

MODUL 4

SAS® VIYA PROGRAMMING INTERFACE: SAS® STUDIO

THEME DESCRIPTION

Students understand the concept and implementation of the SAS® Viya® CAS analytics platform (Cloud Analytics Services) with the power of an in-memory engine and parallel processing capabilities to increase the speed of data management and analysis through one of the web-enabled application features of SAS® Studio.

WEEKLY LEARNING OUTCOMES (SUB-LESSONS)

CLO-1-Sub-CLO-4, Well understand and be able to explain and interpret the Big Data management concepts and make use of the Apache Hadoop technology -C3.

Through the following learning steps:

Introduction

1. Introduction
 - ▶ SAS® Viya Overview
 - ▶ SAS® Viya Servers
 - ▶ SAS® Viya Programming Interface: Using SAS® Studio
 - ▶ SAS® OnDemand for Academics (ODA) Registration
 - ▶ SAS® Programming Language
2. SAS® OnDemand for Academics (ODA) Registration
3. First SAS data step program
4. First use of a SAS PROC

PRACTICUM SUPPORTS

- a. Windows Operating System
- b. (any) Browser Application

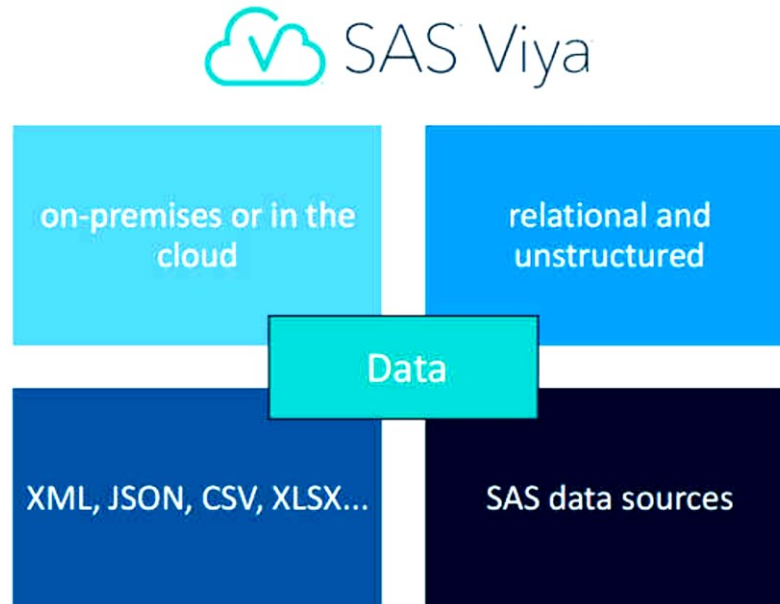
INTRODUCTION

1. SAS® Viya Overview

- ▶ SAS® Viya is the latest enhancement of the **SAS®** Platform.
- ▶ SAS® Viya is cloud enabled and allows scalable, web-based access for your particular data processing needs.
- ▶ SAS® Viya includes an in-memory engine and parallel processing capabilities for enhanced execution speed.
- ▶ SAS® Viya enables you to use familiar SAS code that you use to write in SAS®9. However, with a few modifications, your code can take advantage of SAS Viya in-memory processing for accelerated performance.
- ▶ SAS® Viya provides integration with open-source tools such as Python, R, and other open-source languages.

1) SAS Viya Data

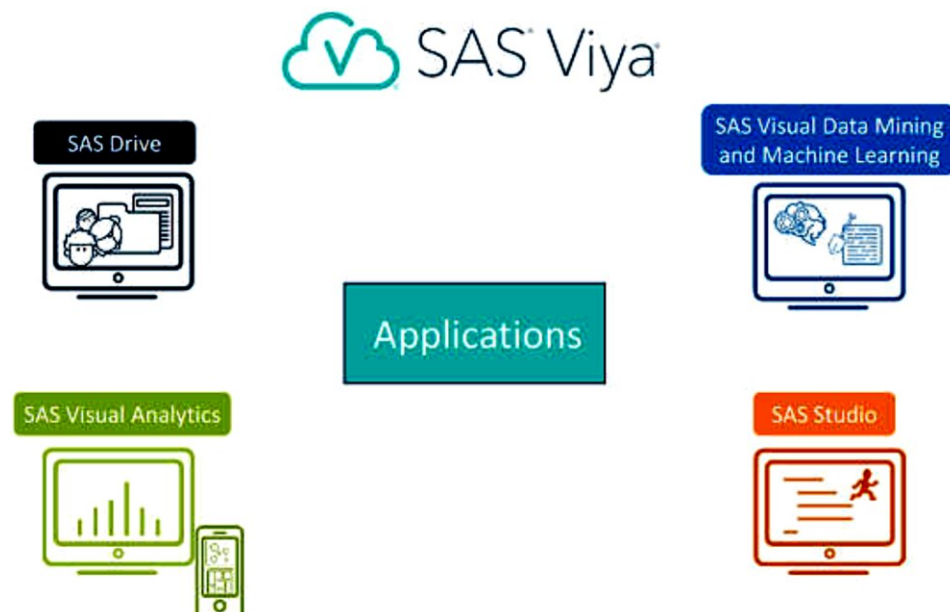
- ◆ In SAS Viya, you can access a variety of data sources in addition to traditional SAS tables.
- ◆ SAS Viya can directly access familiar file formats such as XML, JSON, CSV, or XLSX.
- ◆ With data connectors, you can process data from relational databases, Hadoop, and other data stores (for example, structured tables and semi-structured and unstructured text files). You can easily access data that is stored on premises or in the cloud.



2) SAS Viya Application

SAS Viya includes several services and applications.

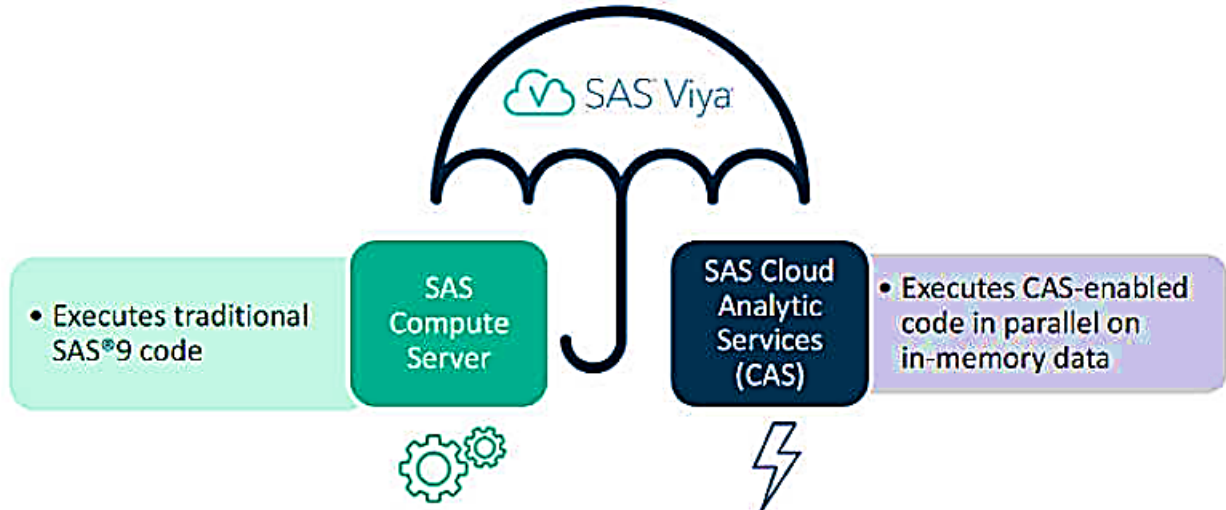
- ◆ SAS Drive for organizing and accessing all SAS content
- ◆ SAS Visual Analytics for web-based reporting and dashboards
- ◆ SAS Visual Data Mining and Machine Learning
- ◆ SAS Studio



