

# Intro to IPython and Jupyter Notebook

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# Further Reading

- ▶ Python Data Science Handbook, Chapter 1
- ▶ Python for Data Analysis, Chapter 2, sections 2.1-2.2

# IPython

- ▶ IPython is short for Interactive Python
- ▶ It was started in 2001 by Fernando Perez as an enhanced Python editor
- ▶ IPython can be run in the shell or in a notebook (usually a Jupyter notebook)

# Python

```
(base) tass:~ sneeley$ python
Python 3.7.1 (default, Dec 14 2018, 13:28:58)
[Clang 4.0.1 (tags/RELEASE_401/final)] :: Anaconda, Inc. on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> greeting = "Hello Python"
>>> print(greeting)
Hello Python
>>> greeting
'Hello Python'
>>> 4+8
12
>>> 12//5
2
>>> print(12//5)
2
>>> a = 12//5
>>> a
2
>>> type(a)
<class 'int'>
>>> █
```

# IPython

```
[(base) tass:~ sneeley$ ipython
Python 3.7.1 (default, Dec 14 2018, 13:28:58)
Type 'copyright', 'credits' or 'license' for more information
IPython 7.2.0 -- An enhanced Interactive Python. Type '?' for help.

[In [1]: greeting = "Hello Python"

[In [2]: print(greeting)
Hello Python

[In [3]: greeting
Out[3]: 'Hello Python'

[In [4]: 4+8
Out[4]: 12

[In [5]: 12//5
Out[5]: 2

[In [6]: print(12//5)
2

[In [7]: a = 12//5

[In [8]: type(a)
Out[8]: int

In [9]: █
```

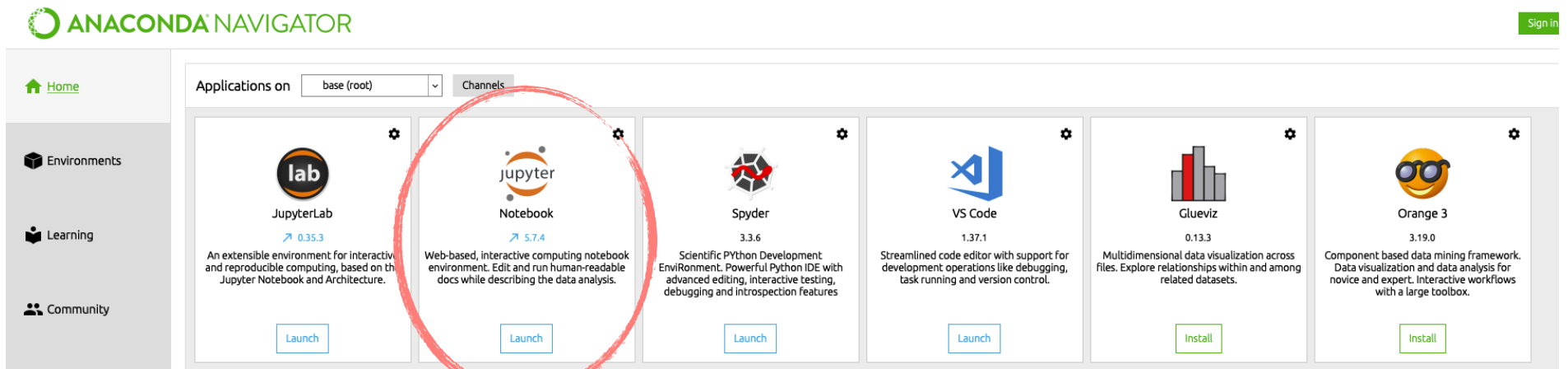
# Jupyter Notebook

## ► Jupyter Notebook

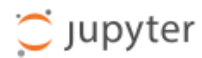
- Interactive document for code, text, data visualizations and other output
- **JU**lia **PYT**hon **e R**
- The Jupyter notebook can be used with many programming languages
- See Project Jupyter at [jupyter.org](http://jupyter.org)

# Starting Jupyter

- ▶ From the command line
  - Navigate to desired folder and type
  - `> jupyter notebook`
- ▶ From Anaconda navigator



# Jupyter Interface

[Quit](#)[Logout](#)[Files](#)[Running](#)[Clusters](#)

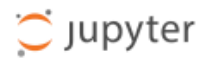
Select items to perform actions on them.

[Upload](#)[New ▾](#)☐ 0 ▾[/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks](#)[Name ▾](#)[Last Modified](#)[File size](#)[..](#)[seconds ago](#)[01 Python Review Part 1.ipynb](#)[Running 7 days ago](#)[13.7 kB](#)[02 Python Review Part 2.ipynb](#)[7 days ago](#)[22.1 kB](#)[03 Python NumPy Review.ipynb](#)[7 days ago](#)[15.3 kB](#)[04 Pandas.ipynb](#)[6 days ago](#)[7.48 kB](#)



# Jupyter Interface

Pull in notebook from somewhere else on system



Quit

Logout

Files

Running

Clusters

Select items to perform actions on them.

