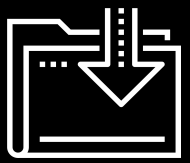
Introduction to Flask

Data Boot Camp



Class Objectives

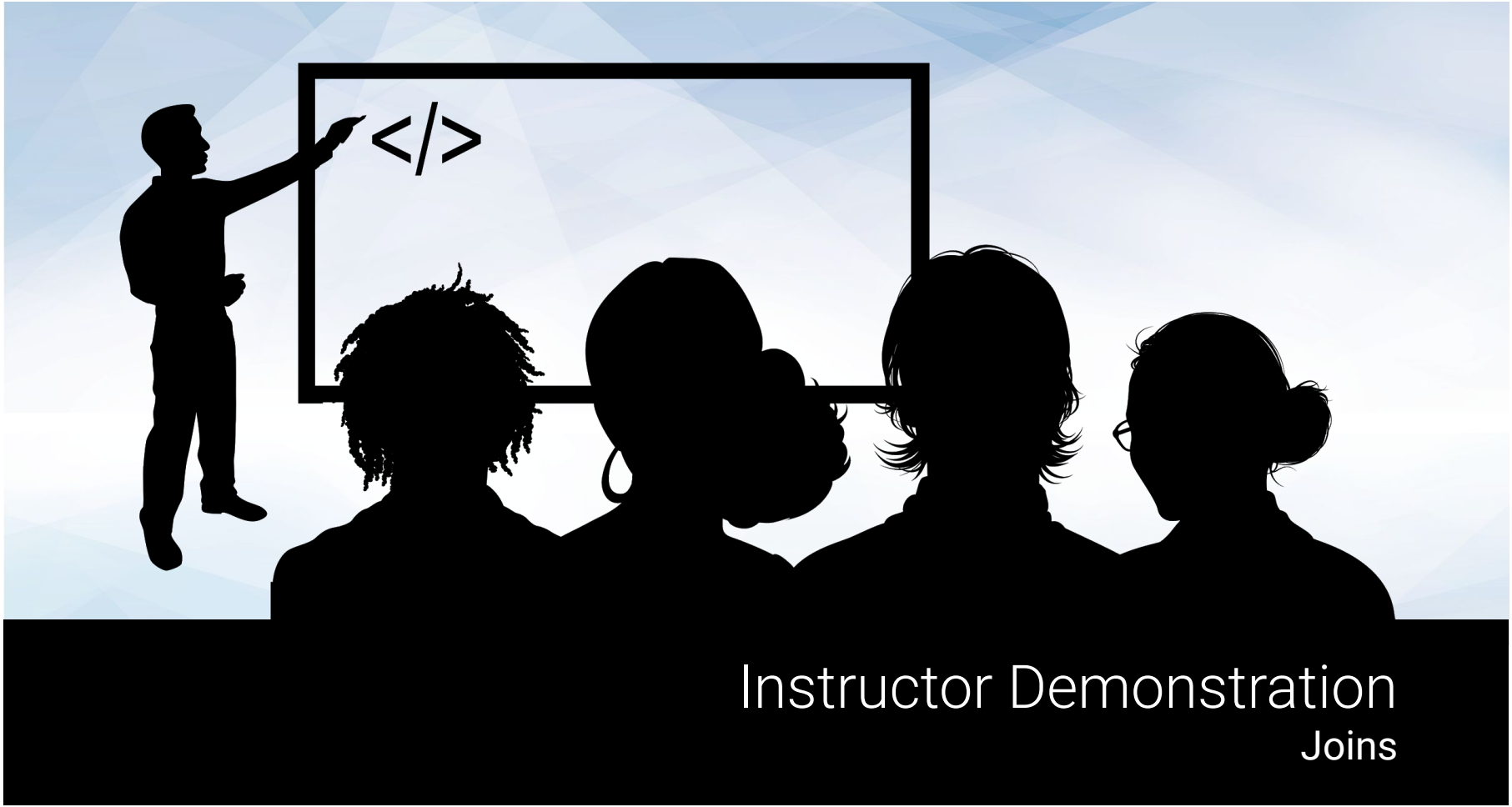
By the end of today's class you will be able to:

Create and run a Flask server.

Create static query endpoints in Flask.

Execute dynamic database queries with Flask.

Return API query results in JSON.



Instructor Demonstration

Joins

Joins in **SQLAlchemy** are very similar to joins in **Pandas**!

SQLAlchemy Joining Tables Step-By-Step

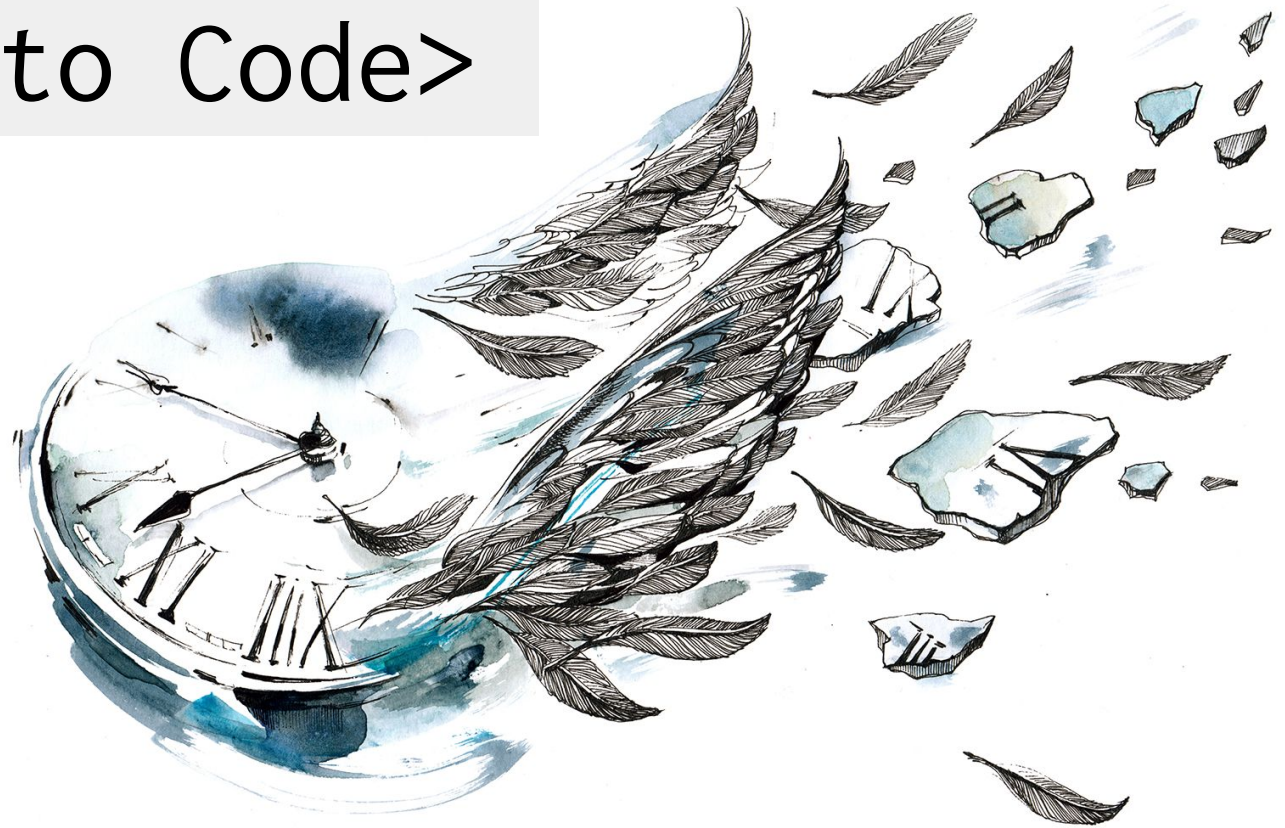
01 Use inspect(engine).get_table_names() to find table names in the database

