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## Flask,

Conquering a Fundamental Web Stack.

# First, a word from our sponsor.







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Tweet must use **#PizzaFund** and **tag MLH**.



#### Thanks again to our Pizza Fund Partners!







**GitHub** 

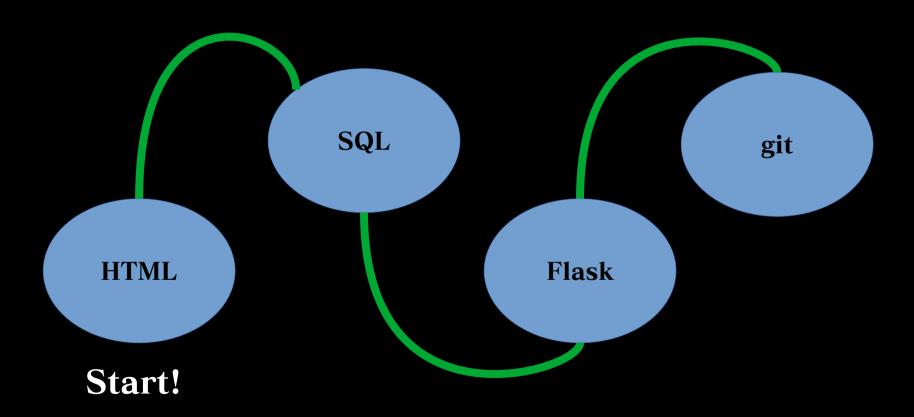




## There is a lot to cover. so strap in!

Questions are encouraged!

#### Roadmap



### 

#### **SECTION:1**

The foundation of every web page.

#### Hypertext Markup Language

- The language for specifying web pages.
- Tags are the building blocks.
- · What you want the page to look like.

<tag>content</tag>



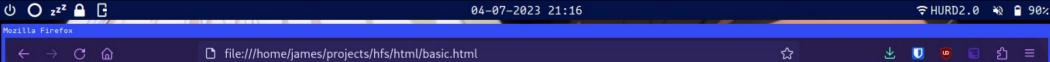
```
<!DOCTYPE html>
<html>
 everything lives here
</html>
```

```
<!DOCTYPE html>
<html>
 <body>
    main content of web page
 </body>
</html>
```

#### **Basic Tags**

- -- Paragraph.
- <h1> -- Header.
- <h2> -- Subheader.
- <h3> -- Subsubheader.
- <h4> -- You get the idea... (goes down to 6).
- <strong> -- Bold text.
- <em> -- Italic text.
- <br/>
   Line break (no content => does not need end tag).

```
<!DOCTYPE html>
<!-- This is a comment. -->
<html>
 <body>
   <h1>Welcome to my webpage!</h1>
   >
    HTML is <strong>really</strong> <em>cool</em>.
   </body>
</html>
```



#### Welcome to my webpage!

HTML is really cool.

#### HTML Lists

- · Can be ordered or unordered.
- -- Unordered list (e.g. bullets).
- - Unordered list (e.g. 1, 2, 3...).
- -- Item in both lists.

```
<!DOCTYPE html>
<!DOCTYPE html>
                        <html>
<html>
                         <body>
 <body>
  <h1>Unordered List.</h1>
                         <h1>0rdered List.</h1>
                          <l
                           item one
  item one
                           item two
   item two
                          </body>
</body>
                        </html>
</html>
```

#### **Unordered List.**

- · item one
- · item two

#### Ordered List.

- 1. item one
- 2. item two

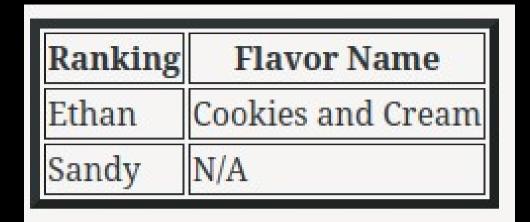
#### HTML Tables

- -- Table container.
  - Border size can be many things:
    - e.g. px, em, pt
- > -- Table row container.
- -- Table heading.
- Table cell contents.

