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11. Web Frameworks and Forms

Today's Objectives

- Define web framework
- Build a simple Flask webpage
- Create a simple template
- Create a website form
- Validate user input with clear error messages

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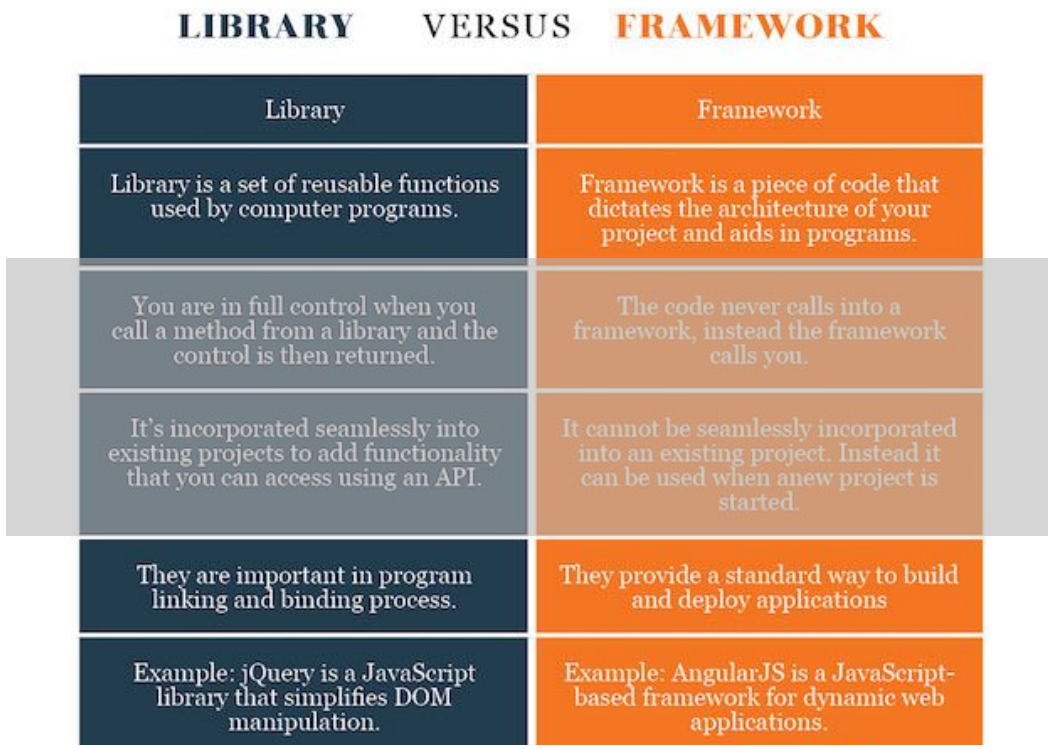
Web Framework

Web Framework

- As we learned, a framework is structured code that makes it easier for a developer to create a desktop/mobile/web application; it usually includes a set of libraries to perform various tasks



Web Framework

- As we learned, a framework is structured code that makes it easier for a developer to create a desktop/mobile/web application; it usually includes a set of libraries to perform various tasks
- A **web framework** is a framework for web development
  - Examples: Django, Flask, Bottle, Angular, etc.
- We will be using Flask !
  - It's easy to learn and highly flexible

Flask

- Is a web framework that uses Python
- Helps with routing and fetching, and HTML/CSS for layout
- Almost makes development too easy…
- “Hello, world” web app is about 10 lines of Python code, and nothing else!!
- Advertises itself as a “micro-framework”
- The micro- prefix here just means it abstracts over very little (meaning you can decide what to abstract)

Hello World in Flask (in .py file)

```
from flask import Flask

# gets name of the .py file so Flask knows it's name
app = Flask(__name__)

# tells you what URL the method below is related to
@app.route("/")
def hello_world():
    # prints HTML to the webpage
    return "<p>Hello, World!</p>"
```

Running Flask in Codio (option 1)

- Add the following to the end of your python file:
  - `if __name__ == '__main__’:`
    `app.run(host="0.0.0.0")`
- Start the Flask server using normal python command:
  - `python3 file_name.py`
  - Stop server using CTRL + C
- Click "Flask Application" in the top menu bar to see the webpage
  - If you see 404, check that your server is running

Running Flask in Codio (option 2)