Upload

New ▾



☐ 0 ▾

/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks

Name ▾

Last Modified

File size

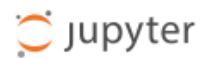
..

seconds ago

<input type="checkbox"/>	01 Python Review Part 1.ipynb	Running 7 days ago	13.7 kB
<input type="checkbox"/>	02 Python Review Part 2.ipynb	7 days ago	22.1 kB
<input type="checkbox"/>	03 Python NumPy Review.ipynb	7 days ago	15.3 kB
<input type="checkbox"/>	04 Pandas.ipynb	6 days ago	7.48 kB

# Jupyter Interface

Create a new notebook



Quit

Logout

Files

Running

Clusters

Select items to perform actions on them.

Upload

New ▾



<input type="checkbox"/> 0 ▾ / Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks			Name ▾	Last Modified	File size
..				seconds ago	
<input type="checkbox"/>	01 Python Review Part 1.ipynb	Running		7 days ago	13.7 kB
<input type="checkbox"/>	02 Python Review Part 2.ipynb			7 days ago	22.1 kB
<input type="checkbox"/>	03 Python NumPy Review.ipynb			7 days ago	15.3 kB
<input type="checkbox"/>	04 Pandas.ipynb			6 days ago	7.48 kB

# Jupyter Interface

Stop the Jupyter server



Quit Logout

Files

Running

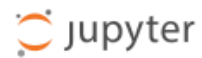
Clusters

Select items to perform actions on them.

Upload New ↕

<input type="checkbox"/> 0 ▾	/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks	Name ▾	Last Modified	File size
	..		seconds ago	
<input type="checkbox"/>	01 Python Review Part 1.ipynb		Running 7 days ago	13.7 kB
<input type="checkbox"/>	02 Python Review Part 2.ipynb		7 days ago	22.1 kB
<input type="checkbox"/>	03 Python NumPy Review.ipynb		7 days ago	15.3 kB
<input type="checkbox"/>	04 Pandas.ipynb		6 days ago	7.48 kB

# Jupyter Interface

[Quit](#)[Logout](#)[Files](#)[Running](#)[Clusters](#)

Select items to perform actions on them.

[Upload](#)[New ▾](#)☐ 0 ▾[/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks](#)[Name ▾](#)[Last Modified](#)[File size](#)[..](#)[seconds ago](#)[01 Python Review Part 1.ipynb](#)[Running 7 days ago](#)[13.7 kB](#)[02 Python Review Part 2.ipynb](#)[7 days ago](#)[22.1 kB](#)[03 Python NumPy Review.ipynb](#)[7 days ago](#)[15.3 kB](#)[04 Pandas.ipynb](#)[6 days ago](#)[7.48 kB](#)

# Jupyter Interface

Options when selected notebook is "running"

The screenshot shows the Jupyter web interface. At the top, there's a 'jupyter' logo and 'Quit' and 'Logout' buttons. Below that are tabs for 'Files', 'Running', and 'Clusters'. The 'Running' tab is active, showing a toolbar with 'Duplicate', 'Shutdown', 'View', 'Edit', and a delete icon. A red circle highlights this toolbar. Below the toolbar is a breadcrumb path: '/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks'. To the right of the path are buttons for 'Name', 'Last Modified', and 'File size'. A table lists the notebooks:

	Name	Last Modified	File size
<input checked="" type="checkbox"/>	01 Python Review Part 1.ipynb	Running 7 days ago	13.7 kB
<input type="checkbox"/>	02 Python Review Part 2.ipynb	7 days ago	22.1 kB
<input type="checkbox"/>	03 Python NumPy Review.ipynb	7 days ago	15.3 kB
<input type="checkbox"/>	04 Pandas.ipynb	6 days ago	7.48 kB

A red circle highlights the first row, specifically the green checkmark icon and the notebook name. A red arrow points from the text 'Options when selected notebook is "running"' to the toolbar. Another red arrow points from the text '"Green" Icon shows that the notebook is running' to the green checkmark icon.

"Green" Icon shows that the notebook is running

# Jupyter Interface

Make a copy of the notebook




The screenshot shows the Jupyter web interface. At the top left is the Jupyter logo. On the right are 'Quit' and 'Logout' buttons. Below the logo are tabs for 'Files', 'Running', and 'Clusters'. The 'Files' tab is active, and the 'Duplicate' button is circled in red. A red arrow points from the 'Duplicate' button to the handwritten text 'Make a copy of the notebook'. Below the tabs are buttons for 'Duplicate', 'Shutdown', 'View', 'Edit', and a trash icon. On the right are 'Upload', 'New', and a refresh icon. The breadcrumb path is '/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks'. Below the path is a table of notebooks.

