Week 1 Tutorial: Introduction to Jupyter, CLI, Git

POP77001 Computer Programming for Social Scientists

Module website: tinyurl.com/POP77001

Integrated Development Enviroments (IDEs)

- There is a number of integrated development environments (*IDE*s) available for:
    - R (RStudio) and
    - Python (Spyder, PyCharm)
- As well as text editors with R/Python-specific extensions (Visual Studio Code, Atom, Sublime Text, Vim)
- Try different ones and choose what works best for you!

Jupyter Notebook

- Jupyter Notebook is a language-agnostic web-based interactive computational environment.
- It is available with backends (*kernels*) for different programming languages (**Ju**lia, **Py**thon, **R** = **Jupy**t**er**)
- Can be used both locally and remotely.
- Good for ad-hoc data analysis and visualization.

Jupyter Notebook Cells

- Notebooks allow writing, executing and viewing the output of Python code within the same environment
- All notebook files have `.ipynb` extension for **i**nteractive **py**thon **n**ote**b**ook
- The main unit of notebook is *cell*, a text input field (Python, Markdown, HTML)
- Output of a cell can include text, table or figure

Jupyter Notebook Installation

- There are two main ways to install Jupyter Notebook locally:
    - pip and
    - conda
- Unless you have prior experience with Python, I recommend installing Anaconda distribution, which contains all the packages required for this course.
- Alternatively, you can try using Kaggle Code or Google Colab, online platforms for hosting Jupyter Notebooks.
- Their interfaces are slightly different and you need to register on Kaggle or have a Google account, but it does not require any local installations.
- However, for this module and course more broadly I recommend installing toolchain for working with Jupyter Notebooks locally.

