



# Introduction to **Spyder** IDE

# About Spyder

What is Spyder?



# What is **Spyder** IDE?

Spyder is an open source cross-platform integrated development environment (IDE) for scientific programming in the Python language.



# First Steps

Installation and opening





Anaconda Python/R Distribution x +

anaconda.com/distribution/

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## Anaconda Distribution

The World's Most Popular Python/R Data Science Platform

Download

The open-source Anaconda Distribution is the easiest way to perform Python/R data science and machine learning on Linux, Windows, and Mac OS X. With over 15 million users worldwide, it is the industry standard for developing, testing, and training on a single machine, enabling *individual data scientists* to:

- Quickly download 1,500+ Python/R data science packages
- Manage libraries, dependencies, and environments with Conda
- Develop and train machine learning and deep learning models with scikit-learn, TensorFlow, and Theano
- Analyze data with scalability and performance with Dask, NumPy, pandas, and Numba
- Visualize results with Matplotlib, Bokeh, Dask, and HoloViews

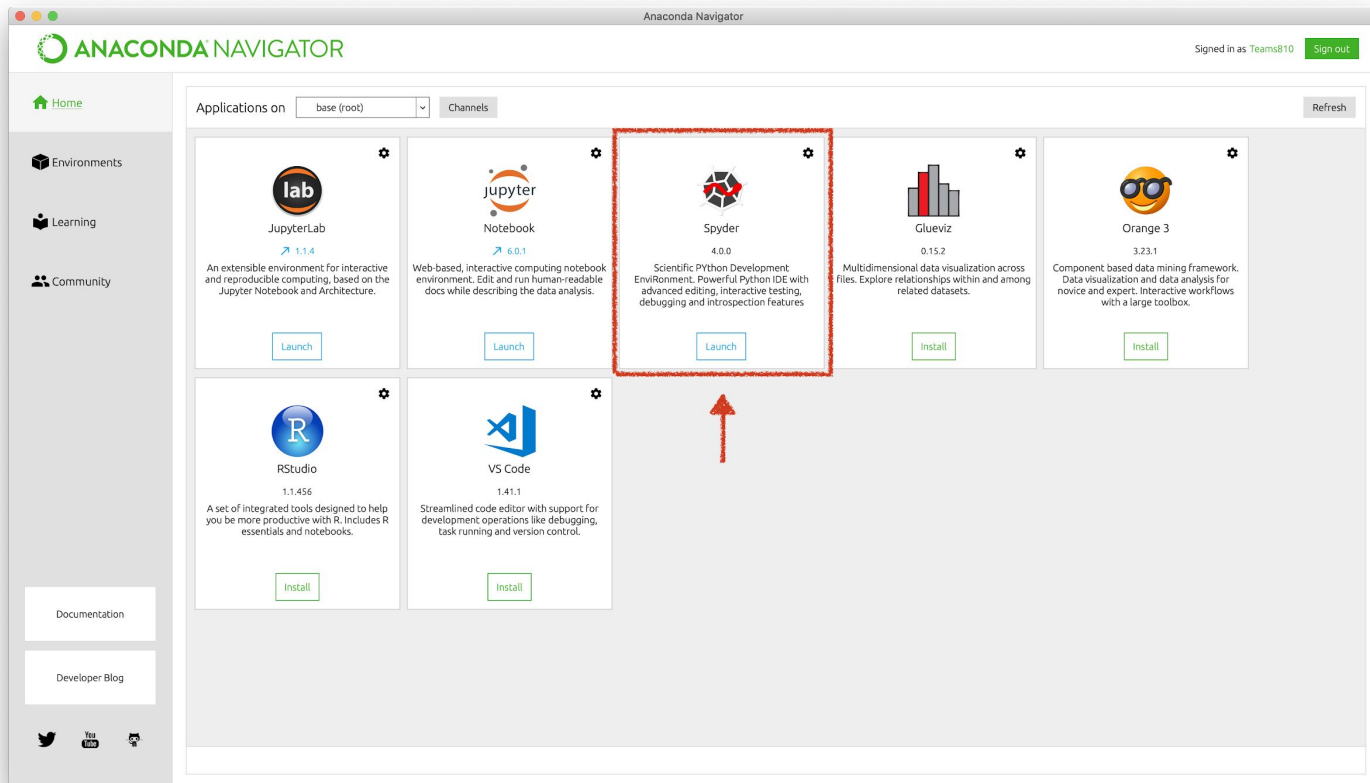
Windows | macOS | Linux

Anaconda 2019.10 for macOS Installer

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ACCEPT

Download: <https://www.anaconda.com/distribution/>

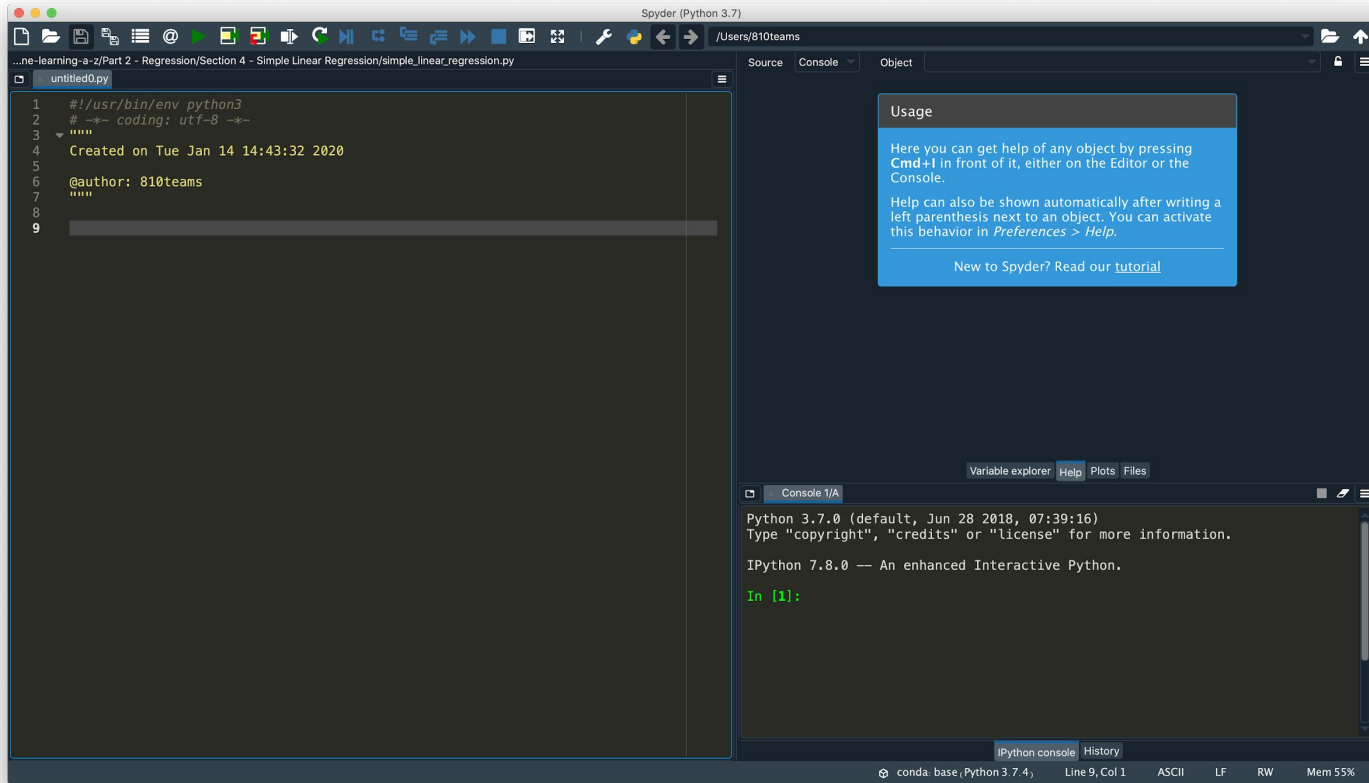


Opening via Anaconda Navigator



```
810teams — -bash — 80x24  
(base) SaintMacBookPro:~ 810teams$ spyder
```

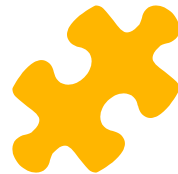
Opening via Command Line



Spyder IDE

# Files

Exploring files and folders



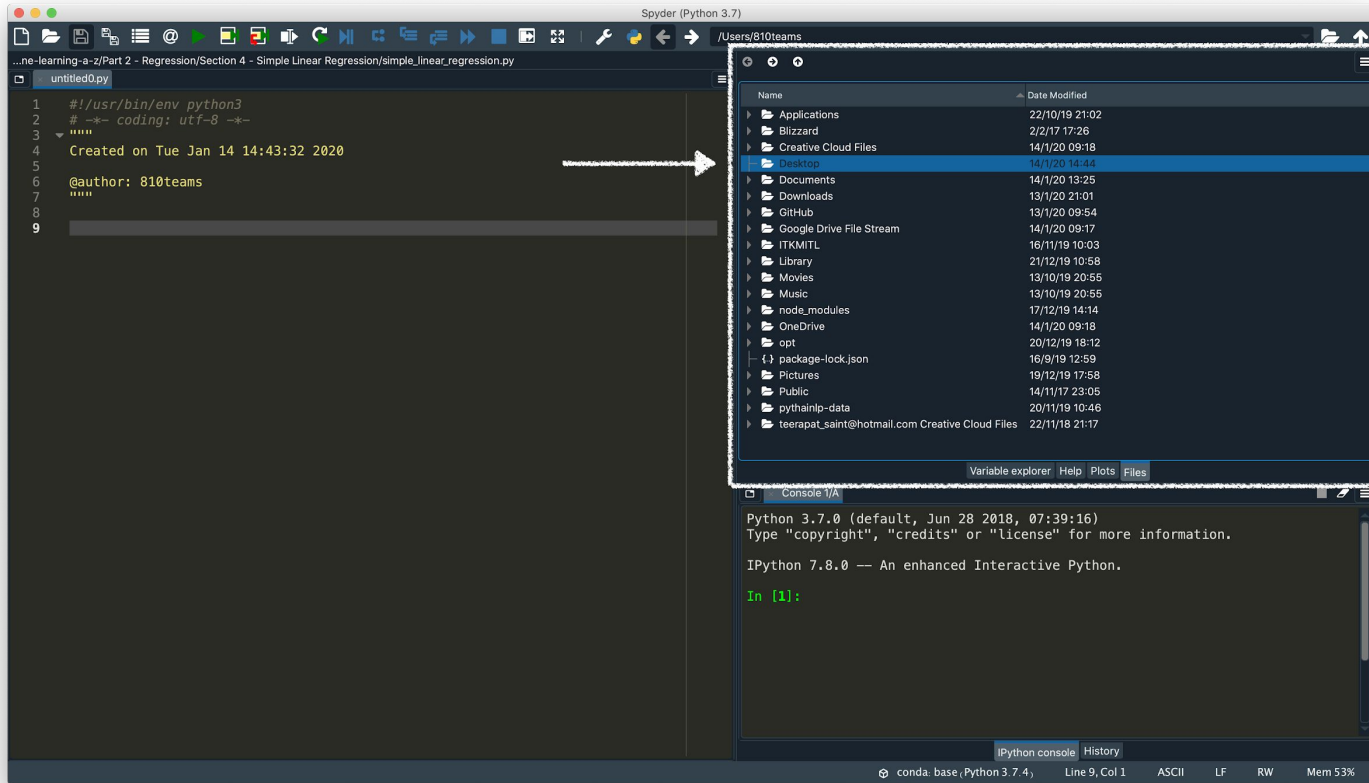
# File Explorer

## Explore

Use file explorer to explore files and folders in your system.

