



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.



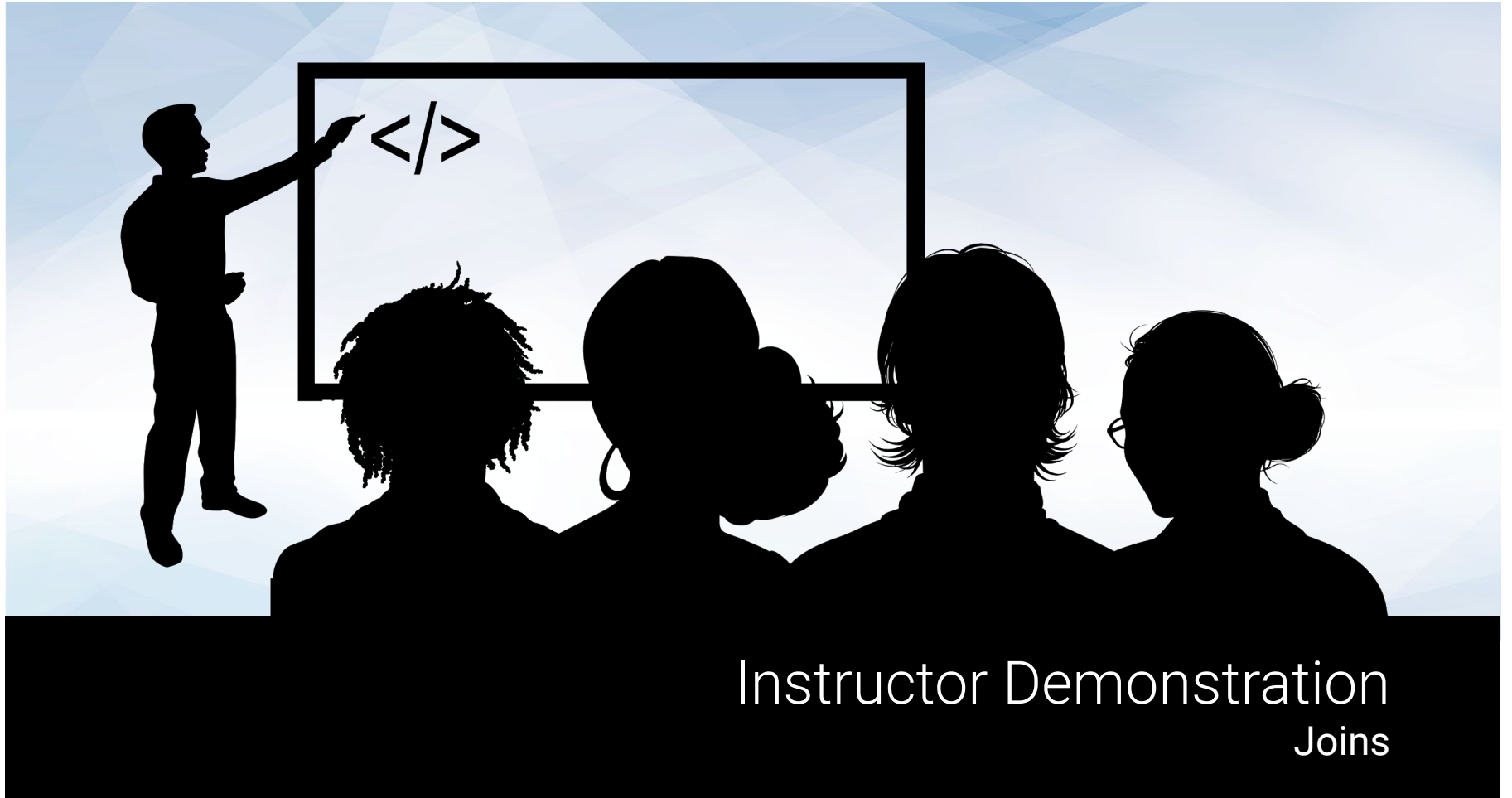
Create static query endpoints in Flask.