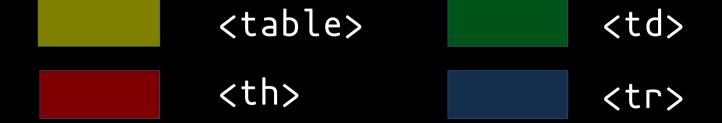
```
<!-- Outer tags omitted for readability. -->
 >
   Name
   Flavor
  >
   Ethan
   Cookies and Cream
  >
   Sandy
   N/A
```

#### My Friends' Favorite Ice Cream Flavors

Ranking	Flavor Name
Ethan	Cookies and Cream
Sandy	N/A







#### HTML Links

- <a href="link destination"> -- Hyperlink.
- Link destination could be many things:
  - Local HTML page.
    - e.g. "path/to/page.html"
  - Other things on the web.
    - e.g. "https://youtu.be/dQw4w9WgXcQ"

```
<!-- Outer tags omitted for readability. -->
<h1>Links!</h1>
<l
   <!-- basic.html is another page in the current directory. -->
   <a href="basic.html">Check out my awesome page!
   <a href="https://youtu.be/dQw4w9WgXcQ">Look at this cool video.
```

#### Links!

- Check out my awesome page!
- · Look at this cool video.



#### Welcome to my webpage!

HTML is really cool.

#### Hypertext Transfer Protocol

- How you actually talk with the web.
- Many flavors of requests.

Client (you)

**HTTP Request** 

Response

Server
(Website lives here)

#### **GET Requests**

- "Get" the state of the server.
- · Retrieve data, no changes.

Client (you)

GET Request

Webpage

Server
(Website lives here)

#### **POST Requests**

- Hand new data to the server.
- · Useful in form responses, file uploads.

Client (you)

**POST Request** 

Acknowledgement

Server
(Website lives here)

#### HTML Forms – Container and Actions

- <form method="http method" action="where to send data">
  - method -- HTTP method to send data with.
    - GET is default, appends data to new URL and goes there.
      - $-\mathbf{e.g.}$  myform.com o myform.com?response=form\_response.
    - We will use POST, which sends data in POST request.
  - action -- Where form sends data, default is to current page.
    - We will use the default, but could use PHP, Web API, etc.

#### HTML Forms – Input and Labels

- The <input> tag can take many forms, a couple are:
  - <input name="name"> -- Text input identified by name.
    - · Add required to make it a required input.
      - e.g. <input name="input\_name" required>
  - <input name="submit" value="text"> -- From submit button.
    - text will appear on the button.
  - <input> tags do not require an end tag.
- <label for="name"> -- Label for input identified by name.

```
<!-- Outer tags omitted for readability. -->
<h1>Innocent Form</h1>
    <form method="post">
      <label for="ssn">Social Security #</label>
      <input name="ssn" required>
      <input type="submit" value="Press here for free stuff!">
    </form>
```

#### **Innocent Form**

Social Security # 785-330-9797

Press here for free stuff!

POST Request

#### POST Request

ssn=785-330-9797

What do we do with this request? Just wait...

## Still with me?

Questions? Speak now or forever hold you peace!

## SQL

# SECTION:2 Persistently storing data.

#### What is a Database?

- · A persistent way to store and access data.
  - Could be as simple as a txt file.
- Two main flavors:
  - Relational (e.g. SQLite)
    - · We will focus on these.
  - Non-relational (e.g. MongoDB)

#### What is a Relational Database?

- Data is organized into tables.
- Each table is rows and columns
- · A unique key identifies each row.
  - Called the "primary key".
- Sort-of like a spreadsheet.



Employee ID (Primary Key)

Other fields



Table Record Field

## Database Management System (DBMS)

- · How you interact with the database.
- · Allows you to CRUD, or
  - Create
  - Read
  - Update
  - Delete
- We will use SQLite, but there are many options:
  - e.g. MySQL, MariaDB.
- Specifically, we will use an RDBMS

#### Structured Query Language

- Standard language for interacting with an RDBMS.
- Nonstandard across different RDBMS.
  - Basics are more or less the same everywhere.
- · Use "statements" to do things to database.
  - End with a semicolon.
  - Not case-sensitive.
- Input statements:
  - Directly at RDBMS prompt.
  - In a .sql file.