## Set as workspace

Double click the folder to set the folder as the workspace. Running scripts will be done in the selected directory.

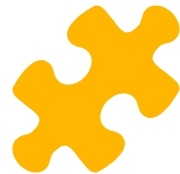


Files explorer

# Code Execution

Code execution methods and the variable explorer





# Code Execution

## Run file

Press F5 to run every part of the code, or the whole file.

## Run specific line

Highlight the specific part of the code, then press F9 to execute it. Results will remain.

## IPython console

Interactive mode of Python can be used in IPython console, available in the bottom right of the Spyder IDE.

## Run specific cell

Using `#%` to separate cells, an individual cell can be run with "Run current cell" button.



# Variable Explorer

## What is it?

Variable explorer is a feature which allows you to view all variables available or created from executing the code.

## Details

Each variable in the variable explorer will contain name, type, size, and value.

## Location

Variable explorer is located in the top right of the Spyder IDE.



Run the highlighted part of code



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Tue Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  price = 1050
10 tax = 0.07
11 service_charge = 0.1
12
```

(2) →

Name	Type	Size	Value
price	int	1	1050

Variable explorer | Help | Plots | Files

Console 1/A

Python 3.7.0 (default, Jun 28 2018, 07:39:16)  
Type "copyright", "credits" or "license" for more information.

IPython 7.8.0 -- An enhanced Interactive Python.

In [1]: price = 1050

In [2]:

IPython console | History

conda: base (Python 3.7.4), Line 12, Col 1 UTF-8 LF RW Mem 54%

Executed variable declaration appears in the variable explorer



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial

sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Tue Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  price = 1050
10 tax = 0.07
11 service_charge = 0.1
12
```

Name	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07

Variable explorer Help Plots Files

Console 1/A

Python 3.7.0 (default, Jun 28 2018, 07:39:16)  
Type "copyright", "credits" or "license" for more information.

IPython 7.8.0 -- An enhanced Interactive Python.

```
In [1]: price = 1050
In [2]: tax = 0.07
...: service_charge = 0.1
In [3]: price = 2100
```

IPython console History

conda: base (Python 3.7.4), Line 6, Col 18 UTF-8 LF RW Mem 54%

Custom code execution in IPython console



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial

sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Tue Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  price = 1050
10 tax = 0.07
11 service_charge = 0.1
12
```

(2) →

Name	Type	Size	Value
price	int	1	2100
service_charge	float	1	0.1
tax	float	1	0.07

(1) →

Console 1/A

Python 3.7.0 (default, Jun 28 2018, 07:39:16)  
Type "copyright", "credits" or "license" for more information.

IPython 7.8.0 -- An enhanced Interactive Python.

```
In [1]: price = 1050
In [2]: tax = 0.07
...: service_charge = 0.1
In [3]: price = 2100
In [4]:
```

Variable explorer Help Plots Files

IPython console History

conda: base (Python 3.7.4), Line 6, Col 18 UTF-8 LF RW Mem 54%

Executed code in IPython console altered the value of variable



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample\_intro.py

untitled0.py sample\_intro.py

```
1 #!/usr/bin/env python3
2 #-*- coding: utf-8 -*-
3
4 """
5 Sample Code - Introduction
6 Created on Wed Jan 15 13:40:00 2020
7
8 @author: 810teams
9 """
10
11 # %%
12
13 from math import ceil
14
15 # %%
16 price = 1050
17 tax = 0.07
18 service_charge = 0.1
19
20 total = price * (1 + tax) * (1 + service_charge)
21
22 # %%
23
24 print(ceil(total))
25
26
```

(2)

(1)

Name	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07
total	float	1	1235.8500000000001

(3)

Variable explorer Help Plots Files

Console 1/A

File "/Users/810teams/Desktop/untitled0.py", line 8, in <module>  
main()  
NameError: name 'main' is not defined

In [10]: runfile('/Users/810teams/Desktop/untitled0.py', wdir='/Users/810teams/Desktop')

In [11]: runcell(2, '/Users/810teams/Desktop/spyder-tutorial/sample\_intro.py')

In [12]:

IPython console History

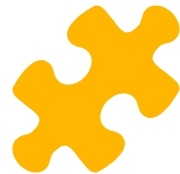
conda base (Python 3.7.4) Line 21, Col 28 UTF-8 LF RW Mem 53%

Run the specific cell of code

## Reset

Start over by resetting all variables





# Resetting Methods

## Reset with button

Press the eraser button above the variable explorer to reset all variables.

## Reset with command

Type `%reset` into the IPython console to reset all variables. This requires confirmation via the IPython console.

Sample Code - Introduction  
Created on Wed Jan 15 13:40:00 2020  
@author: 810teams

