CSE 4020/5260
Database Systems

Instructor: Fitzroy Nembhard, Ph.D.

Installing and Setting up Kernels for Python, Java and C in Jupyter

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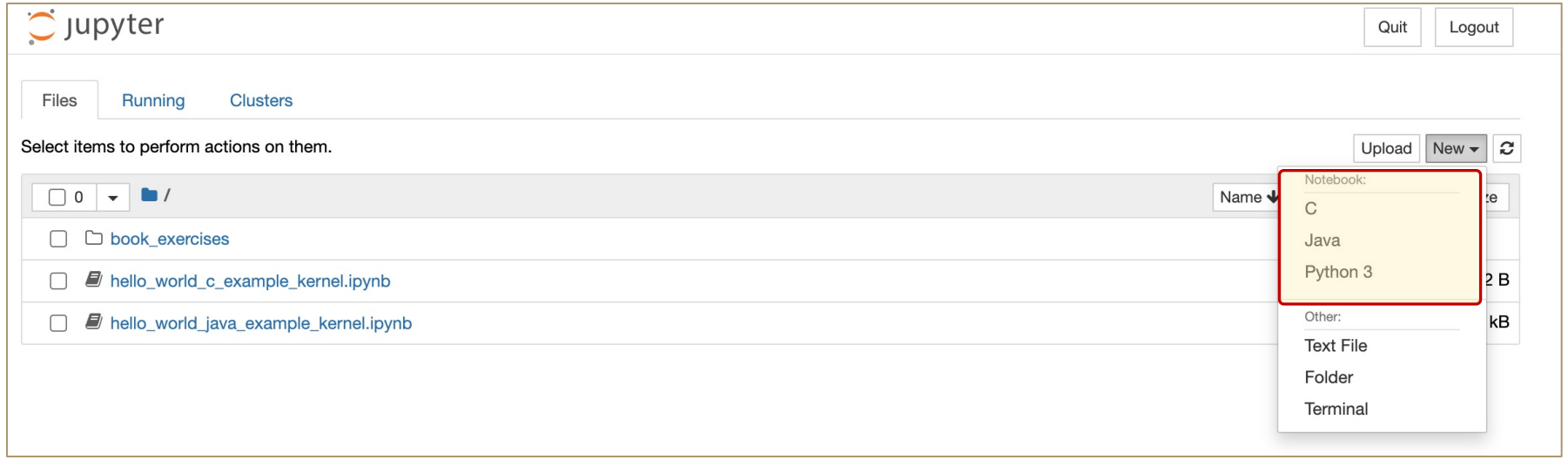
Jupyter Notebooks

- We will be using Jupyter Notebooks to interact with Databases throughout the course
  - First, install Miniconda (lightweight) or Anaconda (consumes more space) on your personal computer.
  - Miniconda will install Python on your computer (https://docs.conda.io/en/latest/miniconda.html)
- You may choose a kernel based on your preferred programming language. I will provide setup tips for Python, Java and C (preferably Mac/Linux)

Jupyter Notebooks

- After Setting up your kernel, you should see your language in the list of kernels on the computer as shown below.



Contents

Using Anaconda to Launch Jupyter Notebook

- The following slides will show you how to use Anaconda/Miniconda to launch and use Jupyter Notebooks.

Using Anaconda to Launch Jupyter Notebook

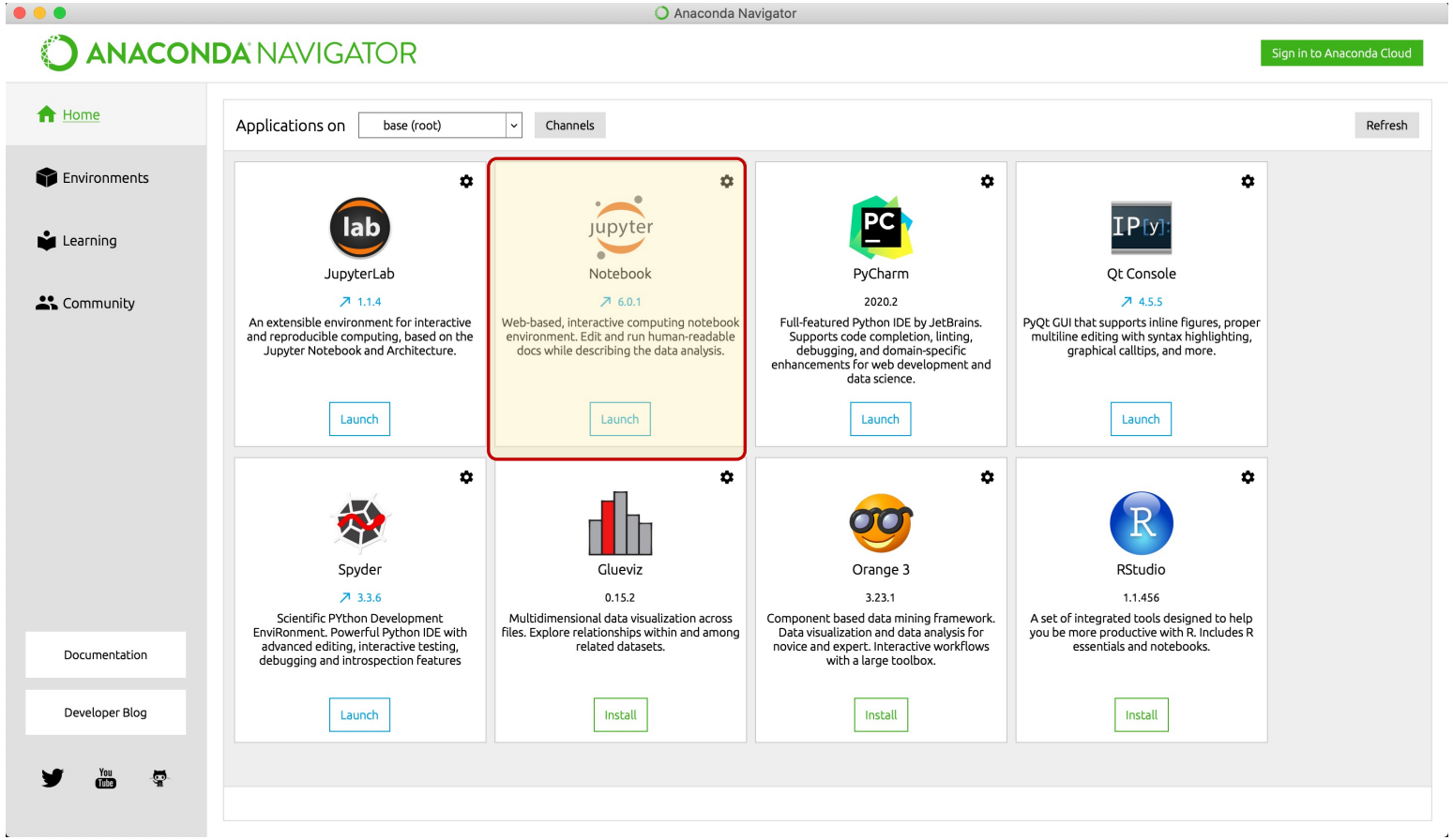
Open Anaconda Navigator from your Applications Menu.

