Freie Universität Berlin

Computational Sciences Projektseminar

A Python package for solving Poisson's equation

1st group project: Poisson solver

- Design/implement a complete Python package
- Develop on github
- Use a test-driven approach
- Discretised Laplacian and successive over-relaxation

Setting up your github account

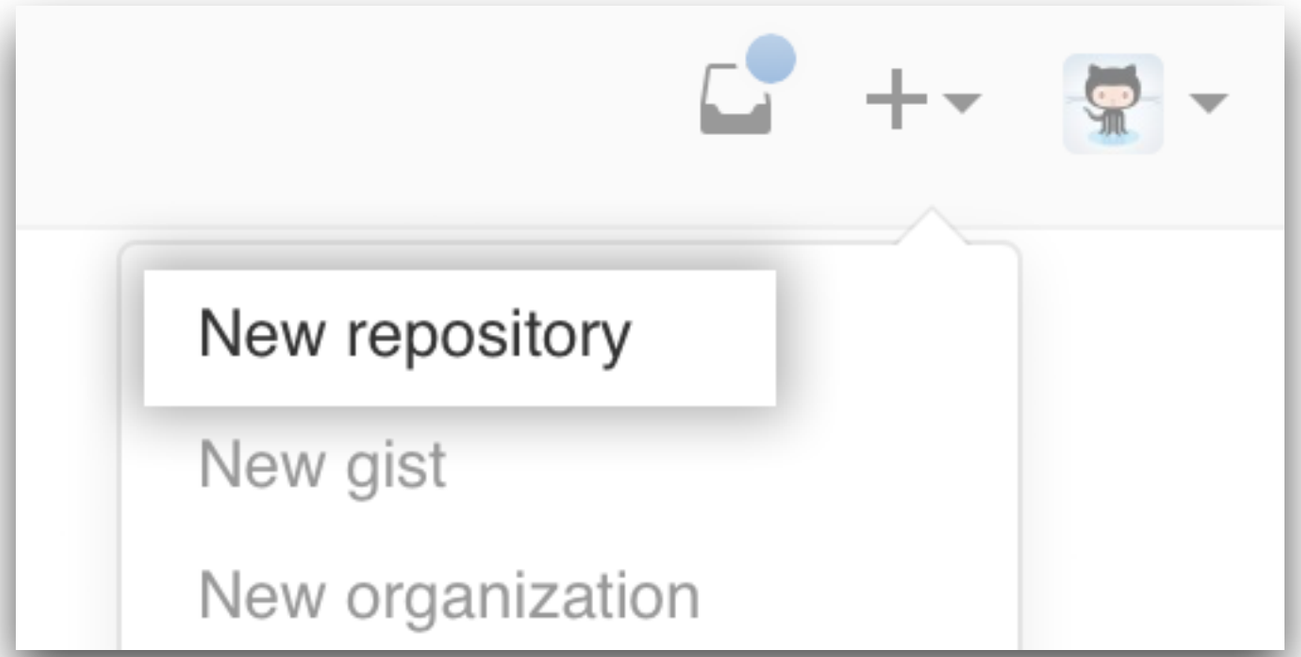
browser

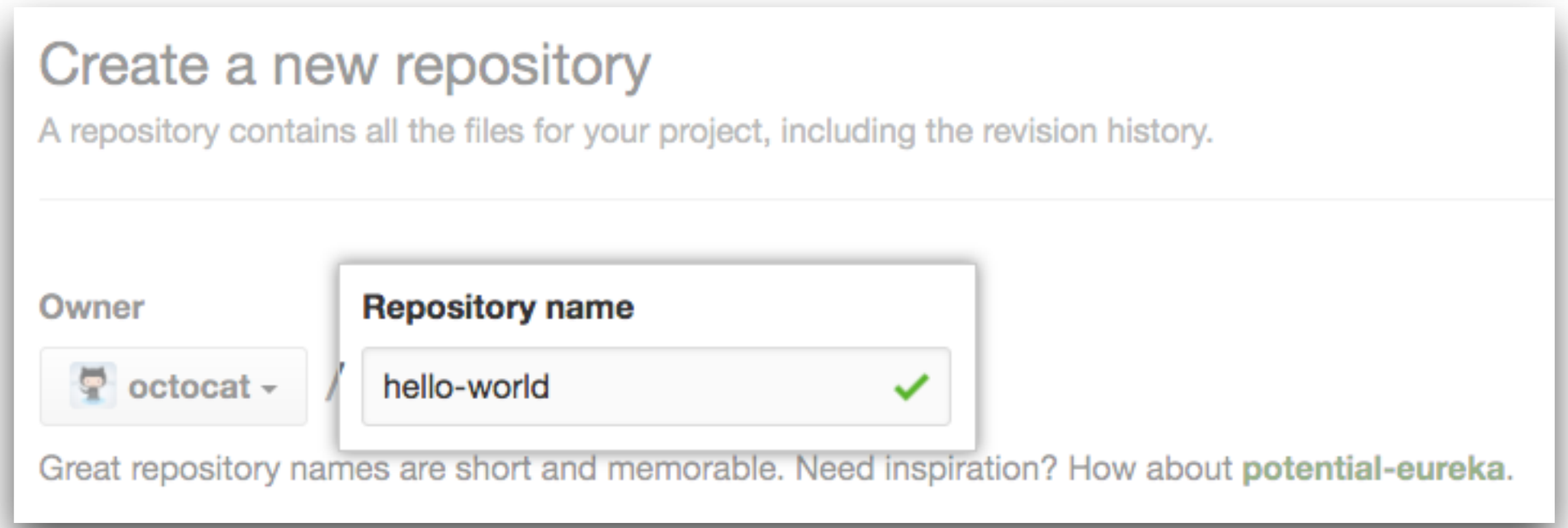
```
https://github.com/join
```

bash

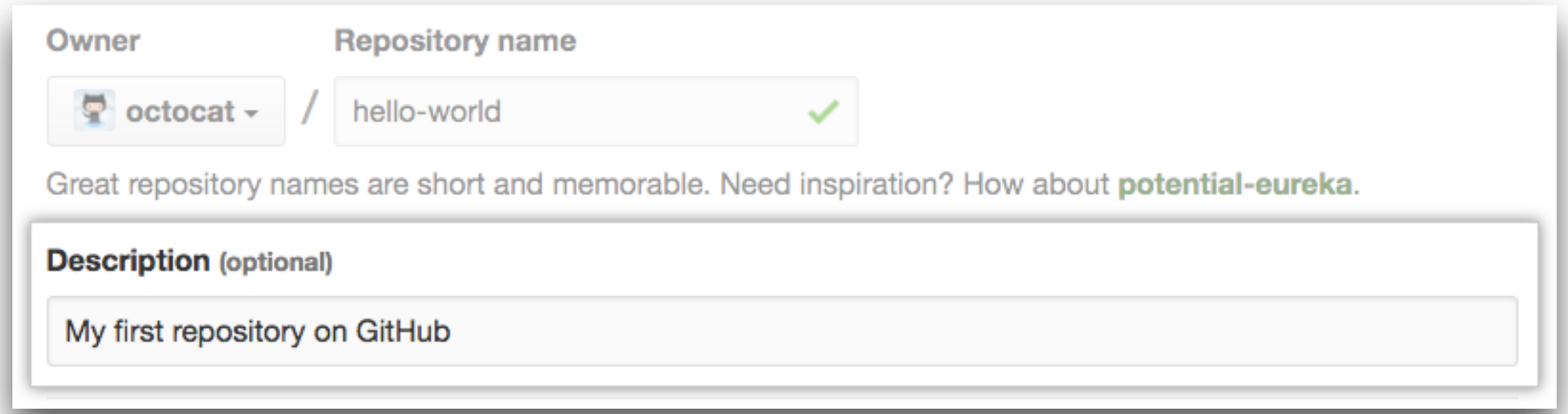
```
git config --global user.name "Mona Lisa"
git config --global user.email "email@example.com"
```