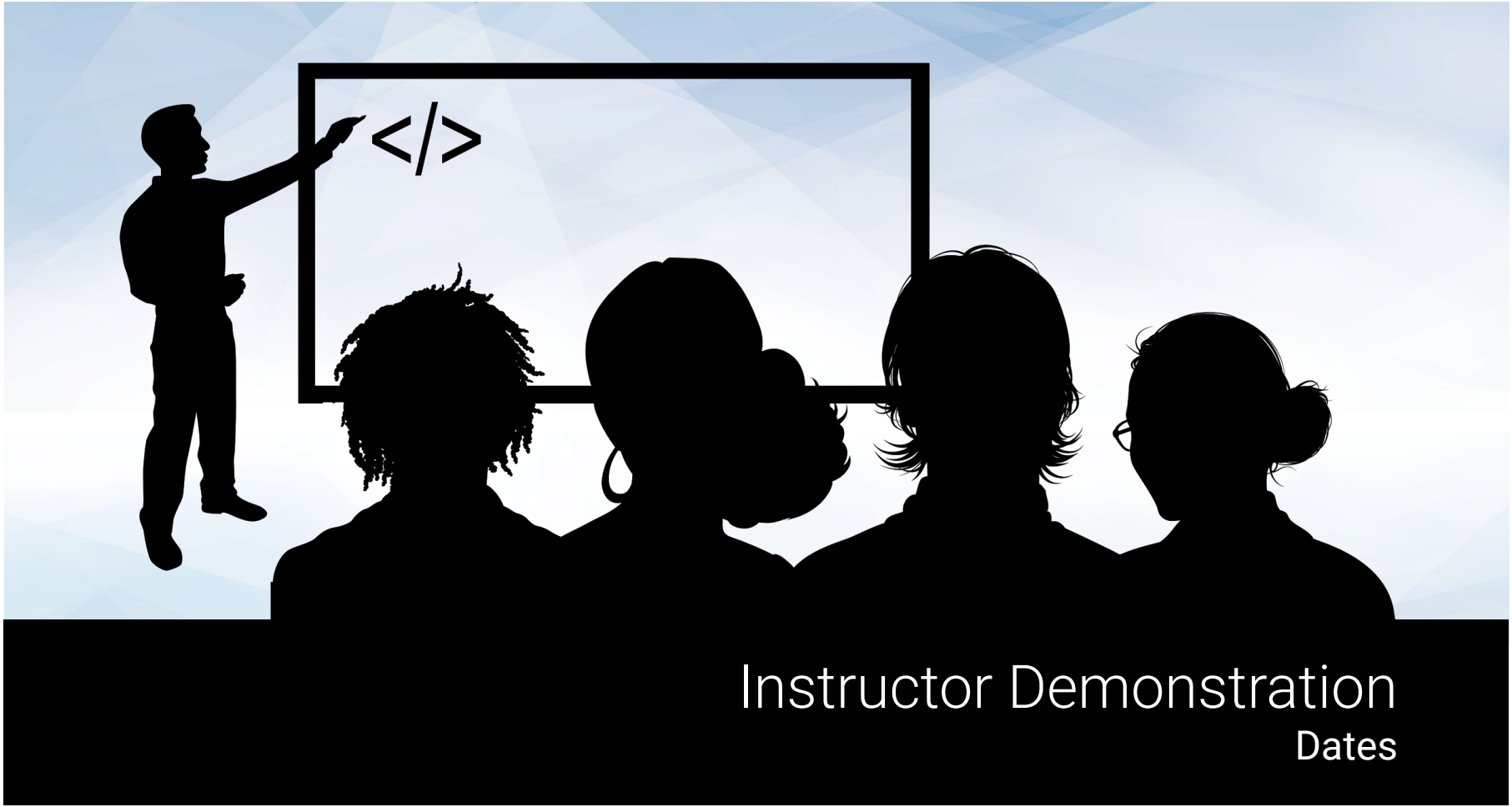
02 Use inspect(engine).get_columns(table) to get the column names

03 Create a list of all table columns you wish to keep

04 Use .filter() to describe what columns to join on

<Time to Code>





Instructor Demonstration

Dates

Times and dates are bit trickier than integers or decimals

- Throughout all programming
- In some cases we may need to do conversions

  to add or subtract time
  - Days, months, years to seconds
  - Then convert everything back!
- Many ways to annotate a date
  - 10/21/2020
  - 21/10/2020
  - 21Oct2020
  - October 21, 2020
- Python libraries like `datetime` makes things easier!

Datetime and SQLAlchemy work well together!

- Dates and times can be stored in many ways
  - Datetime objects
  - Strings
  - Integers (number of seconds)
- It could be difficult to compare, or query for a specific date/time
- Python's `datetime` library helps make dates and times easier

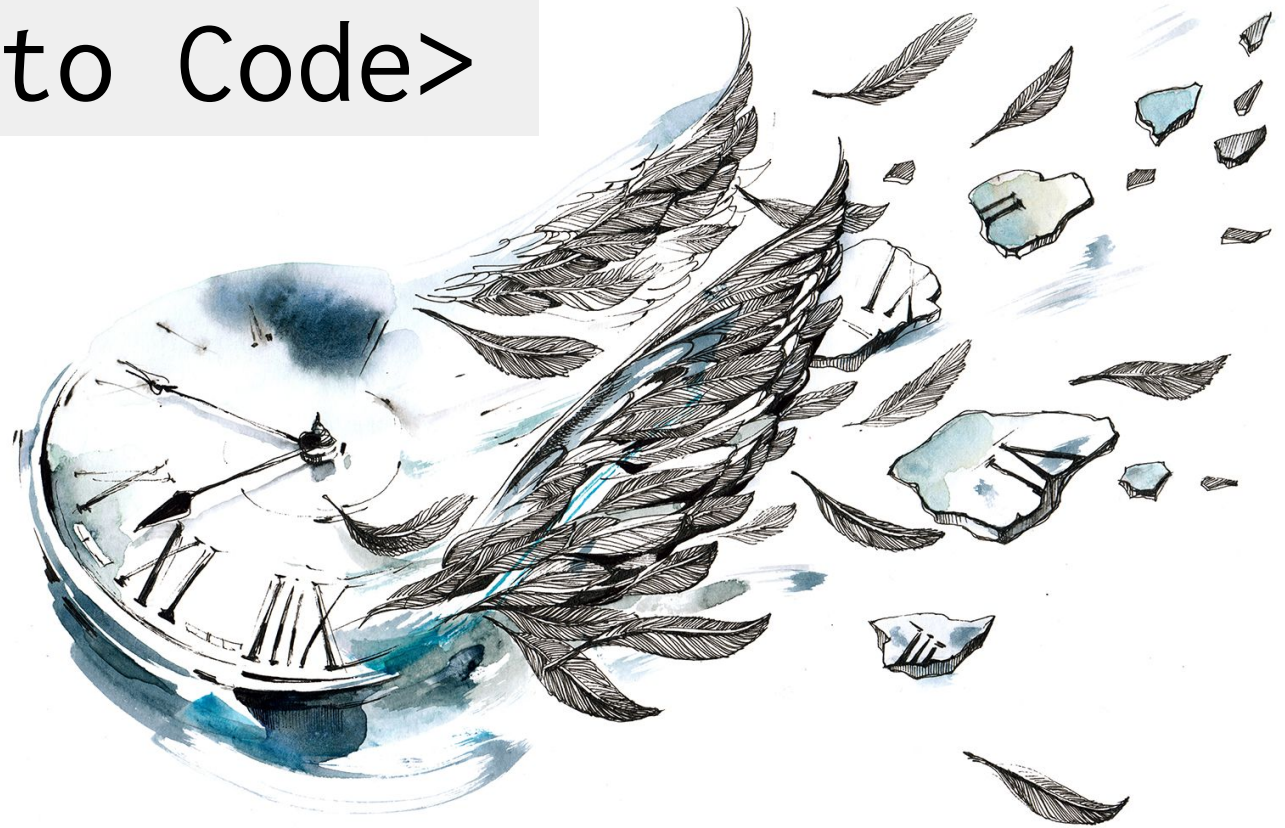
```
# Query for the Dow closing price for `CSCO`
# 1 week before `2011-04-08` using the datetime library
query_date = dt.date(2011, 4, 8) - dt.timedelta(days=7)
print("Query Date: ", query_date)
```