```
1  #!/usr/bin/env python3
2  #-*- coding: utf-8 -*-
3  """
4  Sample Code - Introduction
5  Created on Wed Jan 15 13:40:00 2020
6
7  @author: 810teams
8  """
9
10 from math import ceil
11
12 price = 1050
13 tax = 0.07
14 service_charge = 0.1
15
16 total = price * (1 + tax) * (1 + service_charge)
17
18 print(ceil(total))
19
```

Variable	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07
total	float	1	1235.8500000000001

Python 3.7.0 (default, Jun 28 2018, 07:39:16)  
Type "copyright", "credits" or "license" for more information.

IPython 7.8.0 -- An enhanced Interactive Python.

In [1]: runfile('/Users/810teams/Desktop/spyder-tutorial/sample\_intro.py',  
wdir='/Users/810teams/Desktop/spyder-tutorial')  
1236

In [2]:

Reset variables button





Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample\_intro.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Sample Code - Introduction
5  Created on Wed Jan 15 13:40:00 2020
6
7  @author: 810teams
8  """
9
10 from math import ceil
11
12 price = 1050
13 tax = 0.07
14 service_charge = 0.1
15
16 total = price * (1 + tax) * (1 + service_charge)
17
18 print(ceil(total))
19
```

(2) →

Name	Type	Size	Value
------	------	------	-------

(1) →

In [2]:  
Removing all variables...

In [2]:

Variable explorer | Help | Plots | Files

Console 1/A

IPython console | History

conda: base (Python 3.7.4) | Line 1, Col 1 | UTF-8 | LF | RW | Mem 56%

Variables removed



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Wed Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  from math import ceil
10
11  price = 1050
12  tax = 0.07
13  service_charge = 0.1
14
15  total = price * (1 + tax) * (1 + service_charge)
16
17  print(ceil(total))
18
```

Name	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07
total	float	1	1235.8500000000001

Variable explorer | Help | Plots | Files

Console 1/A

```
In [7]: runfile('/Users/810teams/Desktop/spyder-tutorial/sample.py', wdir='/Users/810teams/Desktop/spyder-tutorial')
1236
In [8]: %reset
```

Python console | History

conda: base (Python 3.7.4), Line 18, Col 1, UTF-8, LF, RW, Mem 53%

Reset variables command



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial

sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Wed Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  from math import ceil
10
11  price = 1050
12  tax = 0.07
13  service_charge = 0.1
14
15  total = price * (1 + tax) * (1 + service_charge)
16
17  print(ceil(total))
18
```

(2) →

Variable explorer

Var	Type	Size	Value
-----	------	------	-------

Console 1/A

```
In [7]: runfile('/Users/810teams/Desktop/spyder-tutorial/sample.py', wdir='/Users/810teams/Desktop/spyder-tutorial')
1236

In [8]: %reset
Once deleted, variables cannot be recovered. Proceed (y/[n])? y

In [9]: |
```

IPython console History

conda: base (Python 3.7.4), Line 18, Col 1 UTF-8 LF RW Mem 53%

Variables deleted

# Documentation

Inspect a documentation of a certain function, class, or method



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Tue Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  from math import ceil
10
11  price = 1050
12  tax = 0.07
13  service_charge = 0.1
14
```

(1) Ctrl + I or Cmd + I

(2) →

ceil

Definition: `ceil(x: SupportsFloat) -> int`

Return the ceiling of x as an Integral.

This is the smallest integer  $\geq x$ .

Variable explorer | Help | Plots | Files

Console 1/A

Python 3.7.0 (default, Jun 28 2018, 07:39:16)  
Type "copyright", "credits" or "license" for more information.

IPython 7.8.0 -- An enhanced Interactive Python.

```
In [1]: price = 1050
In [2]: tax = 0.07
...: service_charge = 0.1
In [3]: price = 2100
In [4]:
```

IPython console | History

conda: base (Python 3.7.4), Line 9, Col 21 UTF-8 LF RW Mem 55%

Documentation inspection

# Debugging

Use debug feature, along with the variable explorer



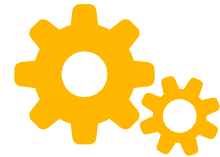


# Debugging

Debugging is the process of finding and resolving defects or problems within a computer program that prevent correct operation of computer software or a system.

Debugging tactics can involve the following:

- Interactive bugging
- Control flow analysis
- Unit testing
- etc.



# Debugging in Spyder



## Start Debugging

Press Ctrl + F5 to start debugging.



## Execute current line

Execute code line by line until you noticed the bug, mistake, or flaw.



## Stop Debugging

Press Ctrl + Shift + F12 to stop debugging.



## Code Fix

Edit the part of the code where the bug, mistake, or flaw is found.



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Tue Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  from math import ceil
10
11  price = 1050
12  tax = 0.07
13  service_charge = 0.1
14
15  total = price * tax * service_charge
16
17  print(ceil(total))
18
```

(1) → (3)

(2) →

Variable explorer

Name	Type	Size	Value
------	------	------	-------

Console 1/A

```
In [5]: total = price * tax * service_charge
In [6]: debugfile('/Users/810teams/Desktop/spyder-tutorial/sample.py', wdir='/Users/810teams/Desktop/spyder-tutorial')
> /Users/810teams/Desktop/spyder-tutorial/sample.py(7)<module>()
5
6 @author: 810teams
7 """
8
9 from math import ceil

ipdb>
```

IPython console | History

conda: base (Python 3.7.4) Line 7, Col 1 UTF-8 LF RW Mem 54%

Start debugging



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3
4  Created on Tue Jan 14 14:43:32 2020 (2)
5
6  @author: 810teams
7  """
8
9  from math import ceil
10
11  price = 1050
12  tax = 0.07
13  service_charge = 0.1
14
15  total = price * tax * service_charge (1)
16
17  print(ceil(total))
18
```

Run current line

Name	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07

Variable explorer Help Plots Files

Console 1/A