Note: The Navigator is only provided in the full version of Anaconda.

If you installed Miniconda, follow the instructions on Slide 10.

Using Anaconda to Launch Jupyter Notebook

Open Jupyter Notebook from the list of Applications



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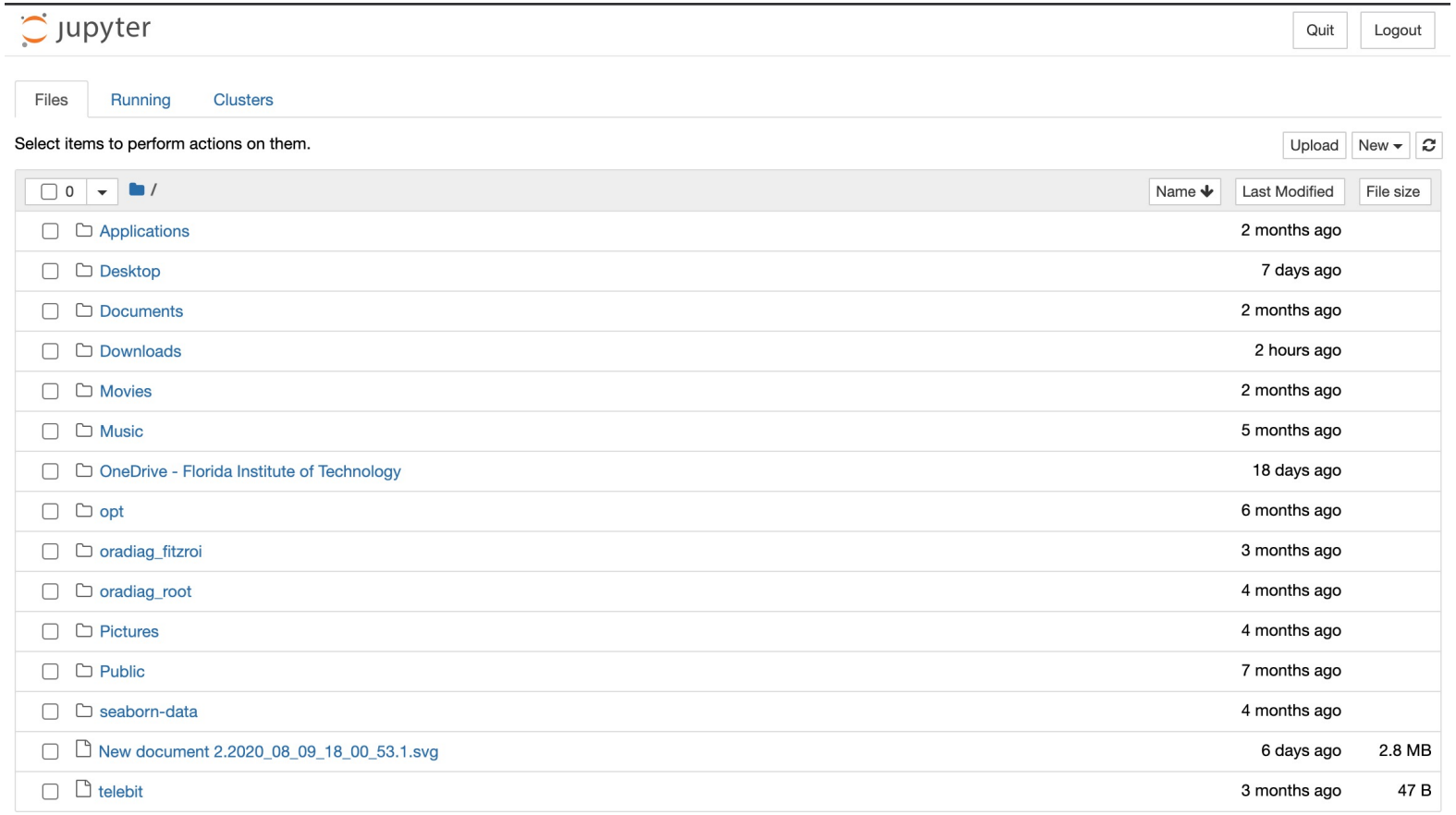
Using Anaconda to Launch Jupyter Notebook

Launching Jupyter using Anaconda will present a screen that looks like the following.