	Name ↓	Last Modified	File size
📁	..	seconds ago	
<input checked="" type="checkbox"/> 📄	01 Python Review Part 1.ipynb	Running 7 days ago	13.7 kB
<input type="checkbox"/> 📄	02 Python Review Part 2.ipynb	7 days ago	22.1 kB
<input type="checkbox"/> 📄	03 Python NumPy Review.ipynb	7 days ago	15.3 kB
<input type="checkbox"/> 📄	04 Pandas.ipynb	6 days ago	7.48 kB

# Jupyter Interface

Shutdown the notebook



The screenshot shows the Jupyter web interface. At the top left is the Jupyter logo. On the right are 'Quit' and 'Logout' buttons. Below the logo are tabs for 'Files', 'Running', and 'Clusters'. The 'Running' tab is active, and the 'Shutdown' button is circled in red. A red arrow points from the 'Shutdown' button to the text 'Shutdown the notebook'. Below the tabs are buttons for 'Duplicate', 'View', 'Edit', and a trash icon. On the right are 'Upload', 'New', and a refresh icon. The main area shows a file browser with a breadcrumb path: '/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks'. Below the path is a table of running notebooks.

	Name ↓	Last Modified	File size
1	..	seconds ago	
<input checked="" type="checkbox"/>	01 Python Review Part 1.ipynb	Running 7 days ago	13.7 kB
<input type="checkbox"/>	02 Python Review Part 2.ipynb	7 days ago	22.1 kB
<input type="checkbox"/>	03 Python NumPy Review.ipynb	7 days ago	15.3 kB
<input type="checkbox"/>	04 Pandas.ipynb	6 days ago	7.48 kB

# Jupyter Interface

Open the notebook (you can  
also click on the name of the  
notebook to open)



The screenshot shows the Jupyter web interface. At the top left is the Jupyter logo. To the right are 'Quit' and 'Logout' buttons. Below the logo are tabs for 'Files', 'Running', and 'Clusters'. The 'Files' tab is active, showing a file browser. The breadcrumb path is '/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks'. Below the path are buttons for 'Duplicate', 'Shutdown', 'View', 'Edit', and a trash icon. To the right are 'Upload', 'New', and a refresh icon. The file list shows four notebooks:

	Name	Last Modified	File size
<input checked="" type="checkbox"/>	01 Python Review Part 1.ipynb	Running 7 days ago	13.7 kB
<input type="checkbox"/>	02 Python Review Part 2.ipynb	7 days ago	22.1 kB
<input type="checkbox"/>	03 Python NumPy Review.ipynb	7 days ago	15.3 kB
<input type="checkbox"/>	04 Pandas.ipynb	6 days ago	7.48 kB



# Jupyter Interface

Open the raw JSON file

 jupyter

Quit

Logout

Files

Running

Clusters

Duplicate

Shutdown

View

Edit



Upload

New ▾



 1 ▾ / Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks

Name ▾

Last Modified

File size

..

seconds ago

☒  01 Python Review Part 1.ipynb

Running 7 days ago 13.7 kB

☐  02 Python Review Part 2.ipynb

7 days ago 22.1 kB

☐  03 Python NumPy Review.ipynb

7 days ago 15.3 kB

☐  04 Pandas.ipynb

6 days ago 7.48 kB

# Jupyter Interface

Delete the notebook



 jupyter

Quit

Logout

Files

Running

Clusters

Duplicate

Shutdown

View

Edit



Upload

New



 1  / Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks

Name

Last Modified

File size

..

seconds ago

☒  01 Python Review Part 1.ipynb

Running 7 days ago 13.7 kB

☐  02 Python Review Part 2.ipynb

7 days ago 22.1 kB

☐  03 Python NumPy Review.ipynb

7 days ago 15.3 kB

☐  04 Pandas.ipynb

6 days ago 7.48 kB

# Jupyter Interface

Two more options show up when a "non-running" notebook is selected

jupyter

Quit

Logout

Files

Running

Clusters

Duplicate

Rename

Move

Download

View

Edit

Upload

New

1 / Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks

Name

Last Modified

File size

..

