HIBALL Hacking Hour

JÜLICH
Forschungszentrum

McGill

HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES

HEALTHY BRAINS
HEALTHY LIVES

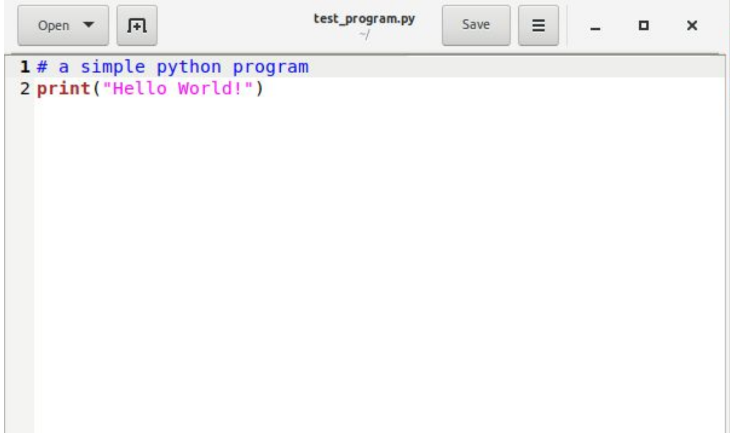
- **Part 1**: Basics
  - Basics I
    - variables, data structures, functions
  - Basics II
    - standard Python functions and libraries, strings, I/O
  - Software Design
    - writing safe, reusable software

- **Part 2**: Libraries
  - 2D and 3D Images
    - numpy, imageio, nibabel
  - Data frames and visualization
    - pandas, matplotlib
  - Image processing
    - scipy, skimage

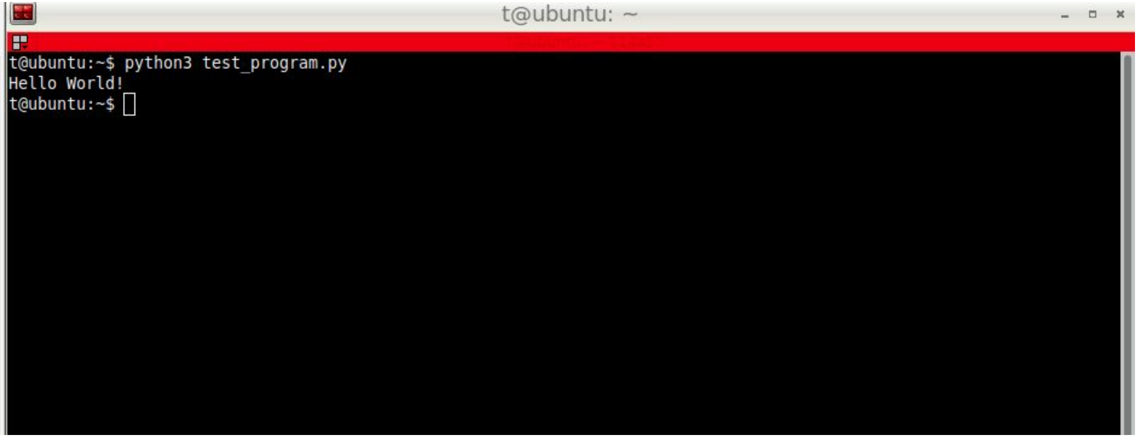
- **Part 3**: Applications
  - some ideas…
    - Statistics
    - Segmentation
    - Registration
    - Machine Learning / AI
    - fMRI

How Do People Normally Write Software?