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

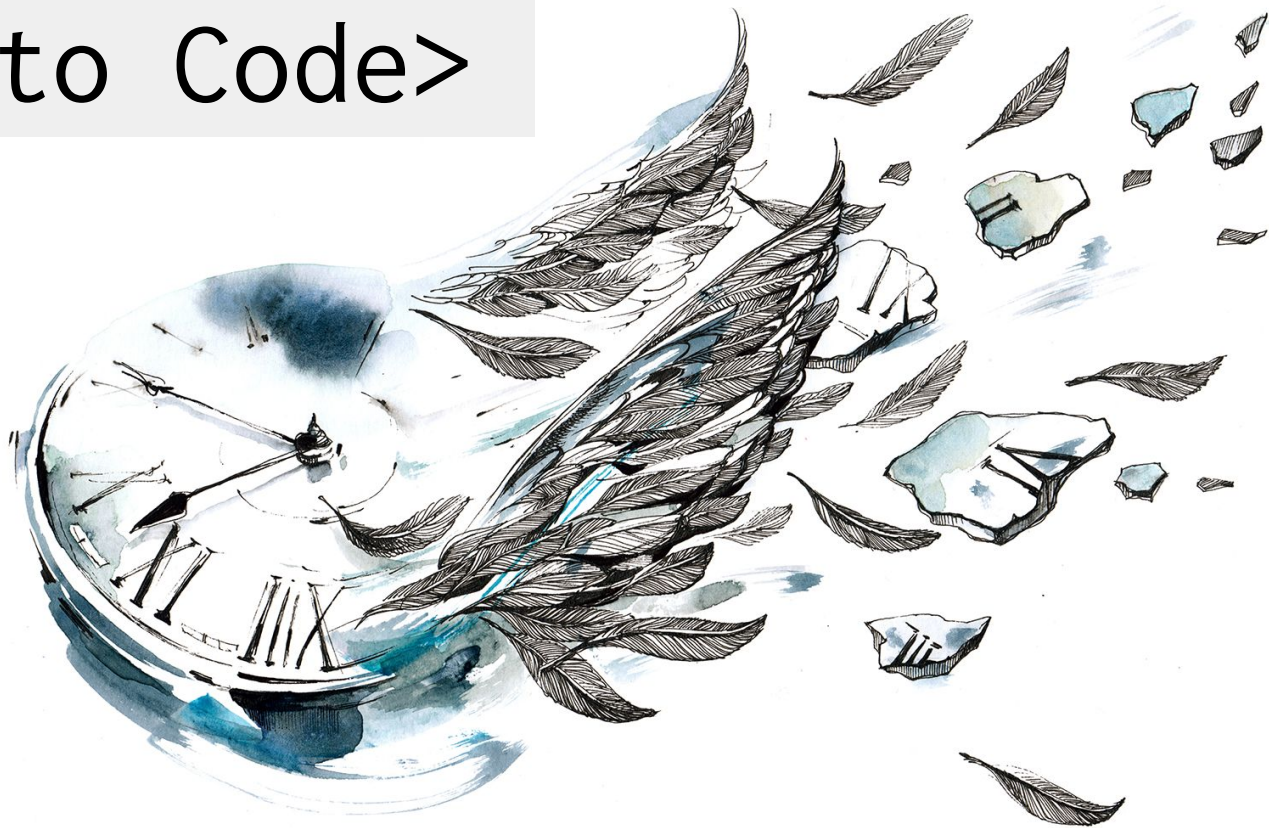
```
# Query for the Dow closing price for `CSCO`  
# 1 week before `2011-04-08` using the datetime library  
query_date = dt.date(2011, 4, 8) - dt.timedelta(days=7)  
print("Query Date: ", query_date)
```

