about how these Tasks work, so looking at the code generated by SAS Studio in the Distribution Analysis example discussed earlier could be helpful, as shown in Figure 18.

```

CODE LOG RESULTS
14
15ods noproctitle;
16ods select where=(lowcase(_path_) ? 'plot' or lowcase(_path_) ? 'gram');
17
18proc univariate data=SASHELP.BASEBALL noprint;
19    class Team;
20    histogram nRuns / normal kernel;
21    inset n / position=ne;
22run;

```

Figure 18. SAS code generated by Distribution Analysis Task in SAS Studio.

The code in Figure 18 is part of the generated code from a SAS Studio Task, but, if the user wishes to type in some SAS code themselves, then opening a new program will open a Code tab, where copied text from this generated code can be pasted and amended at will. While code is being typed into the Code tab useful hints and tips will pop-up giving information about SAS syntax, as shown in Figure 19, which is another way to learn about SAS programming.

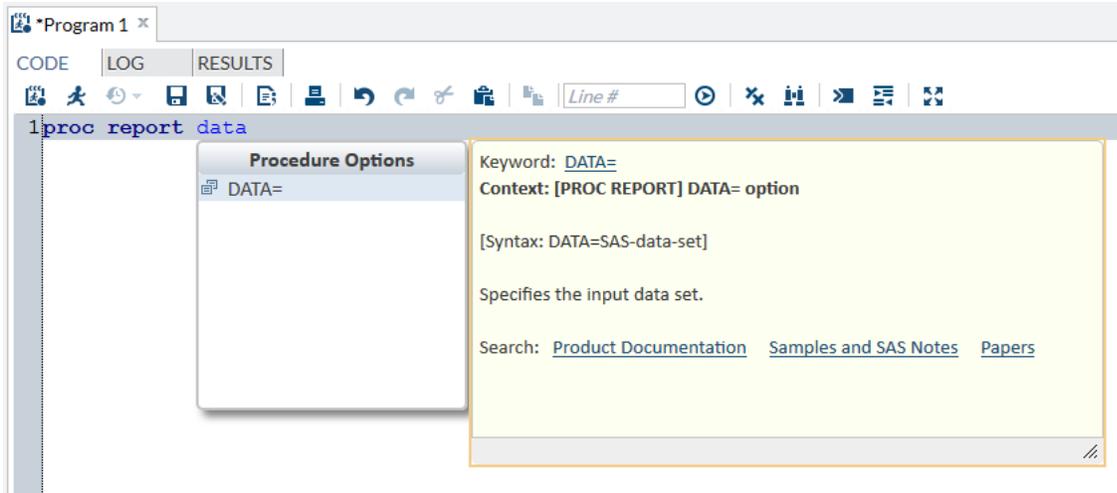


Figure 19. SAS syntax hints and help in SAS Studio.

Enterprise Guide

Enterprise Guide includes a large, and growing, list of Tasks, which can be used to generate SAS code to perform generic data manipulation and reporting actions.

As a Novice and Intermediate Programmer you may be interested in learning more about how the Tasks work, so looking at the code generated by Enterprise Guide in the Distribution Analysis example discussed earlier could be helpful, as shown in Figure 20.

