

SAS® Studio: A New Way to Program in SAS®

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ABSTRACT

SAS Studio is an important new interface for SAS, designed for both traditional SAS programmers and for point-and-click users. For SAS programmers, SAS Studio offers many useful features not found in the traditional Display Manager including integrated syntax help, one touch code formatting, and the ability to drag and drop variable and data set names into your code. SAS Studio runs in a web browser. You write programs in SAS Studio, submit the programs to a SAS server, and the results are returned to your SAS Studio session. SAS Studio is included in the license for Base SAS, is the interface for SAS® University Edition, and is the default interface for SAS® OnDemand for Academics. Both SAS University Edition and SAS OnDemand for Academics are free of charge for non-commercial use. With SAS Studio becoming so widely available, this is a good time to learn about it.

INTRODUCTION

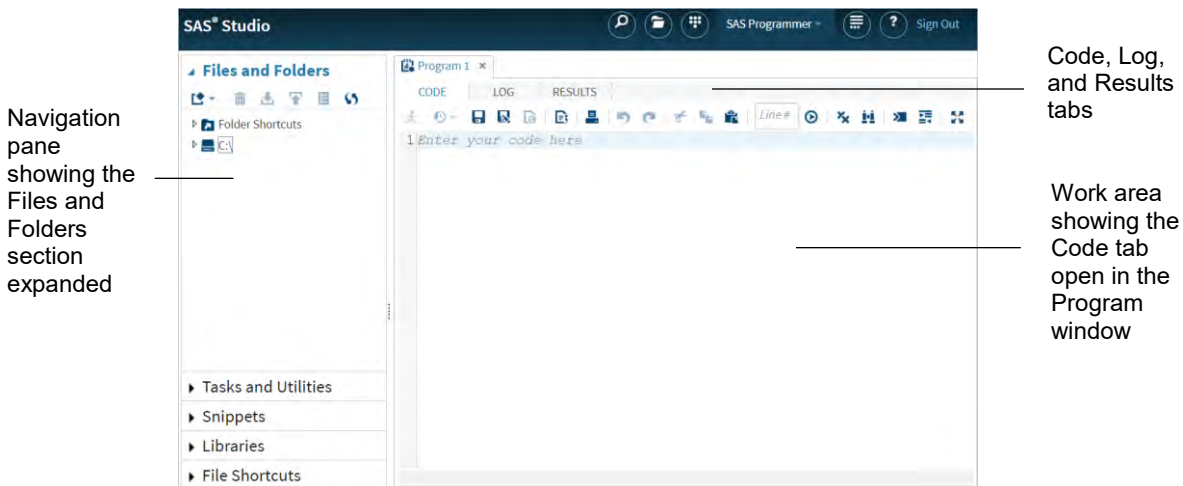
For many years SAS programmers only had one interface, the SAS windowing environment (also known as Display Manager), where they could write code and see the SAS log and their results all in one place. Now we have three choices: the traditional Display Manager, SAS Enterprise Guide® which was introduced several years ago, and SAS Studio. SAS Studio is different because it runs in a web browser. This means that you can run SAS Studio from most devices that can open a web browser. In contrast, SAS Enterprise Guide is limited to Windows computers and Display Manager will only work on Windows, UNIX and z/OS.

When you start SAS Studio, it opens in a web browser. Then when you submit your SAS programs, your code is sent to the SAS server associated with the SAS Studio session and results are returned to your browser. The SAS server can be your local computer, a server in your network, or a hosted server in the cloud. SAS University Edition uses SAS Studio as the interface to a SAS server that runs on a virtual Linux server installed on your local computer. SAS OnDemand for Academics runs on Linux servers hosted by SAS Institute. If you have SAS installed on your local computer, then you can use the single-user version of SAS Studio which comes with Base SAS. All examples in this paper use SAS Studio single-user edition.

The fact that SAS Studio runs in a web browser is not the only thing that makes it different. SAS Studio offers great new tools that can make programming easier. This paper describes several of these new tools and gives an overview of the SAS Studio Interface.

THE SAS STUDIO INTERFACE

When you first open SAS Studio, you will see the navigation pane on the left, and work area on the right. At the top of the window you can choose either Visual Programmer mode or SAS Programmer mode. If you choose SAS Programmer mode, then the work area will show the Program window with the Code, Log, and Results tabs. Other windows also appear in the work area, but are closed by default. The following figure shows the home screen for a SAS Studio session in SAS Programmer mode showing the navigation pane on the left and the Program window in the work area on the right.





Display 1. The SAS Studio Interface in SAS Programmer Mode

The navigation pane gives you easy access to your files and SAS libraries as well as tasks, code snippets, and file shortcuts. You can expand a section of the navigation pane by clicking it. The single-user edition of SAS Studio (as shown here) has a section named Files and Folders, while SAS University Edition and SAS OnDemand for Academics have a section named Server Files and Folders instead.

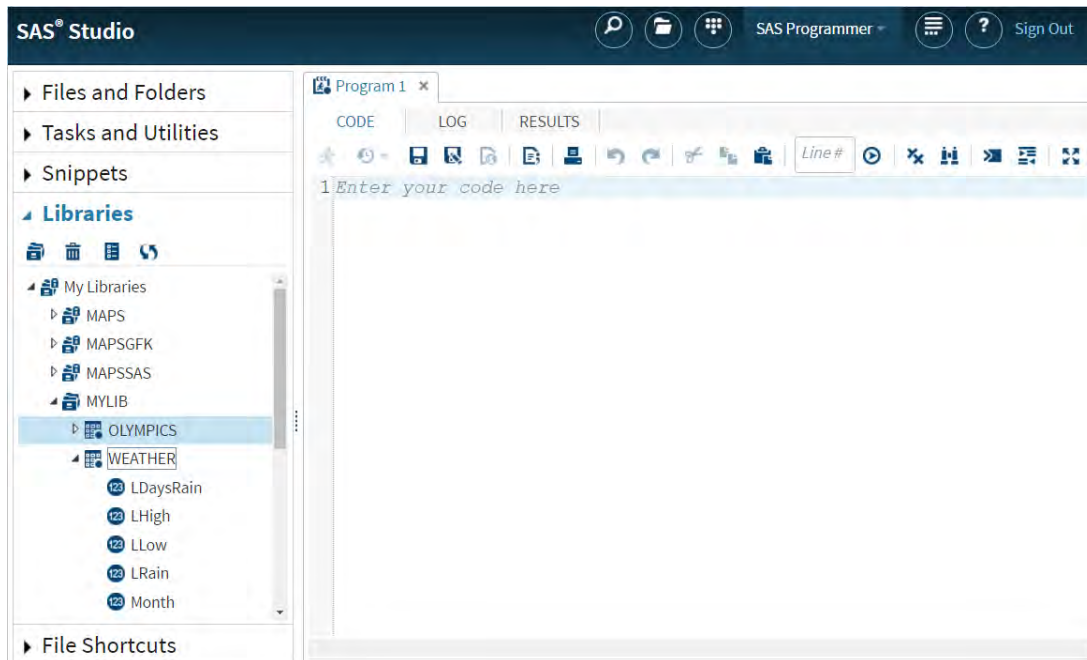
The work area on the right is where you write and submit your SAS programs and view your results. There are three tabs in this window. The Code tab contains a text editor. You can use the editor to type, edit, and run SAS programs as well as edit other text files such as raw data files. The Log tab contains notes about your SAS session. After you run a SAS program, any notes, errors, or warnings associated with your program as well as the program statements themselves will appear in the Log tab. If your program generates any printable results, then they will appear in the Results tab. In addition, if your program creates any SAS data sets, these will be displayed in a fourth tab labeled Output Data.

The toolbar located just below the tabs in the work area, gives you quick access to icons for many operations. The toolbar is context sensitive, so the available icons will change depending on which windows are open in the work area.

You can change the relative sizes of the navigation pane and work area by dragging the bar that separates them to the right or left. You can also maximize the work area by clicking the Maximize view icon  on the toolbar. With the work area maximized, you will not see the navigation pane. To return the windows to their original configuration, click the Exit maximized view icon .

ACCESSING SAS DATA SETS

You can access existing SAS data sets through the Files and Folders (or Server Files and Folders) section of the navigation pane, or from the Libraries section. Using the Files and Folders section is simple, but there are advantages to using the Libraries section. In the Libraries section, you can see all the SAS data sets contained in the library as well as all the variables in the data sets. In the Files and Folders section you are not able to see any variable names. The following shows the Libraries section of the navigation pane displaying the contents of the MYLIB library. The MYLIB library contains two SAS data sets, OLYMPICS and WEATHER. In this example, the WEATHER data set has been expanded to show the variable names in the data set.