#### Creating/Deleting a Table

- · We create a table by specifying a Schema.
  - Schema => What a typical record looks like.
- CREATE TABLE name(f1 datatype, f2 datatype, ...);
  - CREATE TABLE IF NOT EXISTS is another way to do this.
- Fields can be many types.
  - e.g. integer, text, float
- · Each field can also have special options after it.
  - AUTOINCREMENT is useful for ints.
    - Automatically generates new int on insert.
- DROP TABLE name; -- Deletes table "name".

```
CREATE TABLE todo(
  id INTEGER AUTOINCREMENT,
  task_name TEXT
);
```

todo

id

task\_name

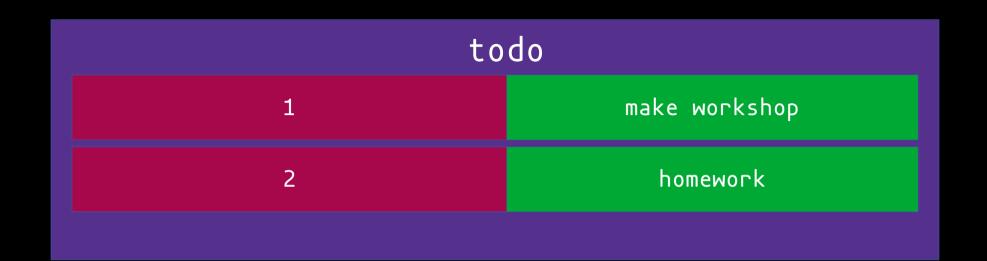
#### Messing With Records

- INSERT INTO name VALUES (f1\_value, f2\_value, ...);
  - Creates a new record with given field values in table name.
  - Fields with AUTOINCREMENT will be automatically created.
- DELETE FROM name WHERE condition;
  - Delete all records where condition is true.
  - No WHERE => all records deleted!!!!!
- UPDATE name SET f1=newval1, f2=newval2, ... WHERE condition;
  - Changes f1 to newval1, f2 to newval2, etc. where condition is true.
- Condition can be any expression that evaluates to a bool.
  - e.g. field = value, field < value.