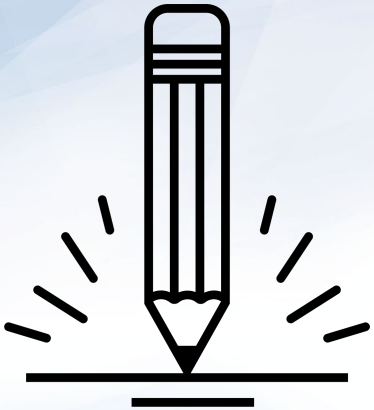
```
Query Date:  2011-04-01
```

```
session.query(Dow.date, Dow.close_price).\
    filter(Dow.stock == 'CSCO').\
    filter(Dow.date == query_date).all()
```

```
[('2011-04-01', 17.04)]
```

<Time to Code>





Activity: Dates

In this activity, you will practice working with dates, both in SQLAlchemy and with the `datetime` library.

(Instructions sent via Slack.)

Suggested Time:
15 Minutes

Dates Instructions

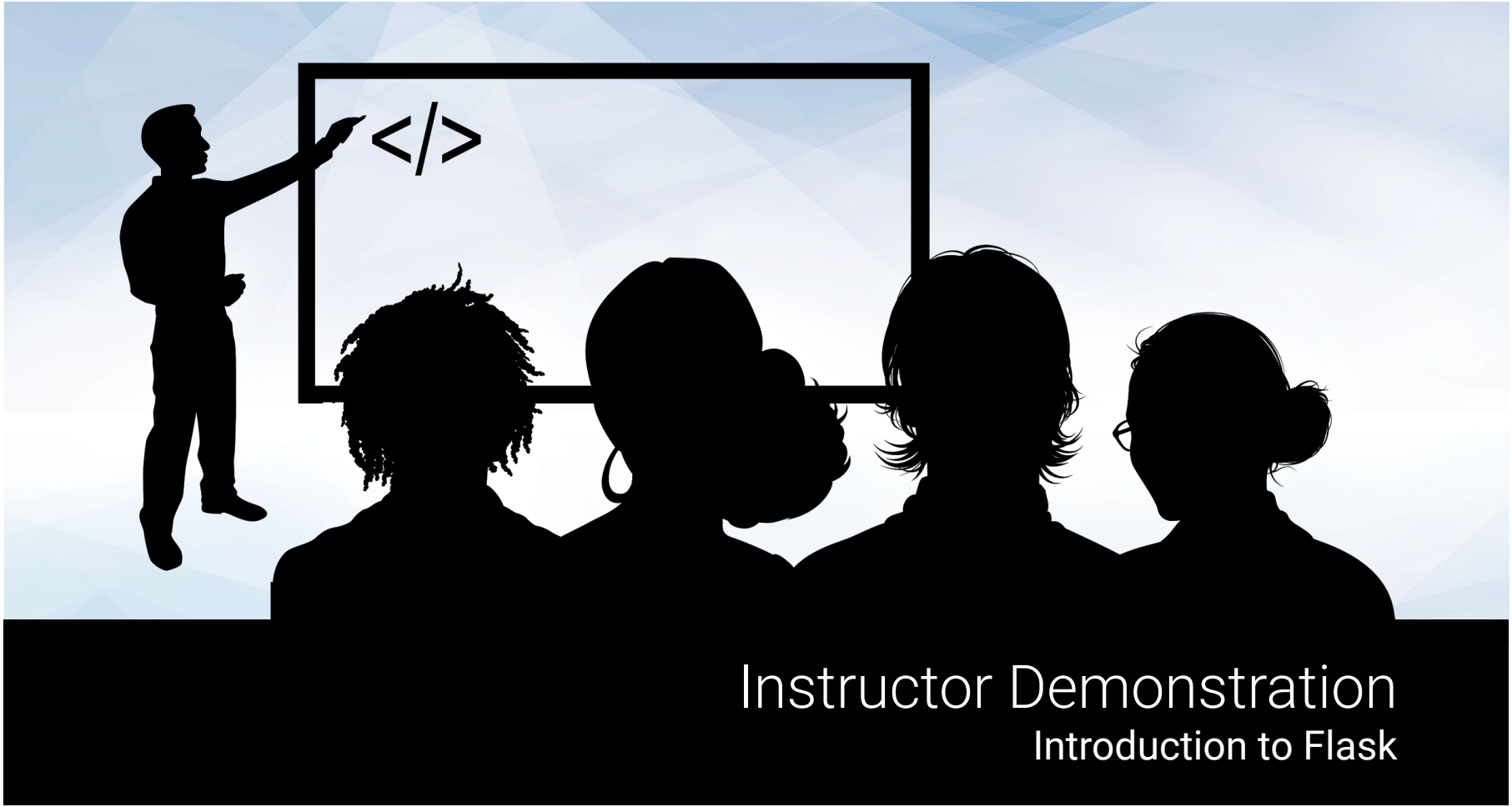
- Use the dow.sqlite dataset provided to analyze the average stock prices (average open, average high, average low, average close) for all stocks in the Month of May

- Plot the results as a Pandas or Matplotlib Bar Chart

Bonus:

- Calculate the high-low peak-to-peak (PTP) values for IBM stock after 2011-05-31.

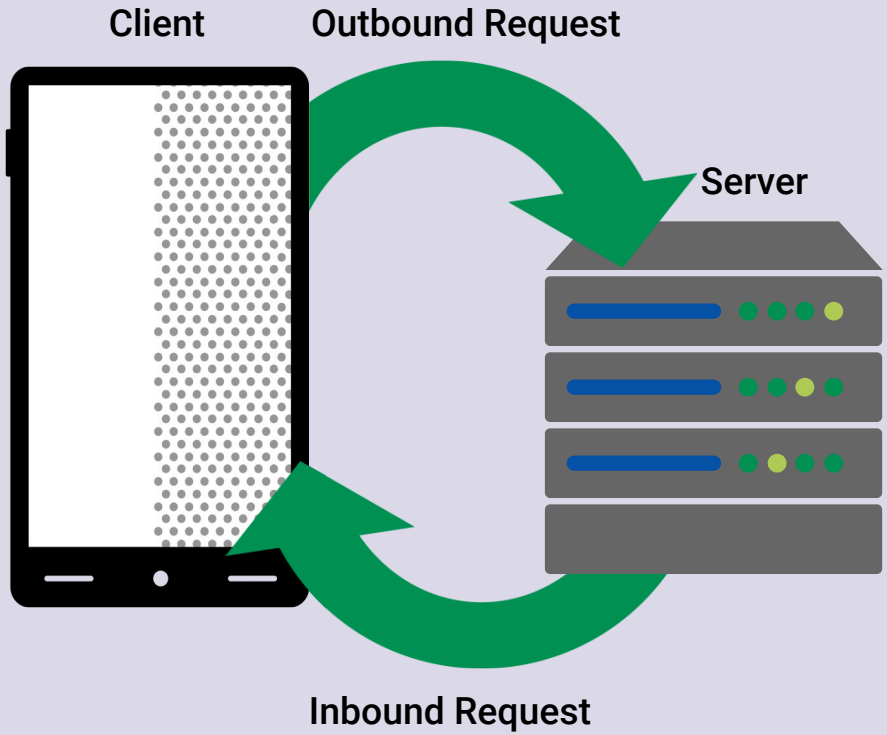
Time’s Up! Let’s Review.