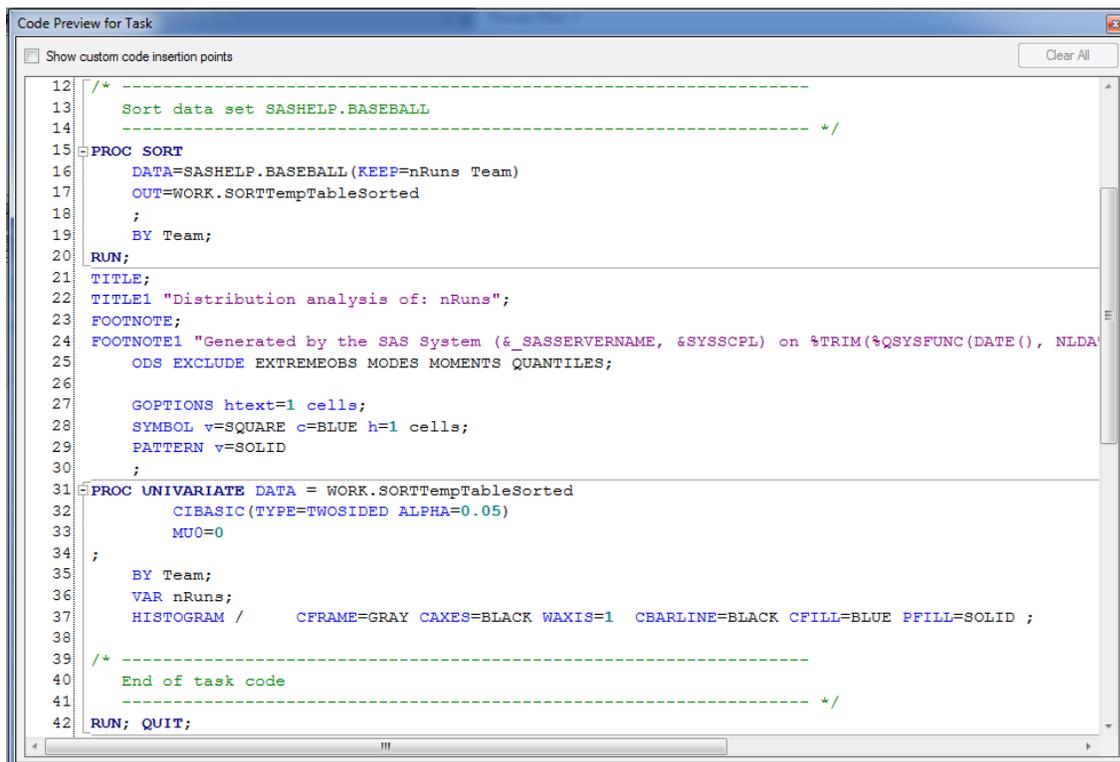


Figure 20. SAS code generated by Distribution Analysis Task in Enterprise Guide 7.1.

The code in Figure 20 is part of the generated code from an Enterprise Guide Task, but, if the user wishes to type in some SAS code themselves, then opening a new program will open a Code window, where copied text from this generated code can be pasted and amended at will. While code is being typed into

the Code tab useful hints and tips will pop-up giving information about SAS possible keywords, as shown in Figure 21.

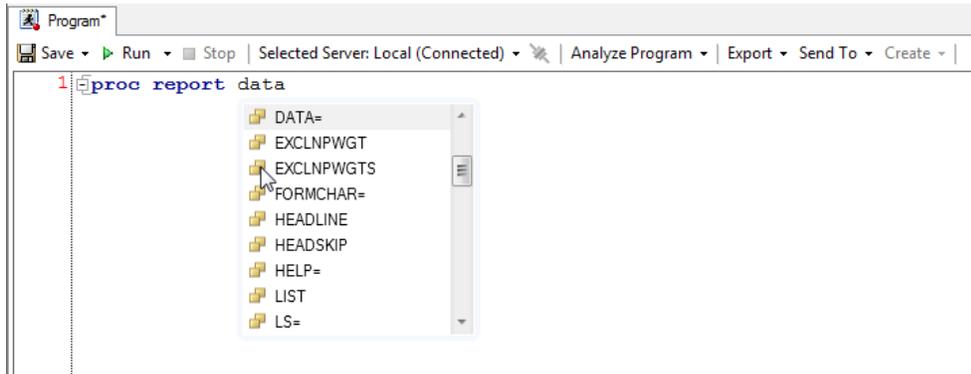


Figure 21. SAS keyword assistance in Enterprise Guide 7.1.

Hovering the mouse over a blue-colored keyword will display more detailed syntax help and links, as shown in Figure 22, which is another way to learn about SAS programming.