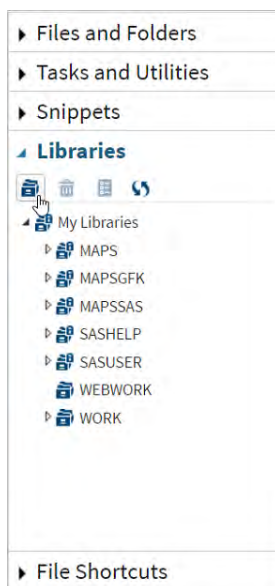


Display 2. The Libraries Section of the Navigation Pane

CREATING A NEW LIBRARY

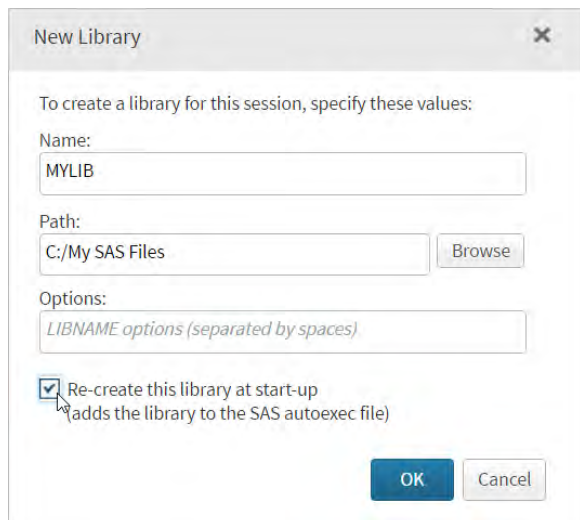
In order to access data sets through the Libraries section, the data sets must be in a SAS library. To create a SAS library you can either, write and submit a LIBNAME statement in a program, or you can use the New Library window.

To open this window, click the New library icon  in the Libraries section of the navigation pane.



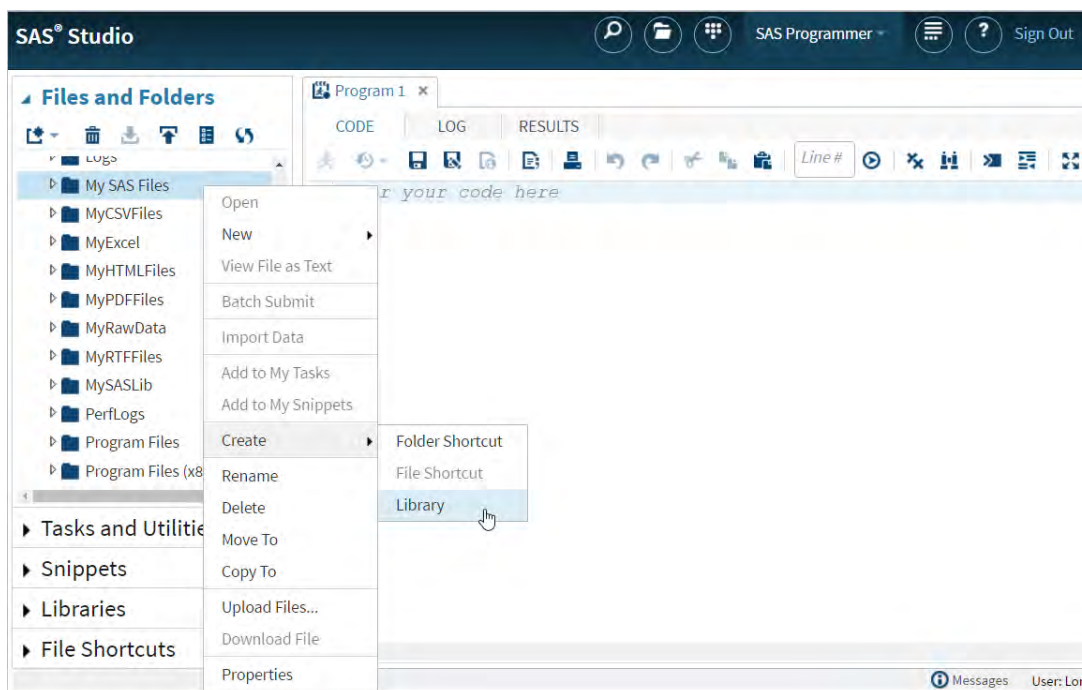
Display 3. Opening the New Library Window from the Libraries Section of the Navigation Pane

In the New Library window, type the name of the library you want to create and type the path for your folder in SAS Studio. This example shows a Windows-style path like you would use for SAS Studio single-user edition. SAS University Edition and SAS OnDemand for Academics both run UNIX so for them you would use the appropriate UNIX-style path. If you don't know the path, you can use another method described next. If you want SAS to define your library reference every time you start SAS Studio, then check the **Re-create this library at start-up** box. Click **OK** and then your new library reference will appear under My Libraries in the Libraries section of the navigation pane.



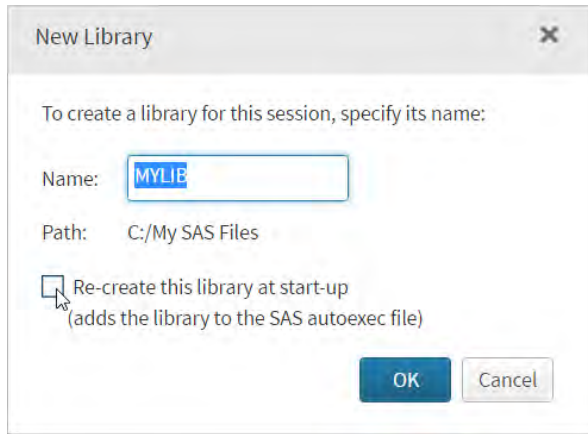
Display 4. The New Library Window When Opened from the Libraries Section of the Navigation Pane

You can also access the New Library window by clicking Files and Folders (or Server Files and Folders) in the navigation pane on the left and clicking the desired folder in the navigation pane. Then right-click the folder and choose **Create ► Library** from the pop-up menu.



Display 5. Opening the New Library Window from the Files and Folders Section of the Navigation Pane

When you open the New Library window this way, the Path field is already filled in with the path for the folder you selected.



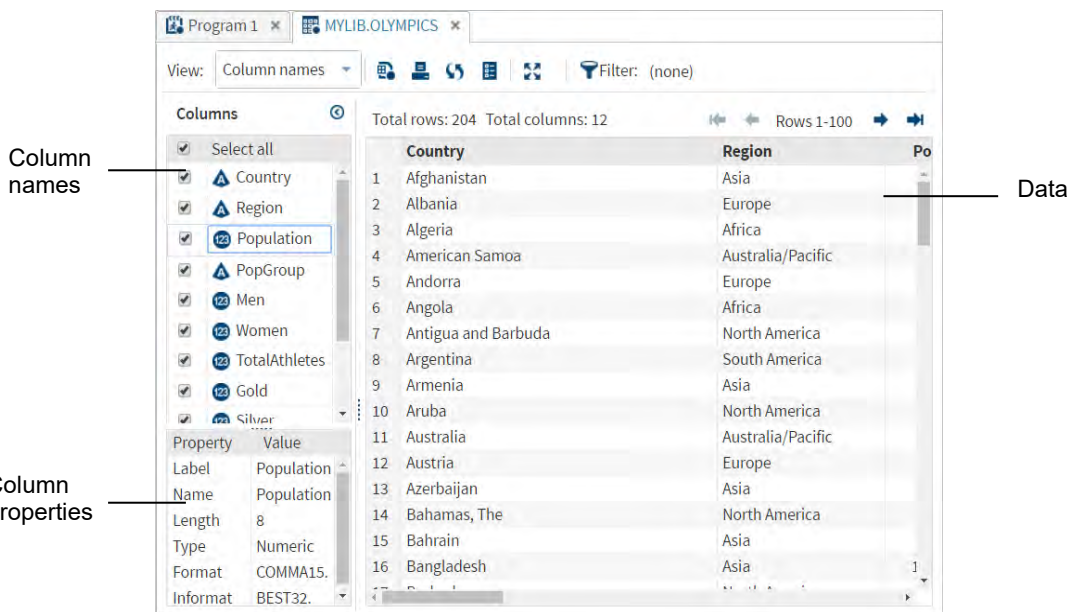
Display 6. The New Library Window When Opened from the Files and Folders Section of the Navigation Pane

VIEWING DATA SETS

In addition to listing your current libraries and creating new libraries, you can also use the navigation pane to open SAS data sets for viewing. The table viewer in SAS Studio has a number of features not available with Viewtable in Display Manager including the ability to change the order of columns and display column names and properties alongside the actual data.

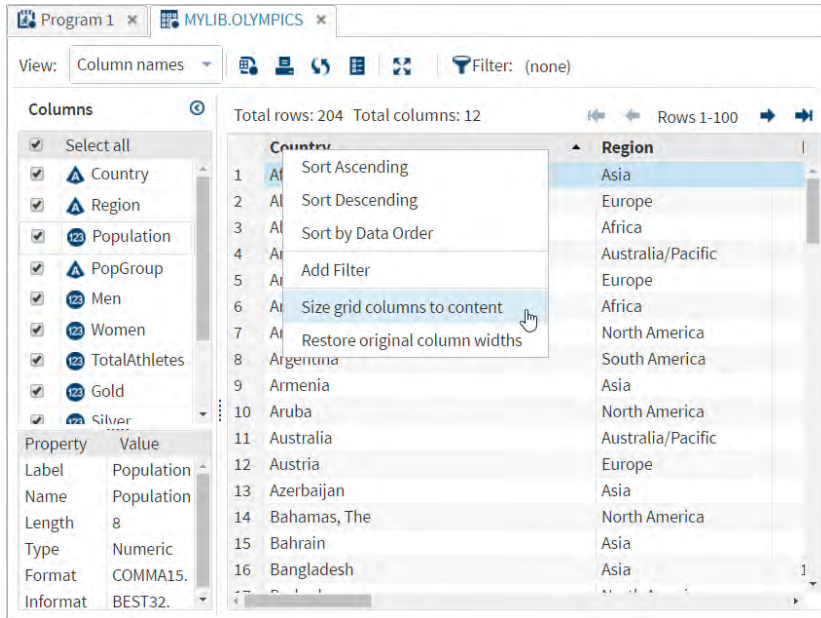
If the data set is in a SAS library, you can open it in the table viewer by double-clicking the data set name in the Libraries section of the navigation pane. Alternatively, from the Files and Folders (or Server Files and Folders) section of the navigation pane, you can right-click the data set name and select **Open** from the pop-up menu, double-click the data set name, or drag the data set to the work area.