Instructor Demonstration

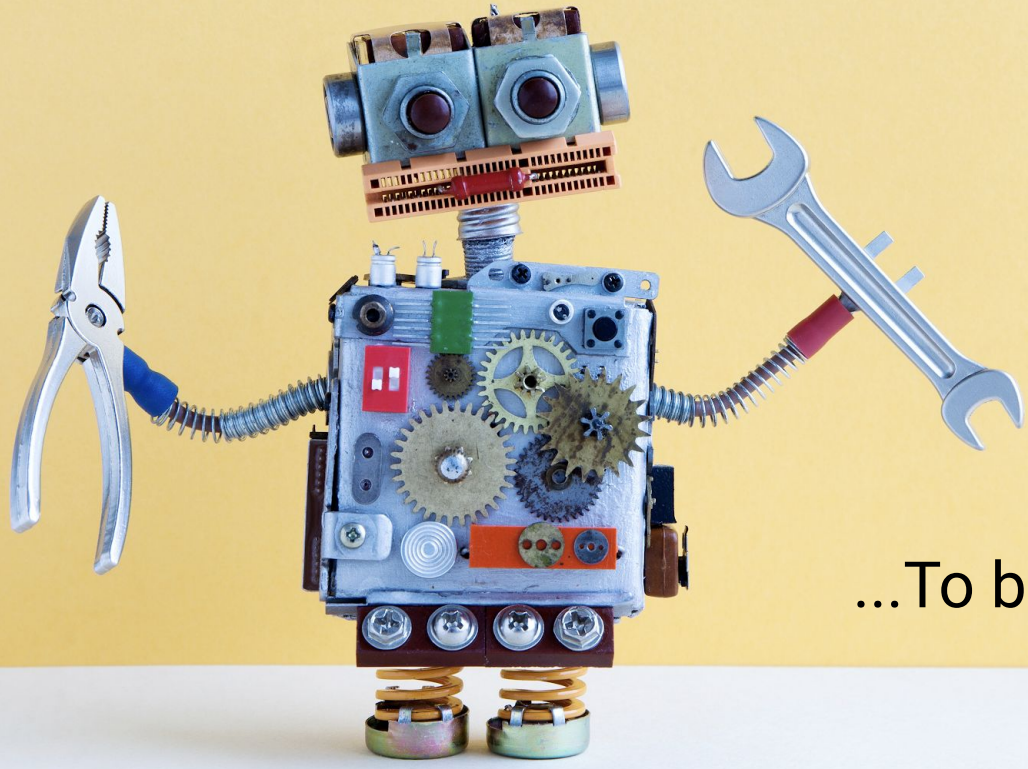
Introduction to Flask

Internet is Built from Clients and Servers



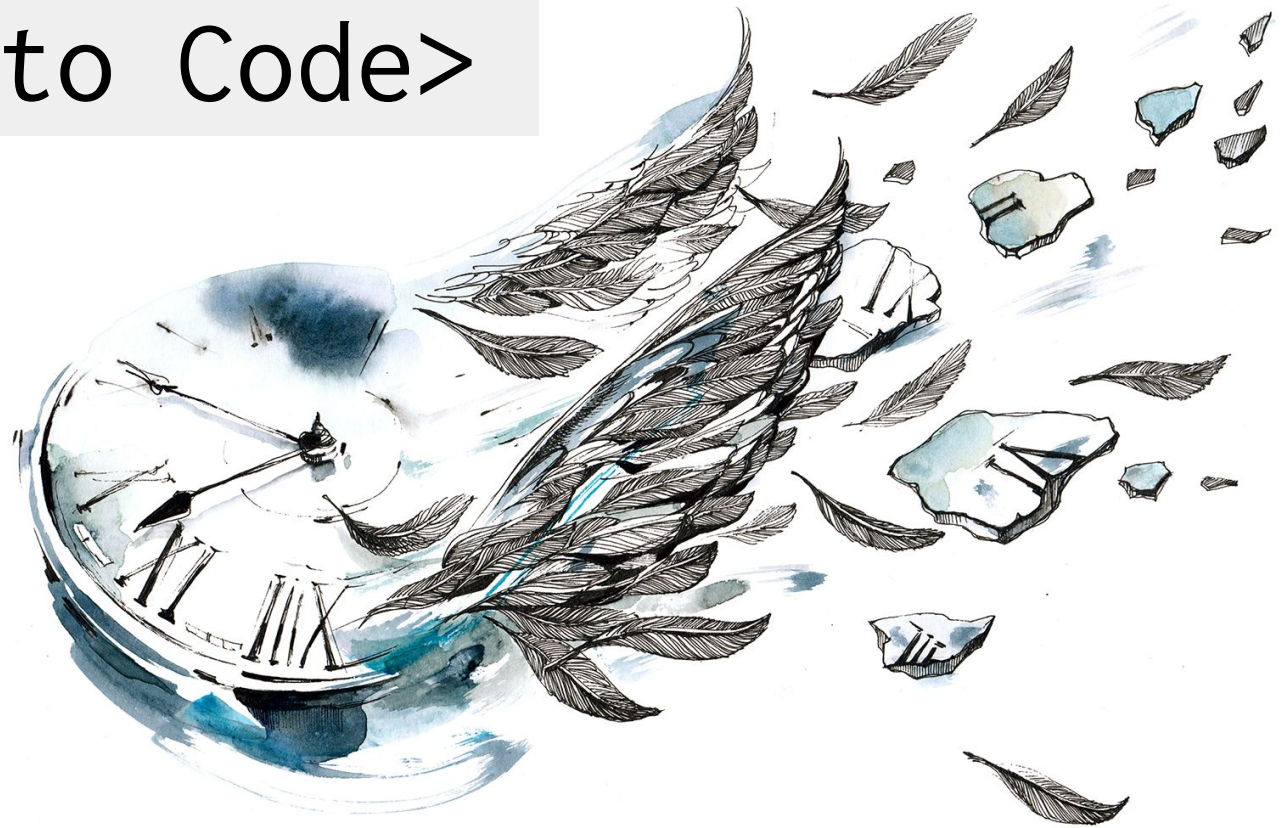
- Whatever application or device that is asking for information is called a “client”
  - A browser makes request on behalf of a user
- A “server” is a process running on a remote machine listening for requests
  - A server is essentially a *program*
- We can write the code that runs a server
  - We can determine what data is displayed
  - We can determine what data is shared

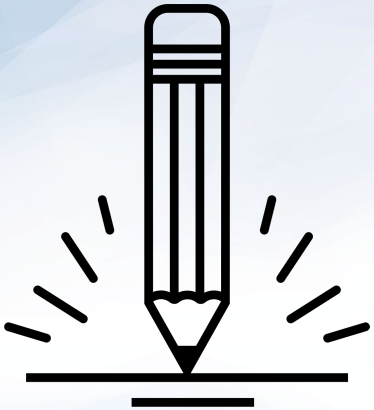
Flask is a micro web framework...



...To build **your** own APIs!

<Time to Code>





Activity: Hello, Web

In this activity, you will create your first Flask server with a few endpoints.