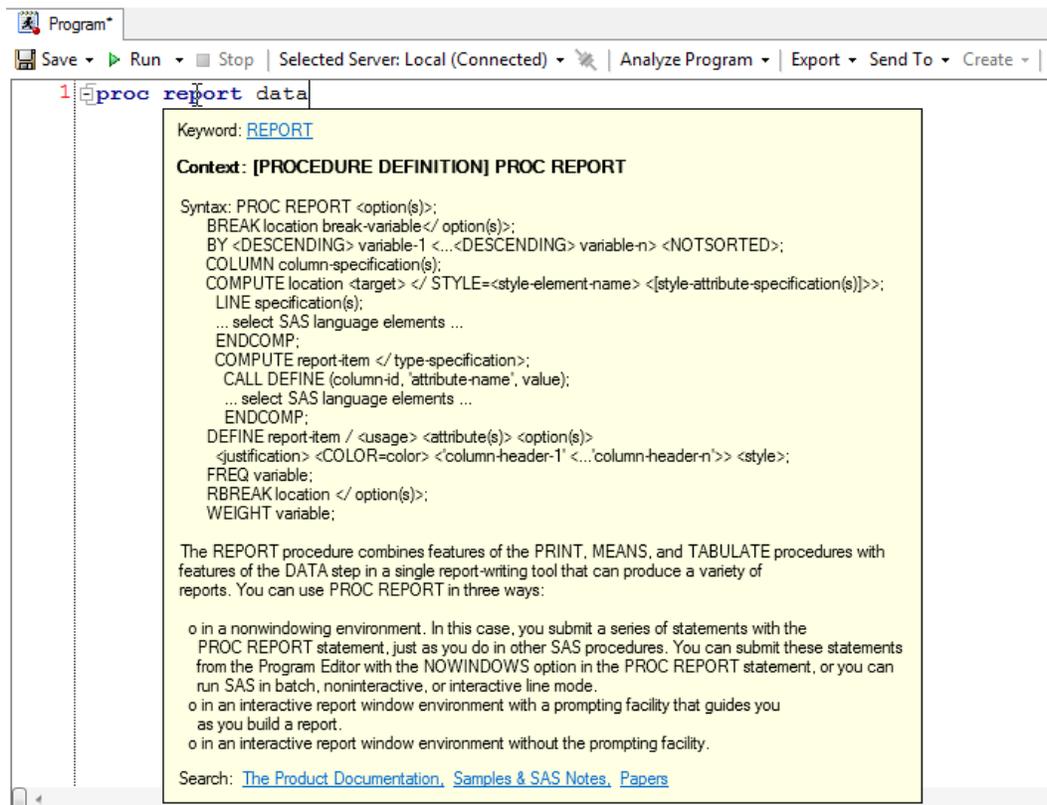


Figure 22. SAS syntax hints and help in Enterprise Guide 7.1.

Power Users

If you are a Power User, then reading to this part of the paper has probably been an achievement in itself. Traditionally, Power Users have programmed everything from scratch, or, at least, started from an existing SAS program and then amended it to suit their current requirements. That said, both SAS Studio and Enterprise Guide may have features that could be of great use to Power Users.

Display Manager (DMS)

Most Power Users will be very familiar with the programming environment of the Display Manager. Enhanced Editor, Log and Output windows are viewed as the natural way to program in SAS.

SAS Studio

SAS Studio introduced the concept of Snippets to the SAS programming environment. Basically a small sample of SAS code that can be pasted directly into an existing program. The following Snippet provides some template code to import an XLS file, as shown in Figure 23.

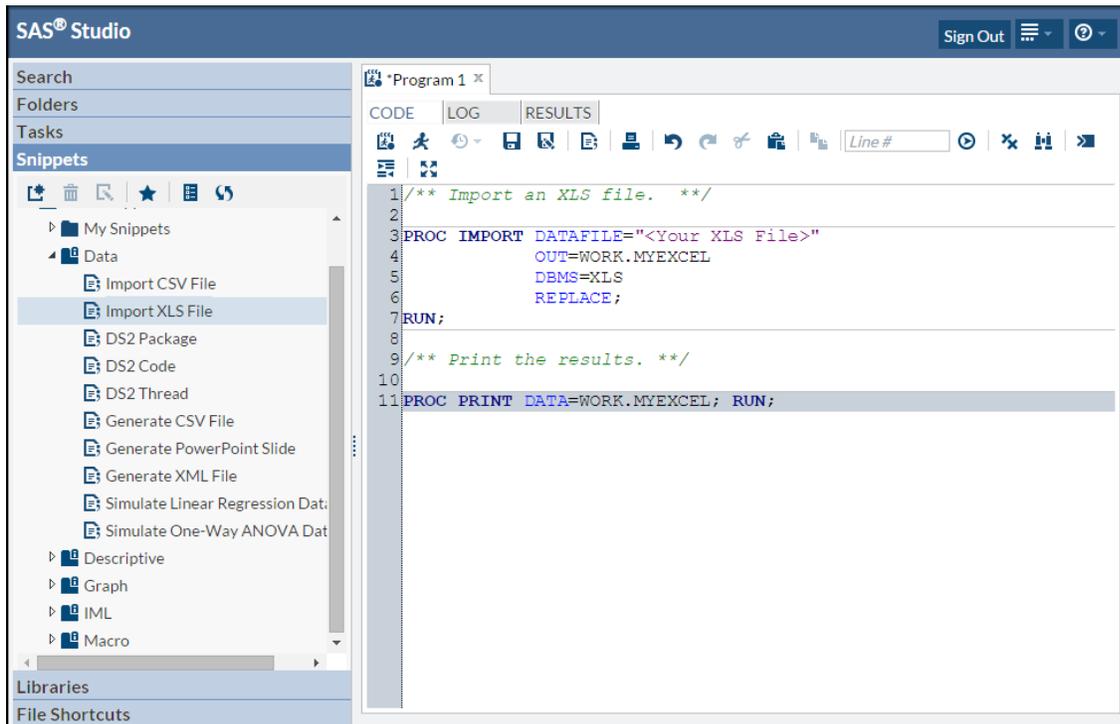


Figure 23. Import XLS File from Data-related Snippets in SAS Studio.