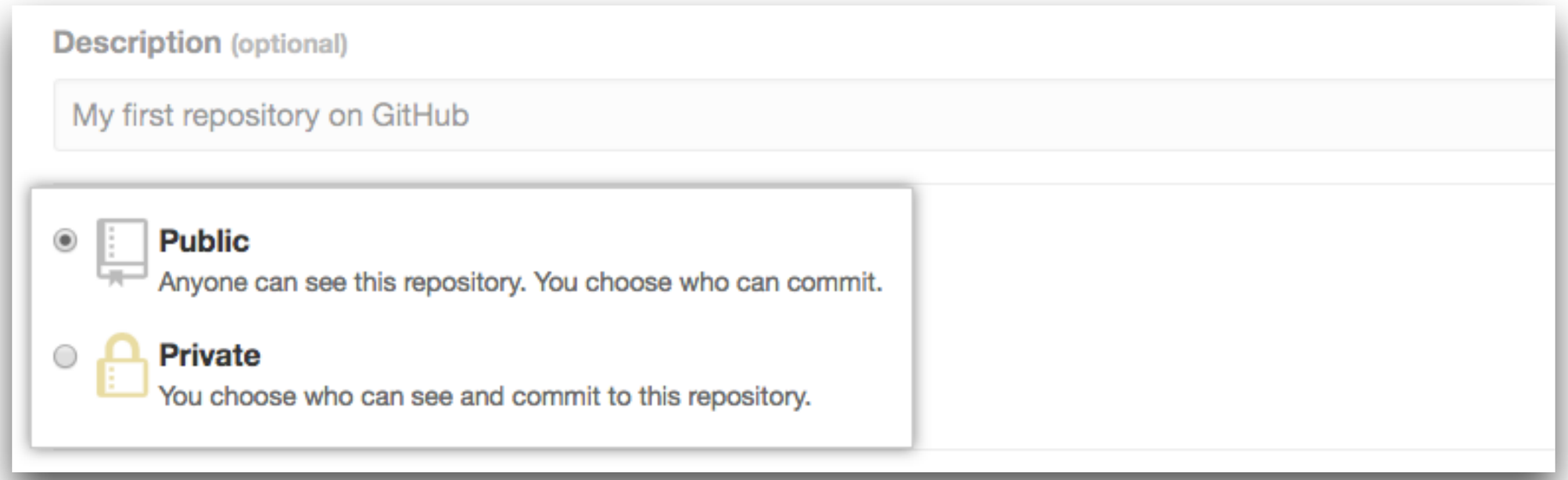
Creating a github repository



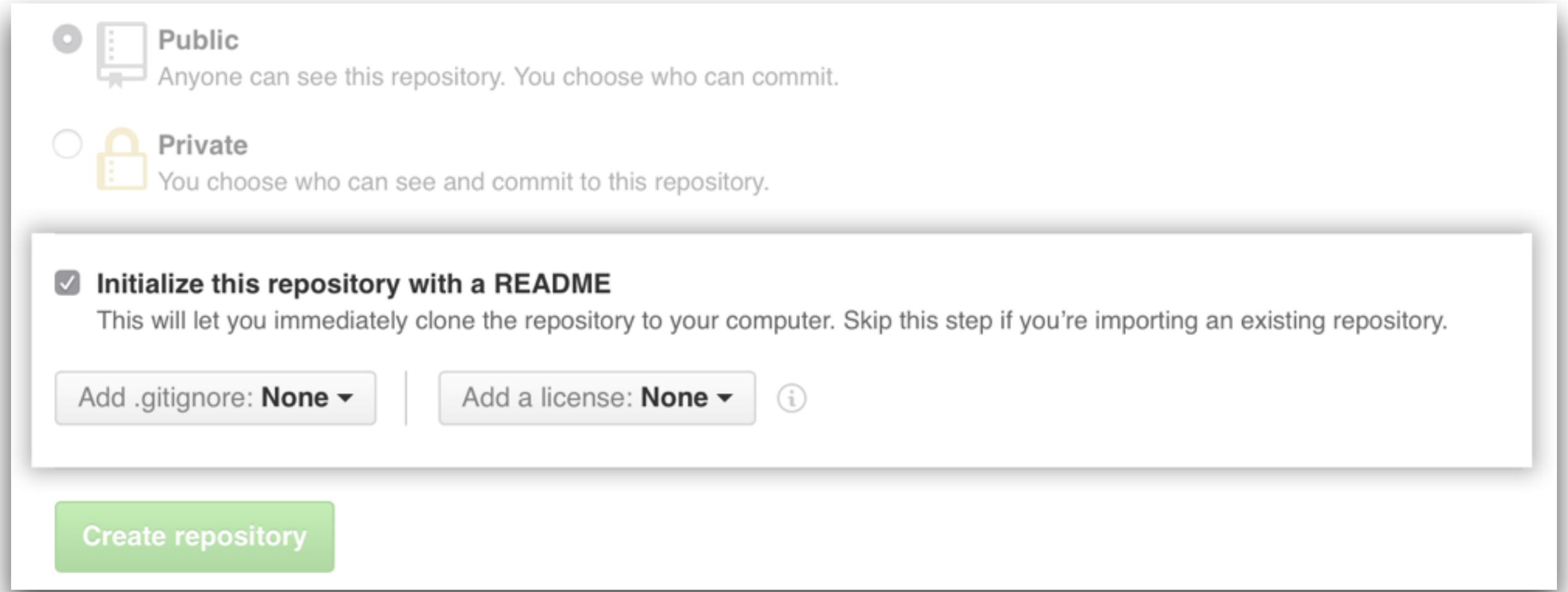


Creating a github repository

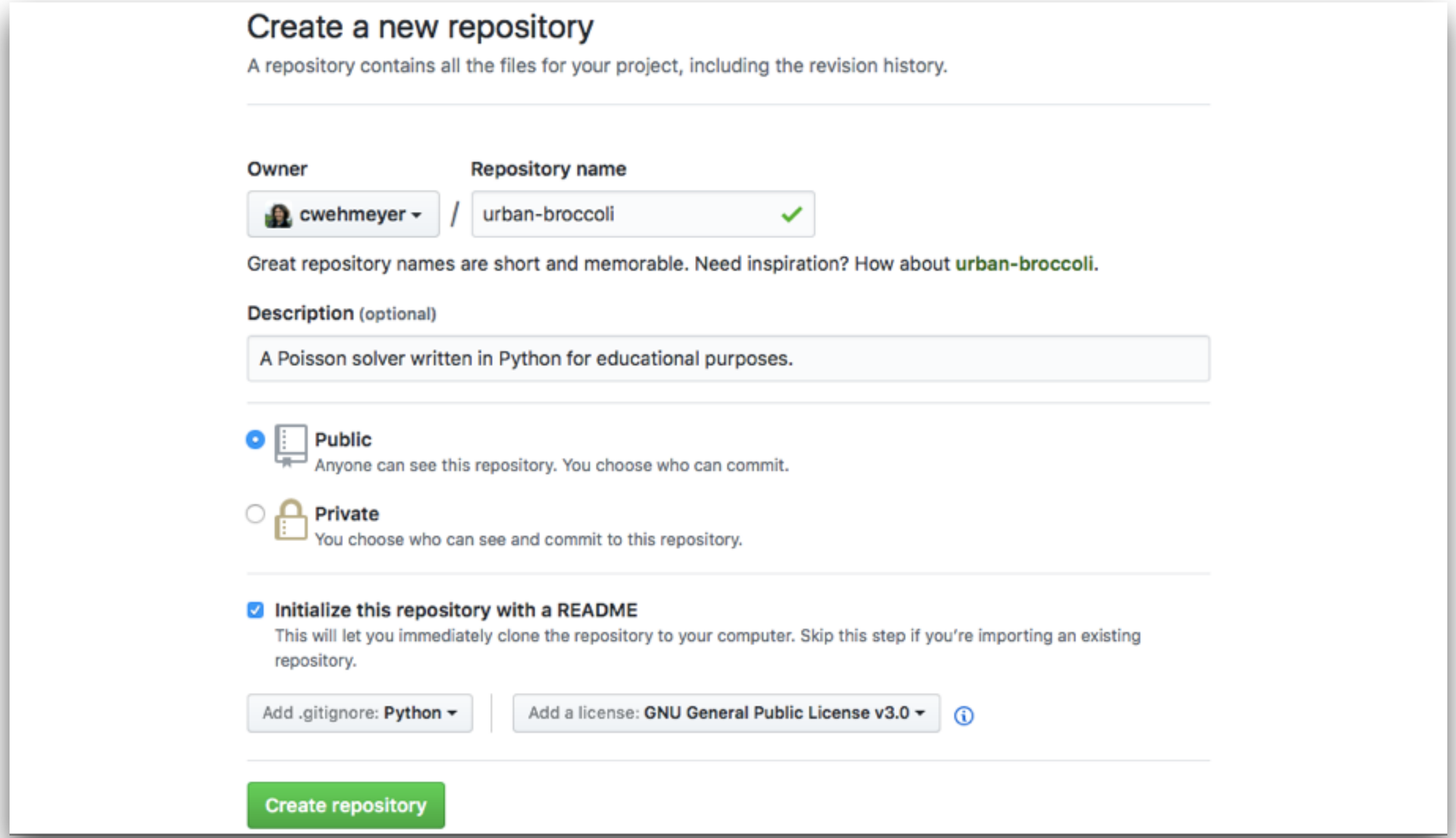




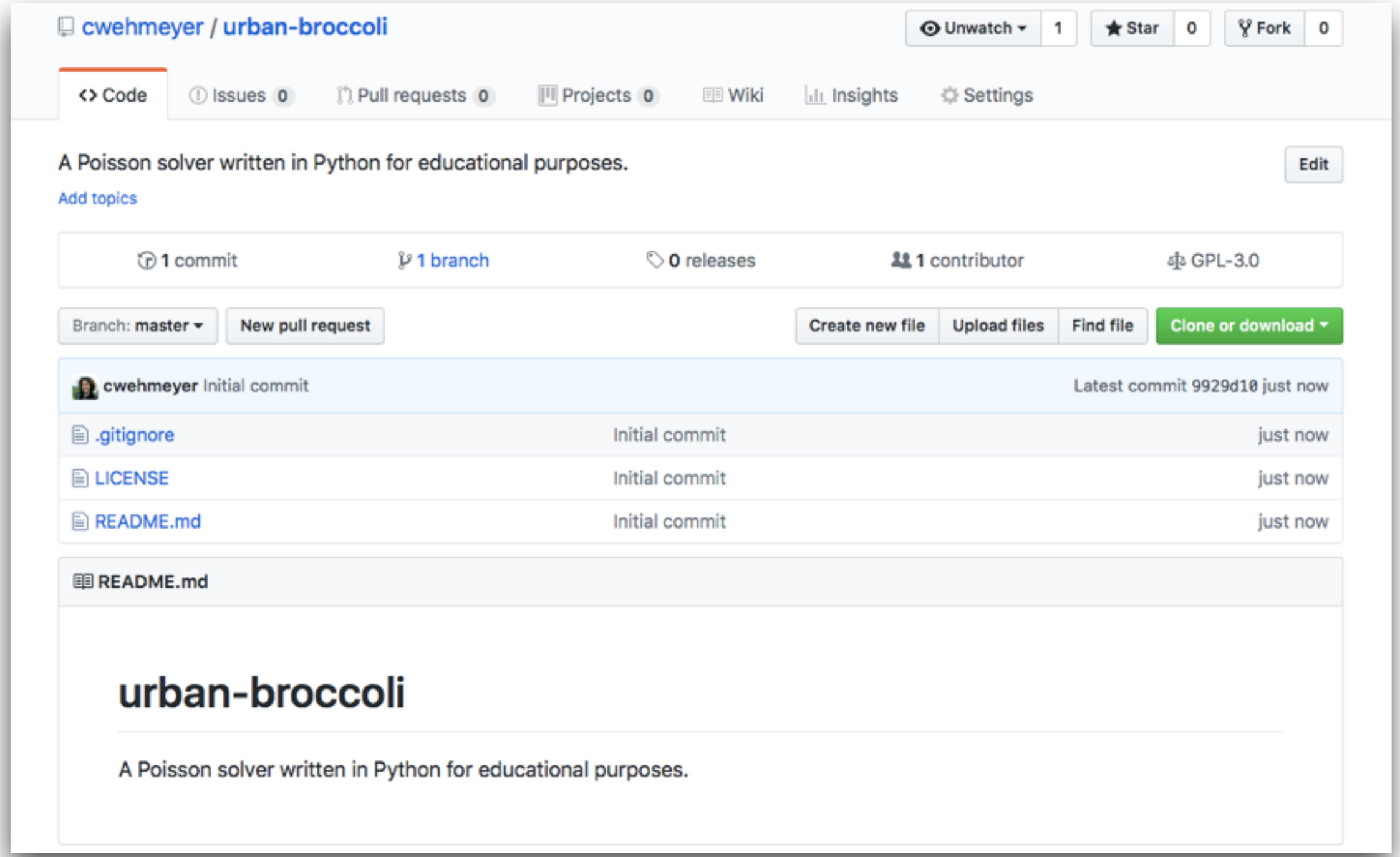
Creating a github repository



Example


Create a new repository
A repository contains all the files for your project, including the revision history.
Owner
Repository name
cwehmeyer
/
urban-broccoli
Great repository names are short and memorable. Need inspiration? How about urban-broccoli.
Description (optional)
A Poisson solver written in Python for educational purposes.
Public
Anyone can see this repository. You choose who can commit.