- Set an environment variable:
  - `export FLASK_APP=file_name_without_extension`
  - e.g. if your file is `hello.py`, run `export FLASK_APP=hello`
- Start the Flask server by running:
  - `flask run --host=0.0.0.0`
  - Stop server using CTRL + C
- Click "Flask Application" in the top menu bar to see the webpage
  - If you see 404, check that your server is running

Making Changes

- If you make a change with the server running and re-load the webpage, you'll notice the change isn't propagated. Either:
  - Re-start the server - stop it using CTRL+C and re-start it
  - Run your server in DEBUG mode

- To run your server in DEBUG, change the last line of code to:
  - `app.run(debug=True, host="0.0.0.0")`

Adding a page to your website

- Set the URL – for example website.com/about isl:
  - `@app.route("/about")`

- Make function that does something on that page:
  - ```
    def about():
        return " About us! "
    ```

- View your new page by:
  - Starting your Flask server
  - Open your website
  - Add `/about` to the URL
    ```

DEMO Using Flask

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Templates

You can render HTML this way...

```
import flask
import random
import os

app = flask.Flask(__name__)

@app.route('/')
def index():
    return '<html itemscope="" itemtype="http://schema.org/WebPage" lang="en"><head><meta content="Search the world's information, including webpages, images, videos and more. Google has many special features to help you find exactly what you're looking for." name="description"><meta content="noodp" name="robots"><meta content="/logos/doodles/2017/bessie-colemans-125th-birthday-5751652702224384-hp.gif" itemprop="image"><link href="/images/branding/product/ico/googleg_lodp.ico" rel="shortcut icon"><meta content="Bessie Coleman’s 125th birthday! #GoogleDoodle" property="og:description">...'

app.run(
    port=int(os.getenv('PORT', 8080)),
    host=os.getenv('IP', '0.0.0.0')
)
```

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HTML template files

- Instead of having to squeeze a bunch of HTML into your python file, you can use templates which are HTML files
  - No need to stuff all HTML into a crazy string
- To use this, you **must** create a `templates` folder/directory (this is the folder that Flask looks for) to hold your HTML files.
- Let's say we create 3 files:
  - `layout.html`
  - `home.html`
  - `about.html`

Rendering templates

Update your python file in the following ways:

1. Import `render_template`
2. Call `render_template` instead of returning raw HTML

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

@app.route("/")
@app.route("/home")
def home():
    return render_template('home.html')
```

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DEMO Using Templates

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Jinja

- Flask has a built-in templating language called Jinja2
  - This will be relevant when you Google for documentation!
- Jinja is what powers templates in flask -- allowing us to do things like leave placeholders called Blocks to be filled later.
- Jinja also helps inject python into HTML pages. Some basic and useful things you can inject are:
  - Variables
  - if statements
  - for loops

Using Jinja

Update your python file in the following ways:

1. In your `render_template` function, add your python variable as a parameter

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

@app.route('/')
@app.route('/home')
def home():
    return render_template("home.html", subtitle='Home Page')
```

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Creating your “layout.html”

- A layout page holds all the code you need for every page, so you don’t need to copy-paste for every new page you make!

```
<!-- layout.html -->
<!DOCTYPE html>
<html>
    <head>
    </head>
    <body>
        <h1>This shows up on every page</h1>
         {% block content %}{% endblock %}
    </body>
</html>
```

Jinja block

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Using “layout.html”

```
{% extends "layout.html" %}
{% block content %}
    <h2>{{ subtitle }}</h2>
{% endblock content %}
```

You can add the code above to any html file, and Jinja will auto include all the text from layout.html.

How the codes:

1. `{% extends "layout.html" %}` - says this inherit code from our layout.html file
2. `{% block content %}...{% endblock content %}` - specifies the part of the layout.html template we are filling in
3. `<h2>{{ subtitle }}</h2>` - says that we are expecting something called subtitle we want to print

DEMO Using Jinja

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Forms

WTForms

- WTForms is a python library for forms validation and rendering
- Forms are made up of Fields with Validators
  - Fields include basic form field types
    - `StringField` – field to input text
    - `PasswordField` – like StringField but value is not rendered back to browser
    - `SubmitField` - allows checking if a given submit button has been pressed
  - Validators check user input
    - `DataRequired` - sets the required flag on fields it is used on
    - `Length` - Validates the length of a string
    - `Email` - Validates an email address using email_validator package
    - `EqualTo` – Compares the values of two fields - used to facilitate the password change form
- Flask-WTF is a library that integrated WTForms with Flask

Create Forms.py