2. SAS® Viya Servers

a. SAS® Viya Servers

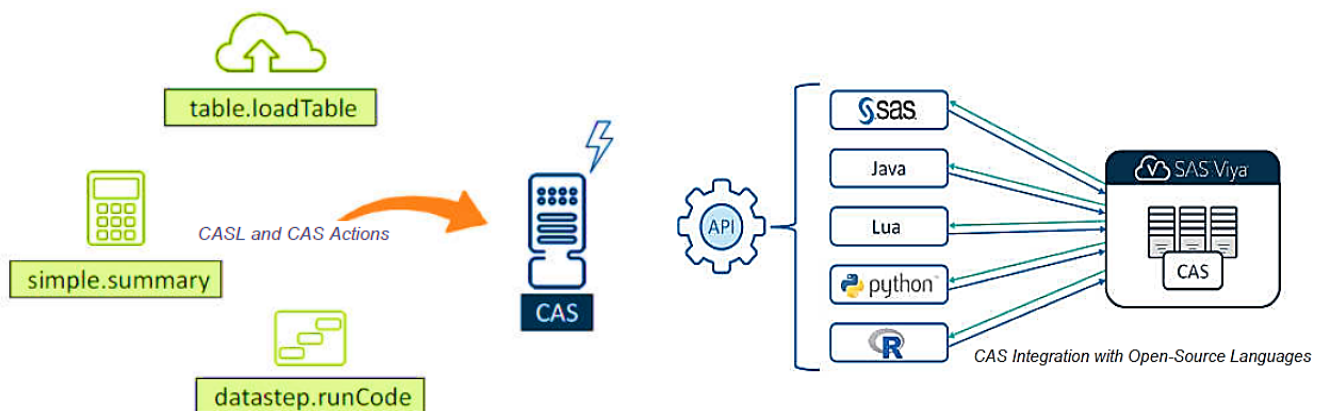
- AS Viya includes multiple servers to execute SAS code.



- The two primary servers are the SAS Compute Server and SAS Cloud Analytic Services, or CAS.
- You can think of the SAS Compute Server as equivalent to the SAS®9 workspace server.
- Your familiar SAS®9 programs can be submitted as is to SAS Viya. By default, the programs run on the Compute Server. There is no need to learn new syntax to use the Compute Server.
- SAS Cloud Analytic Services (CAS) is the high-performance server that allows for parallel processing on in-memory data.
- When your data is large or the computations complex, running your programs in CAS can significantly boost performance.
- Often, only minor code modifications are required for programs to run in CAS.

b. SAS® Cloud Analytic Services (CAS)

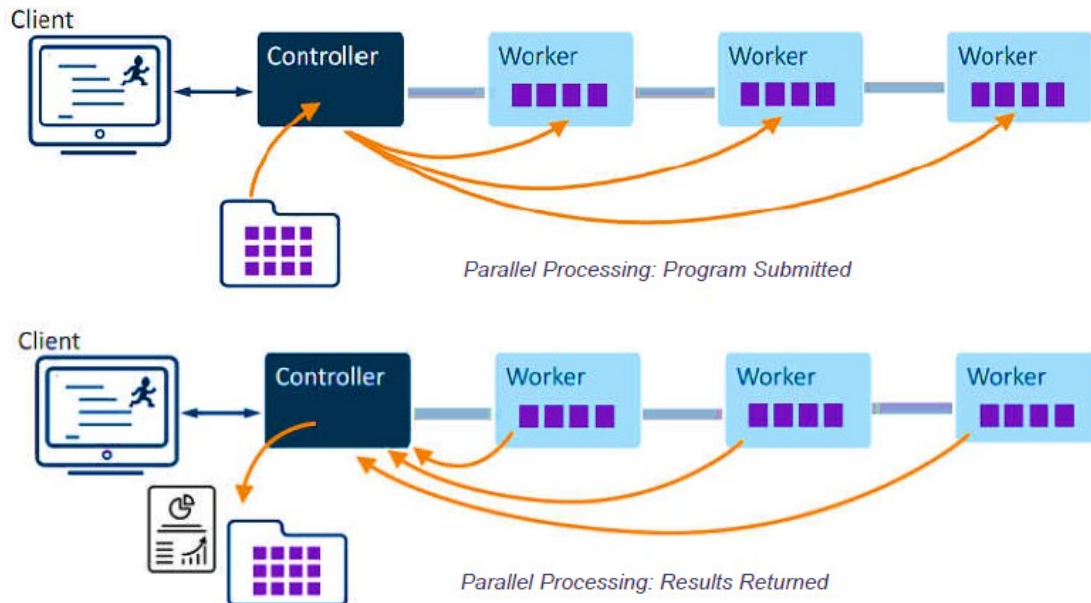
- There are different ways to submit requests to CAS for in-memory parallel processing.
- You can use PROC and DATA steps that are CAS enabled, or you can learn the native CAS language, which is called CASL.



- CASL is a scripting language that is used to call CAS actions.
- CAS actions perform specific tasks such as loading a table.

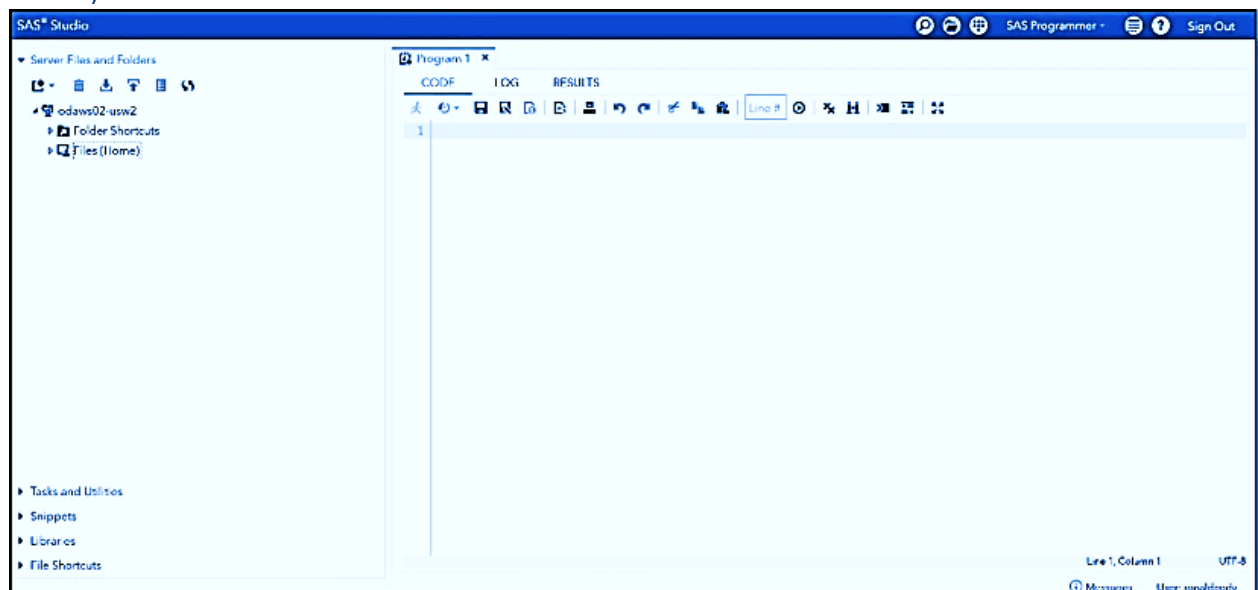
- Many other actions are available to transform data, perform analytics, and create output.
- Actions that perform similar tasks are grouped into action sets. Your CASL code runs in CAS.
- In SAS, you submit CAS actions by using PROC CAS and CASL statements. You can also call CAS actions by using open-source languages, which include Python, Lua, Java, and REST APIs.