The following shows the data set named OLYMPICS from the MYLIB library. The column names and properties appear in the panel on the left, and the data appear on the right. Initially data for all columns are displayed, but you can hide columns if you like by unchecking them in the panel on the left. You can also change the order in which the columns are displayed by dragging the column headings in the table to the left or right, or dragging the column names up or down in the list on the left. The table viewer will display up to 100 observations (also called rows) of data at one time. To see different observations, use the arrows in the top-right corner of the table viewer to go forward and backward in your data set. The total number of rows and columns in the data set are displayed just above the data. Column properties are displayed when you click a column name in the list of columns.



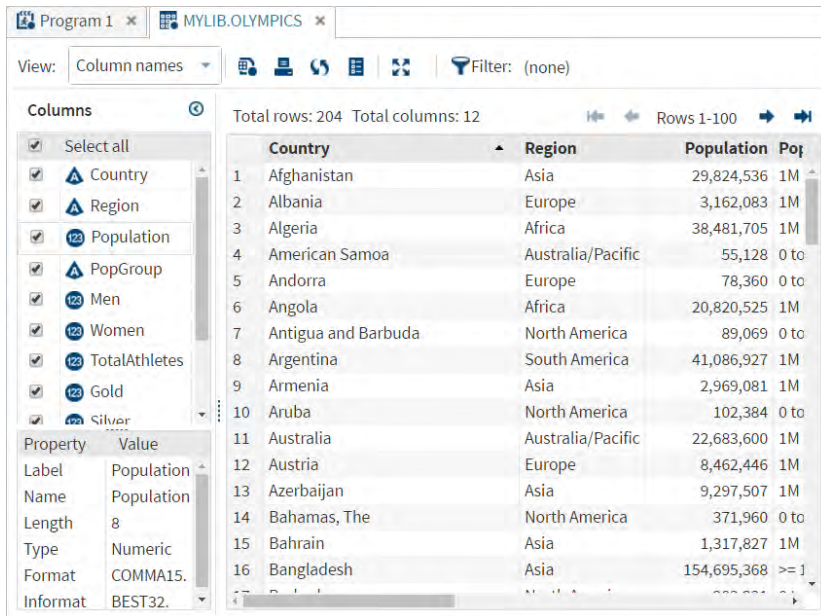
Display 7. The OLYMPICS Data Set Open in the Table Viewer

You can adjust the size of the columns by dragging the column dividers to the right or left. You can also resize all columns at once by right-clicking any column heading and selecting **Size grid columns to content** from the pop-up menu.



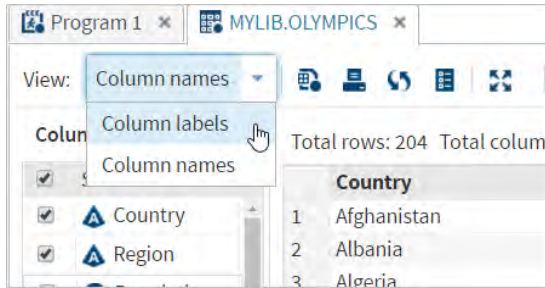
Display 8. Resizing Column Widths to Content

The following shows the OLYMPICS data set after resizing the columns.



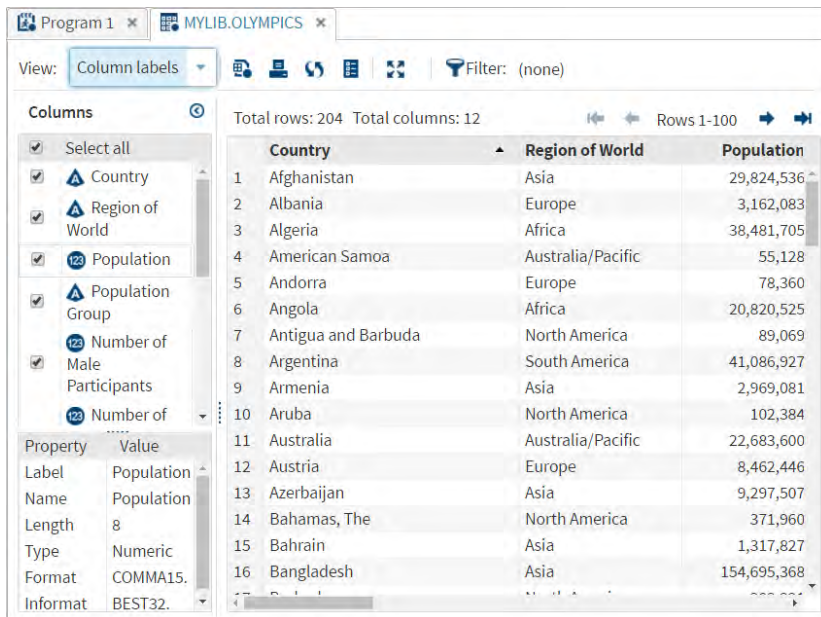
Display 9. The OLYMPICS Data Set after Resizing Column Widths

By default, the table viewer displays variable names for column headings. Sometimes you may want to see the variable labels instead of the names. To do this, click the down-arrow next to **Column names** and select **Column labels**.



Display 10. Choosing to Display Column Labels Instead of Column Names

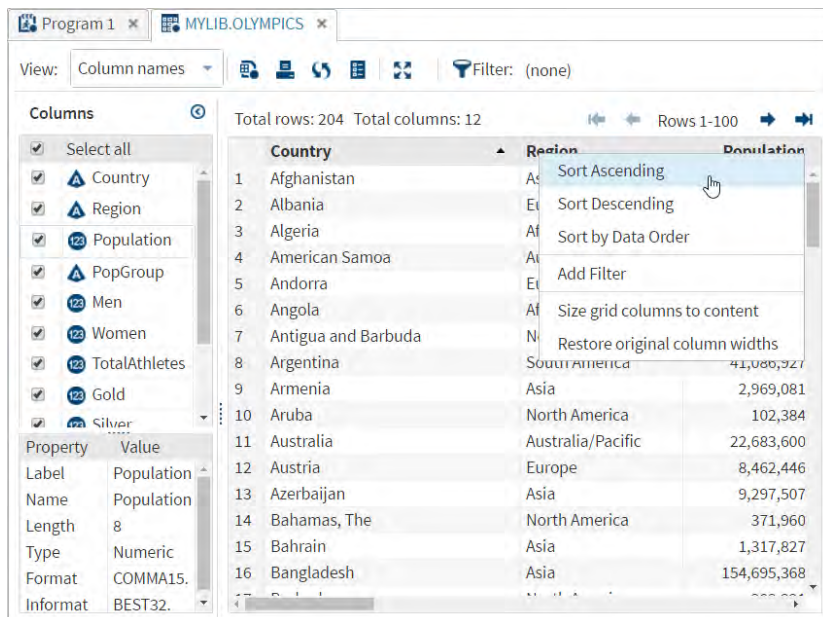
Here is the OLYMPICS data set showing the column labels instead of the names. Note that the labels now appear in the column headings as well as in the list of columns on the left.



Display 11. The OLYMPICS Data Set Showing Column Labels Instead of Names

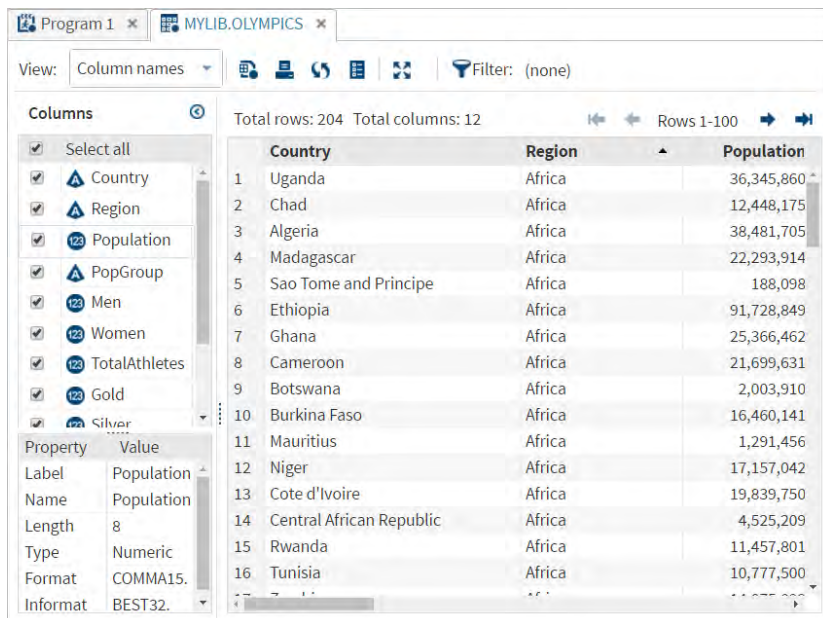
SORTING DATA IN THE TABLE VIEWER

If you click a column heading, SAS will sort the data set by that variable in ascending order. Click the column heading again, and SAS will sort the data set by the variable in descending order. Alternatively, if you right-click a column heading, a pop-up menu will appear. Then you can choose to sort the data set by ascending, descending, or data order (the order in which observations are stored in the data set).