Snippets are provided for a wide range of coding situations. The following Snippet provides some template code to create a horizontal bar chart using ODS Graphics, as shown in Figure 24.

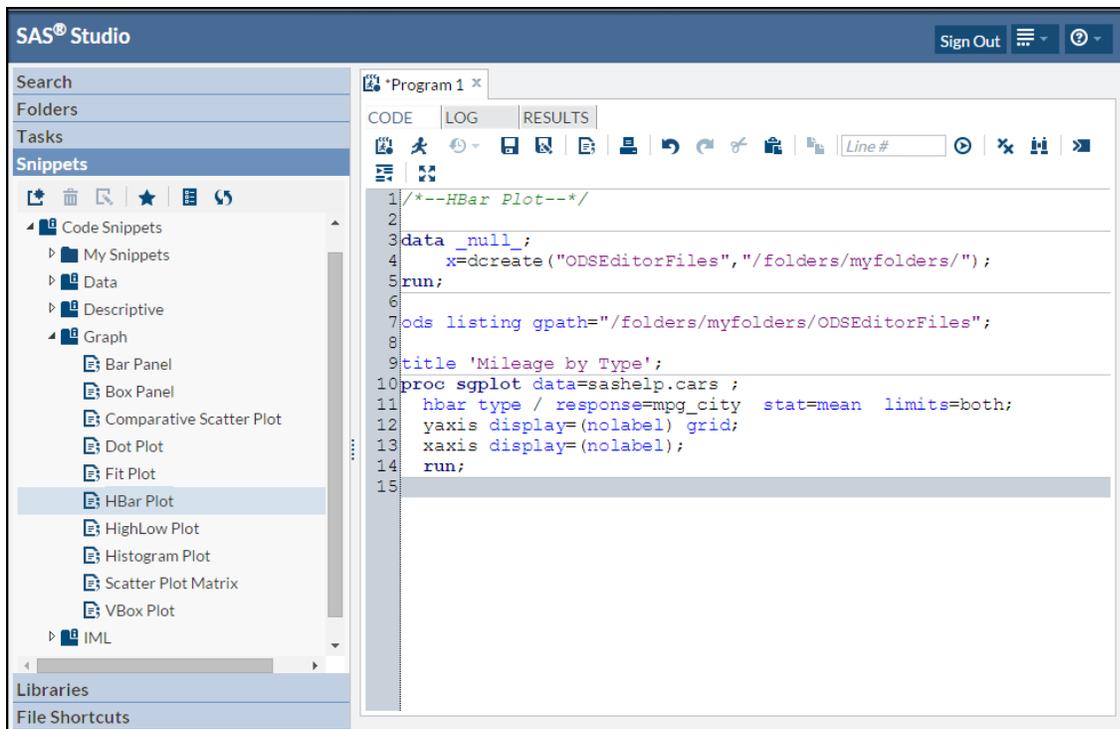


Figure 24. Horizontal Bar chart from Graph-related Snippets in SAS Studio.

While you may not need to be told how to import XLS files or draw Horizontal Bar charts in ODS Graphics, there is also the facility to save your own Snippets in My Snippets, so SAS code that you regularly use, but is time-consuming to type, could be saved there and re-used easily in future programs.

There are a number of features in SAS Studio that could assist Power Users, including formatting code:

The code in Figure 25:

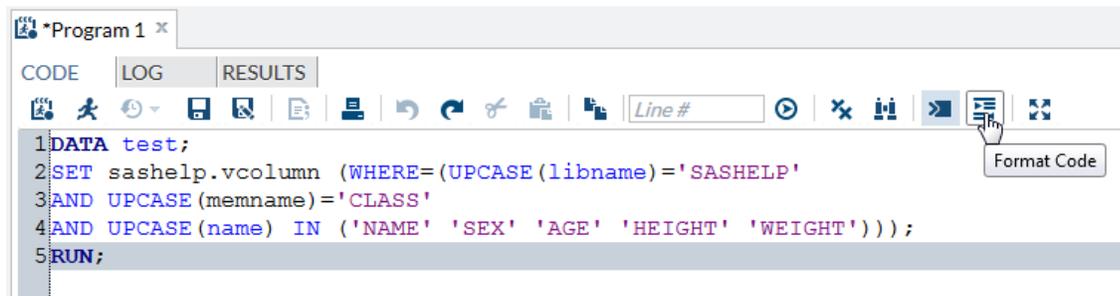


Figure 25. SAS code before formatting by SAS Studio.