Parallel Processing in CAS

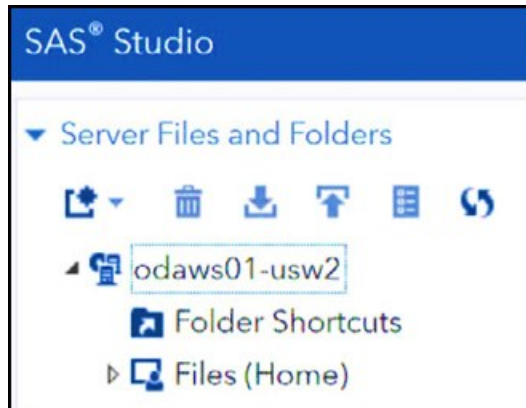


3. SAS® Viya Programming Interface: SAS® Studio

- ▶ SAS Studio is a web-based application that includes a variety of helpful features for developing SAS code.
- ▶ In addition to a modern Program Editor for writing code and viewing the log and results, you can also access files on the local machine or SAS servers, take advantage of stored code for common actions, and generate code with point-and-click tasks.
- ▶ SAS Studio since SAS release 5.2 (currently SAS release: 9.04.01) is specifically designed for use in SAS Viya.



- ▶ The left-hand side of Studio is the navigation pane, and by default the Servers Files and Folders section is open. The other sections are Tasks and Utilities, Snippets, Libraries, and File Shortcuts.
- ▶ Across the top in the dark blue banner you will see several icons, which stand for search, open, new options, a toggle between **SAS Programmer and Visual Programmer views**, More application options, Help, and finally, the Sign Out item.
- ▶ We will primarily make use of the default SAS Programmer view.
- ▶ However, the Visual Programmer view provides a process view and self-documentation of the workflow involved with your program.
- ▶ Feel free to explore all the help items associated with SAS Studio to learn more about this GUI for SAS coding



a. The server files and folders

- ◆ The Folders section of the navigation pane enables you to access your folders, create folder shortcuts, download and upload files, and create new SAS programs.
- ◆ You can expand and collapse folders, and you can open items in the folders, such as a SAS program or table, by double-clicking them or by using a drag-and-drop operation to move them to the work area.

b. Tasks and Utilities

- ◆ The Tasks section of the navigation pane enables you to access tasks in SAS Studio.
- ◆ Tasks are based on SAS procedures and enable you to generate SAS code and formatted results, based on the entry of user-supplied inputs and parameter values.

c. Snippets

- ◆ The Snippets section of the navigation pane enables you to access your code snippets, which are samples of commonly used SAS code that you can insert into your SAS program.
- ◆ SAS Studio is shipped with several predefined code snippets that you can use.

d. Libraries

- ◆ The libraries section of the navigation pane enables you to access all of your SAS table libraries and their contents.
- ◆ Libraries in SAS are pointers to datasets (or tables).
- ◆ Within SAS, they all look the same regardless of whether they are SAS datasets or **data stored in a database** or other data storage systems, such as **Hadoop or SAP HANA**.
- ◆ Datasets are referenced in SAS code by `library-name.dataset-name`.

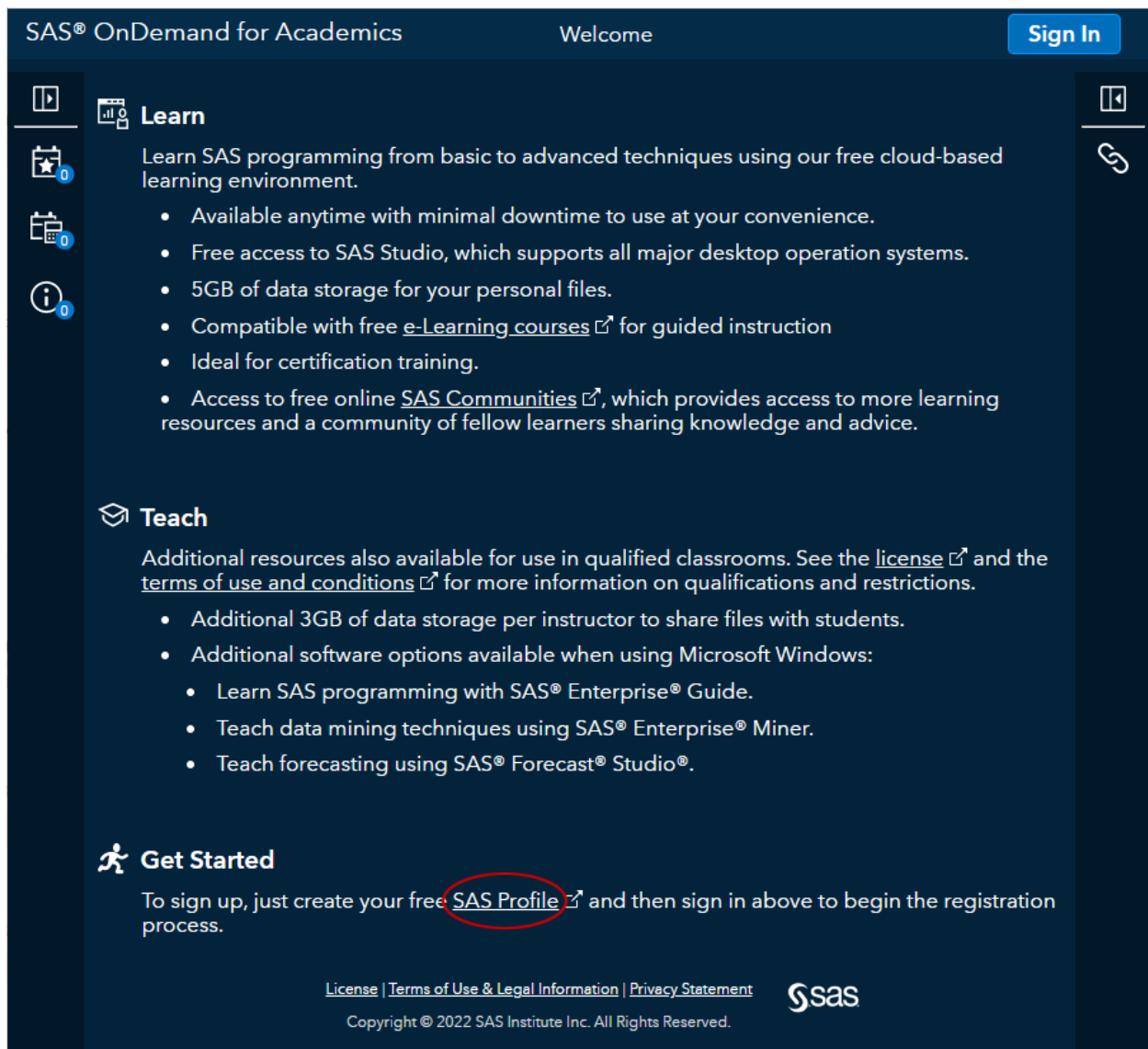
e. **File shortcuts**

- ◆ File shortcuts, also known as SAS File References, enable you to quickly access files.
- ◆ You can create a file shortcut to a file on your SAS server or via a URL.

PRACTICUM STEPS

4. SAS® OnDemand for Academics (ODA) Registration

- ▶ To gain access to ODA, you need to register with SAS Institute. Part of the registration process is to create a SAS profile.
 - ▶ If you already have a SAS profile, skip that portion of the instructions.
 - ▶ To register for SAS OnDemand for Academics, you must complete the following:
 - ➔ Create a SAS Profile
 - ➔ Verify the SAS Profile
 - ➔ Register for SAS OnDemand for Academics with SAS Profile credentials
- a. Start, <https://welcome.oda.sas.com>
- b. These instructions assume that you do not have a SAS Profile. Click **SAS Profile**



SAS® OnDemand for Academics Welcome [Sign In](#)

Learn

Learn SAS programming from basic to advanced techniques using our free cloud-based learning environment.

- Available anytime with minimal downtime to use at your convenience.
- Free access to SAS Studio, which supports all major desktop operation systems.
- 5GB of data storage for your personal files.
- Compatible with free [e-Learning courses](#) for guided instruction
- Ideal for certification training.
- Access to free online [SAS Communities](#), which provides access to more learning resources and a community of fellow learners sharing knowledge and advice.