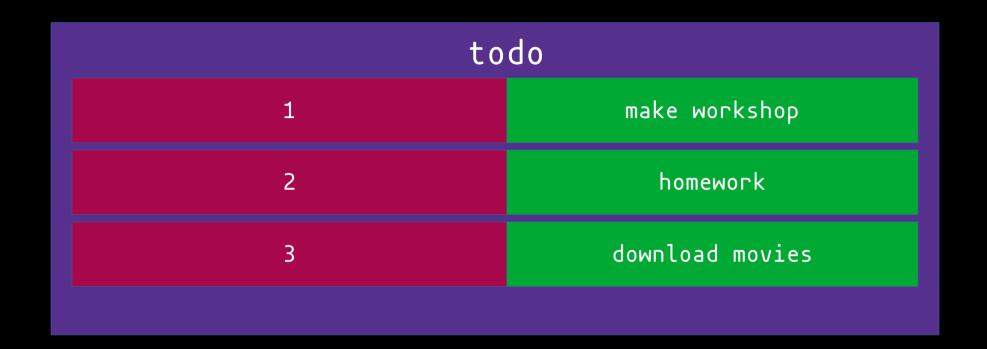
todo

make workshop

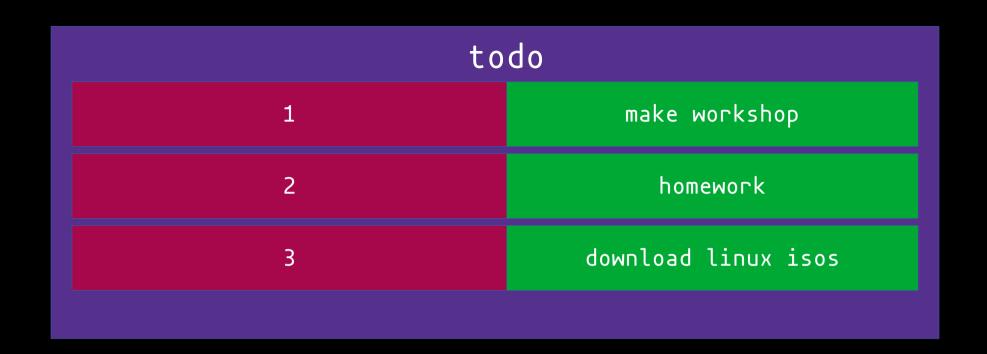
#### INSERT into todo VALUES (make workshop);



#### INSERT into todo VALUES (homework);



#### INSERT into todo VALUES (download movies);



UPDATE todo SET task\_name='download linux isos' WHERE id=3;



#### DELETE from todo WHERE id=1;

#### **Getting Records**

- Querying == getting records form a database.
- SELECT \* from name WHERE condition;
  - Returns all records from name where condition is true.
- SELECT f1, f2, ... from name WHERE condition;
  - Returns fields f1, f2, ... from name where condition is true.
- · condition is the same as before.





SELECT task\_name from todo WHERE id=2; ———— (homework)

# Everyone Still Onboard?

I know this is a lot of information. Please ask questions!

### Okay, this is all cool but how do we actually use these things?

## Flask

## SECTION:3 Putting it all together.

#### What is a Web Framework?

- A collection of tools to build and deploy web applications.
- Manages:
  - Web server connection.
  - Database connection.
  - Templating.
  - Much more!

#### A Brief Note on Decorators

- What they actually are isn't important.
- Adds extra functionality to our functions.
- We will only import these from Flask.
- For nerds: Decorators == higher order functions.

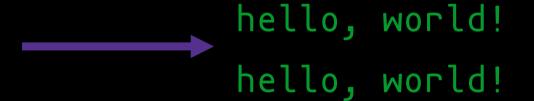


#### A Brief Note on Decorators

```
#!/usr/bin/python

@do_twice

def hello_world():
    print("hello, world!")
hello_world()
```



#### What is Flask?

- · A web framework written in Python.
- · Get it by running pip install flask in your terminal.
- Uses decorators to specify different "routes".
  - For example, the default route is /.
  - e.g. 127.0.0.1/



#### Flask Basics

- Your app is an instance of the Flask object from the flask library
  - Say app is the name of your Flask object in the following.
- (app.route('/route/path', methods=('m1', 'm2',...)
  - Will load what is returned by decorated function in the browser.
  - methods = Tuple of valid HTTP request methods for endpoint.
    - ('GET') is default.
- @app.teardown\_appcontext
  - Flask will execute decorated function upon the end of a session.
  - Decorated functions must take one positional argument.
    - This is because of under the hood Flask stuff we won't get into.

```
from flask import Flask
app = Flask(__name__)

@app.route("/")
def hello():
    return "Hello World!"

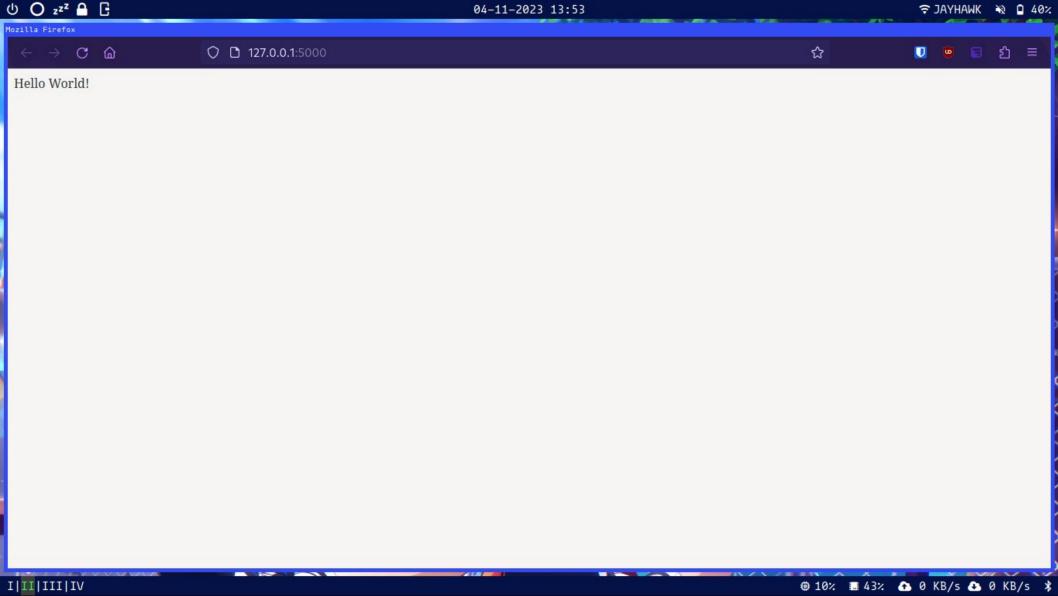
if __name__ == "__main__":
    app.run()
```