becomes the code in Figure 26:

```
1 DATA test;
2     SET sashelp.vcolumn (WHERE=(UPCASE(libname)='SASHELP' AND
3         UPCASE(memname)='CLASS' AND UPCASE(name) IN ('NAME' 'SEX' 'AGE'
4             'HEIGHT' 'WEIGHT')));
5 RUN;
```

Figure 26. SAS code after formatting by SAS Studio.

However, you will see later that Enterprise Guide is much more aware of SAS syntax, which makes its indenting of code much better.

Enterprise Guide

Have you ever needed to run a collection of SAS programs in a particular order, but have forgotten what that order is? Enterprise Guide has a solution to that problem. Any icon on the Process Flow in an Enterprise Guide project can be connected with an arrow to another icon, and the processes associated with each icon will be run according to the direction of that arrow. There is even an icon that can be added that allows conditional execution too, based on macro variable values, or the existence of SAS data sets. Figure 27 demonstrates a very simple flowchart, but branching networks, as well as starting execution from any icon, are possible.

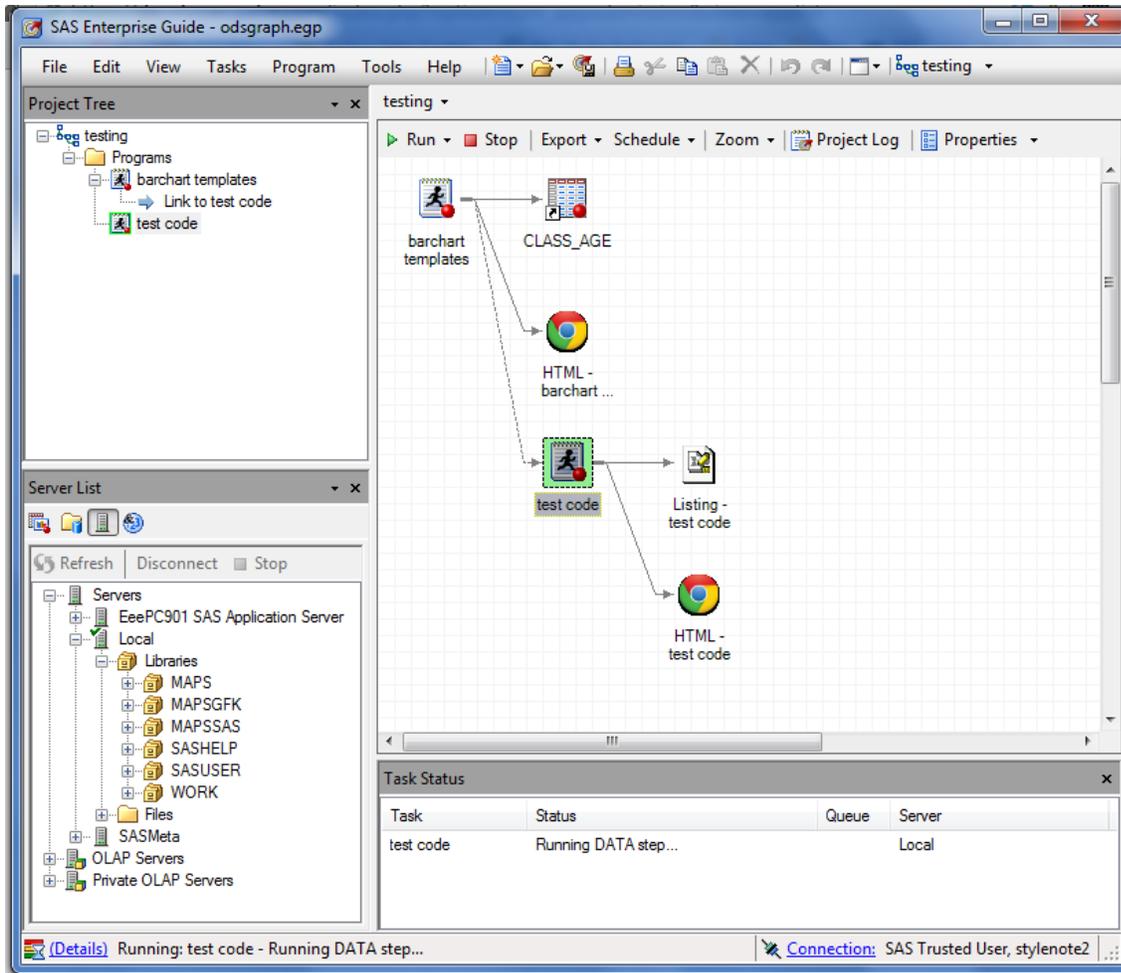


Figure 27. Connected program nodes in Enterprise Guide 7.1.