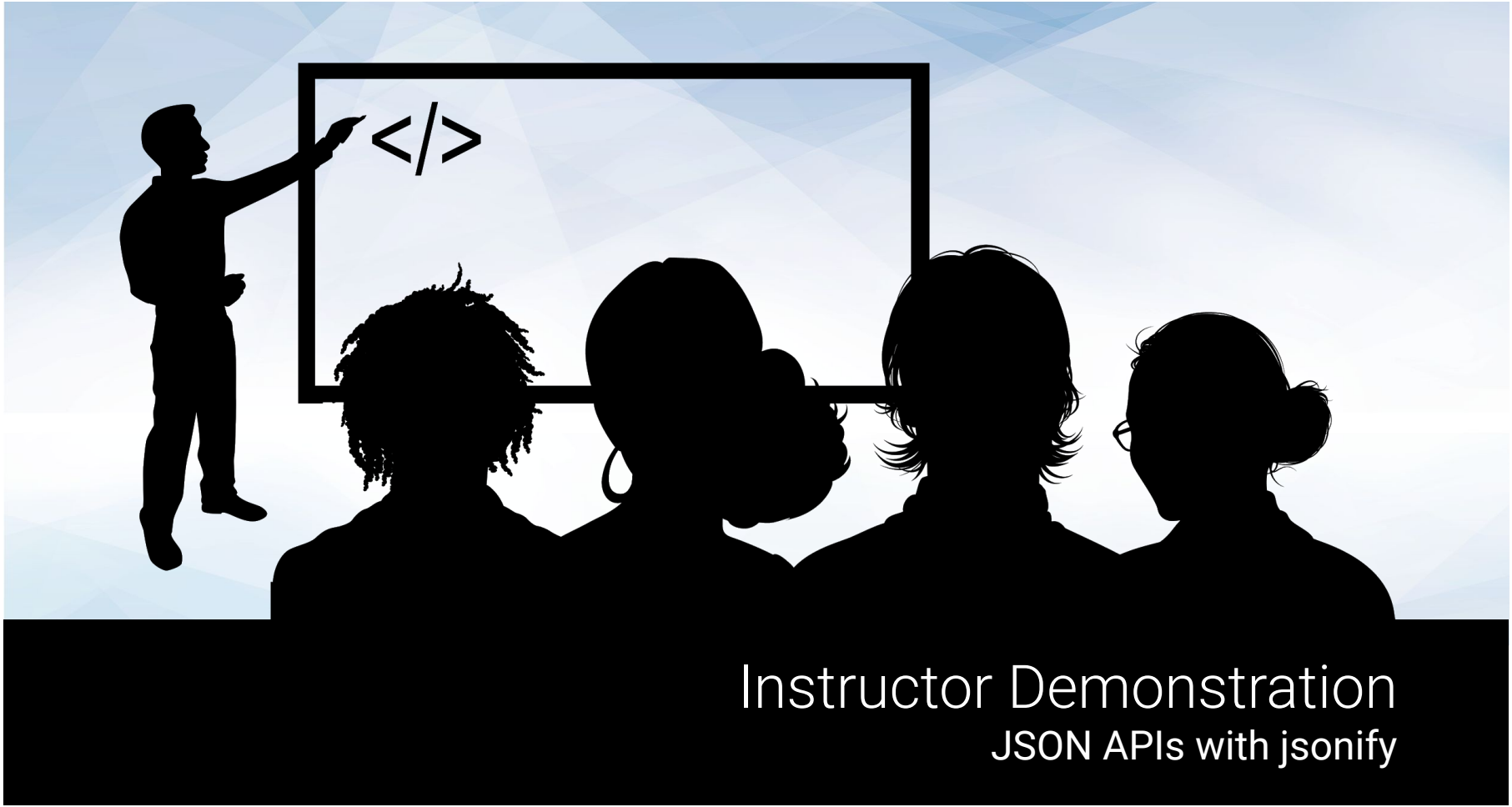
(Instructions sent via Slack.)

Suggested Time:
10 Minutes

Hello, Web Instructions

- Create an `app.py`, and make the necessary imports.
- Use Flask to create an `app` instance.
- Use route decorators to define the endpoints described in the `README.md`
- Finally, add code at the bottom of the file that allows you to run the server from the command line with: `python app.py`.

Time’s Up! Let’s Review.



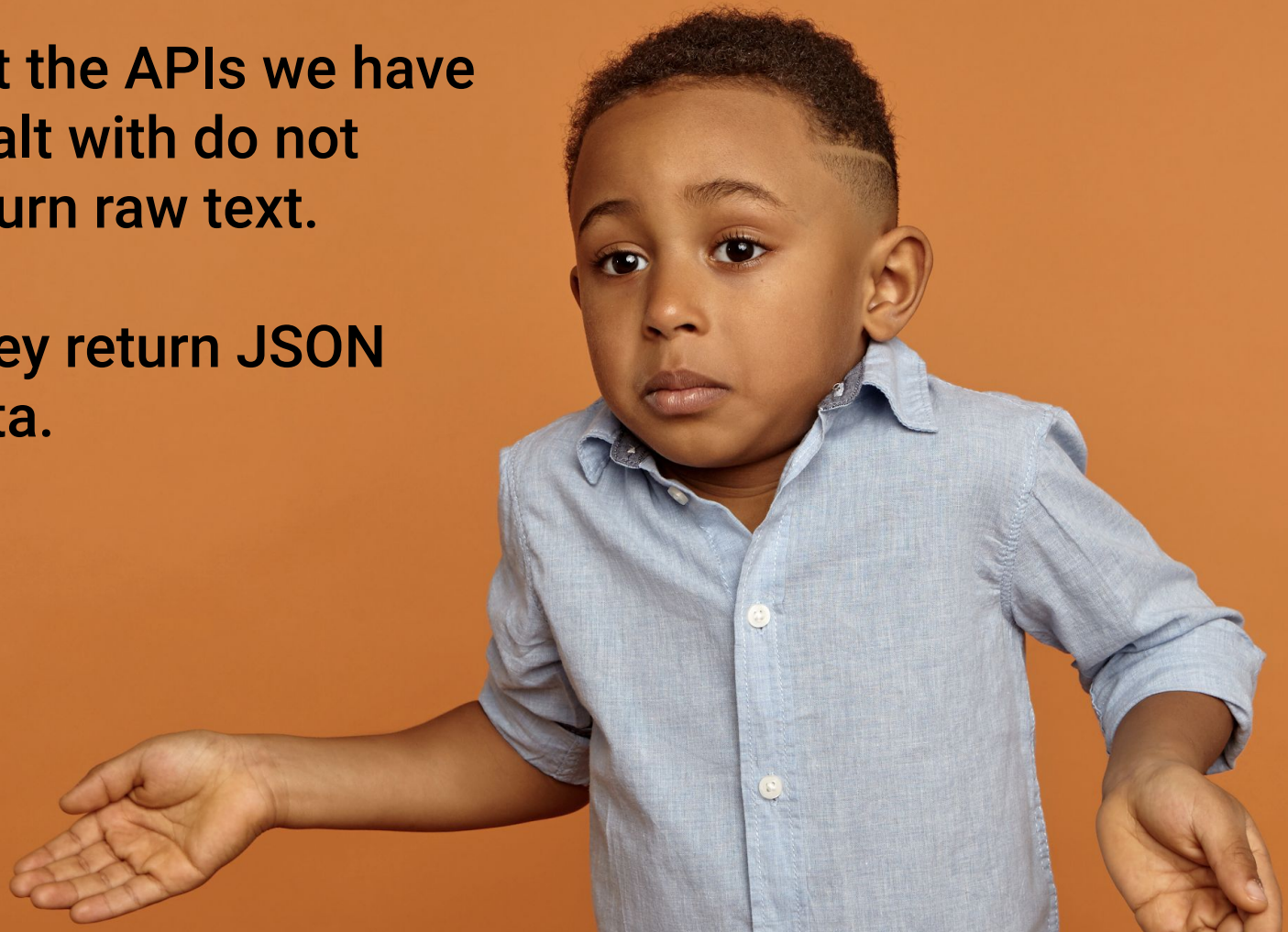
Instructor Demonstration

JSON APIs with jsonify

All routes so far have returned *string* responses.