```
# forms.py

from flask_wtf import FlaskForm
from wtforms import StringField, PasswordField, SubmitField
from wtforms.validators import DataRequired, Length, Email, EqualTo

class RegistrationForm(FlaskForm):
        username = StringField('Username',
                validators=[DataRequired(), Length(min=2, max=20)])
        email = StringField('Email', validators=[DataRequired(), Email()])
        password = PasswordField('Password', validators=[DataRequired()])
        confirm_password = PasswordField('Confirm Password',
                validators=[DataRequired(), EqualTo('password')])
        submit = SubmitField('Sign Up')
```

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Add Form to Website (hello.py)

- Make sure your Flask app can see your form by importing it in `hello.py`:

```
from forms import RegistrationForm
```

- Add a new page to your site:

```
@app.route("/register", methods=['GET', 'POST'])
def register():
    form = RegistrationForm()
    return render_template('register.html', title='Register', form=form)
```

Simple register.html

```
{% extends "layout.html" %}
{% block content %}
   <div class="content-section">
       <form method="POST" action=""> <!--sends information to form -->
           {{ form.hidden_tag() }} <!-- passes your secret key ** -->
           <fieldset class="form-group">
               <legend class="border-bottom mb-4">Join Today</legend>
               <div class="form-group"> <!--add username field -->
                   {{ form.username.label(class="form-control-label") }}
                   {{ form.username(class="form-control form-control-lg") }}
               </div>
               <div class="form-group"> <!--add email field -->
                   {{ form.email.label(class="form-control-label") }}
                   {{ form.email(class="form-control form-control-lg") }}
               </div>
               <div class="form-group"> <!--add password field -->
                   {{ form.password.label(class="form-control-label") }}
                   {{ form.password(class="form-control form-control-lg") }}
               </div>
               <div class="form-group"> <!--add confirm password field -->
                   {{ form.confirm_password.label(class="form-control-label") }}
                   {{ form.confirm_password(class="form-control form-control-lg") }}
               </div>
           </fieldset>
        <div class="form-group">{{ form.submit(class="btn btn-outline-info") }} </div> <!--add button field -->
       </form></div>{% endblock content %}
```

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Secrets Keys??

To protect our website form from bad cookies, we need to set a secret key.

1. Pop open a python interpreter and generate a 16 byte token -- copy it without the quotes

```
>>> import secrets
>>> secrets.token_hex(16)
```

2. In your main `.py` file, after `app = Flask(__name__)` add...

```
app.config['SECRET_KEY'] = 'the key you generated'
```

Passing Success Message

- After you instantiate form (`form = RegistrationForm()`) in your main .py file:

```
if form.validate_on_submit():
        flash(f'Account created for {form.username.data}!', 'success')
        return redirect(url_for('home'))
```

- The f-string allows us to insert a variable -- in this case the data filled in by the user in the username field.
- The `success` part tells bootstrap the type of message we are sending so it style accordingly.
- Finally, because it was validated and the account was "created" we can send the user to the home screen.

- To get the re-direct to work properly in Codio, we need to add a little code.

```
from flask import Flask, render_template, url_for, flash, redirect
from flask_behind_proxy import FlaskBehindProxy
    app = Flask(__name__)
    proxied = FlaskBehindProxy(app)
```

Passing Success Message

```
<!-- layout.html -->
...
<h1>This shows up on every page</h1>
{% with messages = get_flashed_messages(with_categories=true) %}
 {% if messages %}
   {% for category, message in messages %}
      <div class="alert alert-{{ category }}">
        {{ message }}
      </div>
   {% endfor %}
 {% endif %}
{% endwith %}

{% block content %}{% endblock %}
```

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Showing Validation Errors

```
<!-- register.html -->
...
{% extends "layout.html" %}
{% block content %}
    <div class="content-section">
        <form method="POST" action="">
            {{ form.hidden_tag() }}
            <fieldset class="form-group">
<div class="form-group">
    {{ form.username.label(class="form-control-label") }}
    {% if form.username.errors %}
      {{ form.username(class="form-control form-control-lg is-invalid") }}
      <div class="invalid-feedback">
        {% for error in form.username.errors%}
            <span>{{error}}</span>
        {% endfor %}
      </div>
    {% else %}
      {{ form.username(class="form-control form-control-lg") }}
    {% endif %}
</div>
```

Passes data validation errors to user

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DEMO Using Forms

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Thank you!