The next step is to create a folder for this class, preferably in the Documents Folder



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Creating a Class Folder

Click the dropdown labeled “New” to create a new folder.

Name Your folder based on your class name.
Example: CSE4020

Using a Terminal to Launch Jupyter Notebook

The command to launch Jupyter via a command line interface is:

jupyter notebook

After running the command, your browser should automatically open to the Jupyter environment. If not, copy the link provided and paste it in your browser.

If Python was not installed or you have issues installing it, follow the link here: https://tinyurl.com/y6mkdcqd

If you cannot get Anaconda/Miniconda to install correctly, please follow the instructions here: https://tinyurl.com/qrh32cn

```
fitzroi@fitzroys-mbp-15 CSE5150 % jupyter notebook
[I 13:36:18.656 NotebookApp] Serving notebooks from local directory
: /Users/fitzroi/Documents/CSE5150
[I 13:36:18.656 NotebookApp] The Jupyter Notebook is running at:
[I 13:36:18.656 NotebookApp] http://localhost:8888/?token=595e4d649
17976bc224f04f3476e15513f5d3e25935b1803
[I 13:36:18.656 NotebookApp]  or http://127.0.0.1:8888/?token=595e4
d64917976bc224f04f3476e15513f5d3e25935b1803
[I 13:36:18.656 NotebookApp] Use Control-C to stop this server and
shut down all kernels (twice to skip confirmation).
[C 13:36:18.666 NotebookApp]

    To access the notebook, open this file in a browser:
        file:///Users/fitzroi/Library/Jupyter/runtime/nbserver-3580
6-open.html
    Or copy and paste one of these URLs:
        http://localhost:8888/?token=595e4d64917976bc224f04f3476e15
513f5d3e25935b1803
     or http://127.0.0.1:8888/?token=595e4d64917976bc224f04f3476e15
513f5d3e25935b1803
```

Executing Python Code from a Jupyter Notebook

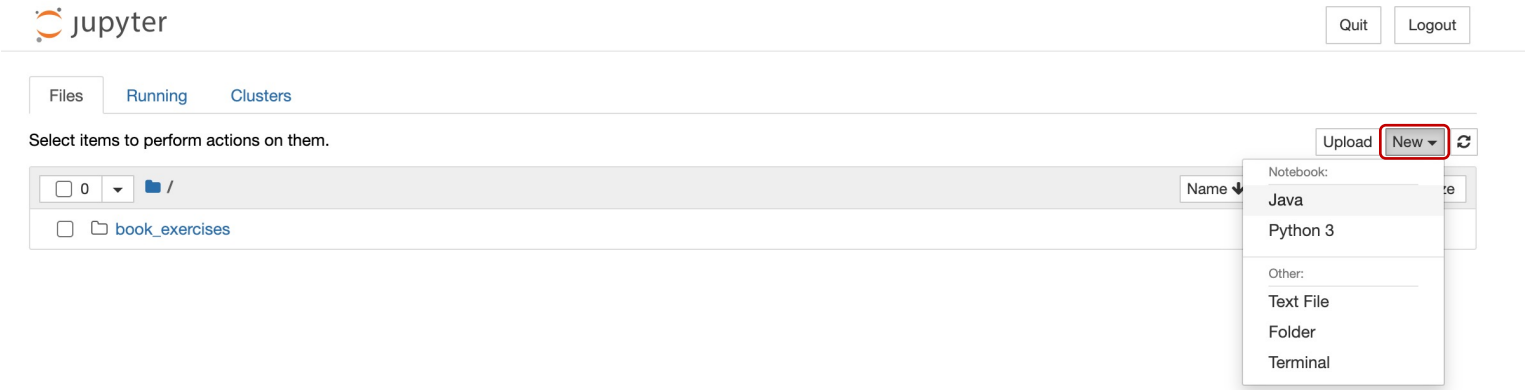
- The following slides will show you how to write and execute Python code in a Jupyter Notebook to run a Reverse-String program.

Launching a Python Kernel in Jupyter

Launch jupyter and ensure that Python 3 is included in the list of kernels by clicking the "New" dropdown menu.