But the APIs we have dealt with do not return raw text.

They return JSON data.

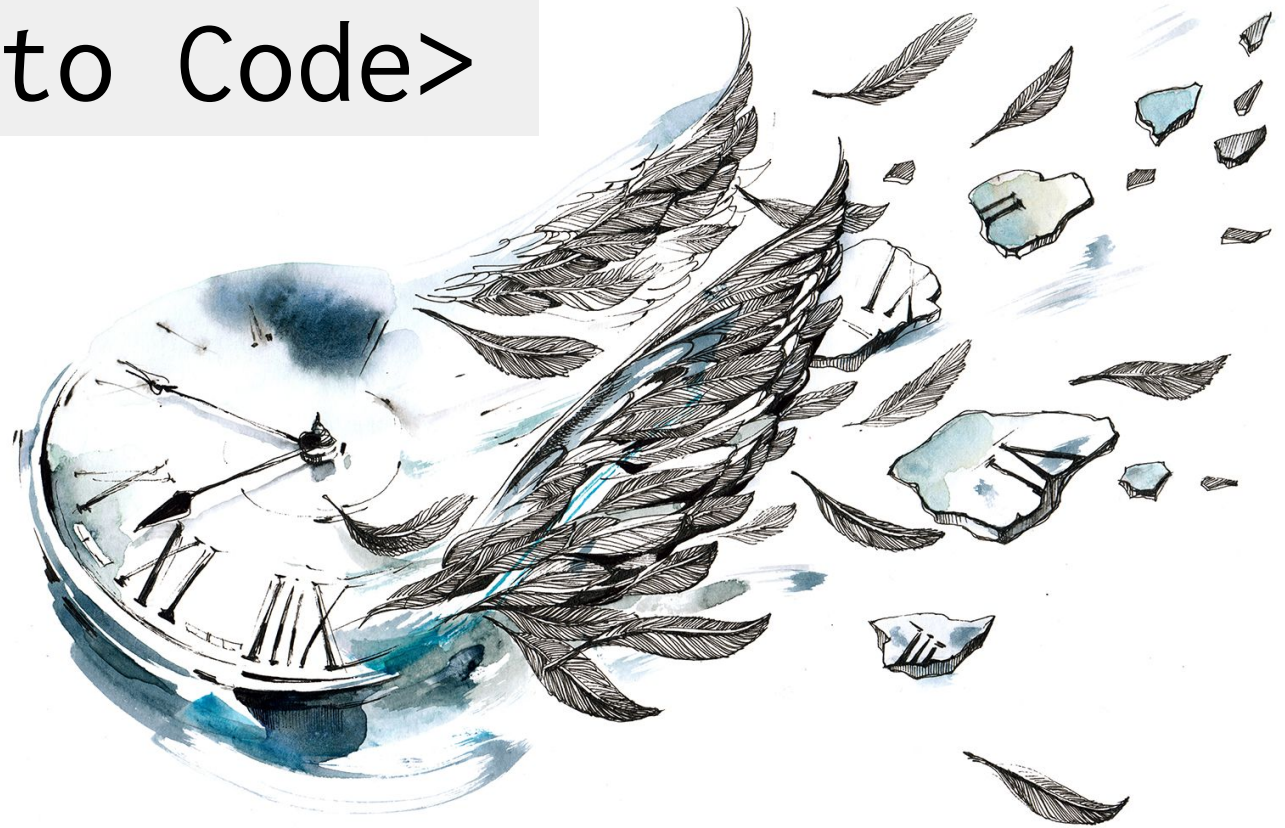


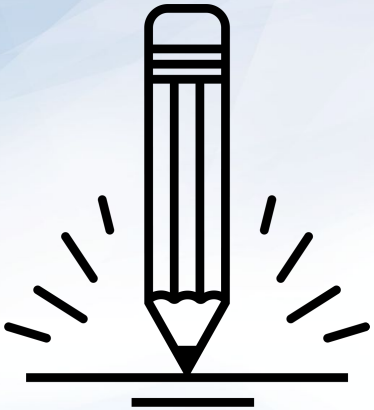
Flask has a function to create JSON responses

- We cannot simply return a dictionary response directly through Python
  - Routes must return HTTP responses
- `jsonify` automatically converts Python dictionaries into JSON responses
  - The converted JSON responses are wrapped in HTTP to send back to the client

```python
from flask import Flask, jsonify


app = Flask(__name__)

hello_dict = {"Hello": "World!"}


@app.route("/")
def home():
    return "Hi"


@app.route("/normal")
def normal():
    return hello_dict


@app.route("/jsonified")
def jsonified():
    return jsonify(hello_dict)
```

<Time to Code>





Activity: Justice League

In this activity, you will create a server that sends welcome text at one endpoint, and JSON data at another endpoint.

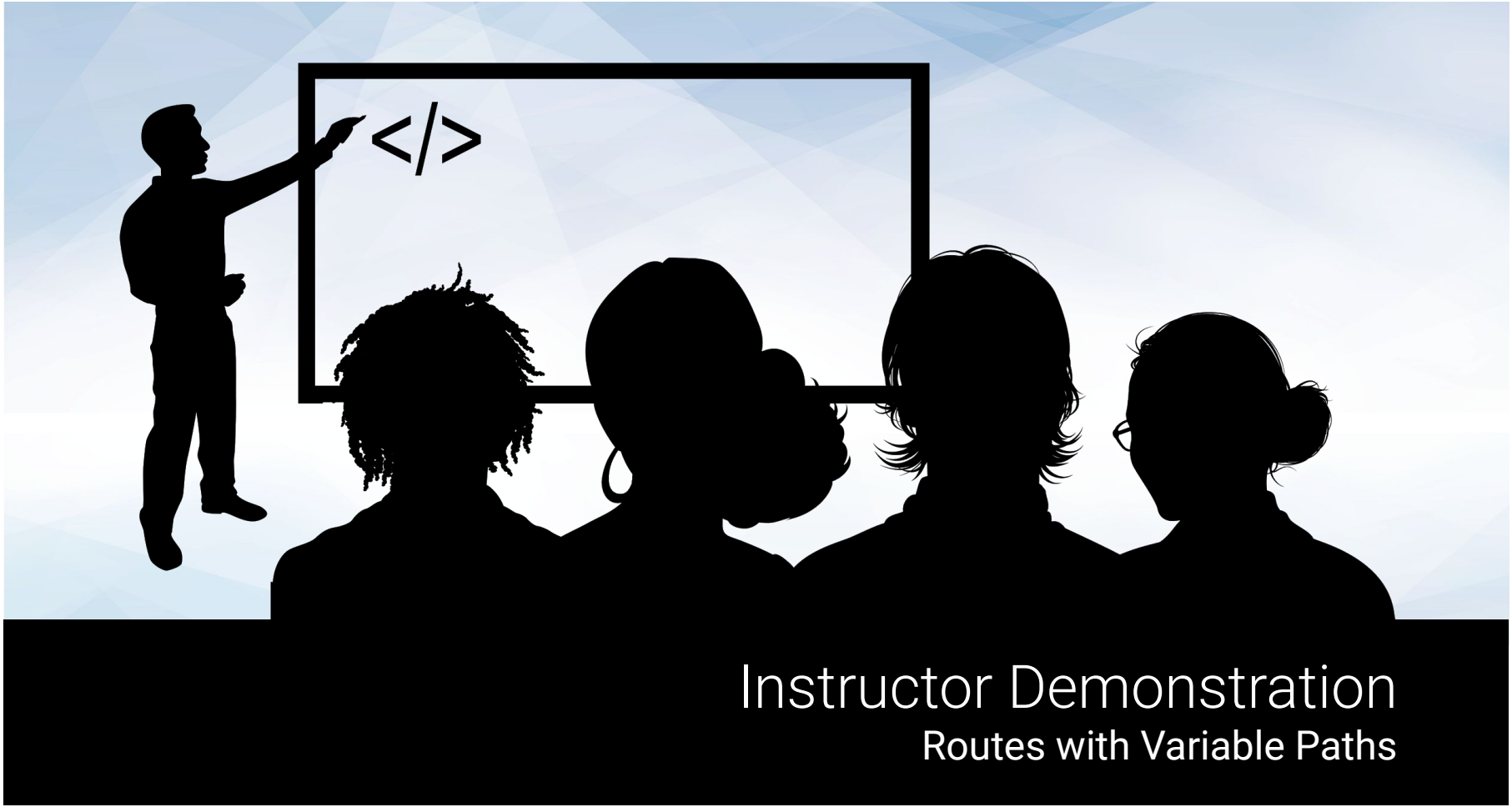
(Instructions sent via Slack.)