app.py file (Must be named this).

Run app by typing flask run in the terminal.

Address of the web app (type this in your address bar).

```
[james@localhost ~]$ flask run
* Debug mode: off
WARNING: This is a development server. Do not use it in a
production deployment. Use a production WSGI server instead.
* Running on http://127.0.0.1:5000
Press CTRL+C to quit
```



#### Rendering HTML With Flask

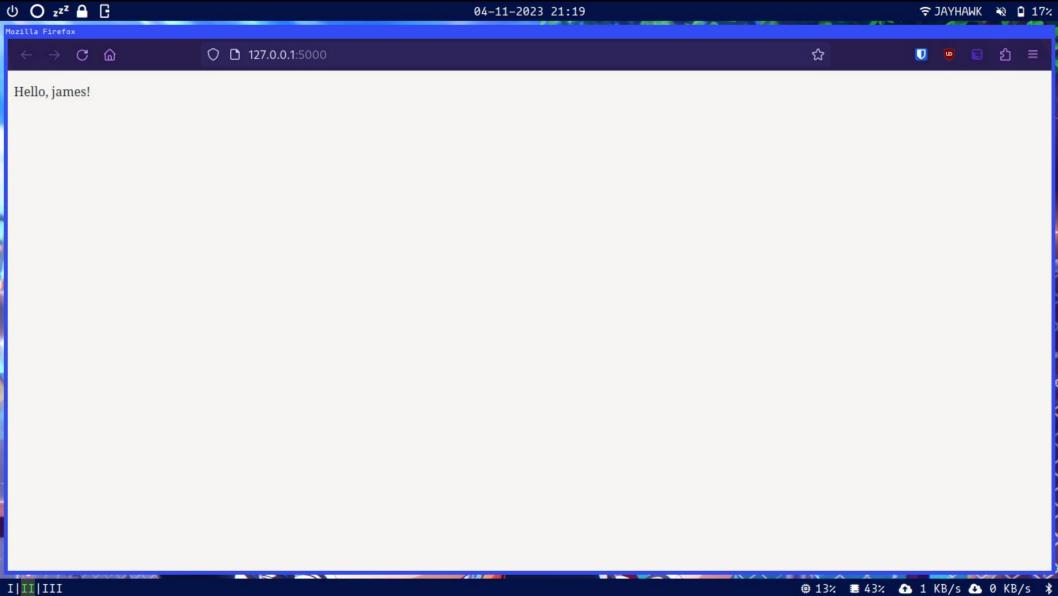
- Flask can show an HTML page using render\_template('filename.html').
  - File must be in a folder called templates located in the same directory as app.py.
- However, Flask lets us do more...