Display 12. Sorting the OLYMPICS Data Set by Region in the Table Viewer

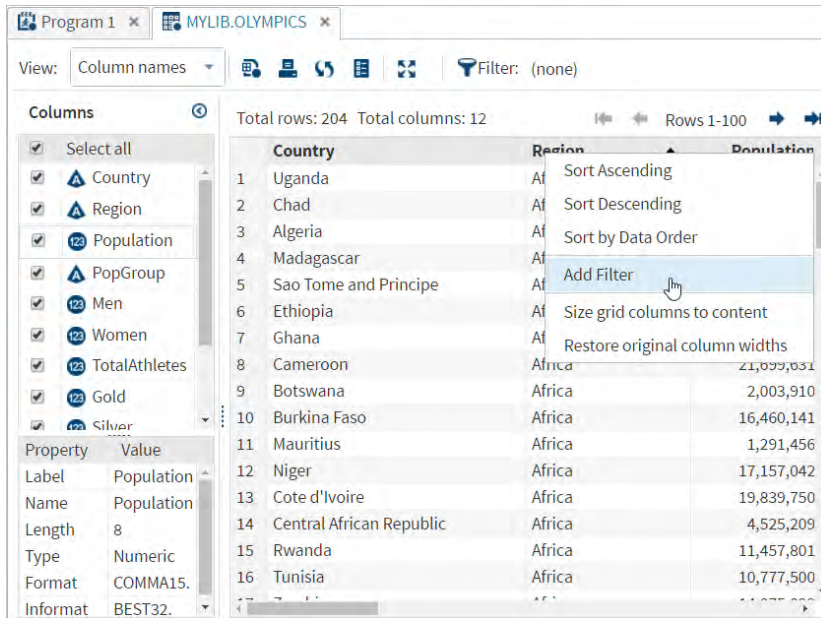
Here is the OLYMPICS data set sorted by Region.



Display 13. The OLYMPICS Data Set after Sorting by Region

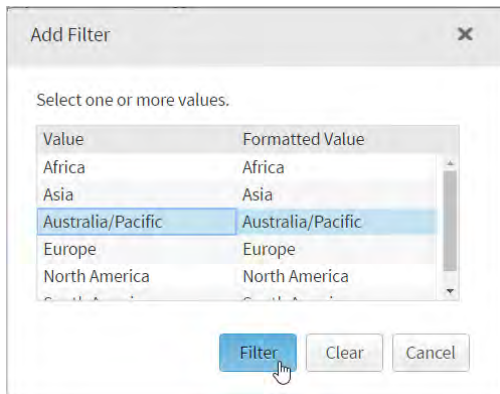
FILTERING DATA IN THE TABLE VIEWER

You can also use the filter feature to show subsets of your data in the table viewer. Access the filter feature by right-clicking the column heading you want to use as the basis of the filter and select **Add Filter** from the pop-up menu.



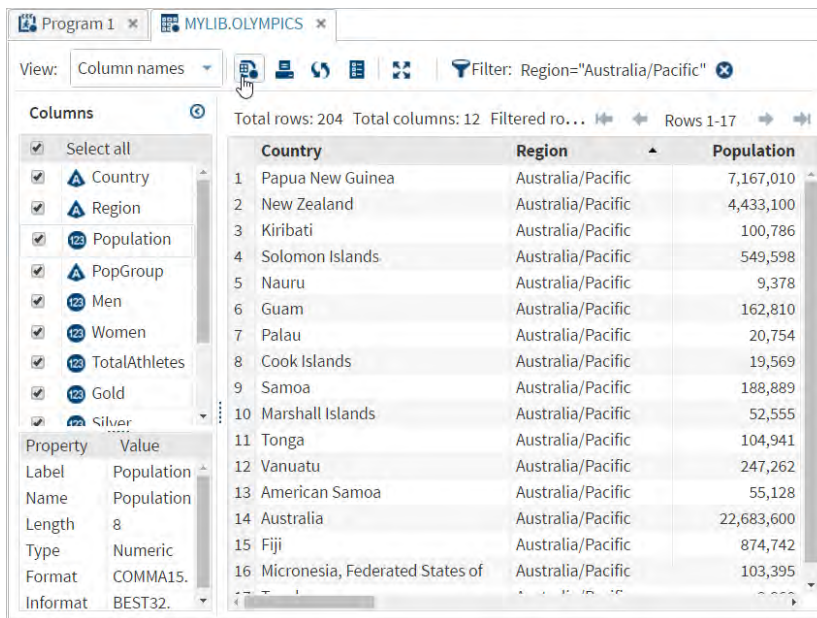
Display 14. Adding a Filter in the Table Viewer

A new window will open where you can specify your filter by selecting one or more values. If your data set is large (>50,000 rows), or you have many unique values for the selected column (>10 for numeric columns, or >30 for character columns) then values will not appear in the Add Filter window and you will need to type in the desired value(s). Here the OLYPMICS data set is being filtered to display only the countries from the Australia/Pacific region.




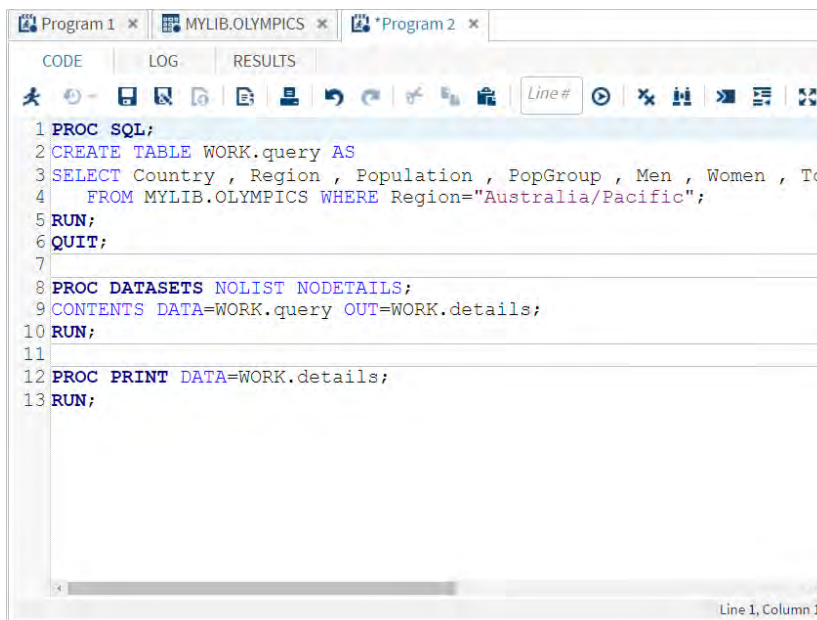
Display 15. The Add Filter Window for the Region Column

Here is the data set after filtering. The new filter (Region = "Australia/Pacific") is displayed on the toolbar.



Display 16. The OLYMPICS Data Set after Filtering for the Australia/Pacific Region

When you open data in the table viewer, PROC SQL code is generated behind the scenes to create the specified view of the data. To view the SQL code that is generated, click the Display the code that generates the current table icon , above the data set. The generated code will be displayed in a new Program window as shown in the following display.



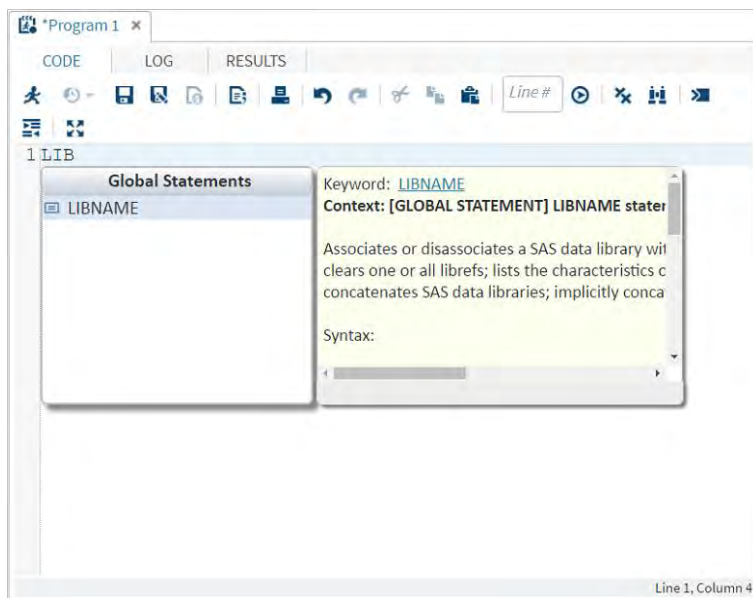
Display 17. The PROC SQL Code Generated by Filtering the OLYMPICS Data Set

THE CODE EDITOR


The code editor in SAS Studio has many features not available in the Display Manager including syntax help, the ability to drag and drop variable and data set names into your code, and a feature for automatically formatting your code.