You may also launch Jupyter from the command line

```
jupyter notebook
```

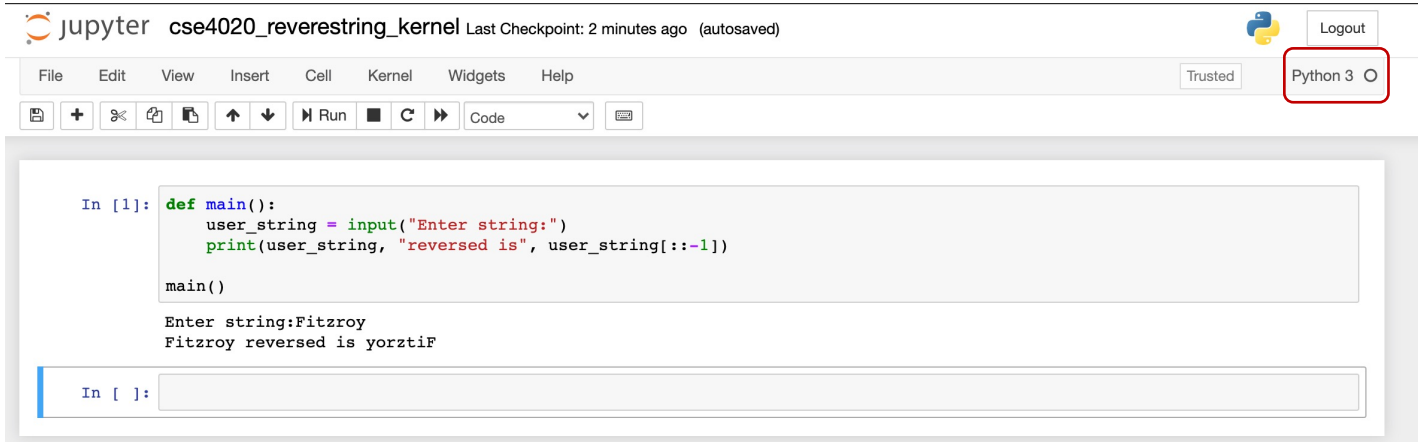


Executing Python Code in Jupyter

Enter Python code in your Notebook as shown in the screenshot on the right.

This example demonstrates how to read a string from the standard input, reverse the string and display the results.

Notice the highlighted kernel named Python 3.



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Executing Java Code Within a Jupyter Notebook

- The following slides will show you how to use Java via Jupyter Notebook to run a Reverse-String program.

Setting Up IJava for Jupyter

Make sure Java is in your path by executing the following version check command from your command line

Terminal

File Edit Options Tools Window Help

```
$ java -version
java version "15.0.1" 2020-10-20
Java(TM) SE Runtime Environment (build 15.0.1+9-18)
Java HotSpot(TM) 64-Bit Server VM (build 15.0.1+9-18, mixed mode, sharing)
```

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Setting Up IJava for Jupyter

Ensure that java is in a location where the jdk was installed and not just the jre. Use the java --list-modules command to do this. The list should contain jdk.jshell

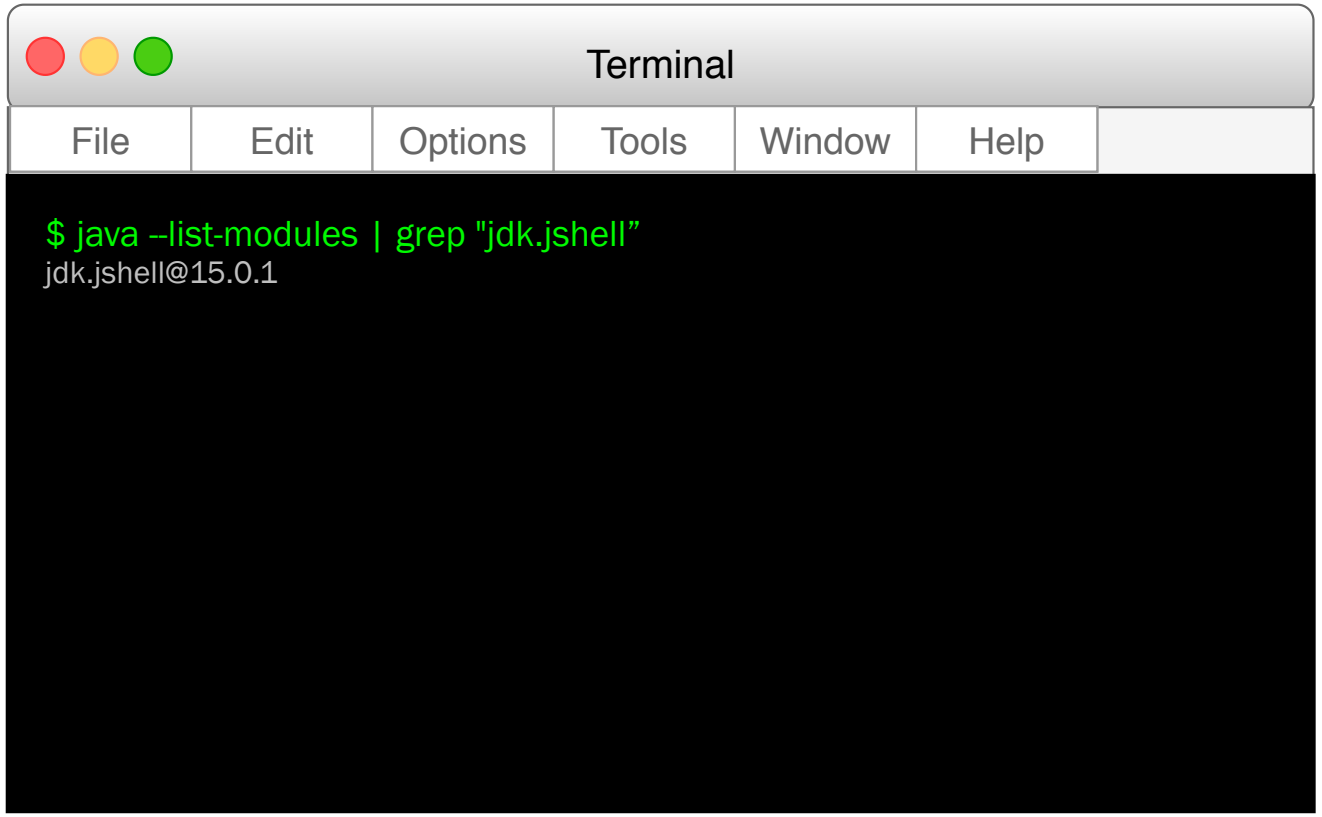
On *nix

```
java --list-modules | grep "jdk.jshell"
```