- Text editor + command line interface



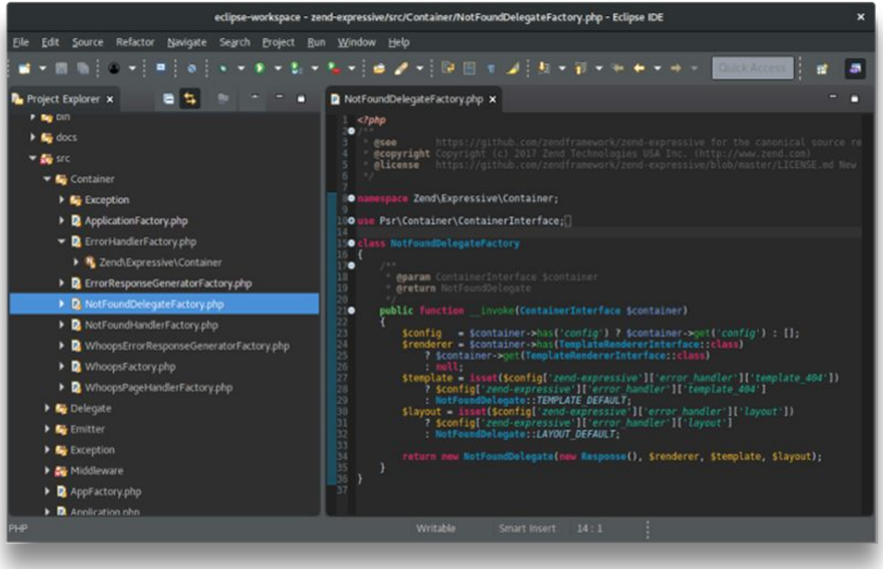
```
# a simple python program
print("Hello World!")
```



```
t@ubuntu:~$ python3 test_program.py
Hello World!
t@ubuntu:~$ 
```

How Do People Normally Write Software?

- Integrated Development Environment (IDE)
    - Software dedicated to writing code.
    - Lots of features, but can be a bit complex.