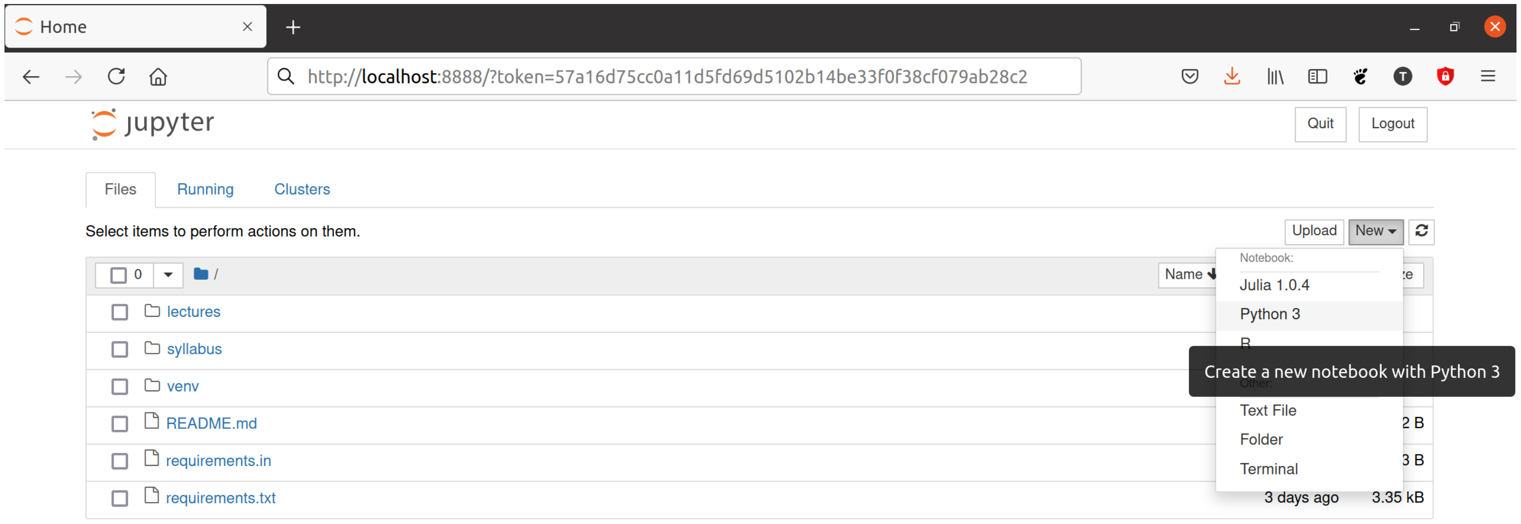
Starting Jupyter

- To start Jupyter, open CLI/Terminal and type `jupyter notebook`
- This will open a browser window with Jupyter Notebook displaying the directory, in which you executed the command above.
- To create a new notebook press `New` and select `Python` from the drop-down menu

Using Jupyter

- In order to run a Python command, create a new cell:
  - Press ➕ in the toolbar or click `Insert`, `Insert Cell Below`
  - Make sure that in the drop-down menu on the toolbar you select `Code`
  - Press CTRL+ENTER to run a command
- Rather than running a Python command, you can also write Markdown in the cell (e.g. to create slides)
  - Select `Markdown` in the drop-down manu on the toolbar
  - Write Markdown (check Markdown Cheatsheet)
  - Press CTRL+ENTER to render Markdown cell

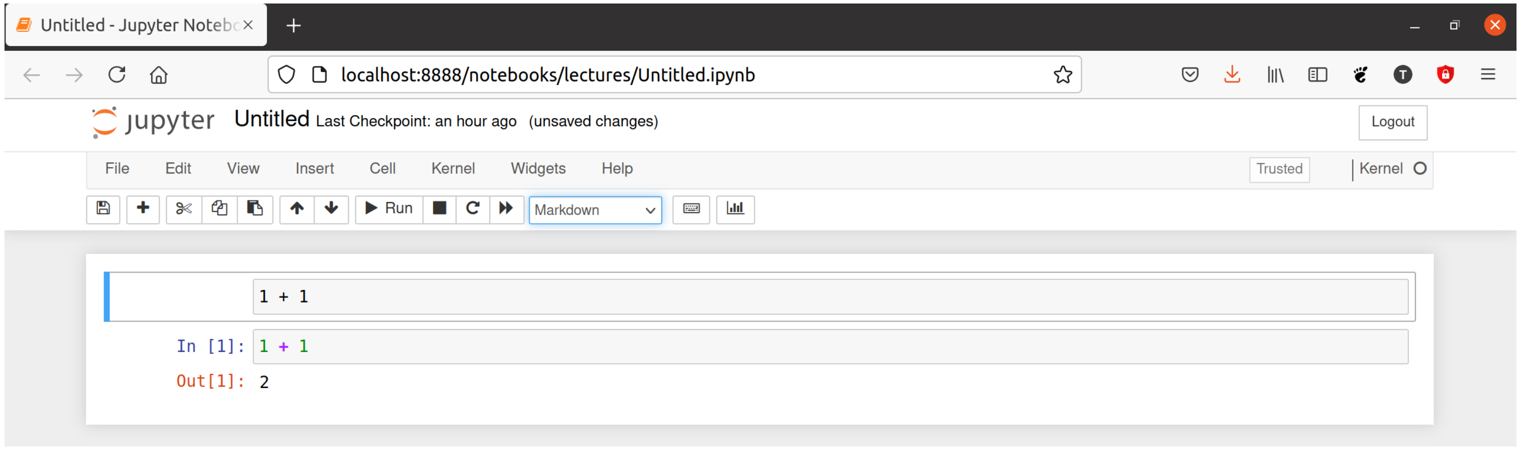
Jupyter Notebook Demonstration


Home
http://localhost:8888/?token=57a16d75cc0a11d5fd69d5102b14be33f0f38cf079ab28c2
jupyter
Quit
Logout
Files
Running
Clusters
Upload
New
Name
Notebook:
Julia 1.0.4
Python 3
R
Create a new notebook with Python 3
Text File
Folder
Terminal