Private
You choose who can see and commit to this repository.
Initialize this repository with a README
This will let you immediately clone the repository to your computer. Skip this step if you're importing an existing repository.
Add .gitignore: Python
Add a license: GNU General Public License v3.0
Create repository

Example


cwehmeyer / urban-broccoli
Unwatch 1
Star 0
Fork 0
Code
Issues 0
Pull requests 0
Projects 0
Wiki
Insights
Settings
A Poisson solver written in Python for educational purposes.
Edit
Add topics
1 commit
1 branch
0 releases
1 contributor
GPL-3.0
Branch: master
New pull request
Create new file
Upload files
Find file
Clone or download
cwehmeyer Initial commit
Latest commit 9929d10 just now
.gitignore Initial commit just now
LICENSE Initial commit just now
README.md Initial commit just now
README.md
urban-broccoli
A Poisson solver written in Python for educational purposes.

Package layout

```
module.py
```

```
import module
```

```
package/
    __init__.py
    module1.py
    module2.py
```

```
import package
```

```
package/
    mypck/
        __init__.py
        module1.py
        module2.py
        test/
            __init__.py
            test_module1.py
            test_module2.py
    setup.py
    README.md
```

```
cd /path/to/package
python setup.py test
python setup.py install

import mypck
```

http://docs.python-guide.org/en/latest/writing/structure/

Interface

```python
import numpy as np
from PACKAGE_NAME import solve, create_laplacian

rho = np.random.rand(100, 50)
rho -= np.mean(rho)
phi = solve(rho, epsilon=1.0, h=[0.1, 0.2])

laplacian = create_laplacian(phi.shape, h=[0.1, 0.2])
phi_ = phi.reshape(-1, 1)
rho_ = np.dot(laplacian, phi_)
rho_ = rho_.reshape(rho.shape)
np.testing.assert_allclose(rho_, rho)
```

$$\frac{\partial^2 \phi}{\partial x^2} \approx \frac{\partial}{\partial x} \frac{\phi(x + \frac{h}{2}) - \phi(x - \frac{h}{2})}{h} \approx \frac{\phi(x + h) + \phi(x - h) - 2\phi(x)}{h^2}$$