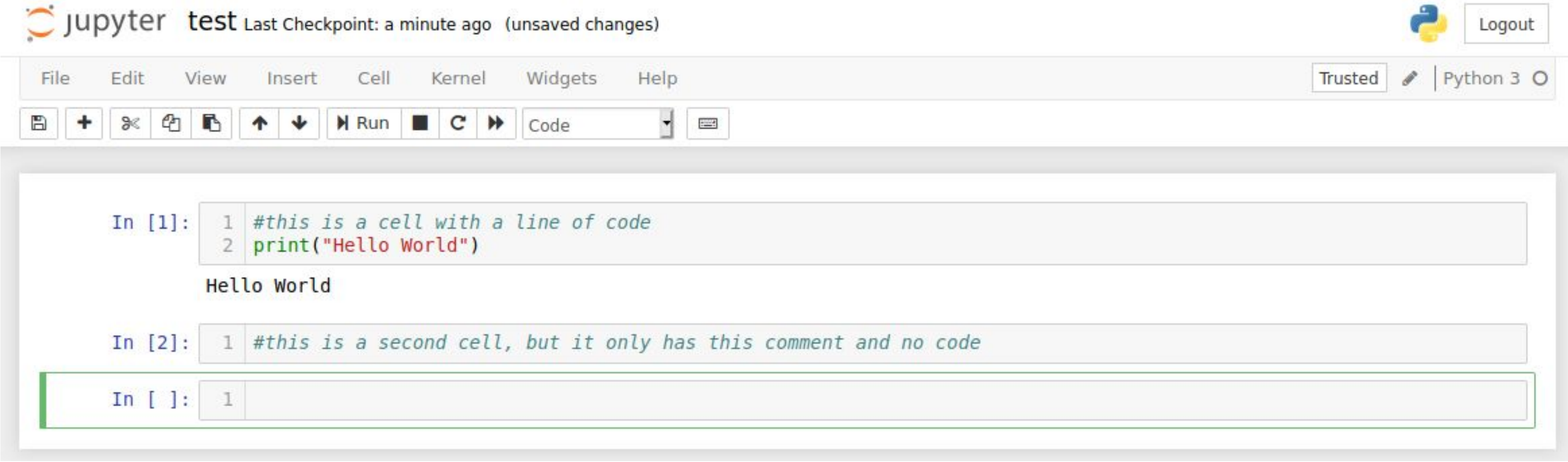

eclipse-workspace - zend-expressive/src/Container/NotFoundDelegateFactory.php - Eclipse IDE
File
Edit
Source
Refactor
Navigate
Search
Project
Run
Window
Help
Quick Access
Project Explorer
bin
docs
src
Container
Exception
ApplicationFactory.php
ErrorHandlerFactory.php
Zend\Expressive\Container
ErrorResponseGeneratorFactory.php
NotFoundDelegateFactory.php
NotFoundHandlerFactory.php
WhoopsErrorResponseGeneratorFactory.php
WhoopsFactory.php
WhoopsPageHandlerFactory.php
Delegate
Emitter
Exception
Middleware
AppFactory.php
Application.php
NotFoundDelegateFactory.php
PHP
Writable
Smart Insert
14 : 1

```php
<?php
/**
 * @see       https://github.com/zendframework/zend-expressive for the canonical source re
 * @copyright Copyright (c) 2017 Zend Technologies USA Inc. (http://www.zend.com)
 * @license   https://github.com/zendframework/zend-expressive/blob/master/LICENSE.md New
 */

namespace Zend\Expressive\Container;

use Psr\Container\ContainerInterface;[]

class NotFoundDelegateFactory
{
    /**
     * @param ContainerInterface $container
     * @return NotFoundDelegate
     */