Teach

Additional resources also available for use in qualified classrooms. See the [license](#) and the [terms of use and conditions](#) for more information on qualifications and restrictions.


- Additional 3GB of data storage per instructor to share files with students.
- Additional software options available when using Microsoft Windows:
 - Learn SAS programming with SAS® Enterprise® Guide.
 - Teach data mining techniques using SAS® Enterprise® Miner.
 - Teach forecasting using SAS® Forecast® Studio®.

Get Started

To sign up, just create your free **SAS Profile** and then sign in above to begin the registration process.

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- c. Complete all the required fields to create a SAS Profile.

SAS Profile

Step 1 of 2: Tell us about yourself.

Preferred Language

First Name *

Last Name *

Email *

Country/Region *

Affiliation With SAS *

Organization/University *

*Required

- d. You must check the box to agree to the SAS Profile terms and conditions at the bottom of the SAS Profile page. Click **Create profile**.

☐ Yes, I would like to receive occasional emails from SAS Institute Inc. and its affiliates about SAS products and services. I understand that I can withdraw my consent at any time by clicking the opt-out link in the emails.

☒ I agree to the terms of use and conditions. *

All personal information will be handled in accordance with the [SAS Privacy Statement](#).

Create profile

After clicking "Create profile," you will receive a verification email with instructions for setting your password and activating your profile.

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The **Create profile** button turns blue when you have filled in all the required fields.

When you **click Create profile**, a message is displayed that tells you that a verification email has been sent to you with instructions on how to activate your SAS Profile.

SAS Profile

Thank you for creating a SAS Profile. You're almost done!

A verification email has been sent to the address you provided. To verify your email address and activate your profile, click the link in the email (subject: *Please activate your SAS Profile*). You will then be prompted to set a password.

It may take a few minutes for the email to reach your inbox. If you do not receive the email, check your junk email folder.

To ensure that emails from SAS are not blocked by your mailserver, add sas.com to your list of safe sender domains.

If you have trouble creating your SAS profile, send email to SASProfileHelp@sas.com.


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- f. Verifying your email address and activate your profile.

replies-disabled@sas.com
To:

Please activate your SAS Profile
Today at 9:16 AM



THE POWER TO KNOW.

Dear ODA User,

Thank you for creating a SAS Profile. Please verify your email address and activate your profile by clicking on the following link:

Activate your SAS Profile.

Once you've activated your profile, you can access free training, SAS communities, technical support and more. If you have any questions or have not requested a SAS Profile, please email SASProfileHelp@sas.com.

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- g. When you click the **Activate your SAS Profile** link, you are taken to a screen so that you can set your SAS Profile password.
- h. Choose Your Password and Confirm.

SAS Profile

Step 2 of 2: Please set your new password.

Password (show)

Confirm password

[Set password](#)

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SAS Profile

Step 2 of 2: Please set your new password.

Password (show)

Do not use #, \, --, first name, last name, or part of your email address.

Your password must contain at least:

- ☒ 8 characters
- ☒ 1 lowercase letter
- ☒ 1 uppercase letter
- ☒ 1 symbol
- ☒ 1 number

Confirm password

[Set password](#)

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When the password entries match, you can click Set password

- i. Your SAS Profile is now active. Click Continue.

SAS Profile

Your profile is now active! You can now sign in using your new SAS Profile credentials.

[Continue](#)

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- j. You are now ready to sign in. Return to the [SAS OnDemand for Academics Sign In page](#).

SAS® OnDemand for Academics
Welcome
Sign In

Learn

Learn SAS programming from basic to advanced techniques using our free cloud-based learning environment.

- Available anytime with minimal downtime to use at your convenience.
- Free access to SAS Studio, which supports all major desktop operation systems.
- 5GB of data storage for your personal files.
- Compatible with free [e-Learning courses](#) for guided instruction
- Ideal for certification training.
- Access to free online [SAS Communities](#), which provides access to more learning resources and a community of fellow learners sharing knowledge and advice.


Teach

Additional resources also available for use in qualified classrooms. See the [license](#) and the [terms of use and conditions](#) for more information on qualifications and restrictions.

- Additional 3GB of data storage per instructor to share files with students.
- Additional software options available when using Microsoft Windows:
 - Learn SAS programming with SAS® Enterprise® Guide.
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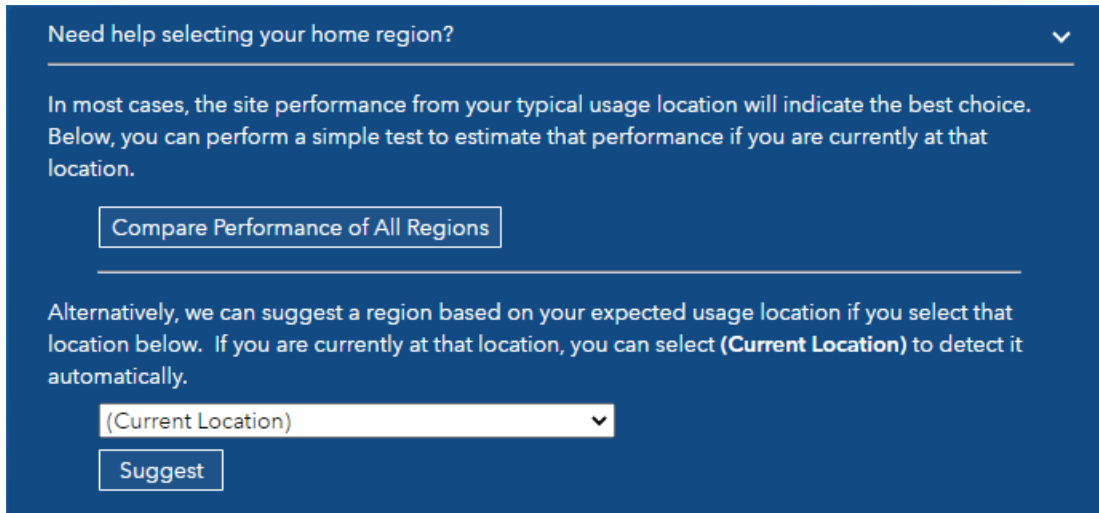
Get Started

To sign up, just create your free [SAS Profile](#) and then sign in above to begin the registration process.



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- k. Enter your email address and your password. Agree to the terms and conditions. Click **Sign In**. You are presented with a screen with options. It is important that you understand these options as they affect how you interact with SAS OnDemand for Academics.



Need help selecting your home region? ▼

In most cases, the site performance from your typical usage location will indicate the best choice. Below, you can perform a simple test to estimate that performance if you are currently at that location.

[Compare Performance of All Regions](#)

Alternatively, we can suggest a region based on your expected usage location if you select that location below. If you are currently at that location, you can select **(Current Location)** to detect it automatically.

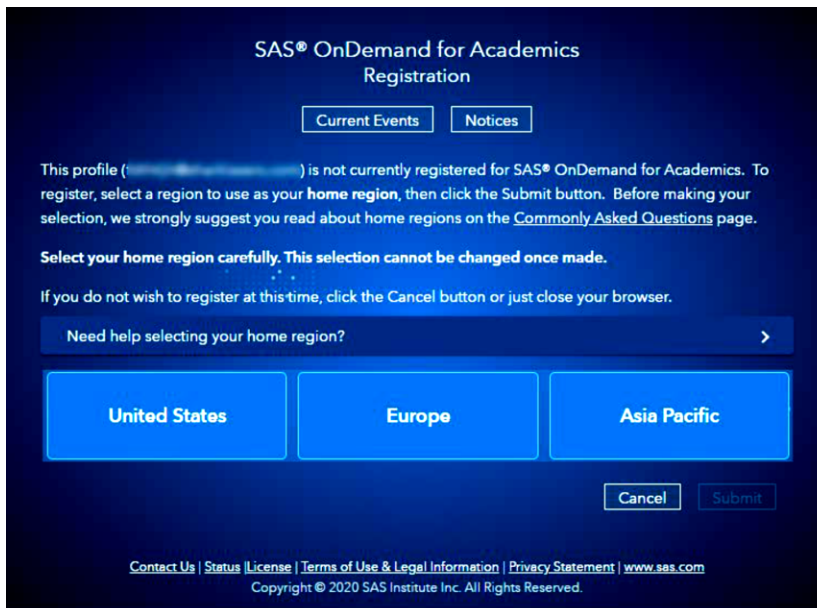
(Current Location) ▼

[Suggest](#)

The Help section named **Need help selecting your home region?** contains embedded tools to aid you in determining the best region for you.