Select items to perform actions on them.

```
0  /
lectures
syllabus
venv
README.md                                   2 B
requirements.in                             3 B
requirements.txt          3 days ago   3.35 kB
```

Jupyter Notebook Demonstration


Untitled - Jupyter Notebo
localhost:8888/notebooks/lectures/Untitled.ipynb
jupyter
Untitled Last Checkpoint: an hour ago (unsaved changes)
Logout
File
Edit
View
Insert
Cell
Kernel
Widgets
Help
Trusted
Kernel
Run
Markdown

```
1 + 1

In [1]: 1 + 1
Out[1]: 2
```

Stopping Jupyter Notebook

- First, make sure you saved your work (!) by pressing Command+S / CTRL+S
- You can close the running notebook by clicking `File` and then `Close and Halt`
- Jupyter Notebook runs as a server
- Which means that closing its tabs/web browser does not stop it
- You need to press `Quit` in the upper right corner of your main Jupyter tab (located at `http://localhost:8888/`)
- Alternatively, you can press CTRL+C in the terminal window

CLI Examples

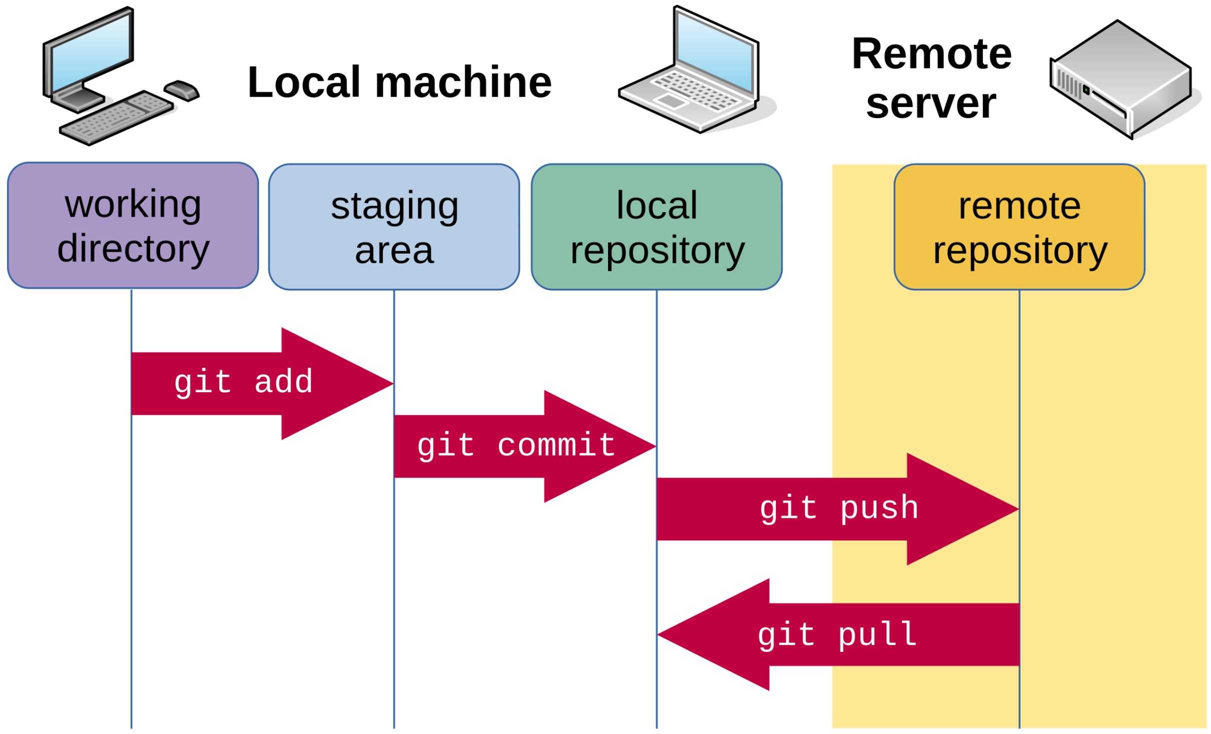
Microsoft PowerShell (Windows)	Z shell, zsh (macOS)	bash (Linux/UNIX)