On windows

```
java --list-modules | findstr "jdk.jshell"
```

If the kernel cannot start with an ShellException error, double check that java is referring to the command for the jdk and not the jre.



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Setting Up IJava for Jupyter

Download the latest Zipped Ijava from Github:
https://github.com/SpencerPark/IJava/releases

Unzip the file and execute the following:

```
python3 install.py --sys-prefix
```

Check that it was installed successfully with jupyter kernelspec list, which should contain java

Terminal

File Edit Options Tools Window Help

```
$ python3 install.py --sys-prefix
Installed java kernel into "/opt/anaconda3/share/jupyter/kernels/java"

$ jupyter kernelspec list
Available kernels:
  java      /opt/anaconda3/share/jupyter/kernels/java
  python3   /opt/anaconda3/share/jupyter/kernels/python3
```

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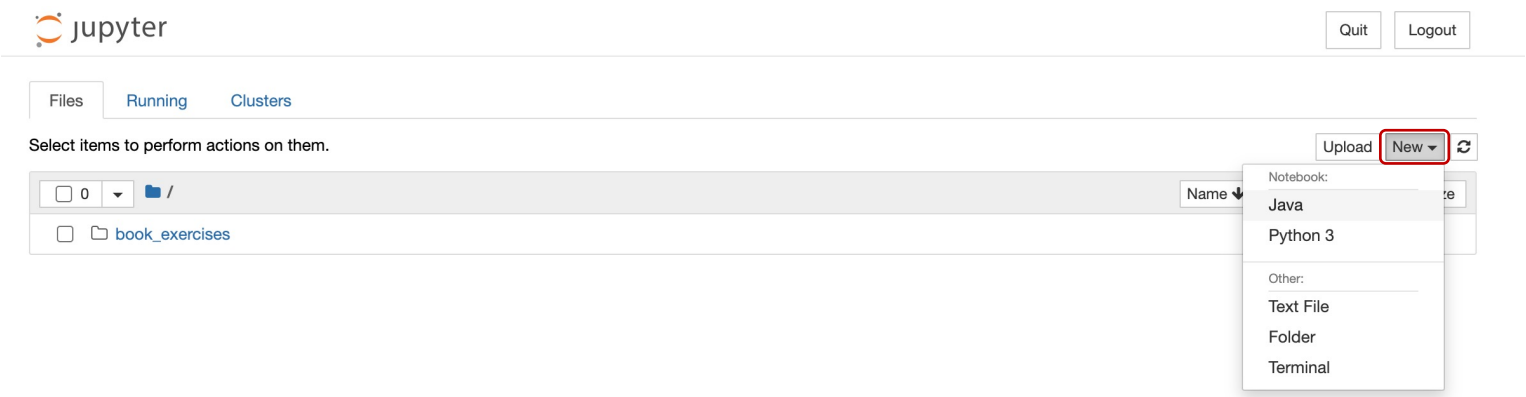
Launching IJava for Jupyter

Launch jupyter and ensure that Java is included in the list of kernels by clicking the "New" dropdown menu.

You may also launch Jupyter in Ijava mode from the command line as follows:

```
jupyter console --kernel=java
```



Testing IJava for Jupyter

Enter Java Code in your Notebook as shown in the screenshot on the right.

This example demonstrates the use of an Object (OOP) by reading a name from the user and reversing it.

Notice the highlighted kernel named Java

jupyter Untitled Last Checkpoint: 5 minutes ago (unsaved changes)

Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted

Java

Run Code

In [2]:

```
import java.util.Scanner;

public class Main{
    public static String reverseString(String str){
        StringBuilder reverse = new StringBuilder();
        for(int i = str.length() - 1; i >= 0; i--){
            reverse.append(str.charAt(i));
        }
        return reverse.toString();
    }

 }

Main myMain = new Main();
Scanner myScanner = new Scanner(System.in);  // Create a Scanner object for reading input
System.out.println("Enter Name: ");

String userName = myScanner.nextLine();  // Read input from the user
System.out.println(userName + " reversed is " + myMain.reverseString(userName));  // Output user input
```

```
Enter Name:
Fitzroy
Fitzroy reversed is yorztiF
```

In [ ]:

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Executing C Code from a Jupyter Notebook

- The following slides will show you how to run a Reverse-String program in C via Jupyter Notebook.

Setting Up a C Kernel for Jupyter

Mac and Linux Users

Execute in your Terminal the commands shown in the graphic to install jupyter-c-kernel.

Dependencies

- gcc
- jupyter
- python 3
- pip

Terminal

File Edit Options Tools Window Help

```
$ pip install jupyter-c-kernel
...
Successfully built jupyter-c-kernel
Installing collected packages: jupyter-c-kernel
Successfully installed jupyter-c-kernel-1.2.2

$ install_c_kernel
...
Installing IPython kernel spec
```

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Setting Up a C Kernel for Jupyter

Windows Users

Make sure the following dependences are installed. Then install docker using the instructions on the following slides.