Click [Compare Performance of All Regions](#). The tool suggests a region based on performance. Alternatively, select the country in which you will primarily use SAS OnDemand for Academics from the drop-down menu above **Suggest**. Click **Suggest**.

- l. The tool suggests a region based on your expected usage location.



SAS® OnDemand for Academics
Registration

[Current Events](#) [Notices](#)

This profile () is not currently registered for SAS® OnDemand for Academics. To register, select a region to use as your **home region**, then click the Submit button. Before making your selection, we strongly suggest you read about home regions on the [Commonly Asked Questions](#) page.

Select your home region carefully. This selection cannot be changed once made.

If you do not wish to register at this time, click the Cancel button or just close your browser.

Need help selecting your home region? >

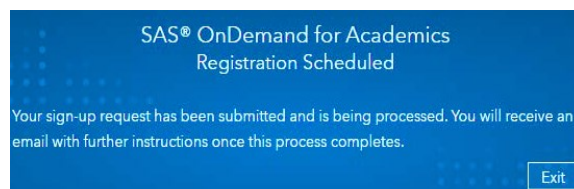
[United States](#) [Europe](#) [Asia Pacific](#)

[Cancel](#) [Submit](#)

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A dialog box prompts you to confirm your selection of a home region. Click **Submit**.

- m. A message is displayed that says that your registration has been submitted and is being processed. An email will be sent to you with further instructions. Click **Exit**.

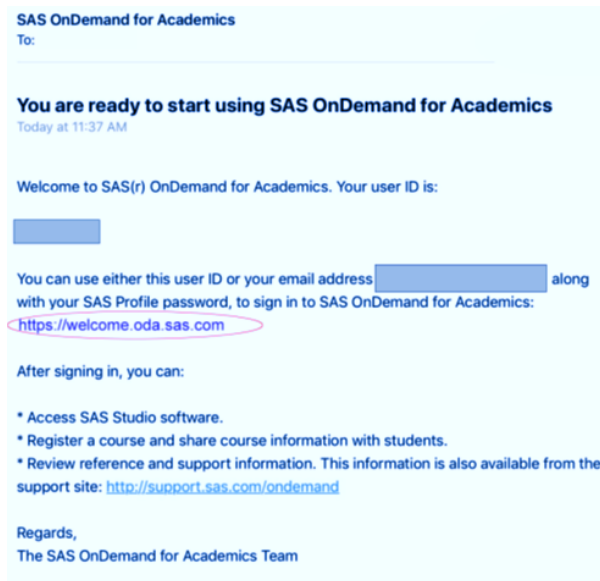


SAS® OnDemand for Academics
Registration Scheduled

Your sign-up request has been submitted and is being processed. You will receive an email with further instructions once this process completes.

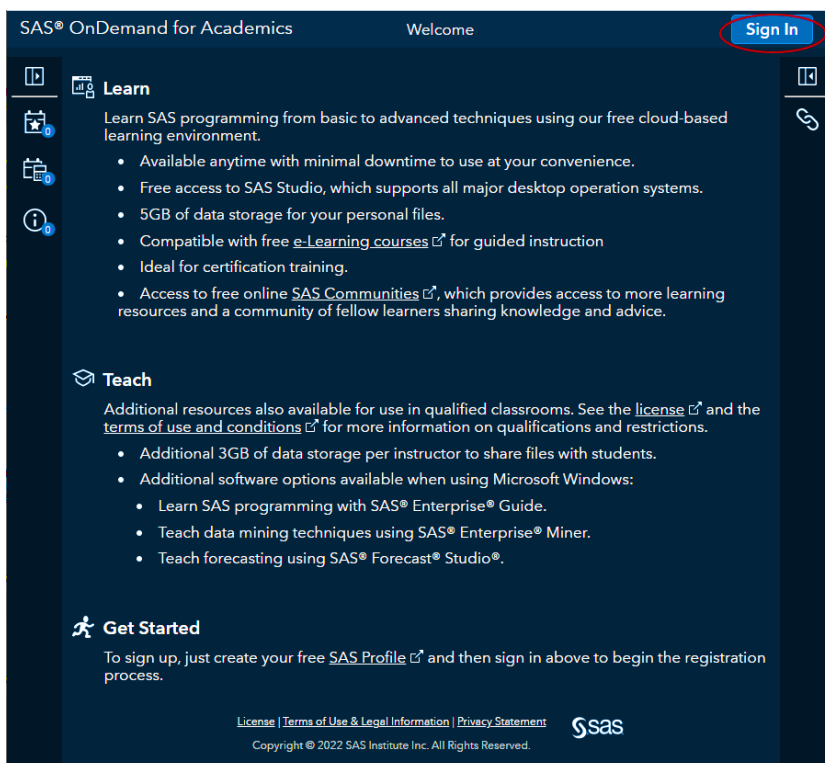
[Exit](#)

n. You should receive a confirmation email

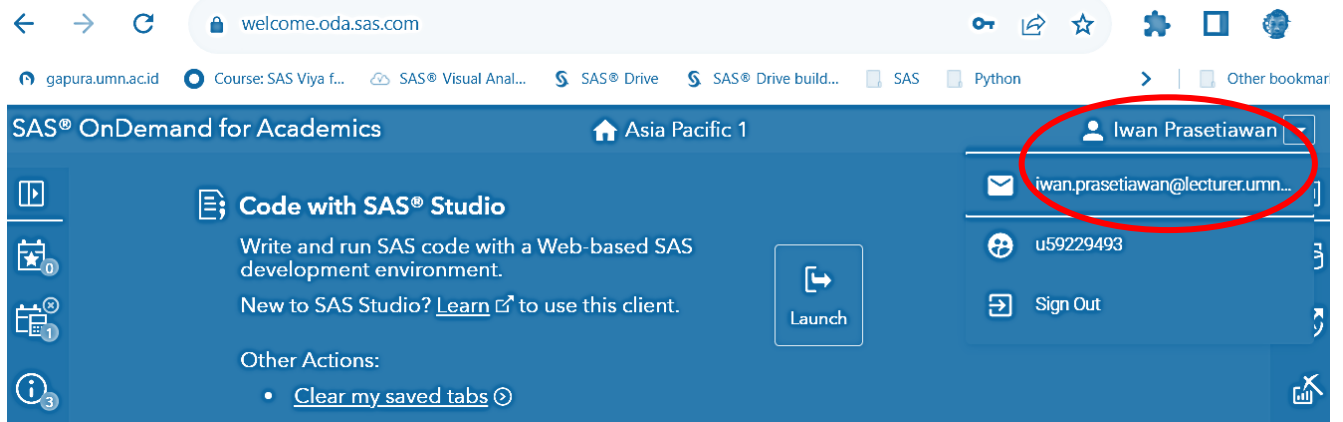


that contains a link to the SAS OnDemand for Academics Sign In page. Click the [link to open SAS OnDemand for Academics](#).

o. At the [SAS OnDemand for Academics Sign In](#) page, enter your email address and password. Agree to the terms and conditions. Click **Sign In**.