Query Date: 2011-04-01

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





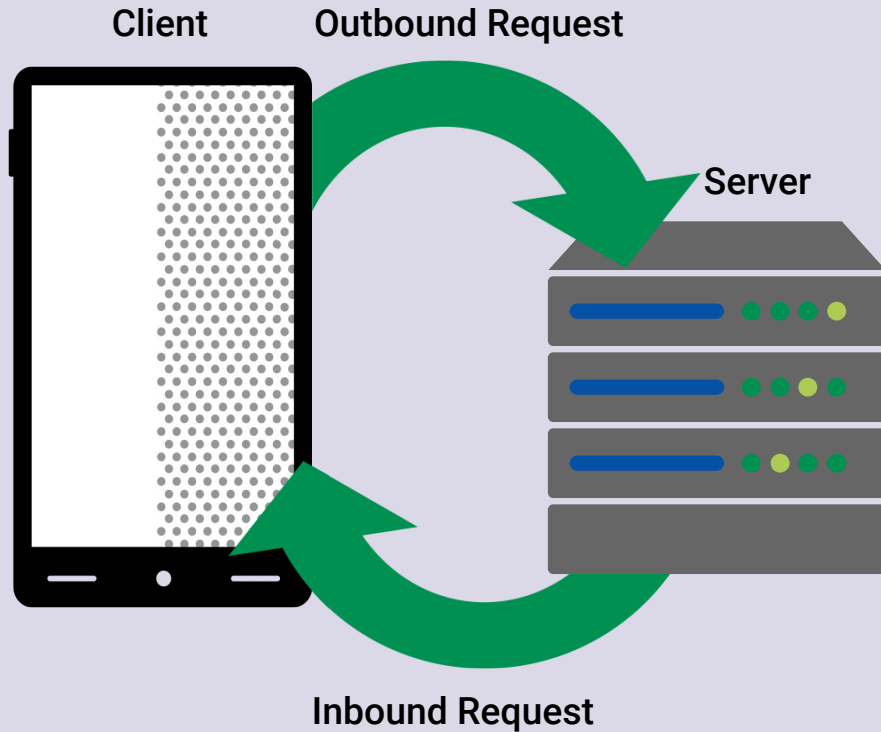
Time's Up! Let's Review.