    public function __invoke(ContainerInterface $container)
    {
        $config   = $container->has('config') ? $container->get('config') : [];
        $renderer = $container->has(TemplateRendererInterface::class)
            ? $container->get(TemplateRendererInterface::class)
            : null;
        $template = isset($config['zend-expressive']['error_handler']['template_404'])
            ? $config['zend-expressive']['error_handler']['template_404']
            : NotFoundDelegate::TEMPLATE_DEFAULT;
        $layout = isset($config['zend-expressive']['error_handler']['layout'])
            ? $config['zend-expressive']['error_handler']['layout']
            : NotFoundDelegate::LAYOUT_DEFAULT;

        return new NotFoundDelegate(new Response(), $renderer, $template, $layout);
    }
}
```

Eclipse IDE

How Do People Normally Write Software?

- Jupyter Notebooks
  - Not a good way to develop software, but very good for educational purposes
  - Consists of blocks of code, i.e., “cells”, that can be run one at a time.



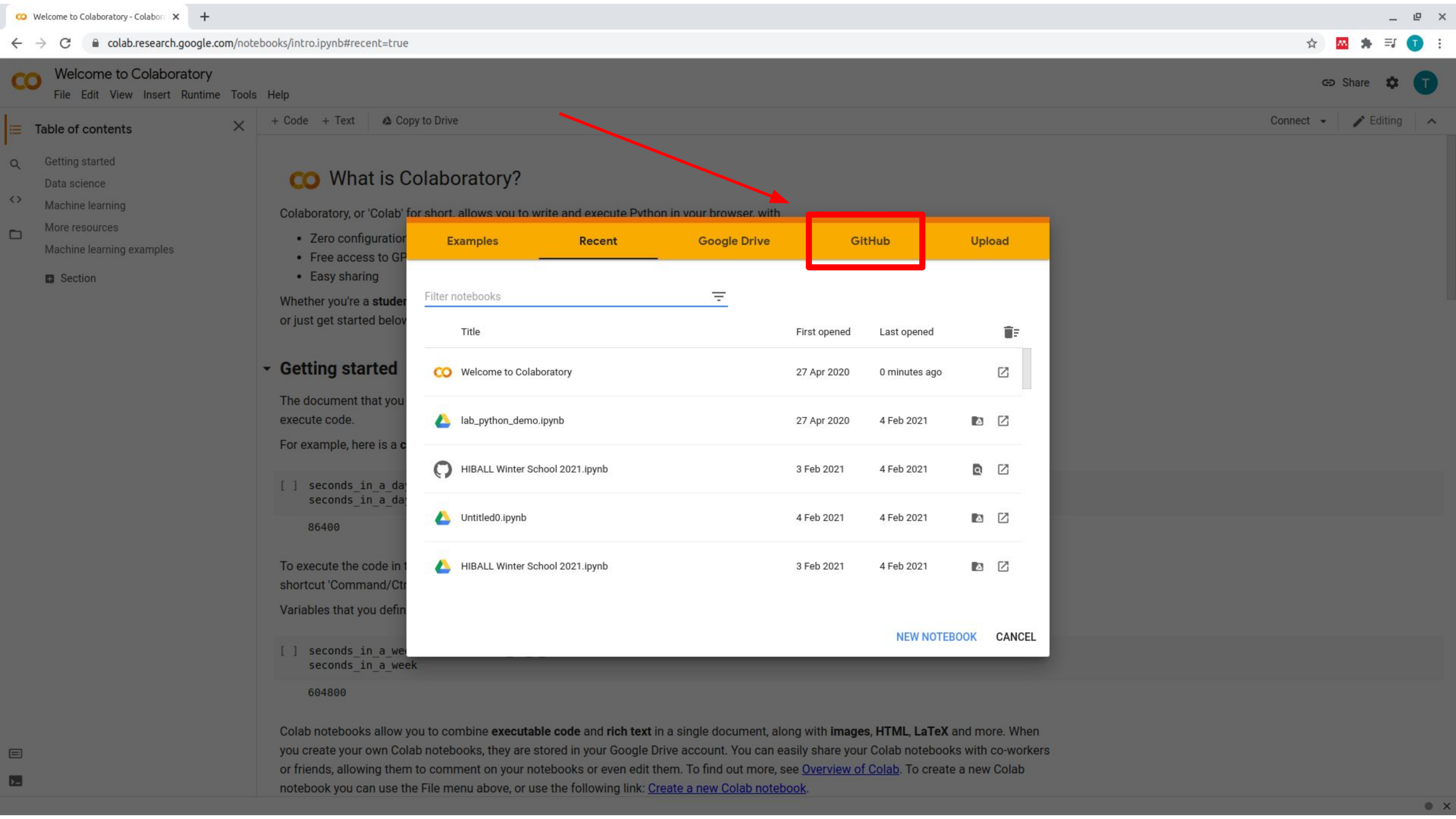
In [1]:
```
#this is a cell with a line of code
print("Hello World")
```

```
Hello World
```