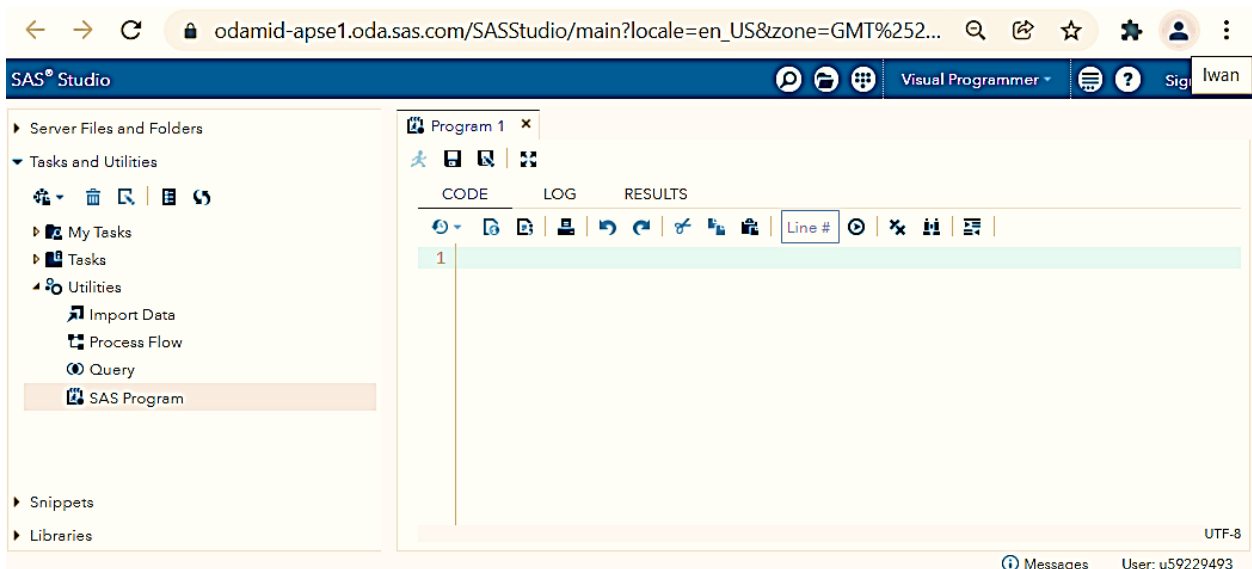
- p. You are then logged in to SAS OnDemand for Academics. All users have access to SAS Studio as part of their registration.
- ▶ The other clients (SAS Enterprise Miner, SAS Enterprise Guide, and SAS Forecast Studio) are all available with associated courses only. An instructor sends a course link to the students to enroll.



- q. Screenshot your SAS ODA page according to the output figure A.
- r. Click Launch to start SAS® Programming Language using SAS® Studio in the next 5. point below.

5. SAS® Programming Language

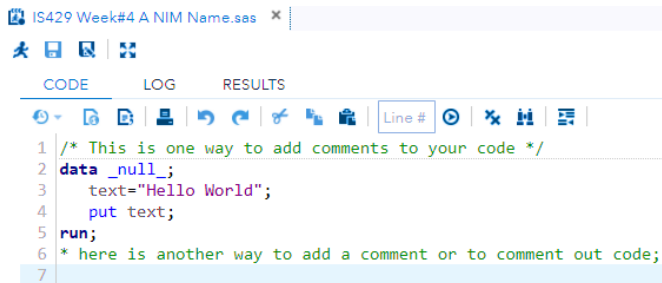
- ▶ The core of SAS technology is known as BASE SAS®.
- ▶ All other or SAS solutions are built on top of this foundation. As mentioned previously, the SAS® programming language is made up of two main parts—the SAS data step, and hundreds of SAS procedures, which are typically referred to as PROCs.
- ▶ BASE SAS® also contains a SAS macro language, the new SAS FedSQL language, which is a SAS proprietary implementation of the ANSI SQL:1999 core standard, the relatively new DS2 language, which is an object-oriented multiple thread language.



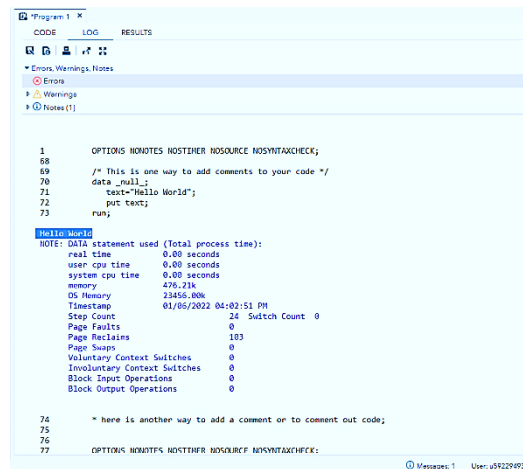
a. First SAS data step program.

- ◆ As has been a tradition in learning any new programming language, we will write some SAS code that will print **Hello World**.

- ◆ This is quite easy to do, and all you need to do to start is to get into your SAS Studio, and, using the right-hand pane, make sure you have the CODE section of your Program1 tab highlighted and then type the following SAS data step code:



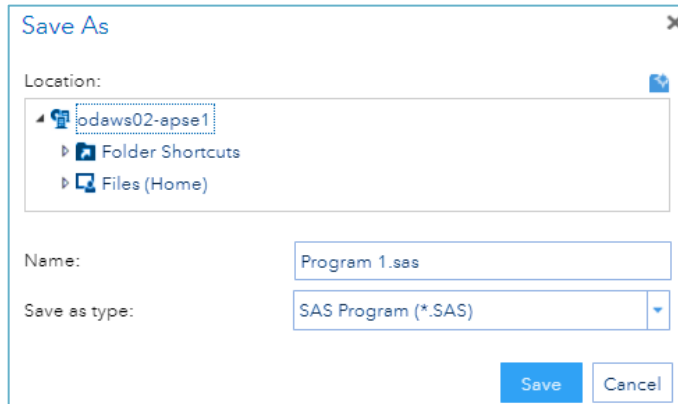
- Now, submit the code by either clicking on the running man icon on the CODE toolbar or by pressing the F3 function key. You should see a window pop-up stating Running, and then be presented with this in SAS Studio:



- ◆ As long as there was not a syntax error in your code, there should only be some blue-colored notes, the code you submitted, and the text Hello World printed out in the LOG.
- ◆ Congratulations on having successfully written and submitted a SAS program!
- ◆ Notice that similar to the color coding used in the CODE tab, the LOG tab uses color to help debug or make it easier to read how the code executed. Errors will show up in red, warnings in green, notes in blue, and code will be in black.
- ◆ Click on the RESULTS tab and note that nothing showed up here. Why didn't the Hello World result show in the RESULTS tab?

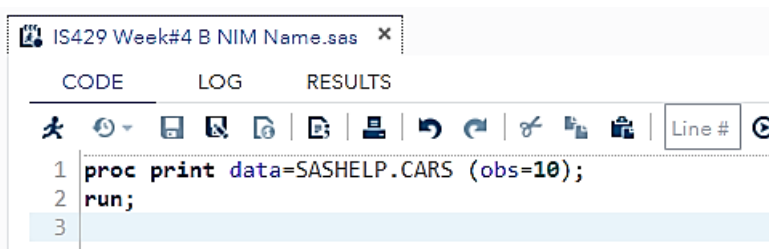
b. Saving a SAS program

- ◆ Move back into the Program1 and the CODE tab. Let's verify that programs and data tables can be saved within the SAS environment.
- ◆ SASUSER is a permanent SAS library that is created automatically for each user, and in this virtual SAS server environment.
- ◆ Select the Save As icon from the CODE toolbar, expand My Folders, select sasuser.v94, and change the program name to Program 1 to **IS429 Week#4 A First Data Step NIM yourName**.