Dependencies

- gcc
- jupyter
- python 3
- pip

Terminal

File Edit Options Tools Window Help

```
$ where gcc
$ where jupyter
$ where python
$ where pip
```

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Setting Up a C Kernel for Jupyter

Windows Users

Install Docker Desktop for windows

Link: https://docs.docker.com/get-docker/

Get Docker

Docker is an open platform for developing, shipping, and running applications. Docker enables you to separate your applications from your infrastructure so you can deliver software quickly. With Docker, you can manage your infrastructure in the same ways you manage your applications. By taking advantage of Docker's methodologies for shipping, testing, and deploying code quickly, you can significantly reduce the delay between writing code and running it in production.

You can download and install Docker on multiple platforms. Refer to the following section and choose the best installation path for you.

Docker Desktop for Mac

A native application using the macOS sandbox security model which delivers all Docker tools to your Mac.

Docker Desktop for Windows

A native Windows application which delivers all Docker tools to your Windows computer.

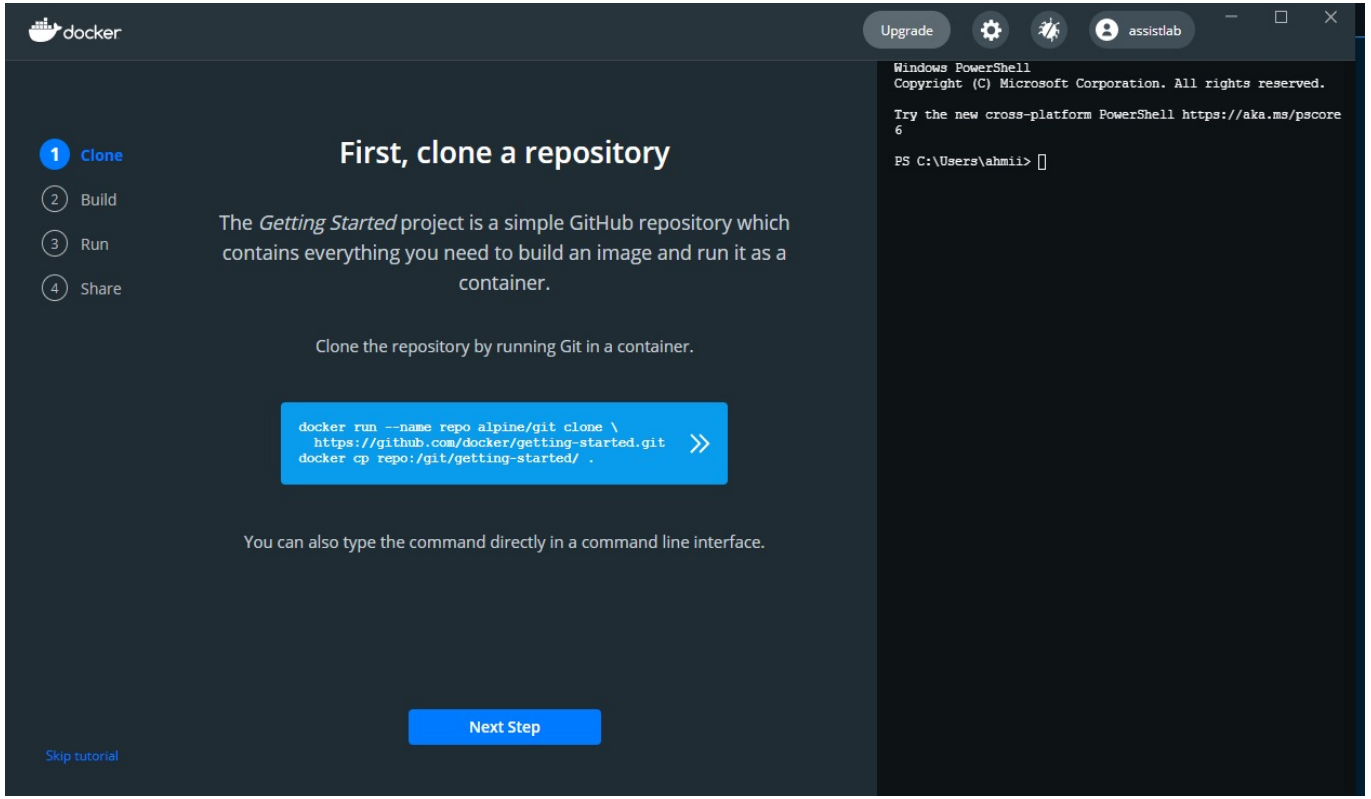
Docker for Linux

Install Docker on a computer which already has a Linux distribution installed.