```
In [5]: from math import ceil
In [5]: total = price * tax * service_charge
In [6]: debugfile('/Users/810teams/Desktop/spyder-tutorial/sample.py', wdir='/Users/810teams/Desktop/spyder-tutorial')
> /Users/810teams/Desktop/spyder-tutorial/sample.py(7)<module>()
5
6 @author: 810teams
7 """
8
9 from math import ceil

ipdb> |
```

IPython console History

conda: base (Python 3.7.4), Line 15, Col 1 UTF-8 LF RW Mem 54%

Execute the current line of code



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

```
1 #!/usr/bin/env python3
2 # -*- coding: utf-8 -*-
3
4 Created on Tue Jan 14 14:43:32 2020
5
6 @author: 810teams
7
8
9 from math import ceil
10
11 price = 1050
12 tax = 0.07
13 service_charge = 0.1
14
15 total = price * tax * service_charge
16
17 print(ceil(total))
```

(1) →

(2) →

(3) →

Name	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07
total	float	1	7.3500000000000005

(4) →

```
8
--Return--
ipdb> |
```

Console 1/A

```
In [6]: debugfile('/Users/810teams/Desktop/spyder-tutorial/sample.py', wdir='/Users/810teams/Desktop/spyder-tutorial')
> /Users/810teams/Desktop/spyder-tutorial/sample.py(7)<module>()
5
6 @author: 810teams
7
8
9 from math import ceil
```

Run current line

conda: base (Python 3.7.4), Line 17, Col 1 UTF-8 LF RW Mem 54%

After line 15 execution, bug found



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Tue Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  from math import ceil
10
11  price = 1050
12  tax = 0.07
13  service_charge = 0.1
14
15  total = price * (1 + tax) * (1 + service_charge)
16
17  print(ceil(total))
18
```

(1)

(2)

Name	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07
total	float	1	7.3500000000000005

Variable explorer Help Plots Files

Console 1/A

```
in [0]: debug: /Users/810teams/Desktop/spyder-tutorial/sample.py, wdir: /Users/810teams/Desktop/spyder-tutorial
> /Users/810teams/Desktop/spyder-tutorial/sample.py (7) <module>()
5
6 @author: 810teams
7 """
8
9 from math import ceil
10
11
12
13
14
15
16
17
18
--Return--
ipdb>
In [7]:
```

IPython console History

conda: base (Python 3.7.4), Line 18, Col 1 UTF-8 LF RW Mem 54%

Stop debugging mode, bug fix



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

```
1  #!/usr/bin/env python3
2  # -*- coding: utf-8 -*-
3  """
4  Created on Tue Jan 14 14:43:32 2020
5
6  @author: 810teams
7  """
8
9  from math import ceil
10
11 price = 1050
12 tax = 0.07
13 service_charge = 0.1
14
15 total = price * (1 + tax) * (1 + service_charge)
16
17 print(ceil(total))
18
```

(1) →

Name	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07
total	float	1	1235.8500000000001

(2) →

```
Console 1/A
> @author: 810teams
> 7 """
> 8
> 9 from math import ceil
>
> 8
--Return--
ipdb>
In [7]: runfile('/Users/810teams/Desktop/spyder-tutorial/sample.py', wdir='/Users/810teams/Desktop/spyder-tutorial')
1236
In [8]:
```

Python console | History

conda: base (Python 3.7.4), Line 18, Col 1 UTF-8 LF RW Mem 54%

Re-execute the whole file, meet desired result

# Plots

View plotted charts plotted by matplotlib





Spypy (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample.py

sample.py

```
1 #!/usr/bin/env python3
2 # -*- coding: utf-8 -*-
3
4 Created on Tue Jan 14 14:43:32 2020
5
6 @author: 810teams
7
8
9 import numpy as np
10 import matplotlib.pyplot as plt
11
12
13 x1 = np.linspace(0.0, 5.0)
14 x2 = np.linspace(0.0, 2.0)
15
16 y1 = np.cos(2 * np.pi * x1) * np.exp(-x1)
17 y2 = np.cos(2 * np.pi * x2)
18
19 plt.subplot(2, 1, 1)
20 plt.plot(x1, y1, 'o-')
21 plt.title('A tale of 2 subplots')
22 plt.ylabel('Damped oscillation')
23
24 plt.subplot(2, 1, 2)
25 plt.plot(x2, y2, '-s')
26 plt.xlabel('time (s)')
27 plt.ylabel('Undamped')
28
29 plt.show()
30
```

(1) →

(2) →

(3) →

Name	Type	Size	Value
price	int	1	1050
service_charge	float	1	0.1
tax	float	1	0.07
total	float	1	1235.8500000000001
x1	Array of float64 (50,)	[0.	0.10204082 0.20408163 ...
x2	Array of float64 (50,)	[0.	0.04081633 0.08163265 ...
y1	Array of float64 (50,)	[1.	0.72367065 0.2320026 ...
y2	Array of float64 (50,)	[1.	0.96729486 0.8713187 ...