Suggested Time:
20 Minutes

Justice League Instructions

- Create a file called app.py for your Flask app.
- Define a Python dictionary containing the superhero name and real name for each member of the DC Comics Justice League
- Create a **GET** route called /api/v1.0/justice-league.
- Define a root route / that will return the usage statement for your API.

Time’s Up! Let’s Review.



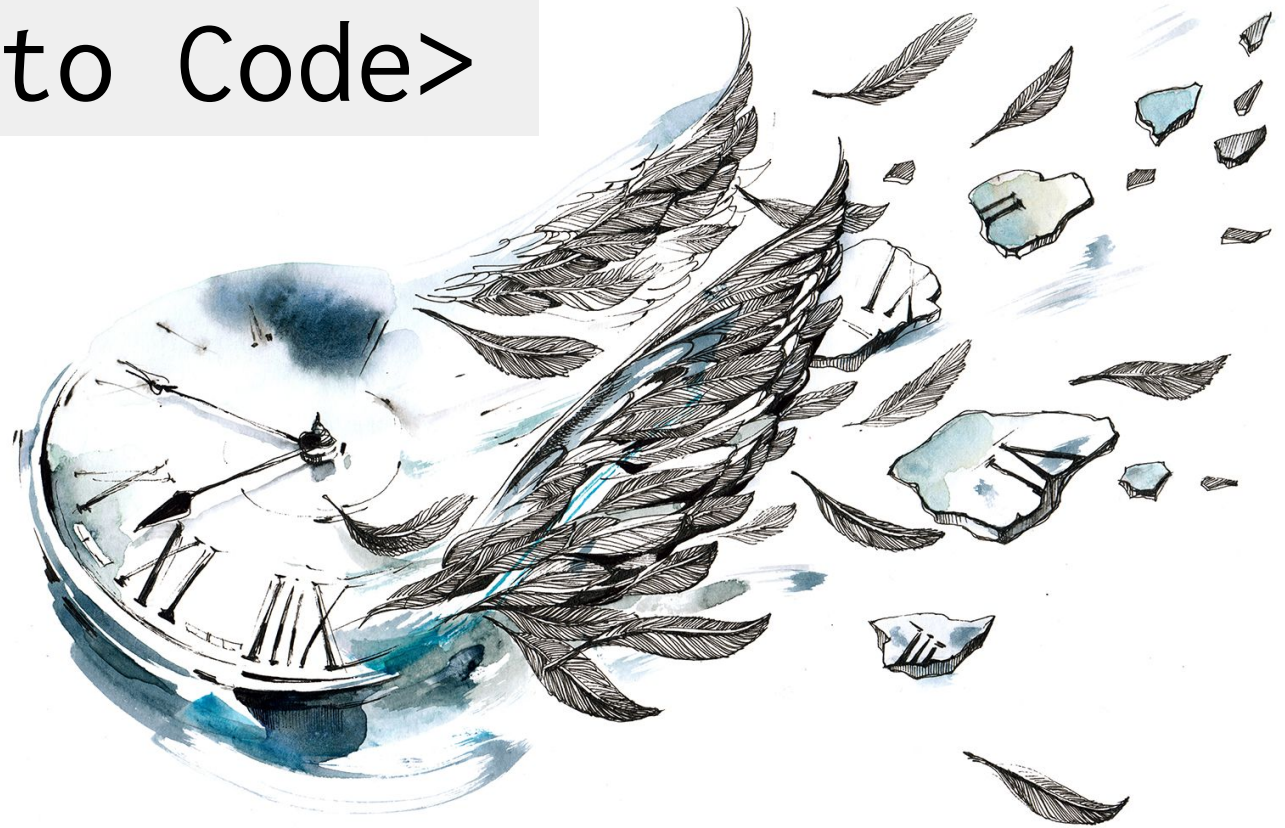
Instructor Demonstration

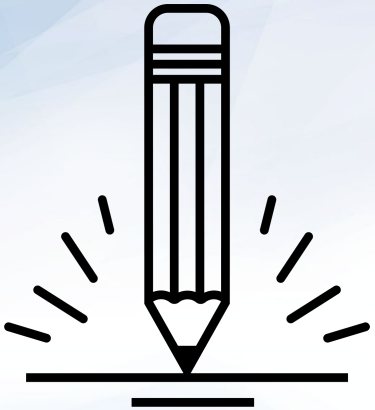
Routes with Variable Paths

Our current API is one-dimensional

- Our current API can only return the *entire* Justice League dataset
- Ideally clients can send a request for a character and expect
  - A JSON response with only specific character information
  - A detailed error response

<Time to Code>





Activity: Routes with Variable Rules

In this activity, you will add an additional API route that returns a JSON containing an individual superheroes information.