Setting Up a C Kernel for Jupyter

Windows Users

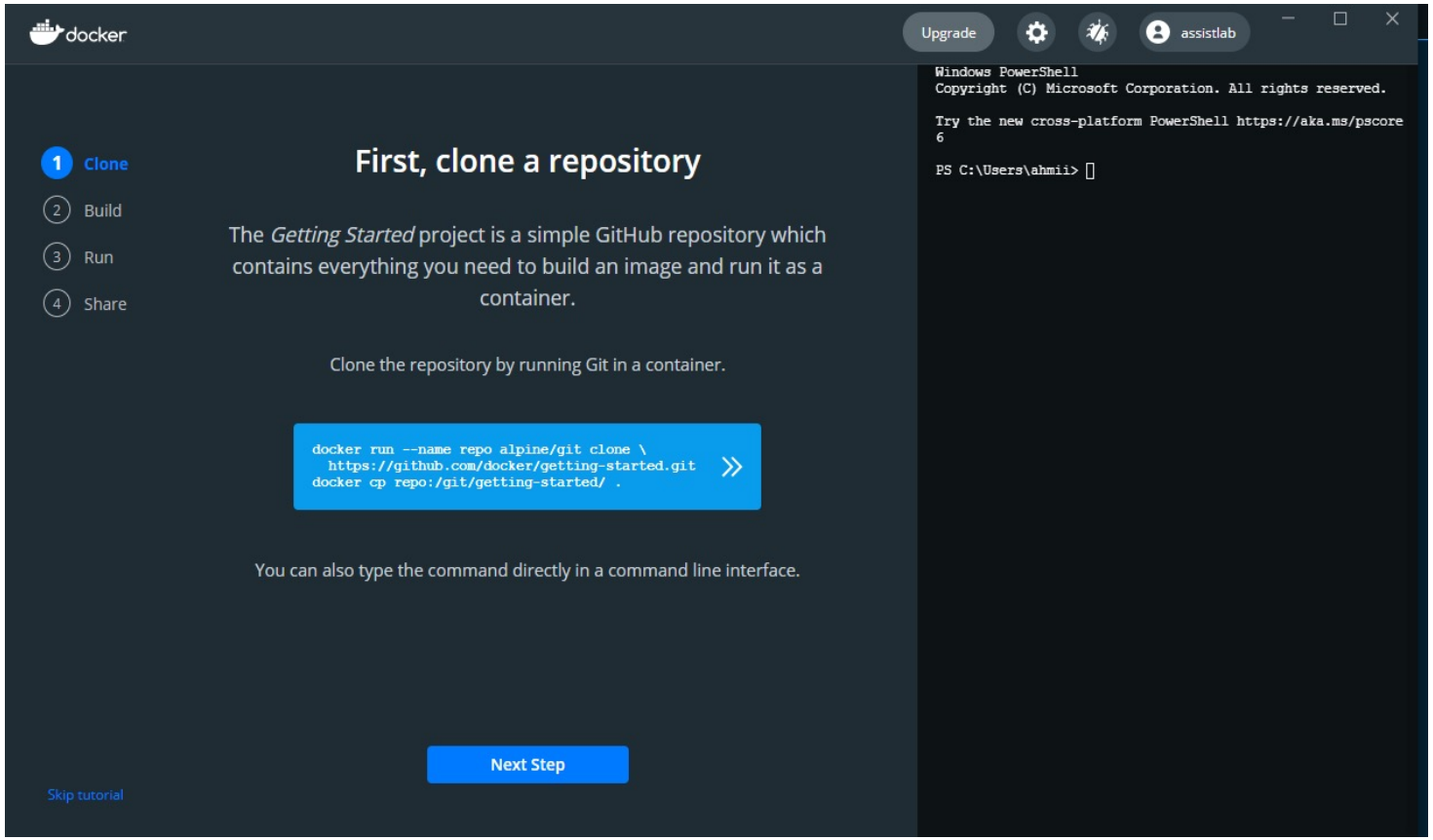
Open the docker App



Setting Up a C Kernel for Jupyter

Windows Users

Follow the instructions to set up Docker



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Setting Up a C Kernel for Jupyter

Windows Users

Open Powershell and run the following command:

```
docker pull brendanrius/jupyter-c-kernel
```

Windows PowerShell

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\ahmii> docker pull brendanrius/jupyter-c-kernel
Using default tag: latest
latest: Pulling from brendanrius/jupyter-c-kernel
a48c500ed24e: Pull complete
1e1de00ff7e1: Pull complete
0330ca45a200: Pull complete
471db38bcfbf: Pull complete
0b4aba487617: Pull complete
730fa79a87e1: Pull complete
9a1a2a0601f1: Pull complete
4dc04ee9eef2: Pull complete
eef2fb844663: Pull complete
ecf7f2c6e9b9: Pull complete
f7201843ff55: Pull complete
07c028e9ca00: Pull complete
480c990dae7d: Pull complete
67ae4c6962d6: Pull complete
59cce7722c55: Pull complete
22dfb185fb26: Pull complete
3dea48053c81: Pull complete
61d27e3f91b4: Pull complete
52de7fa20679: Pull complete
9afa27de8448: Pull complete
f6413a204766: Pull complete
62635b875e05: Pull complete
Digest: sha256:de75bd8d73643fd286f7449a9a06b4dd378ee4db74b57aac0f34b66f5ac68451
Status: Downloaded newer image for brendanrius/jupyter-c-kernel:latest
docker.io/brendanrius/jupyter-c-kernel:latest
PS C:\Users\ahmii>
```

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Setting Up a C Kernel for Jupyter

Windows Users

Next, run the following command

```
docker run -p 8888:8888 brendanrius/jupyter-c-kernel
```

Copy the URL displayed and paste it in your browser.