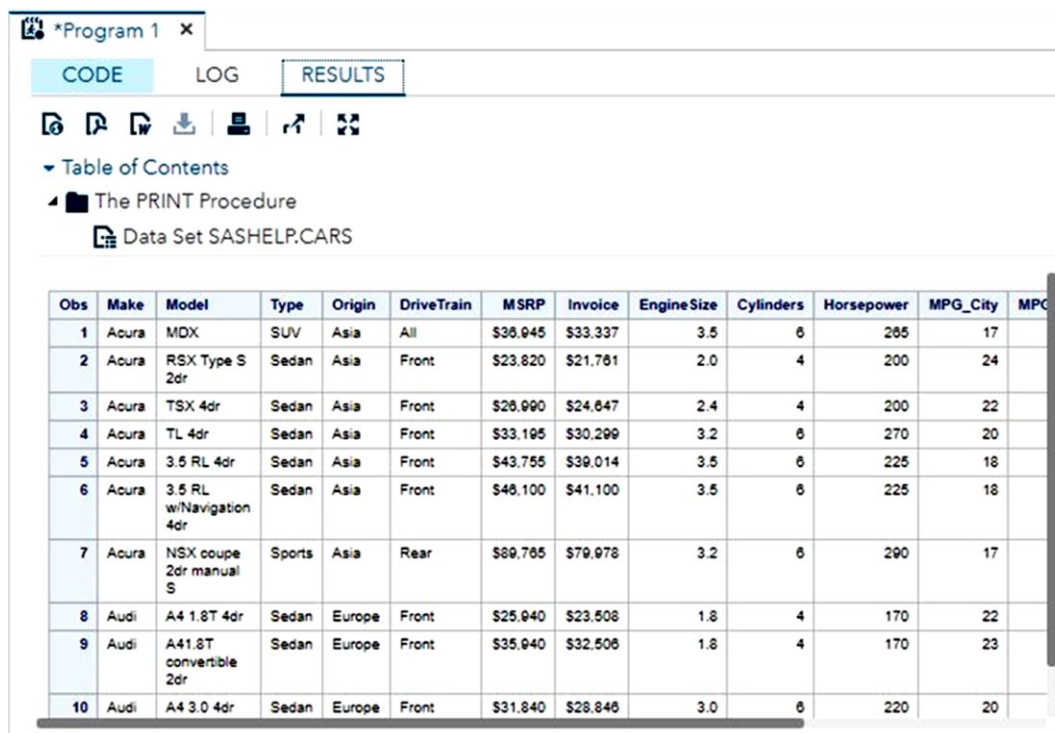


c. First use of a SAS PROC

- ◆ Move back into CODE tab and use the double Xx in the CODE tool bar to clear all code. Now type the following code:



- ◆ **proc print** will print out all the rows of the data table you specify in the data part of the statement.
- ◆ In this case, one of many dataset options, obs is being used to instruct the proc to only perform its functions on the first 10 observations.
- ◆ Submit this code and the results should appear in the RESULTS tab:

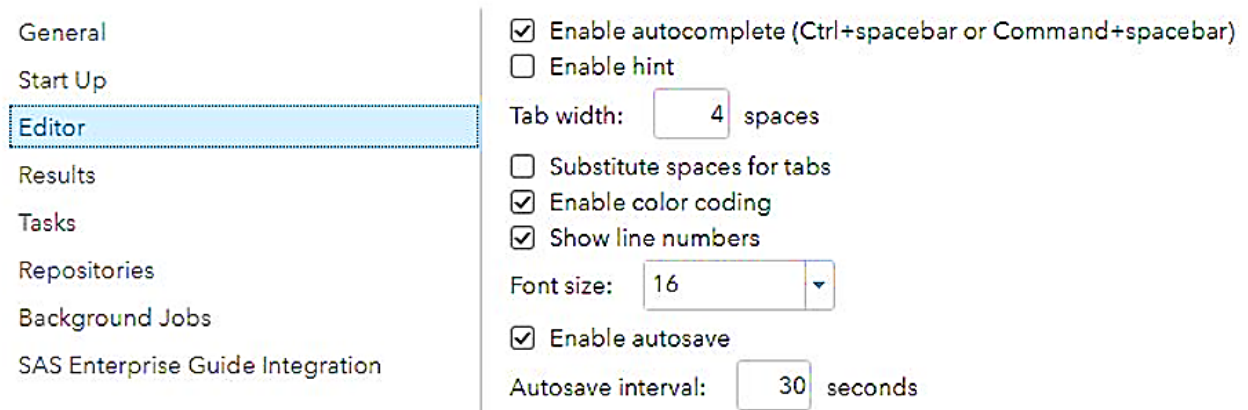


Obs	Make	Model	Type	Origin	DriveTrain	MSRP	Invoice	EngineSize	Cylinders	Horsepower	MPG_City	MPG
1	Acura	MDX	SUV	Asia	All	\$36,945	\$33,337	3.5	6	265	17	
2	Acura	RSX Type S 2dr	Sedan	Asia	Front	\$23,820	\$21,761	2.0	4	200	24	
3	Acura	TSX 4dr	Sedan	Asia	Front	\$26,990	\$24,647	2.4	4	200	22	
4	Acura	TL 4dr	Sedan	Asia	Front	\$33,195	\$30,299	3.2	6	270	20	
5	Acura	3.5 RL 4dr	Sedan	Asia	Front	\$43,755	\$39,014	3.5	6	225	18	
6	Acura	3.5 RL w/Navigation 4dr	Sedan	Asia	Front	\$46,100	\$41,100	3.5	6	225	18	
7	Acura	NSX coupe 2dr manual S	Sports	Asia	Rear	\$69,765	\$79,978	3.2	6	290	17	
8	Audi	A4 1.8T 4dr	Sedan	Europe	Front	\$25,940	\$23,508	1.8	4	170	22	
9	Audi	A4 1.8T convertible 2dr	Sedan	Europe	Front	\$35,940	\$32,508	1.8	4	170	23	
10	Audi	A4 3.0 4dr	Sedan	Europe	Front	\$31,840	\$28,846	3.0	6	220	20	

- ◆ Congratulations on executing a SAS PROC in a SAS program!

- ♦ Think for a moment about the small amount of code that was submitted, which printed out a subset of rows from a data table.
- ♦ Save your program to **IS429 Week#4B First SAS Proc NIM yourName.**
- ♦ *How much code would have had to be written in any other language to achieve the same result?*
- ♦ Yes, SQL could be used, but I doubt it could be done using less code.
- ♦ You can develop further creativity by taking advantage of available features such as the code window provides syntax completion for the programmer so that as you type, the programmer will be prompted for what SAS expects are valid parts of the code being written.
- ♦ This feature is quite useful, especially for new programmers or for experienced programmers starting to use a new PROC they may not be familiar with yet, because it gives a list of options that can be used with that particular PROC.
- ♦ As a programmer gains more experience, they may turn this feature off, which can easily be done by selecting the More application options icon to the left of the Help question mark icon in the top right-hand corner of SAS Studio and selecting Preferences:

Preferences



The screenshot shows the SAS Studio Preferences dialog box with the 'Editor' tab selected. The left sidebar lists various categories: General, Start Up, Editor (highlighted), Results, Tasks, Repositories, Background Jobs, and SAS Enterprise Guide Integration. The right pane shows settings for the Editor tab:

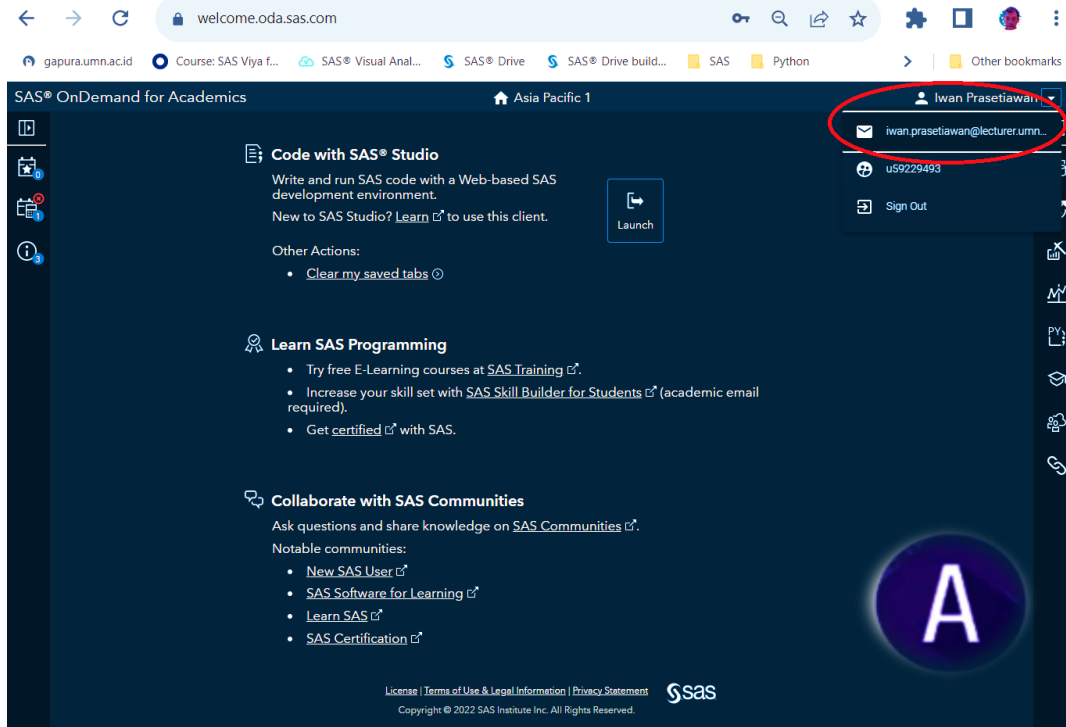
- ☒ Enable autocomplete (Ctrl+spacebar or Command+spacebar)
- ☐ Enable hint
- Tab width: spaces
- ☐ Substitute spaces for tabs
- ☒ Enable color coding
- ☒ Show line numbers
- Font size: (dropdown arrow)
- ☒ Enable autosave
- Autosave interval: seconds

- ♦ If the programmer wants to disable the code completion feature with the CODE tab, simply uncheck the Enable autocomplete (Ctrl+spacebar or Command+spacebar) box.
- ♦ To toggle this feature on and off while in the CODE tab writing code, a programmer can use either of these shortcut key combinations to accomplish this: Ctrl+spacebar or Command+spacebar.

- ➡ Finally, today's practicum is over, collect the one screenshot of your ODA page and the two SAS programs in IS-429 BDA Week#4 NIM yourName.zip format and submit them to e-Learning IS-429 BDA Week#4.

OUTPUT/ RESULTS

A. SAS® OnDemand for Academics (ODA) Registration



SAS® OnDemand for Academics

Asia Pacific 1

Iwan Prasetyawan

iwan.prasetyawan@lecturer.umn...

u59229493

Sign Out

Code with SAS Studio

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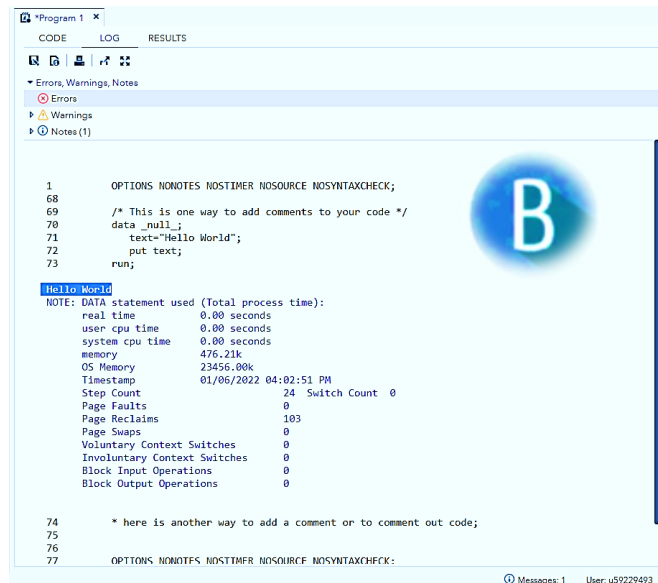
Notable communities:

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- [SAS Certification](#)

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B. First SAS Data Step



*Program 1

CODE LOG RESULTS

Errors, Warnings, Notes

Errors

Warnings

Notes (1)

```
1  OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
68  /* This is one way to add comments to your code */
70  data _null_;
71  text='Hello World';
72  put text;
73  run;
```

Hello World

NOTE: DATA statement used (Total process time):

Measure	Value
real time	0.00 seconds
user cpu time	0.00 seconds
system cpu time	0.00 seconds
memory	476.21k
OS Memory	23456.00k
Timestamp	01/06/2022 04:02:51 PM
Step Count	24
Page Faults	0
Page Reclaims	103
Page Swaps	0
Voluntary Context Switches	0
Involuntary Context Switches	0
Block Input Operations	0
Block Output Operations	0

74 * here is another way to add a comment or to comment out code;

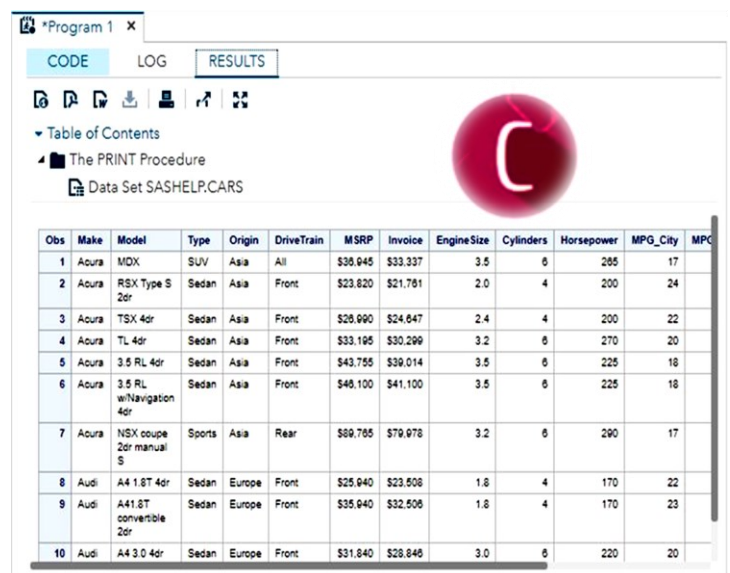
75

76

77 OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;

Messages: 1 User: u59229493

C. First use of a SAS PROC



*Program 1

CODE LOG RESULTS

Table of Contents

The PRINT Procedure

Data Set SASHELP.CARS

Obs	Make	Model	Type	Origin	DriveTrain	MSRP	Invoice	EngineSize	Cylinders	Horsepower	MPG_City	MPG_Hwy
1	Acura	MDX	SUV	Asia	All	\$36,945	\$33,337	3.5	6	265	17	24
2	Acura	RSX Type S 2dr	Sedan	Asia	Front	\$23,820	\$21,761	2.0	4	200	24	32
3	Acura	TSX 4dr	Sedan	Asia	Front	\$26,990	\$24,647	2.4	4	200	22	30
4	Acura	TL 4dr	Sedan	Asia	Front	\$33,195	\$30,299	3.2	6	270	20	28
5	Acura	3.5 RL 4dr	Sedan	Asia	Front	\$43,755	\$39,014	3.5	6	225	18	26
6	Acura	3.5 RL w/Navigation 4dr	Sedan	Asia	Front	\$48,100	\$41,100	3.5	6	225	18	26
7	Acura	NSX coupe 2dr manual S	Sports	Asia	Rear	\$69,785	\$79,978	3.2	6	290	17	24
8	Audi	A4 1.8T 4dr	Sedan	Europe	Front	\$25,940	\$23,508	1.8	4	170	22	30
9	Audi	A41.8T convertible 2dr	Sedan	Europe	Front	\$35,940	\$32,508	1.8	4	170	23	30
10	Audi	A4 3.0 4dr	Sedan	Europe	Front	\$31,840	\$28,846	3.0	6	220	20	28

REFERENCE

- David Pope. 2017. Big Data Analytics with SAS. Packt Publishing Ltd.Birmingham, UK.
- [SAS® Support | Documentation](#)
- Other additional references are excerpts from various Online Learning/websites.

The End