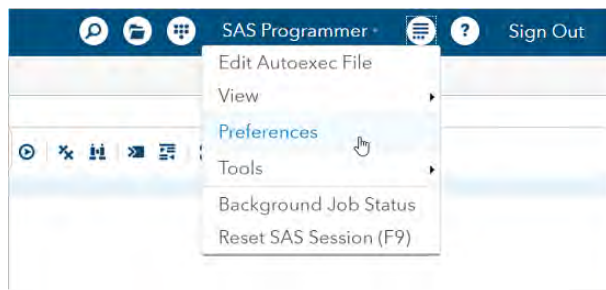
SYNTAX HELP

By default, the code editor has syntax sensitive help that pops up while you type. You can choose to keep the help on all the time, or you can turn it off and only access it when you want. The following figure shows a SAS program being entered into the code editor. You can see that the letters LIB were typed on the first line. A help window has popped up showing syntax for the LIBNAME statement. SAS Studio will give you lists of possible keywords and the associated syntax, and when appropriate, will even show you lists of data set names that you can include in your code.



Display 18. Automatic Syntax Help in the Code Editor

While the syntax help can be very useful, especially if you are new to SAS programming, not everyone likes to see so many pop-up windows. You can turn the syntax help off in the Preferences window. Open the Preferences window by clicking the More application options icon  and selecting **Preferences**.



Display 19. Opening the Preferences Window

Then in the Preferences window, click **Editor** in the selection pane on the left and uncheck **Enable autocomplete**. Click **Save** to save the changes.

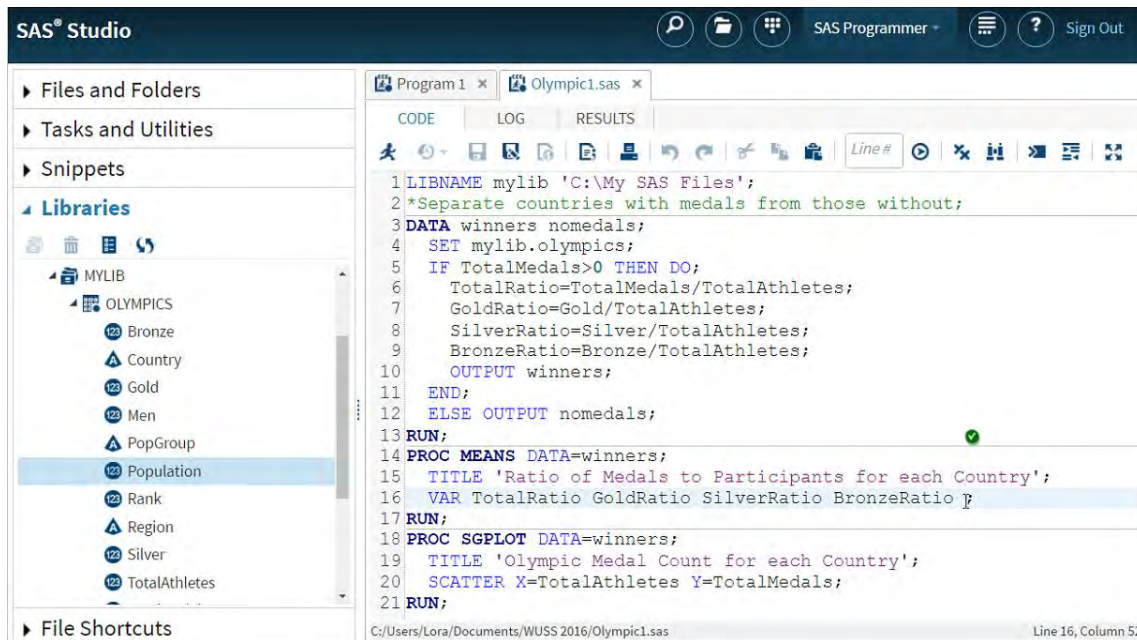


Display 20. Turning Off Autocomplete in the Preferences Window

Now the pop-up windows will not appear automatically, but you can still access them as you type by holding down the Control key <ctrl> and pressing the space bar.


DRAG AND DROP VARIABLE AND DATA SET NAMES

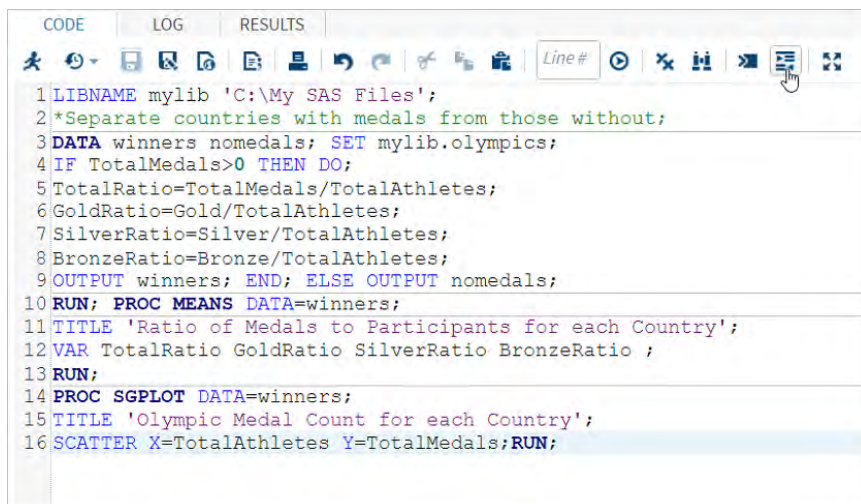
If you have the Libraries section of the Navigation pane open, you can drag and drop variable and data set names directly into your program. Simply position the cursor at the desired location in your program, then drag and drop the name into the code editor. The variable or data set name (including the libref) will be inserted at that position in your code. The following shows the Population variable being inserted at the end of the VAR statement.



Display 21. Dragging and Dropping the Column Name Population into the Code Editor

FORMATTING CODE

The format code feature is great for cleaning up messy code. All you have to do is click the Format Code icon  and SAS Studio will take your code and put every statement on a line by itself and insert appropriate spacing. For example, the following shows an unformatted program in the code editor with the Format Code button being selected.



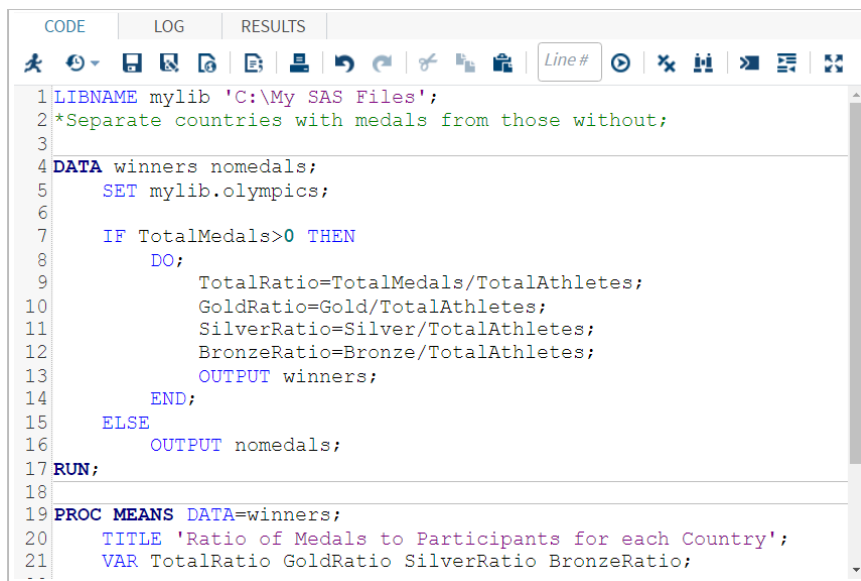
```

1 LIBNAME mylib 'C:\My SAS Files';
2 *Separate countries with medals from those without;
3 DATA winners nomedals; SET mylib.olympics;
4 IF TotalMedals>0 THEN DO;
5 TotalRatio=TotalMedals/TotalAthletes;
6 GoldRatio=Gold/TotalAthletes;
7 SilverRatio=Silver/TotalAthletes;
8 BronzeRatio=Bronze/TotalAthletes;
9 OUTPUT winners; END; ELSE OUTPUT nomedals;
10 RUN; PROC MEANS DATA=winners;
11 TITLE 'Ratio of Medals to Participants for each Country';
12 VAR TotalRatio GoldRatio SilverRatio BronzeRatio ;
13 RUN;
14 PROC SGPLOT DATA=winners;
15 TITLE 'Olympic Medal Count for each Country';
16 SCATTER X=TotalAthletes Y=TotalMedals;RUN;