```
PS C:\Users\ahmii> docker run -p 8888:8888 brendanrius/jupyter-c-kernel
/usr/local/bin/start-notebook.sh: ignoring /usr/local/bin/start-notebook.d/*

Container must be run with group "root" to update passwd file
Executing the command: jupyter notebook
[I 16:56:04.501 NotebookApp] Writing notebook server cookie secret to /home/jovyan/.local/share/jupyter/runtime/notebook
_cookie_secret
[W 16:56:04.627 NotebookApp] WARNING: The notebook server is listening on all IP addresses and not using encryption. Thi
s is not recommended.
[I 16:56:04.651 NotebookApp] JupyterLab beta preview extension loaded from /opt/conda/lib/python3.6/site-packages/jupyte
rlab
[I 16:56:04.651 NotebookApp] JupyterLab application directory is /opt/conda/share/jupyter/lab
[I 16:56:04.655 NotebookApp] Serving notebooks from local directory: /home/jovyan
[I 16:56:04.655 NotebookApp] 0 active kernels
[I 16:56:04.655 NotebookApp] The Jupyter Notebook is running at:
[I 16:56:04.655 NotebookApp] http://[all ip addresses on your system]:8888/?token=dca6fd2280610ace1a8e8c54e4e8ddc4cb2837
f8786be7c0
[I 16:56:04.655 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[C 16:56:04.656 NotebookApp]

    Copy/paste this URL into your browser when you connect for the first time,
    to login with a token:
        http://localhost:8888/?token=dca6fd2280610ace1a8e8c54e4e8ddc4cb2837f8786be7c0
```

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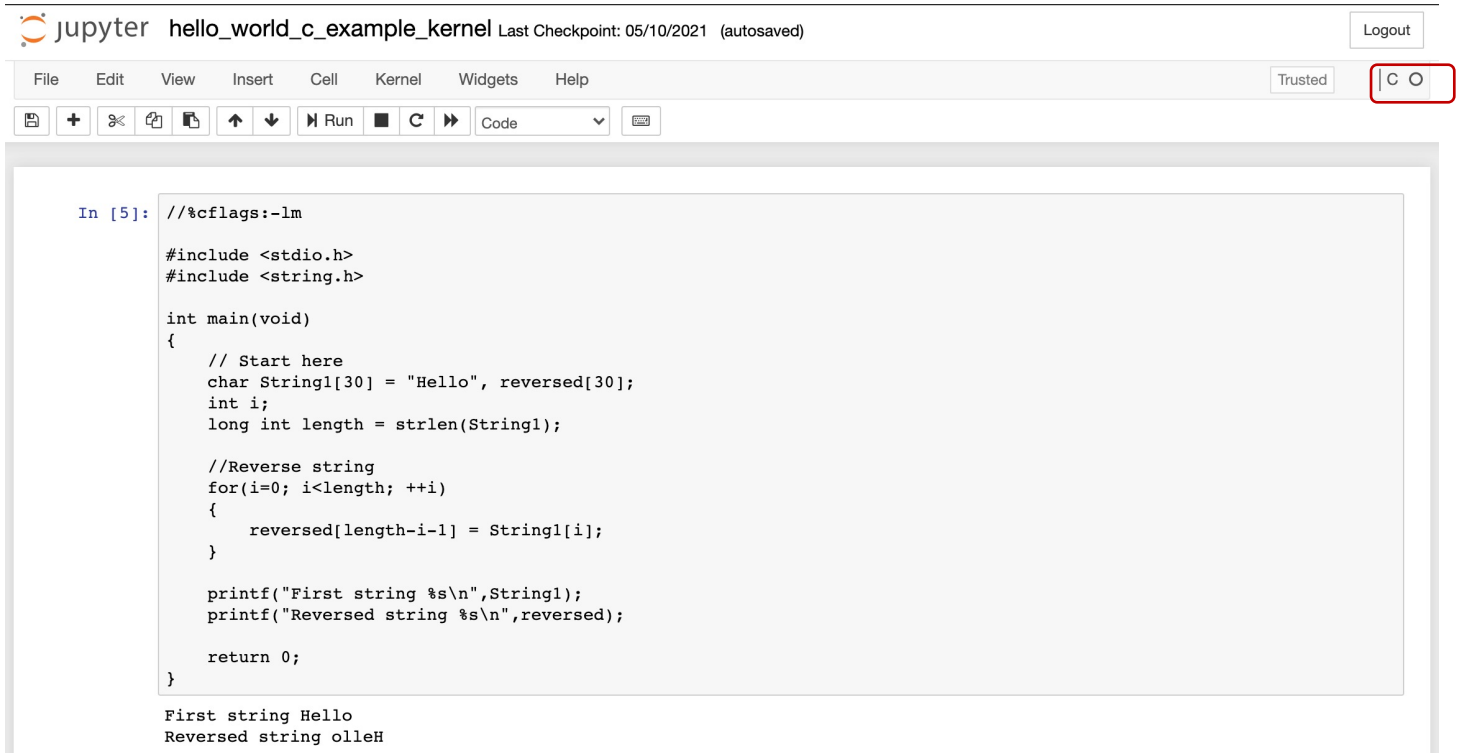
Executing C Code in Jupyter

Enter C Code in your Notebook as shown in the screenshot on the right.

This example demonstrates reversing a string.

Notice the highlighted kernel named C.

The line //%cflags:-lm is used to include cflags. Here -lm includes the math library. Use this same convention to include other libraries.



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References

The following references were used to create this tutorial.

- https://github.com/SpencerPark/IJava#install-pre-built-binary
- https://github.com/brendan-rius/jupyter-c-kernel