There are many other features of Enterprise Guide that can be helpful to Power Users:

- Highlighting of matching brackets, as shown in Figure 28:

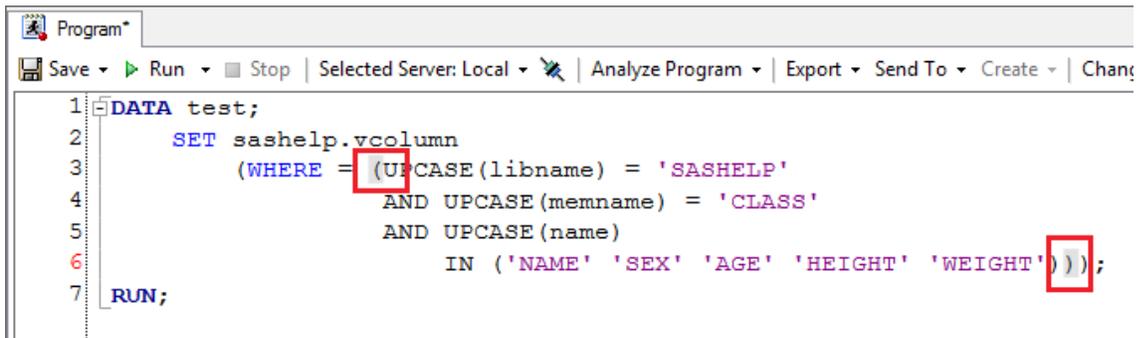
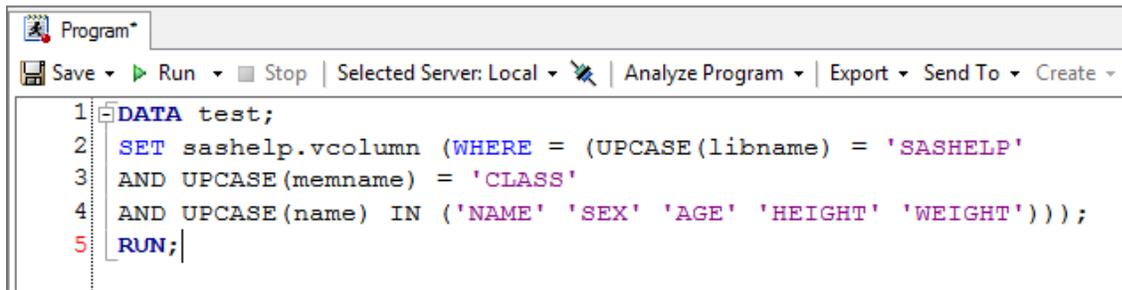


Figure 28. Highlighting matching brackets in Enterprise Guide 7.1.

- Enterprise Guide can very simply indent selected code by just typing [Ctrl + I], but typing [Ctrl + Z] will restore the previous layout if you don't like the changes made. Examples of unformatted and indented code are shown in Figure 29 and Figure 30, respectively.