```

Display 22. Choosing the Format Code Icon in the Program Window

Here is what the program looks like after formatting.




```

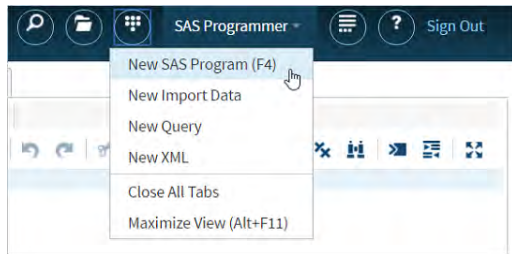
1 LIBNAME mylib 'C:\My SAS Files';
2 *Separate countries with medals from those without;
3
4 DATA winners nomedals;
5     SET mylib.olympics;
6
7     IF TotalMedals>0 THEN
8         DO;
9             TotalRatio=TotalMedals/TotalAthletes;
10            GoldRatio=Gold/TotalAthletes;
11            SilverRatio=Silver/TotalAthletes;
12            BronzeRatio=Bronze/TotalAthletes;
13            OUTPUT winners;
14        END;
15    ELSE
16        OUTPUT nomedals;
17 RUN;
18
19 PROC MEANS DATA=winners;
20     TITLE 'Ratio of Medals to Participants for each Country';
21     VAR TotalRatio GoldRatio SilverRatio BronzeRatio;

```

Display 23. The SAS Program after Formatting


OPENING A NEW PROGRAM WINDOW

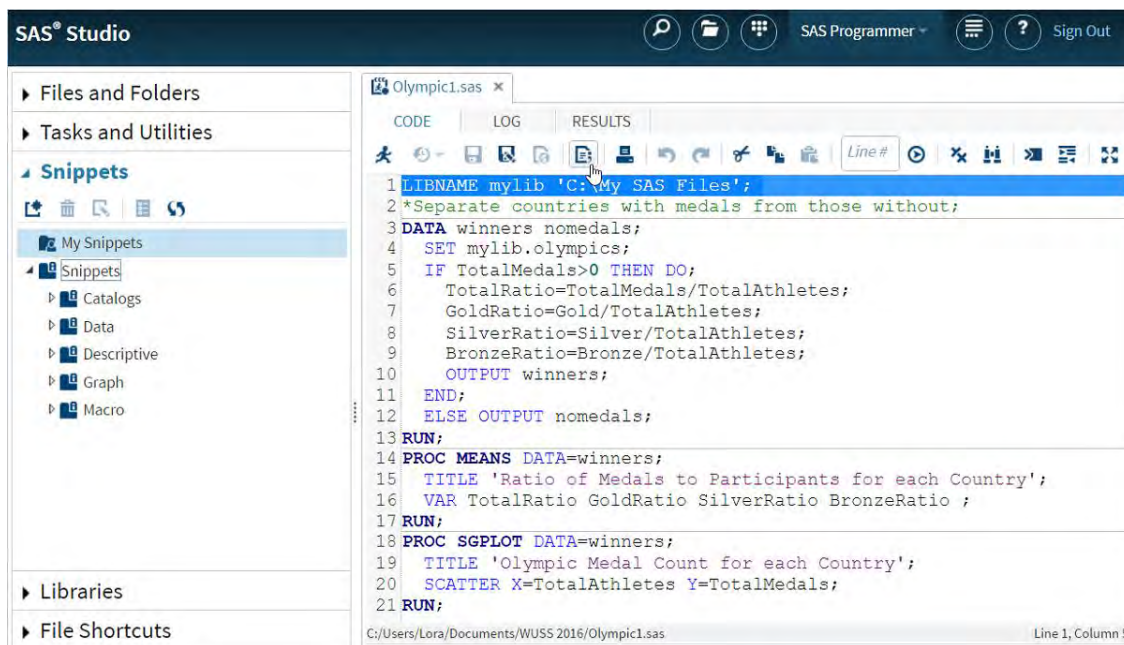
If you want to open a new Program window, click the New options icon  at the top of SAS Studio and select **New SAS Program** from the pop-up menu. This will open an empty Program window in the work area.



Display 24. Opening a New SAS Program Window

CODE SNIPPETS


If you find that you have pieces of code that you use over and over, you can save these to a code snippet for easy access. SAS Studio also has several built-in code snippets that you may find useful. To save code to a code snippet, highlight the code you want to save (the LIBNAME statement in this example) and click the Add to My Snippets icon  on the toolbar above the Code window.



Display 25. Saving the Highlighted Code to a Code Snippet

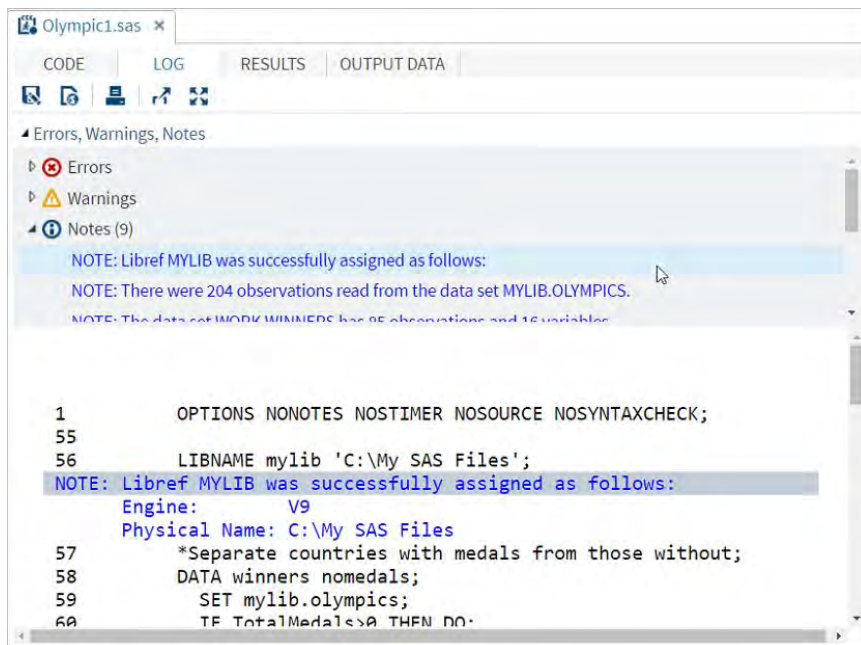
You will be prompted to type a name for your code snippet, and it will be saved in My Snippets which can be accessed in the Snippets section of the Navigation pane. Then anytime you want to use that code snippet, simply drag and drop the snippet to the code editor. The code snippet will be inserted into your code at the cursor location. Add any of the built-in snippets to your code using the same method.

SUBMITTING YOUR PROGRAM

Once your program appears in the code editor, you submit it (either the whole program, or a part you have highlighted) by clicking the Run icon  on the toolbar.

THE SAS LOG

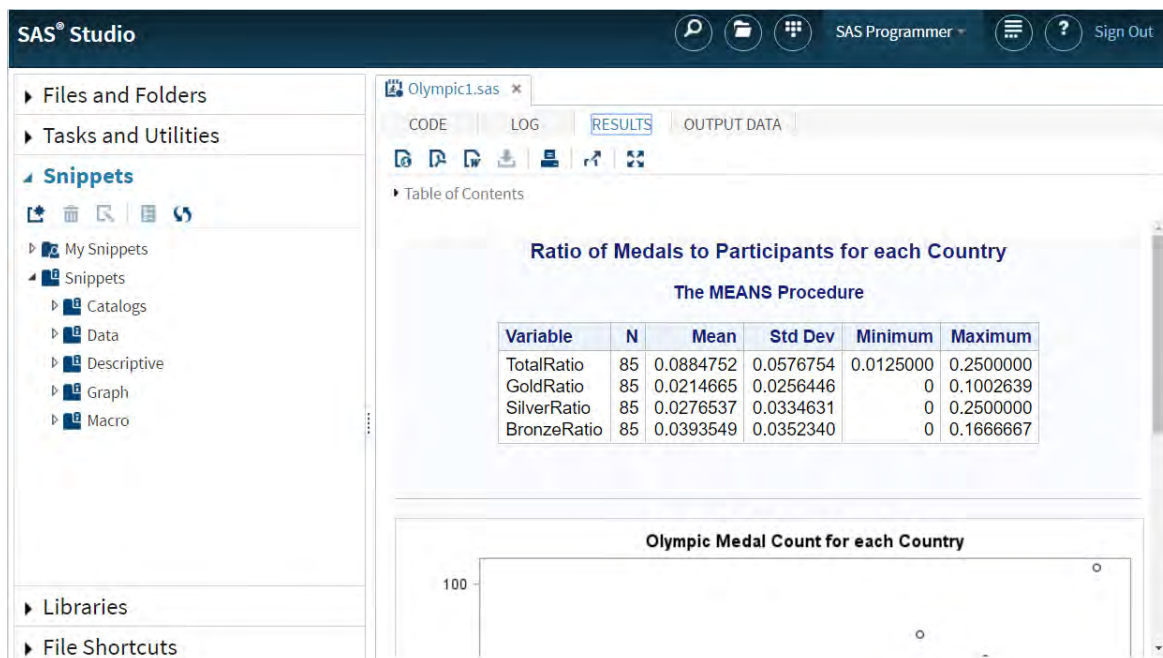
Open the SAS log by clicking the Log tab in the Program window. The following figure shows the Log tab after running the Olympic1.sas program. The bottom portion of the Log tab shows the complete SAS log. The top part of the Log tab has nodes that tell you how many errors, warnings, and notes are in the log. If you click the nodes, then you can see the errors, warnings, or notes listed in a condensed format. Clicking any of these will take you directly to that error, warning, or note in the SAS log below.