seconds ago

☐

01 Python Review Part 1.ipynb

Running 7 days ago 13.7 kB

☒

02 Python Review Part 2.ipynb

7 days ago 22.1 kB

☐

03 Python NumPy Review.ipynb

7 days ago 15.3 kB

☐

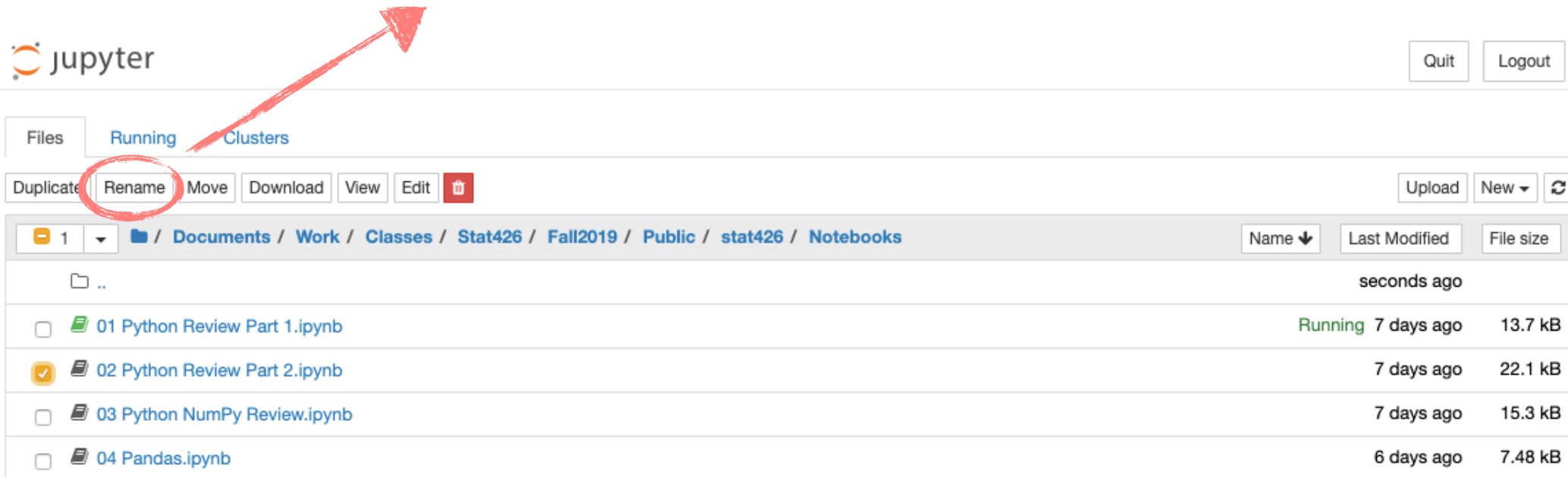
04 Pandas.ipynb

6 days ago 7.48 kB

"Gray" Icon shows that the notebook is not running

# Jupyter Interface

Rename the notebook

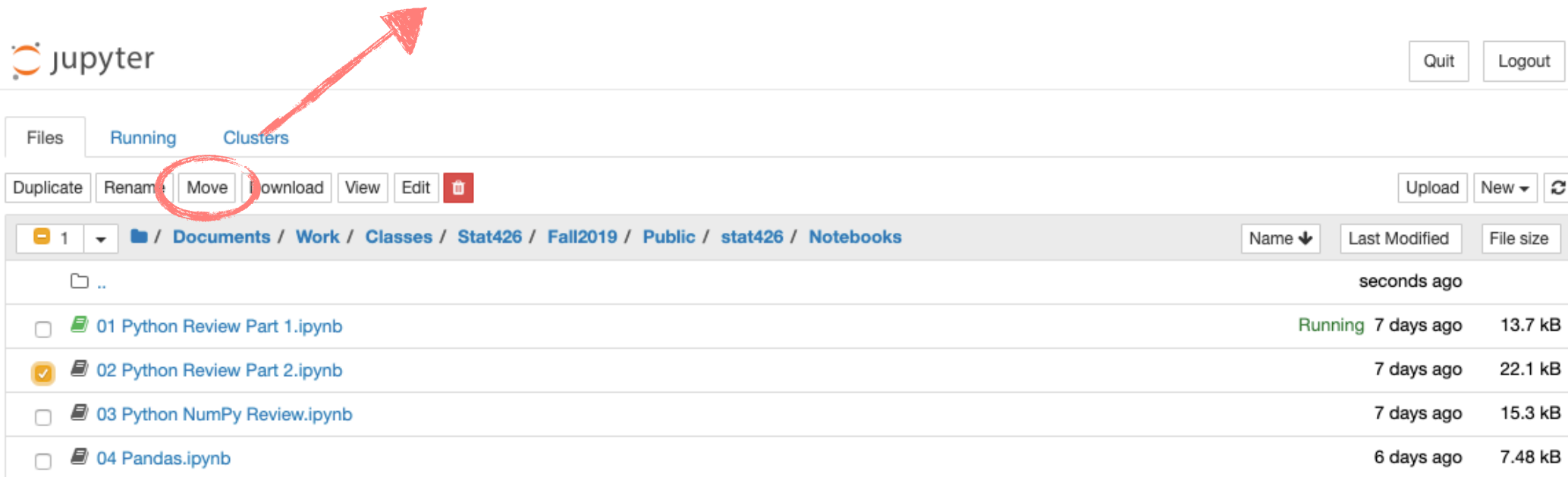


The screenshot shows the Jupyter web interface. At the top, there's a teal header with the title "Jupyter Interface". Below the header, the Jupyter logo is on the left, and "Quit" and "Logout" buttons are on the right. The main interface has a tabbed view with "Files", "Running", and "Clusters". The "Files" tab is active, showing a toolbar with buttons: "Duplicate", "Rename", "Move", "Download", "View", "Edit", and a trash icon. The "Rename" button is circled in red, and a red arrow points from the text "Rename the notebook" to it. Below the toolbar is a breadcrumb path: "/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks". To the right of the path are sorting options: "Name", "Last Modified", and "File size". A table lists the notebooks in the directory:

	Name	Last Modified	File size
<input type="checkbox"/>	01 Python Review Part 1.ipynb	Running 7 days ago	13.7 kB
<input checked="" type="checkbox"/>	02 Python Review Part 2.ipynb	7 days ago	22.1 kB
<input type="checkbox"/>	03 Python NumPy Review.ipynb	7 days ago	15.3 kB
<input type="checkbox"/>	04 Pandas.ipynb	6 days ago	7.48 kB

# Jupyter Interface

Move the notebook to another location



The screenshot shows the Jupyter web interface. At the top, there's a teal header with the title 'Jupyter Interface'. Below it, the Jupyter logo and 'jupyter' text are on the left, and 'Quit' and 'Logout' buttons are on the right. A navigation bar contains 'Files', 'Running', and 'Clusters' tabs. Below this is a toolbar with buttons: 'Duplicate', 'Rename', 'Move' (circled in red), 'Download', 'View', 'Edit', and a trash icon. To the right of the toolbar are 'Upload', 'New' (with a dropdown arrow), and a refresh icon. The main area shows a breadcrumb path: '/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks'. Below the path is a table of files. The first row is '..'. The second row is '01 Python Review Part 1.ipynb' with a status of 'Running'. The third row is '02 Python Review Part 2.ipynb' with a checked checkbox. The fourth row is '03 Python NumPy Review.ipynb'. The fifth row is '04 Pandas.ipynb'.

jupyter

Quit Logout

Files Running Clusters

Duplicate Rename Move Download View Edit

Upload New ↕ ↻

1 / Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks

Name ↓ Last Modified File size

..	seconds ago	
<input type="checkbox"/> 01 Python Review Part 1.ipynb	Running 7 days ago	13.7 kB
<input checked="" type="checkbox"/> 02 Python Review Part 2.ipynb	7 days ago	22.1 kB
<input type="checkbox"/> 03 Python NumPy Review.ipynb	7 days ago	15.3 kB
<input type="checkbox"/> 04 Pandas.ipynb	6 days ago	7.48 kB

# Jupyter Interface

Other Tabs

jupyter

Quit

Logout

Files

Running

Clusters

Select items to perform actions on them.

Upload

New ▾



☐ 0 ▾

/ Documents / Work / Classes / Stat426 / Fall2019 / Public / stat426 / Notebooks

Name ▾

Last Modified

File size

..

seconds ago

☐ 01 Python Review Part 1.ipynb

Running 7 days ago 13.7 kB

☐ 02 Python Review Part 2.ipynb

7 days ago 22.1 kB

☐ 03 Python NumPy Review.ipynb

7 days ago 15.3 kB

☐ 04 Pandas.ipynb

6 days ago 7.48 kB

# Jupyter Interface

Shows all notebooks that are running



The screenshot shows the Jupyter web interface. At the top left is the 'jupyter' logo. To its right are 'Files', 'Running', and 'Clusters' tabs. The 'Running' tab is circled in red, and a red arrow points from the handwritten text 'Shows all notebooks that are running' to it. In the top right corner are 'Quit' and 'Logout' buttons. Below the tabs, the text 'Currently running Jupyter processes' is followed by a refresh icon. There are two main sections: 'Terminals' and 'Notebooks'. The 'Terminals' section shows 'There are no terminals running.' The 'Notebooks' section shows a single notebook: 'Documents/Work/Courses/Stat426/Fall2019/Public/stat426/Notebooks/01 Python Review Part 1.ipynb'. To the right of the notebook name are the labels 'Python 3', a yellow 'Shutdown' button, and the text 'seconds ago'.

jupyter

Quit Logout

Files Running Clusters

Currently running Jupyter processes

Terminals ▾

There are no terminals running.

Notebooks ▾

Documents/Work/Courses/Stat426/Fall2019/Public/stat426/Notebooks/01 Python Review Part 1.ipynb Python 3 Shutdown seconds ago

# Jupyter Interface

For parallel computing environments

 jupyter

Quit

Logout

Files

Running

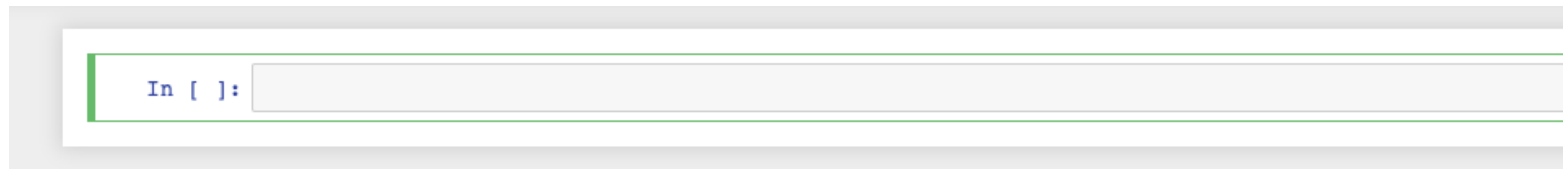
Clusters

Clusters tab is now provided by IPython parallel. See '[IPython parallel](#)' for installation details.