Variable explorer Help Plots Files

Console 1/A

```
In [8]: runfile('/Users/810teams/Desktop/spyder-tutorial/sample.py', wdir='/Users/810teams/Desktop/spyder-tutorial')
```

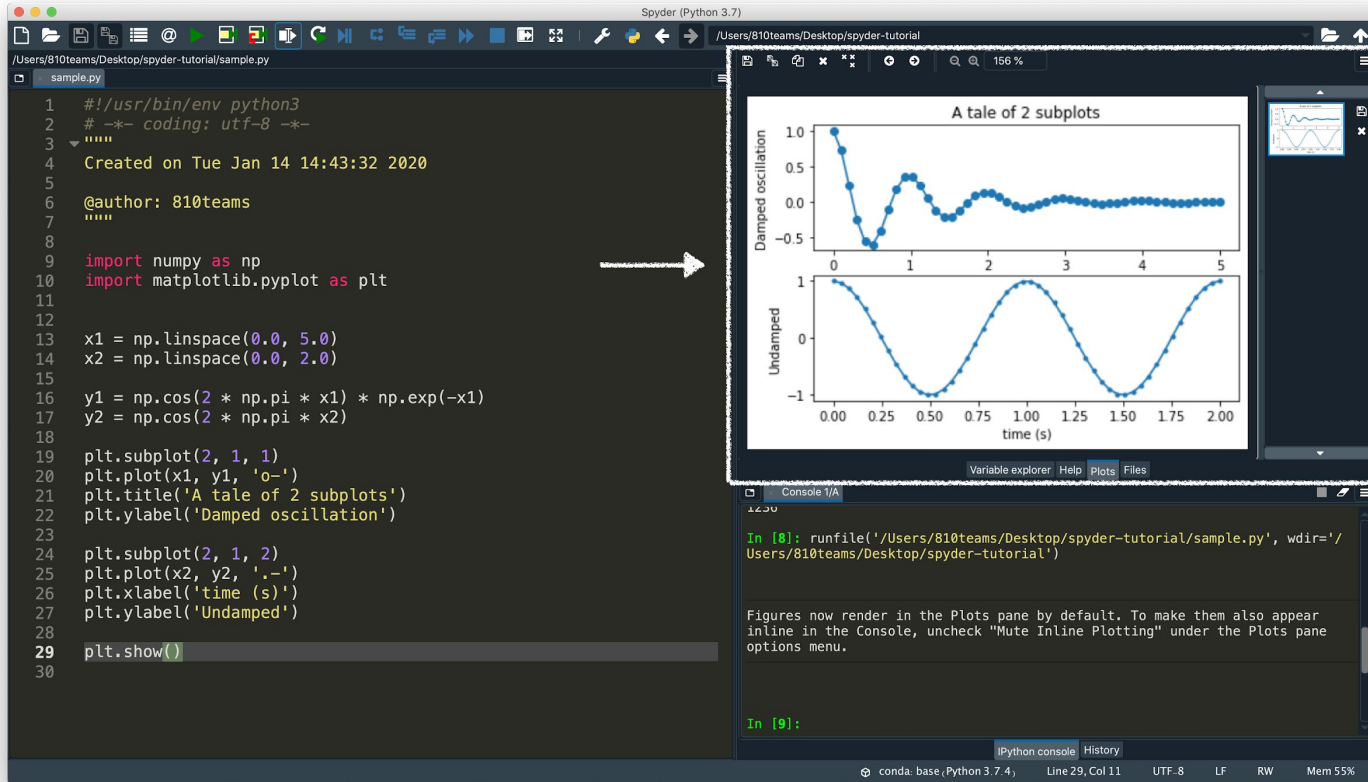
Figures now render in the Plots pane by default. To make them also appear inline in the Console, uncheck "Mute Inline Plotting" under the Plots pane options menu.

In [9]:

Python console History

conda: base, Python 3.7.4 Line 29, Col 11 UTF-8 LF RW Mem 54%

Sample matplotlib code execution



Plots viewing

# Advanced Usage

Preview of Spyder advanced usage



# Advanced Usage

Since Spyder is an IDE for scientific programming, data-related programming and engineering is

Data-related programming:

- Data analysis
- Data visualization
- Machine learning
- etc.



Spyder (Python 3.7)

/Users/810teams/Desktop/spyder-tutorial/sample\_sklearn.py

```
6
7 @author: 810teams
8
9
10 # Importing the libraries
11 import numpy as np
12 import matplotlib.pyplot as plt
13 import pandas as pd
14
15 # Importing the dataset
16 dataset = pd.read_csv('salary_data.csv')
17 X = dataset.iloc[:, 1:2].values
18 y = dataset.iloc[:, 2].values
19
20 # Splitting the dataset into the Training set and Test set
21 from sklearn.model_selection import train_test_split
22 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 1/3, random
23
24 # Fitting Simple Linear Regression to the Training set
25 from sklearn.linear_model import LinearRegression
26 regressor = LinearRegression()
27 regressor.fit(X_train, y_train)
28
29 # Predicting the Test set results
30 y_pred = regressor.predict(X_test)
31
32 # Visualising the Training set results
33 plt.scatter(X_train, y_train, color = 'red')
34 plt.plot(X_train, regressor.predict(X_train), color = 'blue')
35 plt.title('Salary vs Experience (Training set)')
36 plt.xlabel('Years of Experience')
37 plt.ylabel('Salary')
38 plt.show()
39
40 # Visualising the Test set results
41 plt.scatter(X_test, y_test, color = 'red')
42 plt.plot(X_train, regressor.predict(X_train), color = 'blue')
43 plt.title('Salary vs Experience (Test set)')
44 plt.xlabel('Years of Experience')
45 plt.ylabel('Salary')
46 plt.show()
47
```

(1) ←

(2) →

Name	Type	Size	Value
X	Array of float64	(37, 1)	[[ 5.3]
X_test	Array of float64	(13, 1)	[[9. ]
X_train	Array of float64	(24, 1)	[[10.5]
dataset	DataFrame	(37, 2)	Column names: years e...
regressor	linear_model.base.LinearRegression	1	LinearRegression obje...
y	Array of float64	(37,)	[ 76091. 72092. 393...
y_pred	Array of float64	(13,)	[111736. 94944966 653...
y_test	Array of float64	(13,)	[105582. 57081. 1094...
y_train	Array of float64	(24,)	[121872. 98273. 566...