Some Useful CLI Commands

Command (Windows)	Command (macOS/Linux)	Description
`exit`	`exit`	close the window
`cd`	`cd`	change directory
`cd`	`pwd`	show current directory
`dir`	`ls`	list directories/files
`copy`	`cp`	copy file
`move`	`mv`	move/rename file
`mkdir`	`mkdir`	create a new directory
`del`	`rm`	delete a file

Extra: Introduction to CLI

Git/GitHub Workflow



Some Useful Git Commands

Command	**Description**
`git init <project name>`	Create a new *local repository*
`git clone <project url>`	Download a project from *remote repository*
`git status`	Check project status
`git diff <file>`	Show changes between *working directory* and *staging area*
`git add <file>`	Add a file to the *staging area*
`git commit -m “<commit message>”`	Create a new *commit* from changes added to the *staging area*
`git pull <remote> <branch>`	Fetch changes from *remote* and merge into *merge*
`git push <remote> <branch>`	Push local branch to *remote repository*

Extra: Git Cheatsheet

Creating local Git repository

- Let's create a test project and track changes in it
- Create a test directory by typing `mkdir test` in your CLI/Terminal
- Go into the newly created directory with `cd test` command
- To make Git track changes run `git init` command in this directory
- Congratulations! You now have a local repository for your test project

Making a commit

- Open your text editor of choice (Notepad, Sublime Text, Atom, Visual Studio Code, Vim, Emacs, ...)
- Create a file called `test.txt` in your local test repository
- Type whatever you like in this file
- Add this file to your staging area (make Git aware of its existence) by running `git add test.txt` command
- Commit this file to your local repository by running `git commit -m "Added first file"`
- Note that all files that were added at the previous stage with `git add <file>` would be commited
- Check the status of your repository by running `git status` (it should say 'nothing to commit, working tree clean')
- Check the history of your repository by running `git log` and make sure that you see your commit