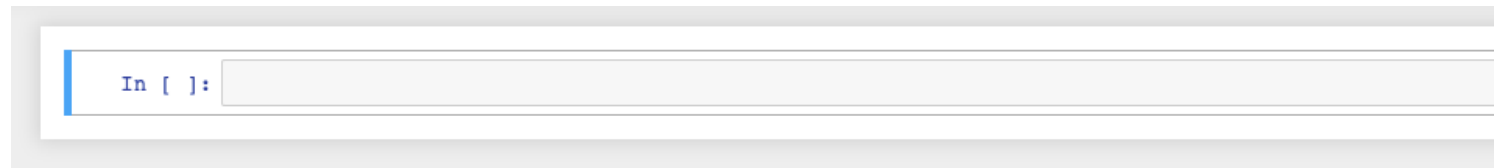
# Jupyter has two modes

## ▶ Edit mode



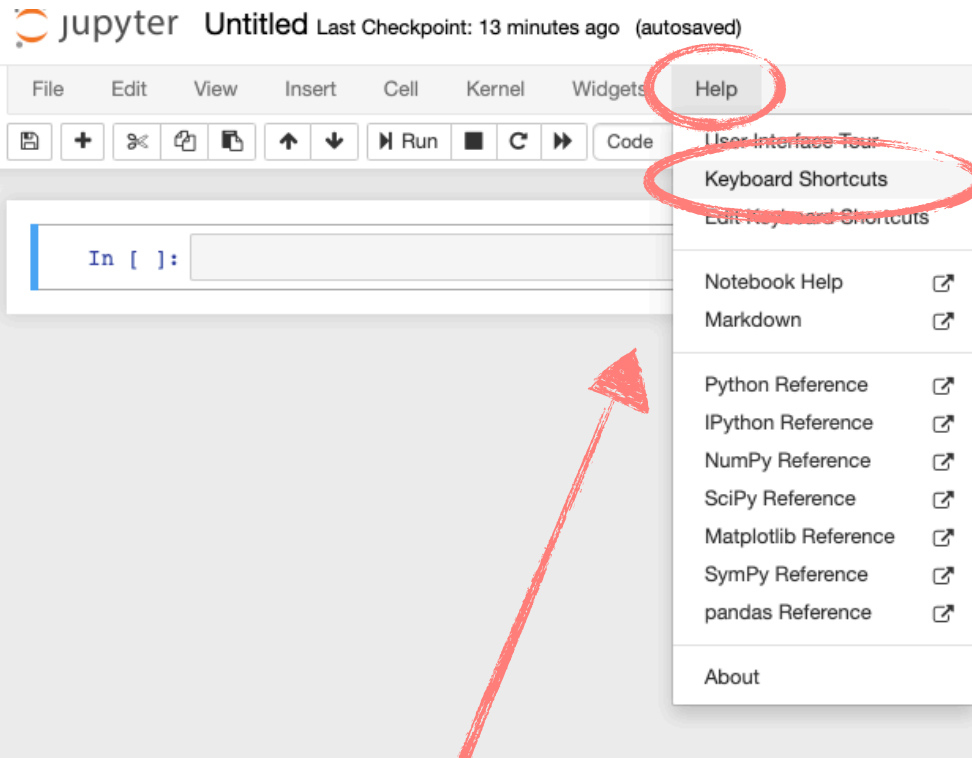
- Cell has green border
- Actions taken within context of a cell
  - (for example, editing/typing code and text)

## ▶ Command mode



- Cell has blue border
- Actions taken in the context of the notebook outside the scope
  - (for example, actions applied to multiple cells or the whole notebook)

# Jupyter Modes



Click "Help" then "Keyboard Shortcuts" to see some of the available commands in each mode

## Command Mode (press `Esc` to enable)

- `F`: find and replace
- `↵`: enter edit mode
- `⌘⇧F`: open the command palette
- `⌘⇧P`: open the command palette
- `P`: open the command palette
- `⇧↵`: run cell, select below
- `^↵`: run selected cells
- `⌘↵`: run cell and insert below
- `Y`: change cell to code
- `M`: change cell to markdown
- `R`: change cell to raw
- `1`: change cell to heading 1
- `2`: change cell to heading 2
- `3`: change cell to heading 3
- `4`: change cell to heading 4
- `5`: change cell to heading 5
- `6`: change cell to heading 6
- `K`: select cell above
- `↑`: select cell above
- `↓`: select cell below
- `J`: select cell below
- `⇧K`: extend selected cells above
- `⇧↑`: extend selected cells above