In [2]:
```
#this is a second cell, but it only has this comment and no code
```

In [ ]:

- Instead of installing anything, we can use jupyter notebooks on Google Colab



What is Colaboratory?

Colaboratory, or 'Colab' for short, allows you to write and execute Python in your browser, with

- Zero configuration
- Free access to GP
- Easy sharing

Whether you're a studer
or just get started belov

Getting started

The document that you
execute code.

For example, here is a c

```
[ ]  seconds_in_a_da
     seconds_in_a_da

     86400
```

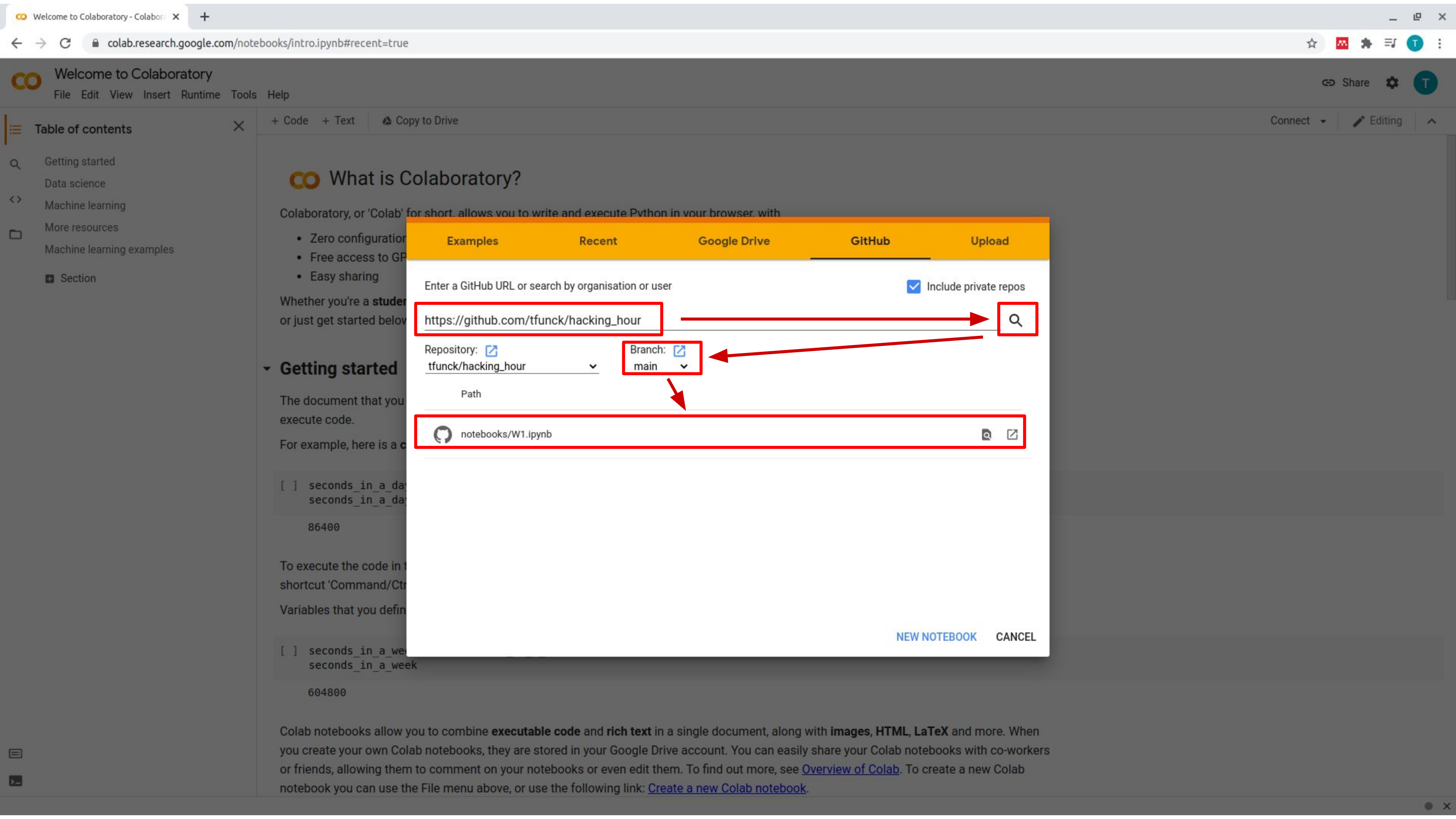
To execute the code in t
shortcut 'Command/Ctr