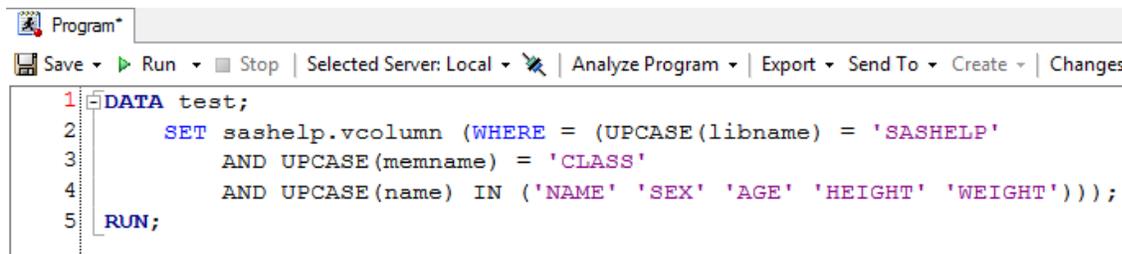


The screenshot shows the SAS Enterprise Guide 7.1 interface. The title bar reads "Program*". The menu bar includes "Save", "Run", "Stop", "Selected Server: Local", "Analyze Program", "Export", "Send To", and "Create". The code editor contains the following SAS code:

```
1 DATA test;
2 SET sashelp.vcolumn (WHERE = (UPCASE(libname) = 'SASHELP'
3 AND UPCASE(memname) = 'CLASS'
4 AND UPCASE(name) IN ('NAME' 'SEX' 'AGE' 'HEIGHT' 'WEIGHT')));
5 RUN;
```

Figure 29. SAS code before formatting by Enterprise Guide 7.1.

becomes:



The screenshot shows the SAS Enterprise Guide 7.1 interface with the same code as Figure 29, but now formatted with indentation. The title bar reads "Program*" and the menu bar includes "Save", "Run", "Stop", "Selected Server: Local", "Analyze Program", "Export", "Send To", "Create", and "Changes". The code editor contains the following SAS code:

```
1 DATA test;
2     SET sashelp.vcolumn (WHERE = (UPCASE(libname) = 'SASHELP'
3         AND UPCASE(memname) = 'CLASS'
4         AND UPCASE(name) IN ('NAME' 'SEX' 'AGE' 'HEIGHT' 'WEIGHT')));
5 RUN;
```

Figure 30. SAS code after formatting by Enterprise Guide 7.1.

You can also customize how and when the indenting is done.

- There is a Log Summary, which displays a list of ERROR, WARNING and NOTE messages from the log.
- Automatic retention of the log and output, as long as you save the EG project file.
- The program icons in the Project Tree and Process flow change to indicate any ERROR or WARNING messages.
- It is possible to save links to external files on the Process Flow, like PDF, DOC(X) and RTF files. Using this feature EG project files can be project desktops, where links to all the relevant files can be found.

Interface and Task Developers

The functionality of both SAS Studio and Enterprise Guide can be extended by writing your own custom Tasks.

SAS Studio

SAS Studio tasks are based on XML files, which can be created and updated within SAS Studio itself by clicking the New Task icon, as shown in Figure 31.

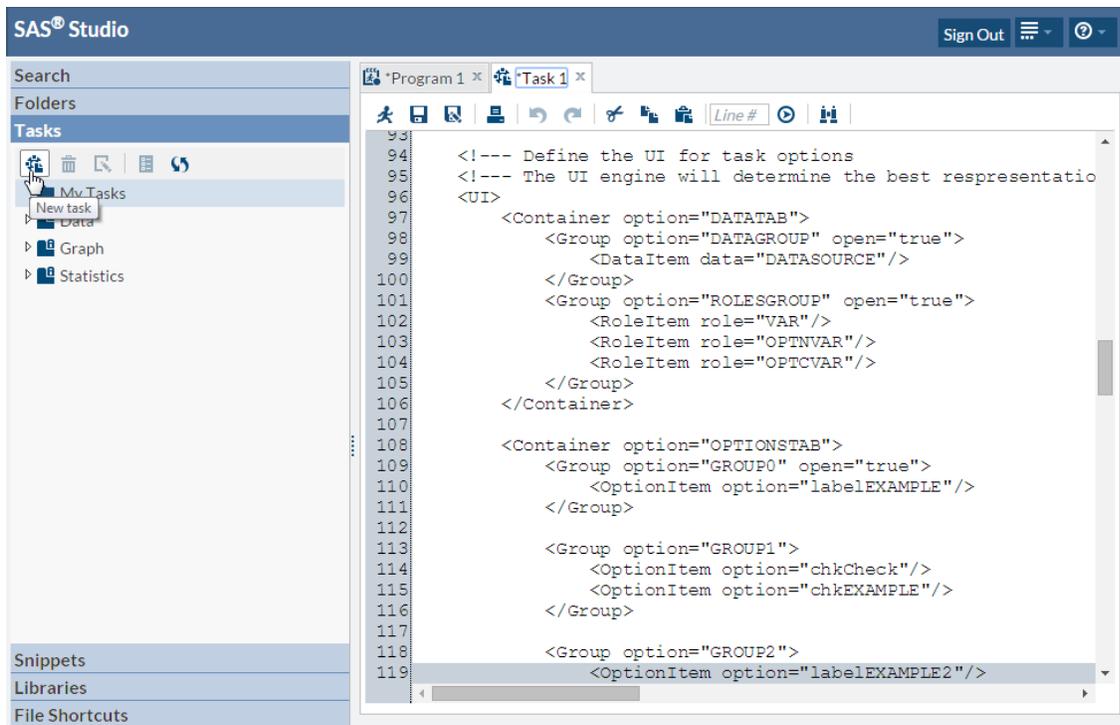


Figure 31. Creating a new Task in SAS Studio.