- `⇧↓`: extend selected cells below
- `⇧J`: extend selected cells below
- `A`: insert cell above
- `B`: insert cell below
- `X`: cut selected cells
- `C`: copy selected cells
- `⇧V`: paste cells above
- `V`: paste cells below
- `Z`: undo cell deletion
- `D, D`: delete selected cells
- `⇧M`: merge selected cells, or current cell with cell below if only one cell is selected
- `⌘S`: Save and Checkpoint
- `S`: Save and Checkpoint
- `L`: toggle line numbers
- `O`: toggle output of selected cells
- `⇧O`: toggle output scrolling of selected cells
- `H`: show keyboard shortcuts
- `I, I`: interrupt the kernel
- `0, 0`: restart the kernel (with dialog)
- `Esc`: close the pager
- `Q`: close the pager
- `⇧L`: toggles line numbers in all cells, and persist the setting
- `⇧_`: scroll notebook up
- `_`: scroll notebook down

Edit Shortcuts

## Edit Mode (press `Enter` to enable)

- `→`: code completion or indent
- `⇧→`: tooltip
- `⌘]`: indent
- `⌘[`: dedent
- `⌘A`: select all
- `⌘Z`: undo
- `⌘/`: comment
- `⌘D`: delete whole line
- `⌘U`: undo selection
- `Insert`: toggle overwrite flag
- `⌘↑`: go to cell start

- `⌘⇧Z`: redo
- `⌘⇧U`: redo selection
- `⌘K`: emacs-style line kill
- `⌘X`: delete line left of cursor
- `⌘D`: delete line right of cursor
- `⌘M`: enter command mode
- `Esc`: enter command mode
- `⌘⇧F`: open the command palette
- `⌘⇧P`: open the command palette
- `⇧↵`: run cell, select below
- `^↵`: run selected cells