Variables that you defin

```
[ ]  seconds_in_a_we
     seconds_in_a_week

     604800
```

Colab notebooks allow you to combine **executable code** and **rich text** in a single document, along with **images**, **HTML**, **LaTeX** and more. When you create your own Colab notebooks, they are stored in your Google Drive account. You can easily share your Colab notebooks with co-workers or friends, allowing them to comment on your notebooks or even edit them. To find out more, see Overview of Colab. To create a new Colab notebook you can use the File menu above, or use the following link: Create a new Colab notebook.

Title	First opened	Last opened
Welcome to Colaboratory	27 Apr 2020	0 minutes ago
lab_python_demo.ipynb	27 Apr 2020	4 Feb 2021
HIBALL Winter School 2021.ipynb	3 Feb 2021	4 Feb 2021
Untitled0.ipynb	4 Feb 2021	4 Feb 2021
HIBALL Winter School 2021.ipynb	3 Feb 2021	4 Feb 2021



Welcome to Colaboratory - Colabor
colab.research.google.com/notebooks/intro.ipynb#recent=true
Welcome to Colaboratory
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Getting started
Data science
Machine learning
More resources
Machine learning examples
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NEW NOTEBOOK
CANCEL

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Enter a GitHub URL or search by organisation or user

☑ Include private repos

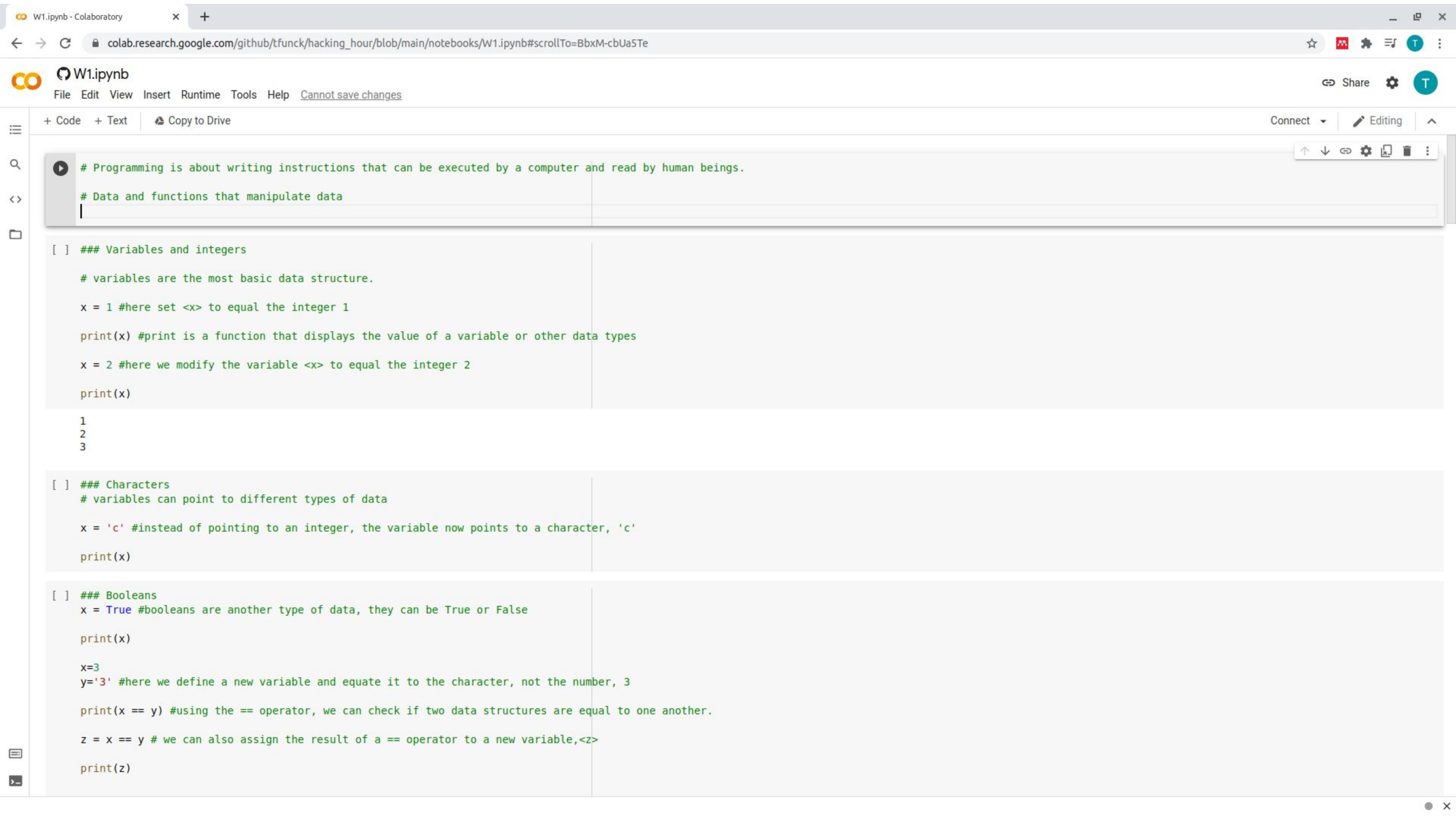
https://github.com/tfunck/hacking_hour

Repository: tfunck/hacking_hour

Branch: main

Path

notebooks/W1.ipynb


W1.ipynb - Colaboratory
colab.research.google.com/github/tfunck/hacking_hour/blob/main/notebooks/W1.ipynb#scrollTo=BbxM-cbUa5Te
W1.ipynb
File Edit View Insert Runtime Tools Help Cannot save changes
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Connect
Editing

```
# Programming is about writing instructions that can be executed by a computer and read by human beings.

# Data and functions that manipulate data
```

```
### Variables and integers

# variables are the most basic data structure.

x = 1 #here set <x> to equal the integer 1

print(x) #print is a function that displays the value of a variable or other data types

x = 2 #here we modify the variable <x> to equal the integer 2

print(x)
```

```
1
2
3
```

```
### Characters
# variables can point to different types of data

x = 'c' #instead of pointing to an integer, the variable now points to a character, 'c'

print(x)
```

```
### Booleans
x = True #booleans are another type of data, they can be True or False

print(x)

x=3
y='3' #here we define a new variable and equate it to the character, not the number, 3

print(x == y) #using the == operator, we can check if two data structures are equal to one another.

z = x == y # we can also assign the result of a == operator to a new variable,<z>

print(z)
```