#### HTML Templates With Jinja

- The Jinja template engine is used by Flask to dynamically generate HTML based on an input.
- Pass data to a template in the render\_template.
  - e.g. render\_template('temp.html', var1=val1, var2=val2, ...) would give us access to all variables passed within the HTML.
- Access variables in template using {{ varname }} syntax. You can include any valid Python in this block.
  - e.g. {{ var1 + var2 }}

```
from flask import Flask, render_template
app = Flask(__name__)
@app.route('/')
def hello():
    return render_template('hello.html', name='james')
if __name__ == '__main__':
    app.run()
```

templates/hello.html



#### More Fun with Templates

- Templates also support:
  - if statements.
  - for loops.
- Works just like Python.

```
{% if condition %}
Some html goes here...
{% else %}
Some more html goes here...
{% endif %}
```

```
{% for var in obj %}
Some html goes here...
{% endfor %}
```

## Connecting to a Database

- Connect to a sqlite database using the sqlite3 library built into Python.
- The g object in Flask allows us to add a database connection to our current session.
  - e.g. g.db = sqlite3.connect('database.db')
    - If file doesn't exist, sqlite will create it.

## Interacting With a Database

- After connecting, run g.db.execute('sql commnd') to interact with your database.
- 'sql command?', var is used to pass variables to SQL strings.
  - Protects from SQL injection attacks.
  - e.g. db.execute('INSERT INTO names VALUES (?)',
     (request.form['name'],))
- Commands that change the DB will need to be followed by g.db.commit() to write changes.
- If querying, use .fetchall() to get all results.
  - e.g. db.execute('SELECT \* FROM names').fetchall()

```
from flask import render_template, Flask, g
import sqlite3
app = Flask(__name__)
def get_db() :
    g.db = sqlite3.connect('database.db')
    g.db.row_factory = sqlite3.Row
    g.db.execute('CREATE TABLE IF NOT EXISTS names(name TEXT)')
    return g.db
@app.teardown_appcontext
def close_db(exception):
    db = g.pop('db', None)
    if db is not None:
        db.close()
```

# **Processing Requests**

- Import the request object from Flask to view request data.
- POST form responses will be in the dictionary request.form
  - Keys are the names of the input tags.
- request.method = HTTP method used.

```
from flask import render_template, request, Flask, g
import sqlite3
app = Flask(__name__)
#database functions from earlier go here
@app.route('/', methods=('GET', 'POST'))
def index():
    db = get_db()
    if request.method == 'POST':
        db.execute('INSERT INTO names VALUES (?)',(request.form['name'],))
        db.commit()
    names = db.execute('SELECT * FROM names').fetchall()
    return render_template('index.html', names=names)
if __name__ == '__main__':
    index()
```

```
<!DOCTYPE HTML>
<h1>Workshop Check-In!</h1>
 <form method="post">
   <label for="name">Please enter your name: </label>
   <input name="name" required>
   <input type="submit" value="Check In!">
 </form>
<h1>People Checked In</h1>
>
   name
 {% for name in names %}
 >
   {{name['name']}}
 {% endfor %}
</section>
```

templates/index.html





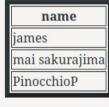


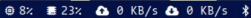


#### Workshop Check-In!

Please enter your name: Check In!

#### **People Checked In**







# I am very tired, are we almost done?

One last thing! But first, questions?

# git

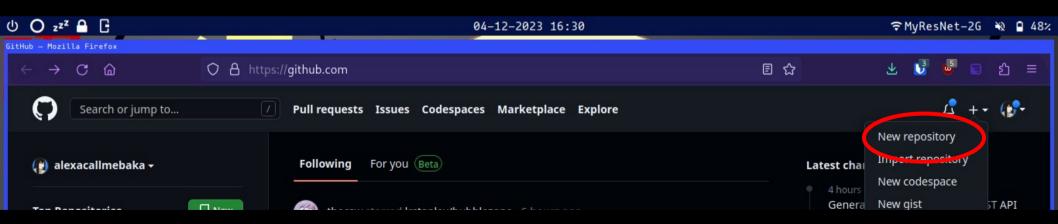
# SECTION:4 Effective collaboration.