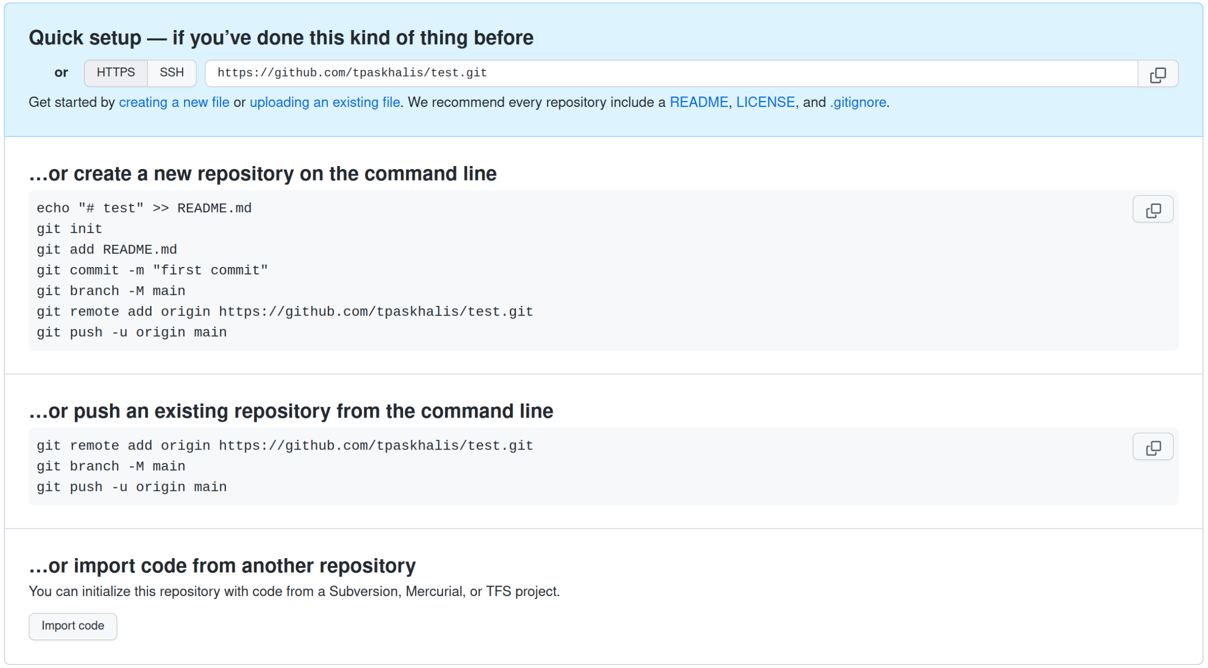
Remote Git repository: GitHub

- Hosting platform for projects that rely on Git fo version control
- Bought by Microsoft in 2018
- Provides extensive tools for collaborative development and search functionality
- Helpful for troubleshooting more narrow problems (check GitHub Issues of the package/library that you have a problem with)
- GitHub is far from the only platform for hosting Git projects
- Popular alternatives to GitHub include GitLab (🇺🇦), SourceForge, ...

Creating remote repository on GitHub

- Register and login into your account on GitHub
- Create a new GitHub repository (choose private repository)
- You should see a similar page with the project URL of the form:

```
https://github.com/<username>/<repository_name>.git
```



Quick setup — if you've done this kind of thing before

or HTTPS SSH `https://github.com/tpaskhalis/test.git`

Get started by creating a new file or uploading an existing file. We recommend every repository include a README, LICENSE, and .gitignore.

...or create a new repository on the command line

```
echo "# test" >> README.md
git init
git add README.md
git commit -m "first commit"
git branch -M main
git remote add origin https://github.com/tpaskhalis/test.git
git push -u origin main
```

...or push an existing repository from the command line

```
git remote add origin https://github.com/tpaskhalis/test.git
git branch -M main
git push -u origin main
```

...or import code from another repository

You can initialize this repository with code from a Subversion, Mercurial, or TFS project.

Synchronising local Git repository with GitHub

- Go to your local Git repository (the one created in the previous step)
- Add link from your local Git repository to remote repository on GitHub by running:

  ```
  git remote add origin <project_url>
  ```

    - where:
        - `git remote add` is the command,
        - `origin` is the name given to this link (`<remote>`), and
        - `<project_url>` is the URL of the repository on GitHub
- Check the status of links between your local Git repository and remotes by running `git remote -v`
    - where:
        - `git remote` is the command, and
        - `-v` is the argument 'verbose'

Pushing local Git changes to GitHub

- Your local Git repository is now linked to the remote repository hosted on GitHub.
- Let's bring the changes made locally to the remote repository.
- We will use the `git push` command for that.
- One last thing to check before doing so is which branch we are currently on.
- Run `git branch` to see the name of the branch you are on (it would be 'master' or 'main')
- Finally, run `git push <remote> <branch>` (e.g. `git push origin master`)
    - where:
        - `git push` is the command,
        - `<remote>` is the name of the remote link, and
        - `<branch>` is the name of the branch.
- Visit your GitHub repository to check that your commit is reflected there.

Cloning module repository

- All module materials are hosted on GitHub in this repo
- You can clone this repository to your local machine by running:

```
git clone https://github.com/ASDS-TCD/POP77001_Computer_Programming_2022
```

- This will create a folder called `POP77001_Computer_Programming_2022` within the directory where you ran this command
- To keep up to date with changes in the remote repository you can run:

```
git pull origin main
```

- Where
    - `origin` is the remote address of the repository - `https://github.com/ASDS-TCD/POP77001_Computer_Programming_2022`
    - `main` is the name of the branch (recall the discussion about `main` / `master` change from the lecture)

Week 1 Exercise (Unassessed)

- Create a Jupyter notebook in your local repository
- Commit it to your local repository in the same way as `test.txt` file