Variable explorer Help Plots Files

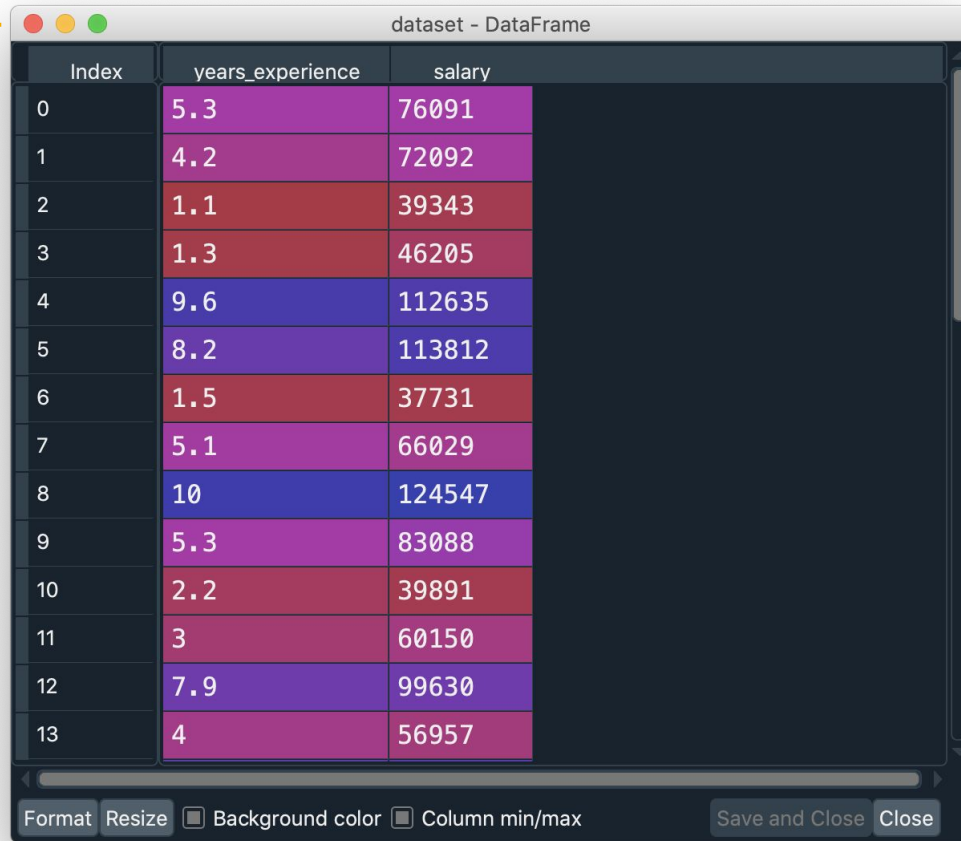
Console 1/A

In [8]:

Python console History

conda: base (Python 3.7.4), Line 47, Col 1 UTF-8 LF RW Mem 56%

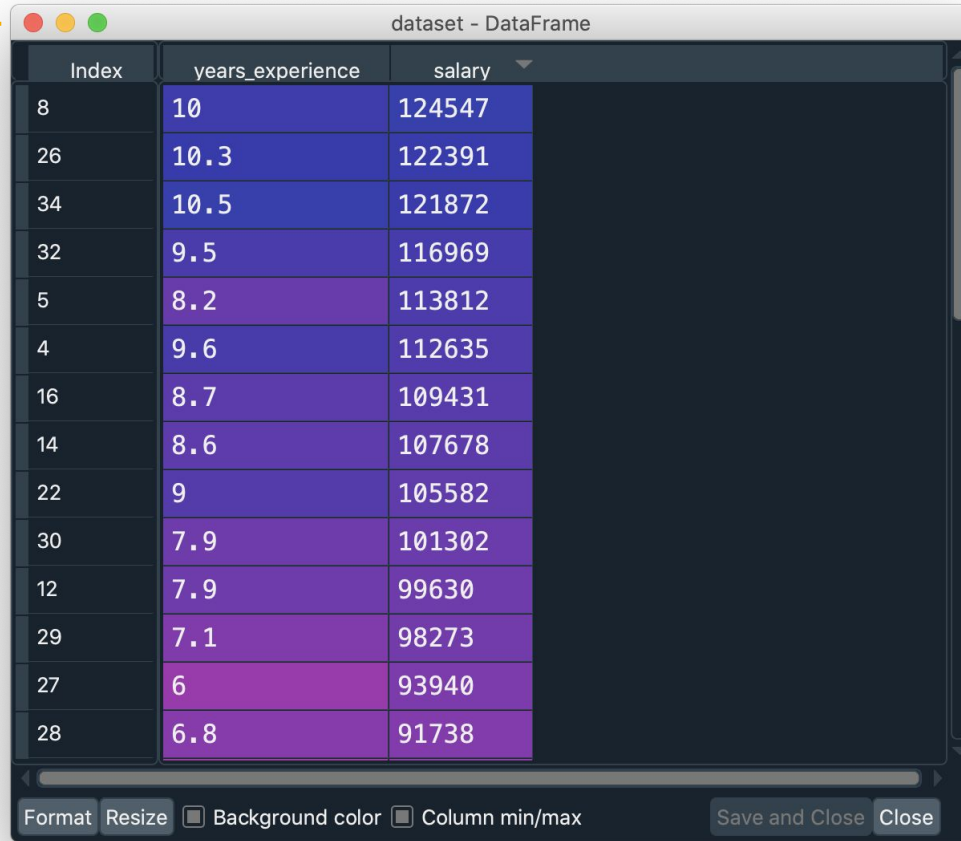
Dataset import



Index	years_experience	salary
0	5.3	76091
1	4.2	72092
2	1.1	39343
3	1.3	46205
4	9.6	112635
5	8.2	113812
6	1.5	37731
7	5.1	66029
8	10	124547
9	5.3	83088
10	2.2	39891
11	3	60150
12	7.9	99630
13	4	56957