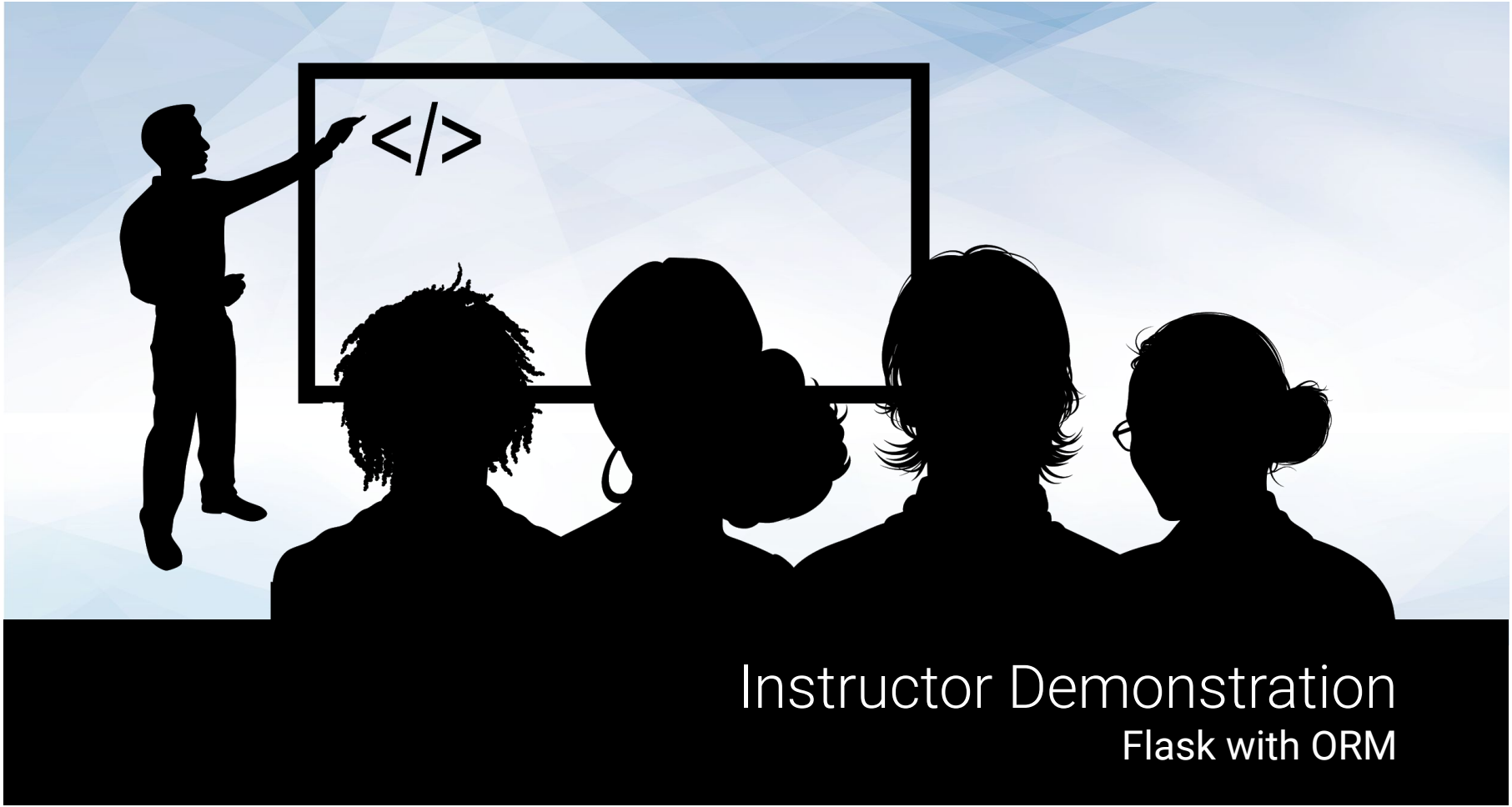
(Instructions sent via Slack.)

Suggested Time:
20 Minutes

Routes with Variable Rules

- Using the last activity as a starting point, add code to allow for getting a specific hero's information based on their superhero name.

Time’s Up! Let’s Review.



Instructor Demonstration

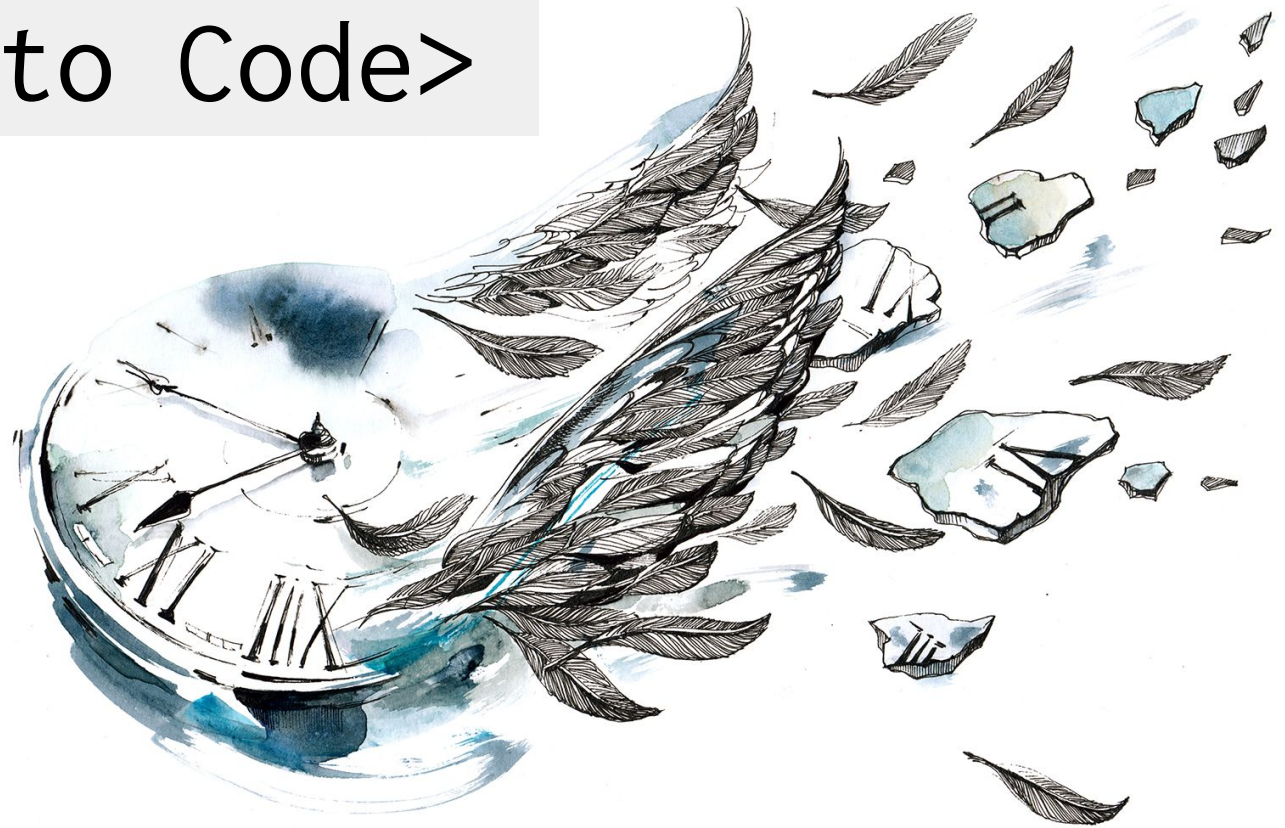
Flask with ORM

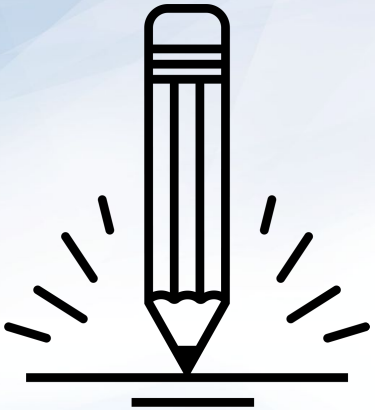
It is time to put all of the pieces together!

Flask and SQLAlchemy

- A useful API will enable the client to make requests and queries on *massive* datasets
  - Potentially too large to load into memory
- SQLAlchemy can be used to perform queries based on a flask route
- Convert the query into a dictionary, then into a JSON with `jsonify`
- Return the JSON query to the endpoint

<Time to Code>





Activity: Chinook Database Analysis

In this activity, you will practice analyzing databases using the SQLAlchemy ORM.

(Instructions sent via Slack.)

Suggested Time:
20 Minutes

Chinook Database Analysis Instructions

- Create a SQLAlchemy engine to the database chinook.sqlite.
- Design a query that lists all of the billing countries found in the invoices table.
- Design a query that lists the invoices totals for each billing country and sort the output in descending order.
- Design a query that lists all of the Billing Postal Codes for the USA.
- Calculate the invoice items totals sum(UnitPrice * Quantity) for each Billing Postal Code for the USA.

Time’s Up! Let’s Review.