### What is git and GitHub?

- git is a version control system (VCS).
  - Saves snapshots of your code at different points called "commits".
  - Download link on the GitHub for this talk.
- git is useful for many things.
  - We will focus on its use as a collaborative tool.
- GitHub is an online platform for hosting git repositories.
  - This is how you share your code with the world!

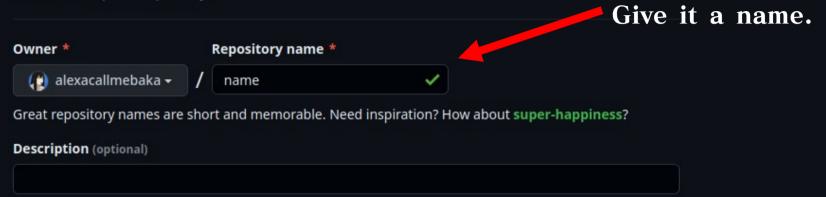
## Setting Up GitHub

- Create a GitHub account.
  - github.com
- Create a new repository on the home page.

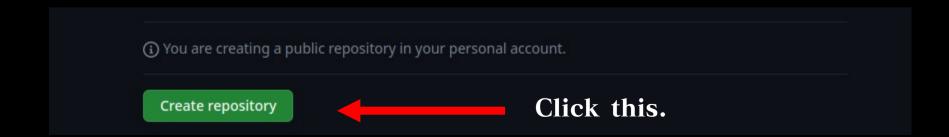


#### Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? Import a repository.