Clicking on the Run (the running man) icon will display the Task template, as shown in Figure 32.

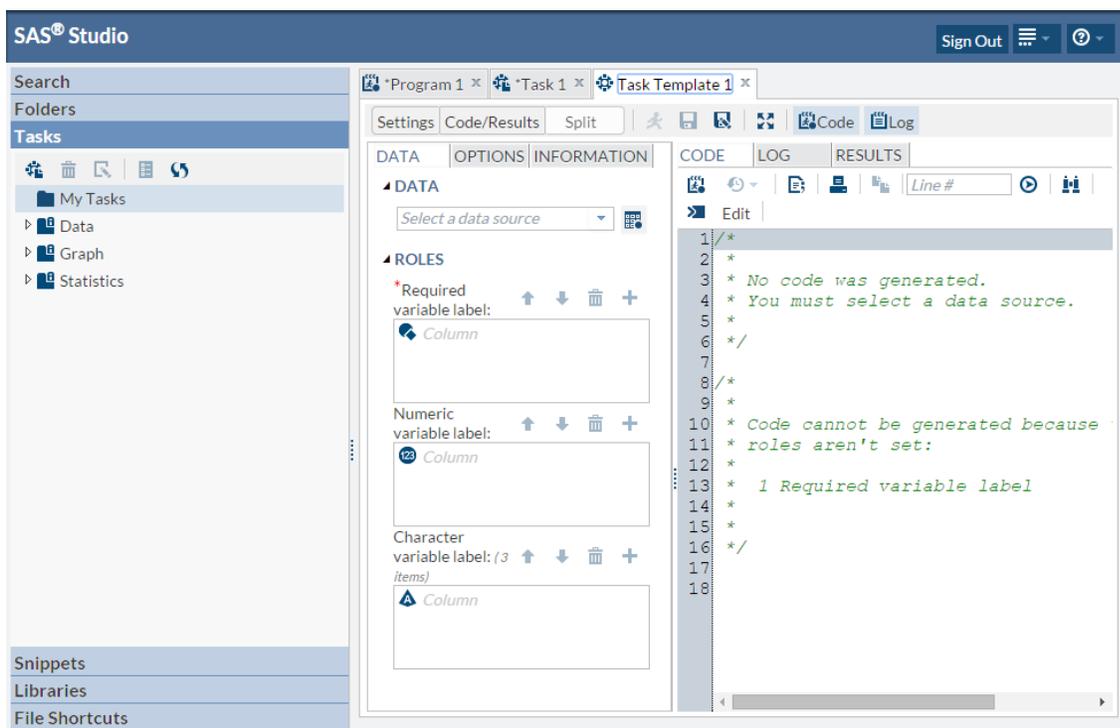


Figure 32. Viewing a new Task Template in SAS Studio.

Enterprise Guide

Custom Tasks for Enterprise Guide can be developed using Microsoft .Net. This could be using Visual Basic .Net, or C# .Net, and copied into specific folders as *.dll files. SAS provide a wide range of libraries for use in Custom Task development.

CONCLUSIONS

The question posed in this paper is which is the best development environment for SAS programming. The answer inevitably depends on what platform you are using, but also on your SAS programming experience.

My recommendations are as follows:

- Academic users should take advantage of SAS Studio, as it is available as a free SAS programming environment in SAS University Edition.
- Novice and intermediate programmers should consider SAS Studio and Enterprise Guide as equally valid alternatives, provided they are working on Windows PCs, otherwise SAS Studio is the recommended option.
- Power Users should, in spite of peer pressure and inertia, be converting their environment of choice from Display Manager to Enterprise Guide. The change will give them access to vastly improved editing functionality, as well as the ability to create a collection of links to relevant documents.
- Interface and Task Developers have to consider whether they want to develop Tasks for SAS Studio or Enterprise Guide, but with the knowledge that SAS Studio Tasks are also available to Enterprise Guide 7.1.

REFERENCES

Holland, Philip R. June 2015. *SAS Programming and Data Visualization Techniques*. Apress.

Hemendinger, Chris. December 2012. *Custom Tasks for SAS Enterprise Guide Using Microsoft .NET*, SAS Press.

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