Instructor Demonstration

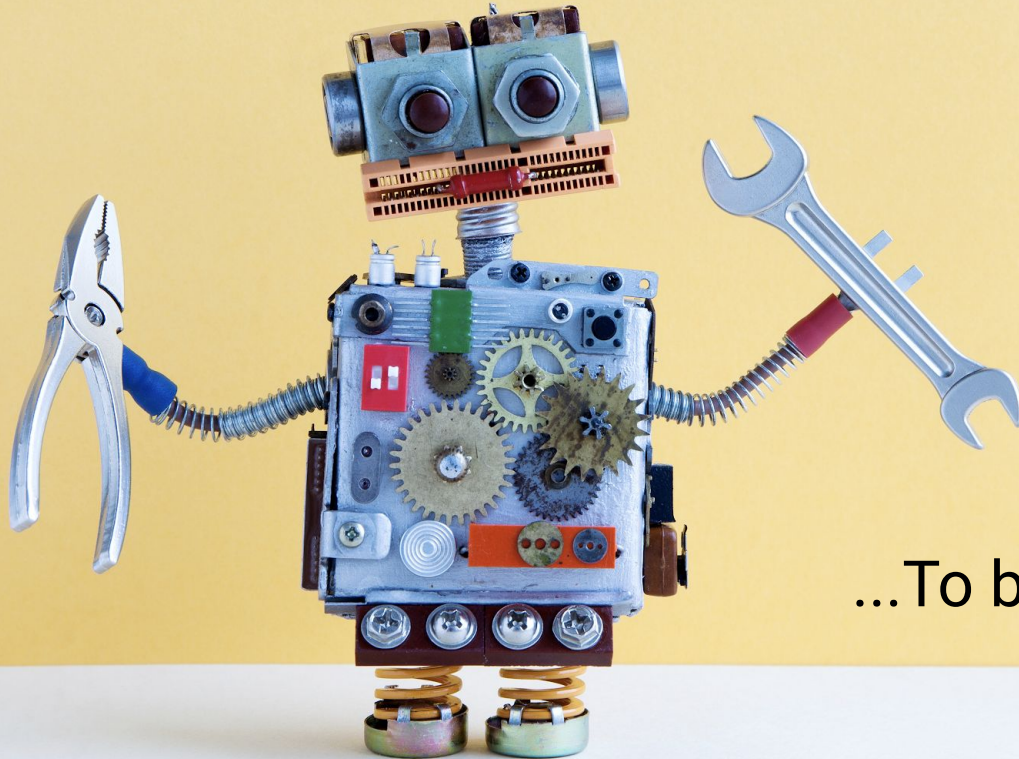
Introduction to Flask

Internet is Built from Clients and Servers



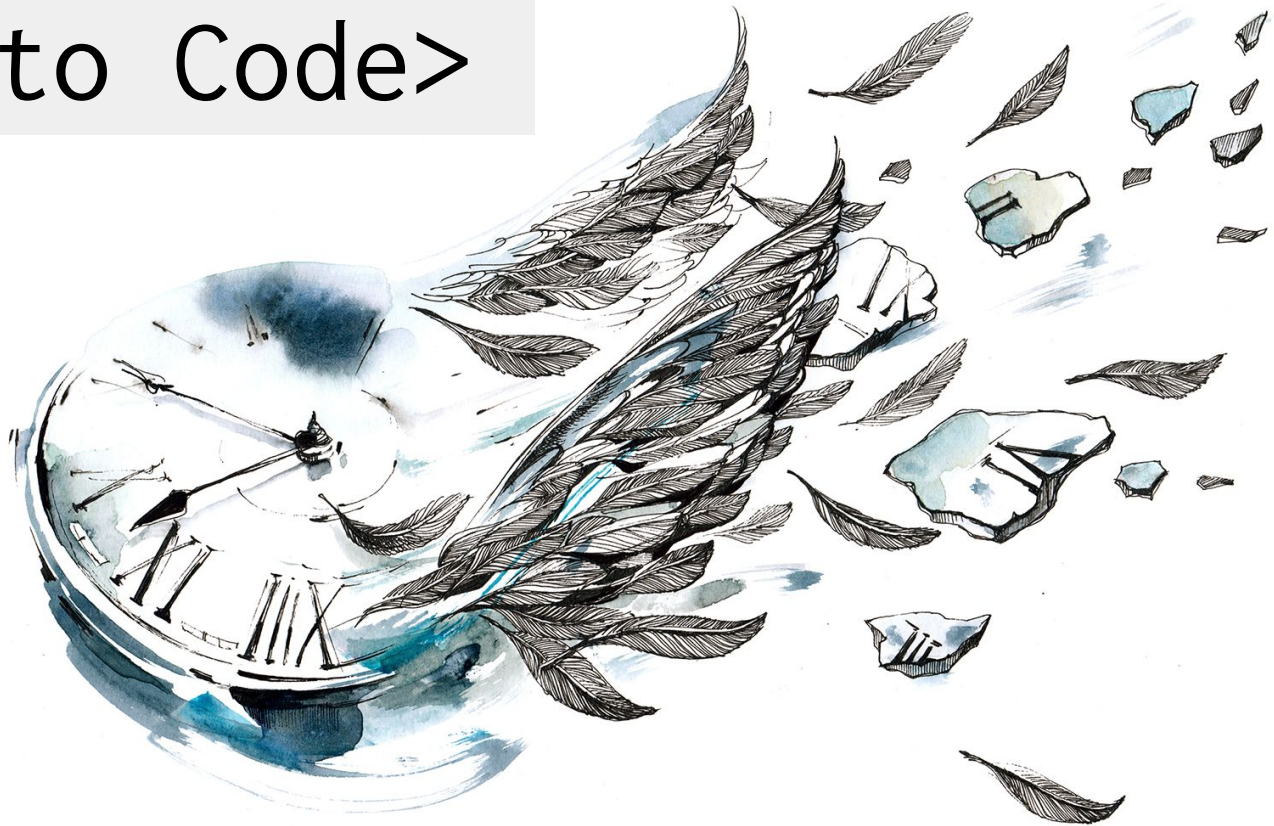
- Whatever application or device that is asking for information is called a “client”
 - A browser makes request on behalf of a user
- A “server” is a process running on a remote machine listening for requests
 - A server is essentially a *program*
- We can write the code that runs a server
 - We can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