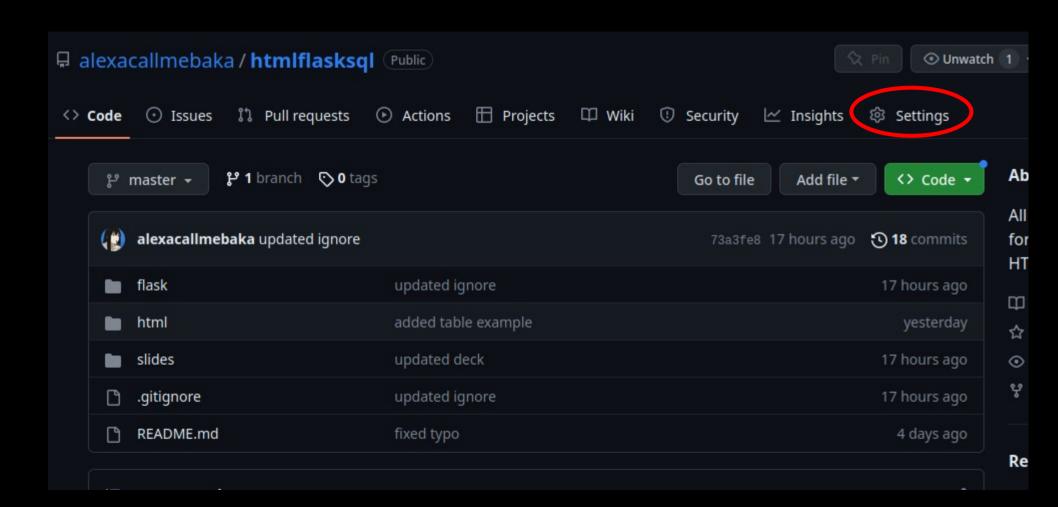


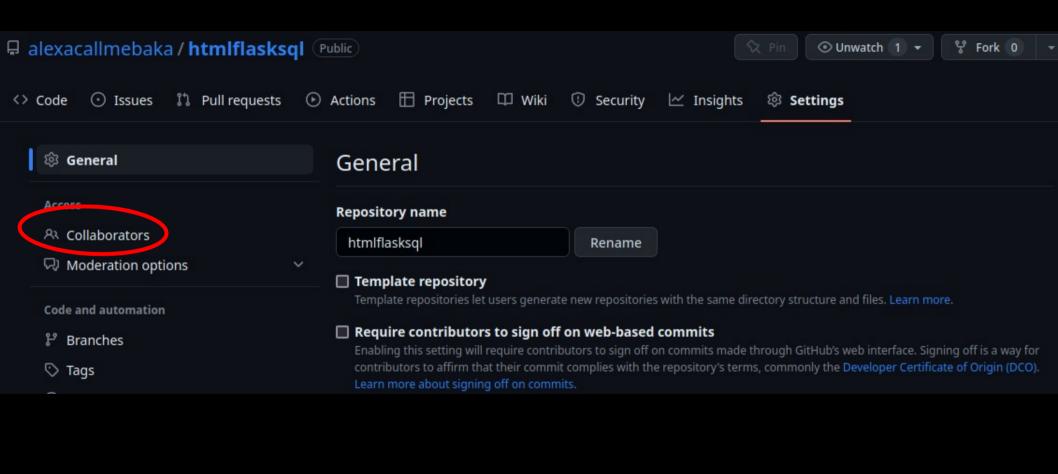
#### Scroll down...

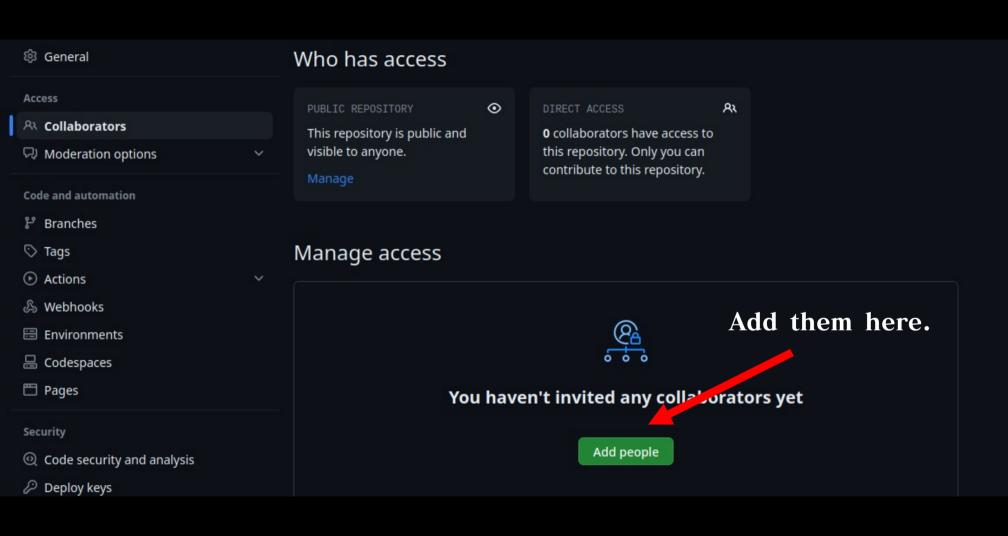


# Whohoo! You made your first GitHub repo!

Now how do you add your friends?







# Now we need to actually make a repo to push to GitHub.

## Baby's First git Repo

- Configure git:
  - git config --global user.name "james"
  - git config --global user.email "jmh@ku.edu"
  - NOTE: THESE WILL BE PUBLICLY VISIBLE!!
- On the command line, navigate to the directory you want your repo to be in, and run:
  - git init
- Connect your GitHub repo located at url:
  - git remote add origin url
- Now make some files, go wild!

### Doing Things in git

- git add filename
  - Add filename to next commit. Called "staging".
- git commit -m 'message'
  - Commit all staged files to repo with message message.
- git push
  - Push changes to GitHub.
  - May need to run git push -u origin master the first time in a new repo.
- git clone url
  - Copy git repo located at url onto your local machine.
- git pull
  - Pull changes from GitHub.

# That is just a taste of what you can do.

Questions?

# Our whirlwind journey has come to an end.

### Where to go next?

- This deck, and all example code on GitHub!
- · You will also find links to helpful resources.
- Flag me down at HackKU or ping me on the Discord!

# hfs.jameshurd.net

# Thank you

FIN.

Contact: jameshurd@ku.edu