Display 26. The Log Tab of the Program Window Showing the List of All Notes Open

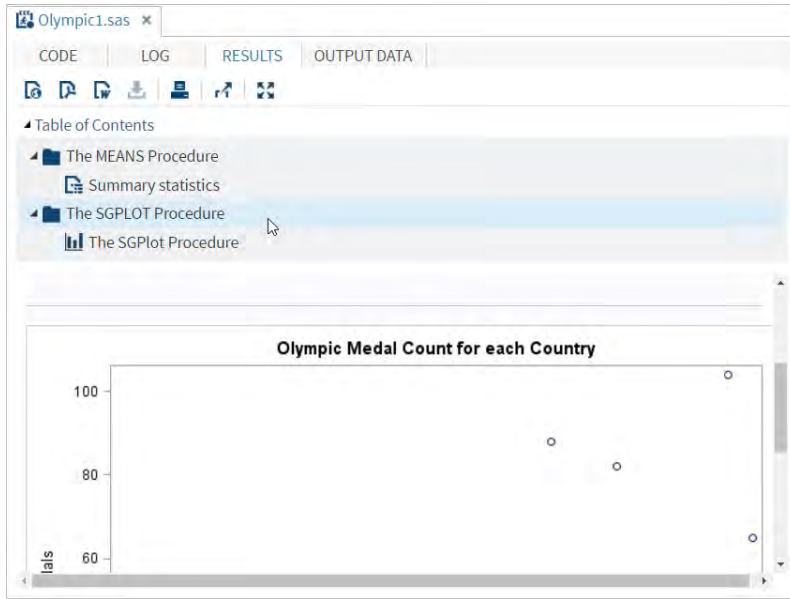
VIEWING YOUR RESULTS

To view results of any submitted SAS procedures in your program, click the Results tab of the Program window. The following shows the Results tab after submitting the Olympics1.sas program which generates results for a PROC MEANS as well as a scatter plot from the SGPLOT procedure.



Display 27. The Results Tab of the Program Window

A table of contents is inserted at the top of the results. If you expand the table of contents, you can jump to particular portions of your results by clicking the result name.



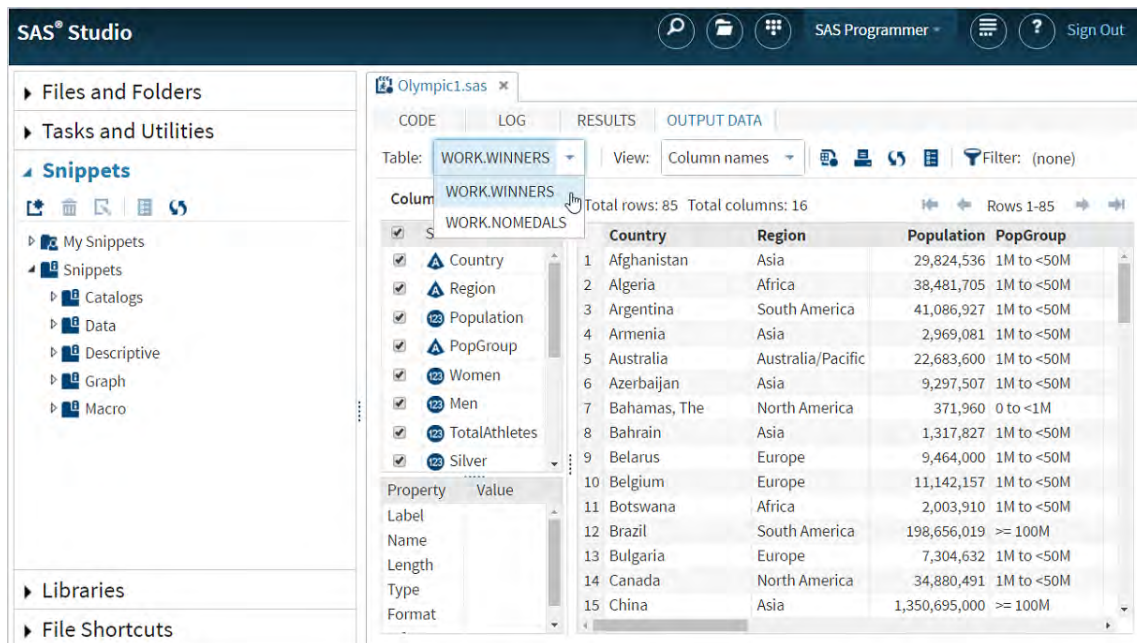
Display 28. The Table of Contents for the Results

You can print your results, or download your results to a file in either HTML, PDF, or RTF format by clicking the appropriate icon on the toolbar.




Display 29. Saving Results to a PDF File

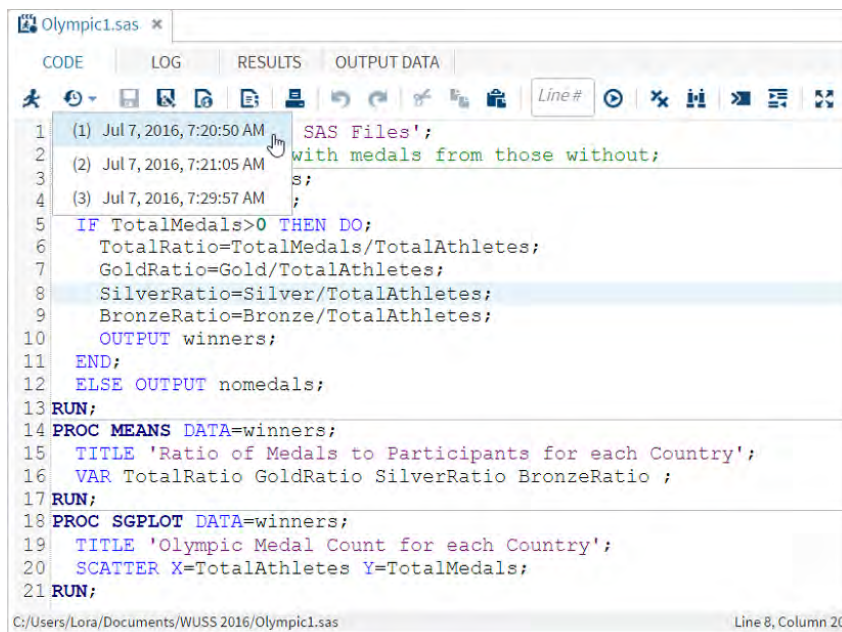
If your program created any SAS data sets, you can view them by clicking the Output Data tab. If more than one data set was created, select the desired data set from the **Table** pull-down menu on the toolbar. The following shows the data set WINNERS that was created by the Olympics1.sas program and shows the second data set created, NOMEDALS, in the Table pull-down list.



Display 30. The Output Data Tab of the Program Window

ACCESSING OLDER VERSIONS OF SUBMITTED CODE

The submission history feature in SAS Studio allows you to access all versions of code submitted in the current SAS Studio session. Click the Submission History icon  on the toolbar in the Program window and a list of all submissions will appear in a pop-up window. The submissions are numbered and identified by the date and time of submission.



Display 31. Accessing Older Versions of Code Via the Submission History Icon

Choose the submission you wish to view and a new Program window will open displaying a read-only version of the submitted code. Although you cannot edit this code, you can copy and paste the code into a new Program window if you wish. The following shows the Program window from the first submission of the Olympics1.sas program.

```

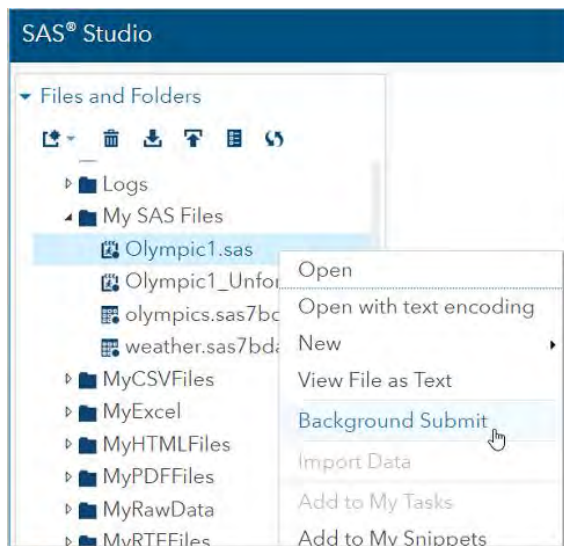
1 LIBNAME mylib 'C:\My SAS Files';
2 *Separate countries with medals from those without;
3 DATA winners nomedals;
4 SET mylib.olympics;
5 IF TotalMedals>0 THEN DO;
6     TotalRatio=TotalMedals/TotalAthletes;
7     GoldRatio=Gold/TotalAthletes;
8     SilverRatio=Silver/TotalAthletes;
9     BronzeRatio=Bronze/TotalAthletes;
10    OUTPUT winners;
11 END;
12 ELSE OUTPUT nomedals;
13 RUN;
    
```