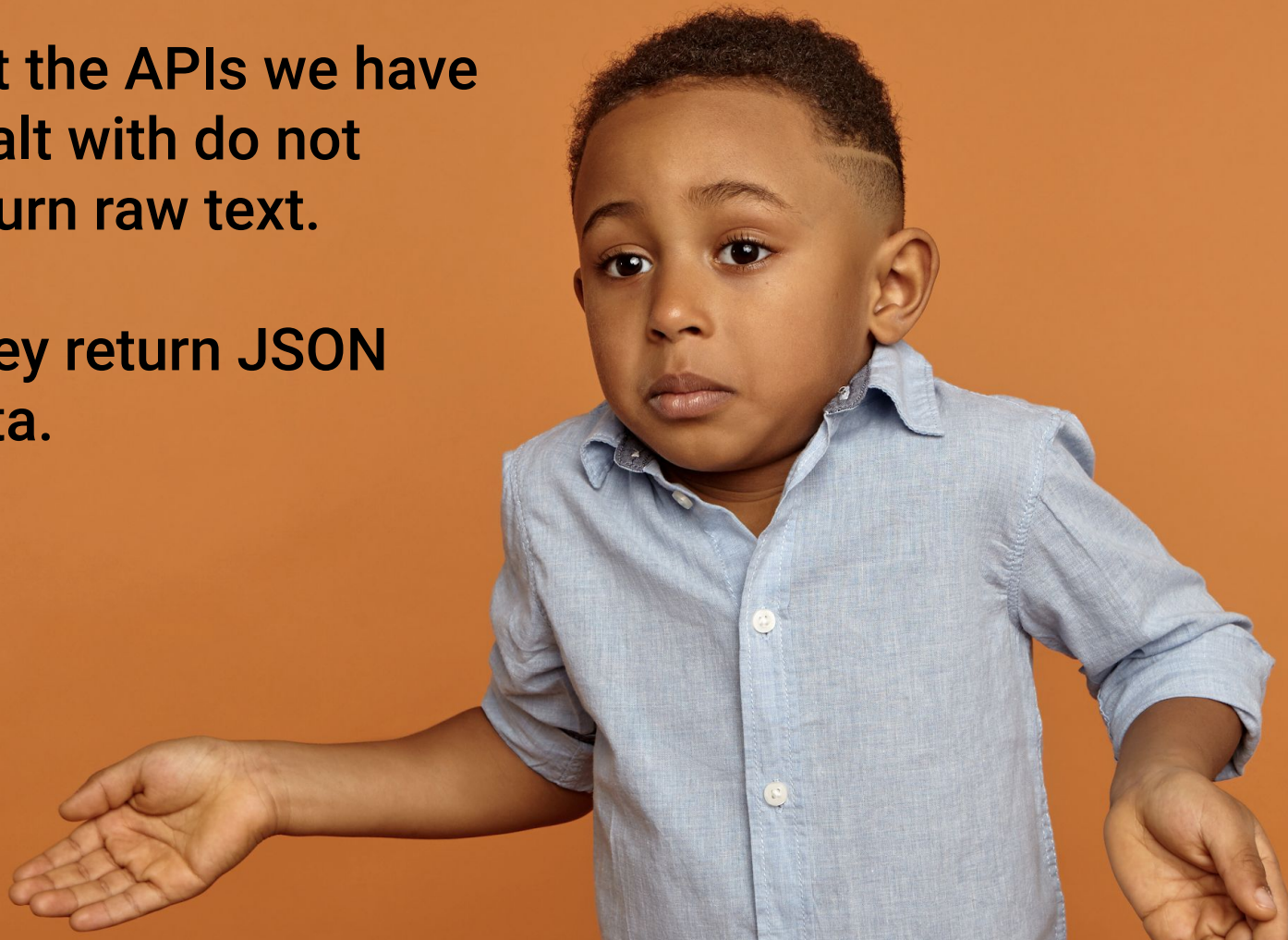
JSON APIs with jsonify



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

```
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 $\text{sum}(\text{UnitPrice} * \text{Quantity})$ for each Billing Postal Code for the USA.





Time's Up! Let's Review.