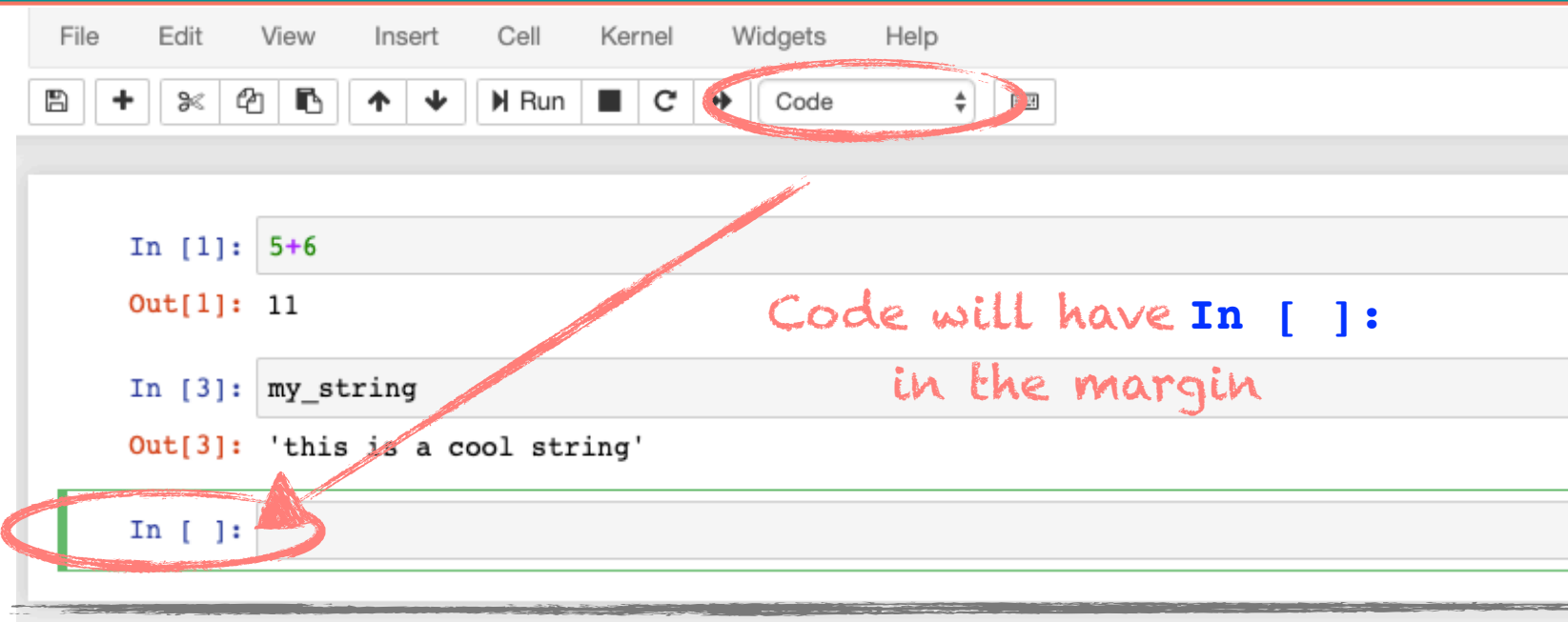
# Common Edit Mode Shortcuts

Mac Shortcut	Windows Shortcut	What it does
cmd + up	ctrl + up	Skip to beginning of line
cmd + /	ctrl + /	Add a comment
opt + left or right	ctrl + left or right	Move a word at a time
cmd + z	ctrl + z	Undo
cmd + shift + z	ctrl + shift + z	Redo
ctrl + shift + minus		split a cell
shift + enter		Run cell and move to next cell
opt + enter	alt + enter	Run cell and insert cell below
ctrl + enter		Run cell and stay
Esc		Enter command mode

# Common Command Mode Shortcuts

Shortcut	What it does
shift + m	Merge selected cells
c	copy
v	paste below
o	toggle output on and off
h	list all available shortcuts
d, d	delete selected cells
enter	switch to edit mode
p	open command pallet

# Types of Cells: Code & Markdown



File Edit View Insert Cell Kernel Widgets Help

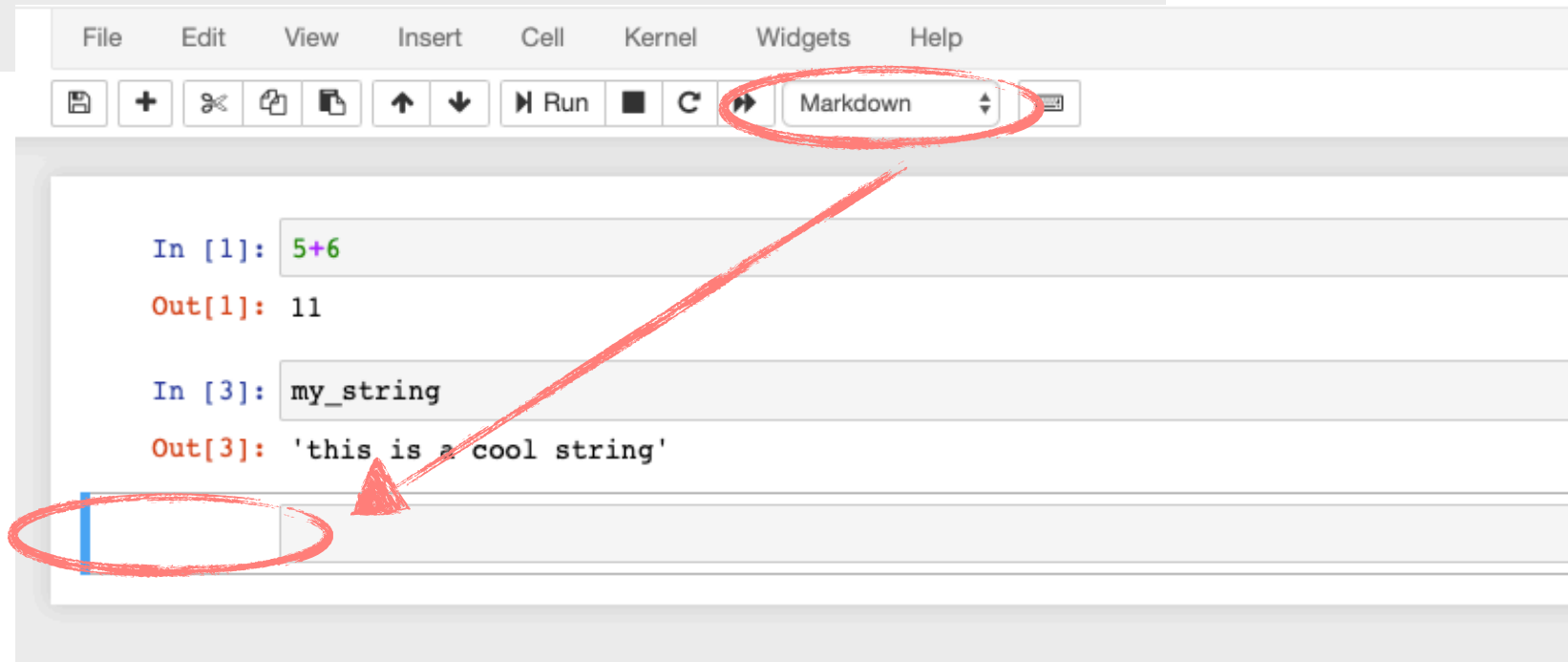
Code

```
In [1]: 5+6
Out[1]: 11

In [3]: my_string
Out[3]: 'this is a cool string'
```

In [ ]:

Code will have In [ ]:  
in the margin



File Edit View Insert Cell Kernel Widgets Help

Markdown

```
In [1]: 5+6
Out[1]: 11

In [3]: my_string
Out[3]: 'this is a cool string'
```

In [ ]:

Markdown doesn't have  
anything in  
the margin