C:/Users/Lora/Documents/WUSS 2016/Olympic1.sas/Olympic1.sas(1) (Read-Only).sas Line 1, Column 5

Display 32. The First Submitted Version of the Olympic1.sas Code

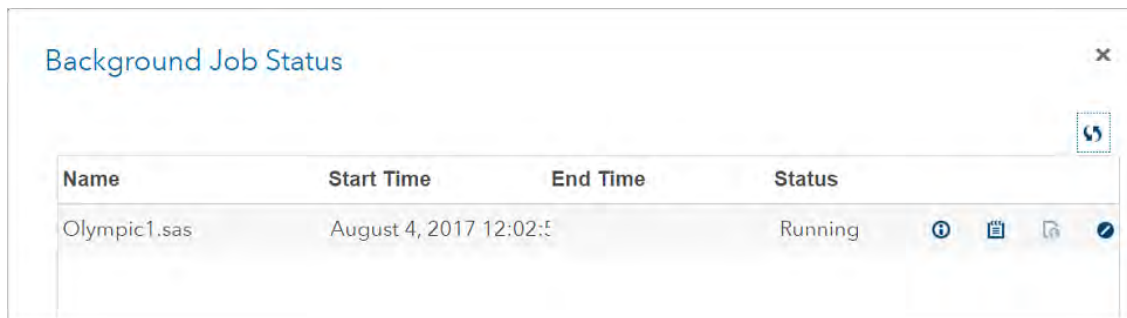
RUNNING PROGRAMS IN THE BACKGROUND

If you have programs that take a long time to run, you may want to submit them in the background (not available if your program is saved on an FTP server, or if the SAS server is running z/OS and using the native file system). With programs running in the background you can still use SAS Studio to do other things, or you can even disconnect from SAS Studio and your program will continue to run. To submit a job in the background, first save the SAS code to a file, then right-click the file name in the Files and Folders section of the navigation pane and select **Background Submit** (or **Batch Submit** in SAS Studio version 3.5).



Display 33. Selecting a SAS Program to Run in the Background

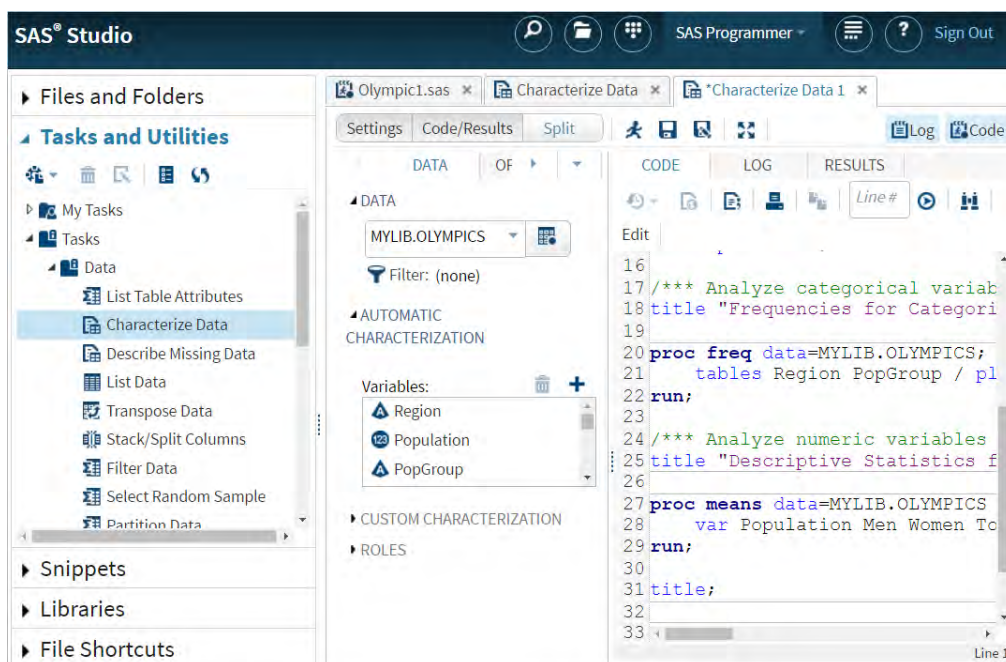
Once you have submitted your program, you can check its status by clicking the More application options icon  and selecting **Background Job status** (or **Batch Submission Status** in SAS Studio 3.5). A window will open where you can see the status of the background job, as well as access the SAS log and output when the job has completed.




Display 34. The Background Job (or Batch Submission) Status Window

TASKS

In addition to all the code writing features, SAS Studio gives you access to many built-in tasks. You can even create your own task if you want. Tasks are point-and-click methods of generating SAS code. Many SAS programmers may never use tasks, but tasks are a quick way to write some code and the nice thing is that you can see the code that is generated as you make your selections. You access tasks from the Tasks and Utilities section of the Navigation Pane. The following shows the Characterize Data task, with the OLYMPICS data set selected. You choose the data set, variables and options in the middle portion of the window, and the generated SAS code is displayed on the right side of the window.

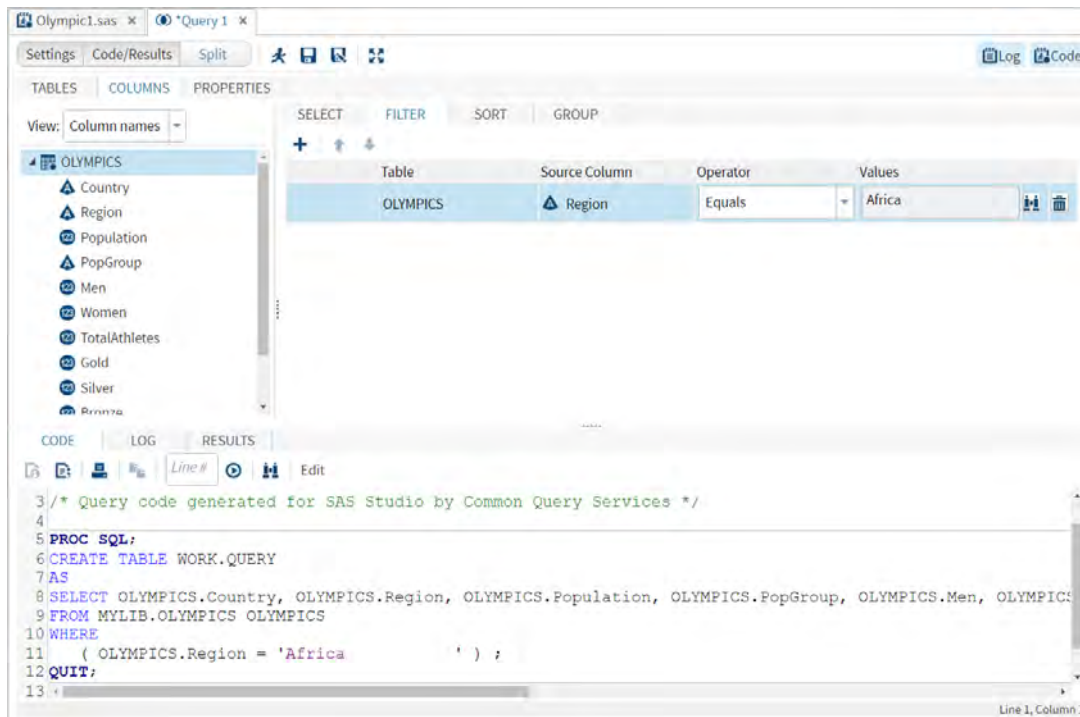


Display 35. The Characterize Data Task


You run code generated by tasks the same way you run code that you write, by clicking the Run icon  above the Program window. The SAS log and results are displayed in the same tabs as when you submit your own code.

QUERIES

In addition to tasks, SAS Studio also has an interactive utility to create queries which generate PROC SQL code. Using queries you can join tables together and select, filter, and sort data. You start a new query by selecting **Query** from the Tasks and Utilities section of the Navigation Pane. In the Query window, you select the tables and columns you want in your result, and you can also filter, sort, or group data if you wish. The following shows a Query window with the OLYMPICS data set selected. This query will select all variables in the data set, but keep only rows where the value of Region equals Africa. The resulting PROC SQL code appears at the bottom of the Query window.



Display 36. The Query Window for the OLYMPICS Data Set

To run a query click the Run icon  located at the top of the Query window. The code, SAS log, and results will display in the appropriate tabs in the Query window. The Query window gives you a quick way to generate SQL code that you can then modify for your own purposes.

CONCLUSION

SAS Studio is a new and powerful programming interface that SAS programmers, both new and experienced, should consider. SAS Studio has many features not available in the traditional Display Manager interface, and is more oriented towards programmers than SAS Enterprise Guide. Because SAS Studio is the interface for SAS University Edition and is the default interface for SAS OnDemand for Academics, its popularity is sure to increase.

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