Dataset inspection



Index	years_experience	salary
8	10	124547
26	10.3	122391
34	10.5	121872
32	9.5	116969
5	8.2	113812
4	9.6	112635
16	8.7	109431
14	8.6	107678
22	9	105582
30	7.9	101302
12	7.9	99630
29	7.1	98273
27	6	93940
28	6.8	91738

Dataset sorting





dataset - DataFrame

Index	years_experience	salary
8	10.00	124547.00
26	10.30	122391.00
34	10.50	121872.00
32	9.50	116969.00
5	8.20	113812.00
4	9.60	112635.00
16	8.70	109431.00
14	8.60	107678.00
22	9.00	105582.00
30	7.90	101302.00
12	7.90	99630.00
29	7.10	98273.00
27	6.00	93940.00
28	6.80	91738.00

Format

Float formatting

Cancel OK

Format Resize ☐ Background color ☐ Column min/max Save and Close Close

Dataset value formatting (viewing-only)

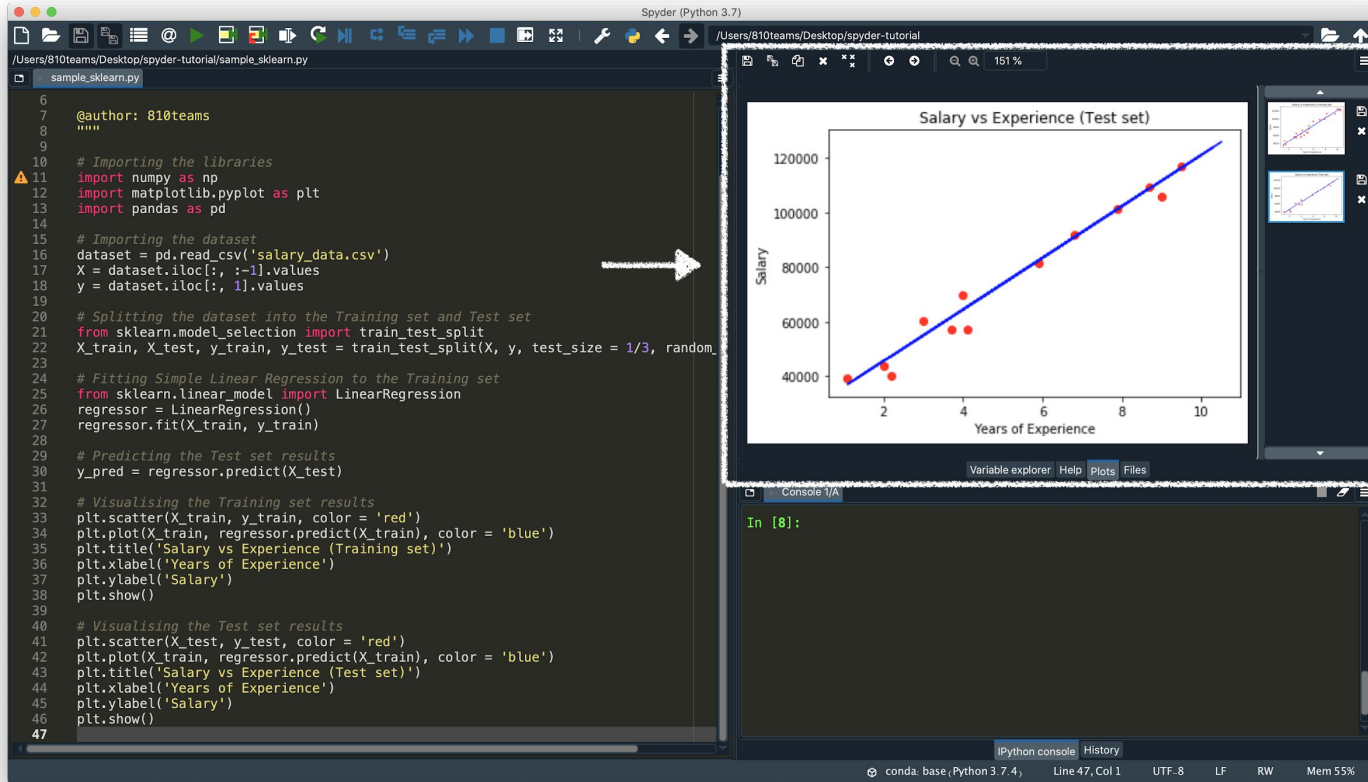


### Number Formatting Types

Type	Meaning
d	Decimal integer
c	Corresponding Unicode character
b	Binary format
o	Octal format
x	Hexadecimal format (lower case)
X	Hexadecimal format (upper case)
n	Same as 'd'. Except it uses current locale setting for number separator
e	Exponential notation. (lowercase e)
E	Exponential notation (uppercase E)
f	Displays fixed point number (Default: 6)
F	Same as 'f'. Except displays 'inf' as 'INF' and 'nan' as 'NAN'
g	General format. Rounds number to p significant digits. (Default precision: 6)
G	Same as 'g'. Except switches to 'E' if the number is large.
%	Percentage. Multiplies by 100 and puts % at the end.



Value formatting



Prediction and plotting



# Thanks!

Any questions?

60070009, 60070021, 60070036, 60070037, 60070063,  
60070072, 60070075, 60070083, 60070119, 60070183