Web Programming

Server-side programming I.

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Recall from Last Time

- HTTP requests
  - GET, POST
- HTTP responses

Today

- Making a simple server-side application
  - Serve static content (css files, html files, images, etc.)
  - Generate dynamic content
  - Handle input from URL and forms

Flask

- Framework for server-side web application development
- Included in the Anaconda distribution (i.e., no need to install anything)
- Others `python -m pip install Flask`
- Practical notes
  - Put each application in a separate folder (even if it consists of a single file)
    - This is also how the examples on GitHub are structured (`examples/python/flask`)
  - Don't call your application `flask` (that would conflict with Flask itself)
- http://flask.pocoo.org/

A Minimal Web Application

examples/python/flask/0_minimal/app.py

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

@app.route('/')
def hello_world():
    return("Hello, World!")

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

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Create an instance of the Flask class
(the argument is the name of the module)

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```

The **app.route** decorator tells Flask which URL should trigger this function

Exercise #0

https://github.com/dat310-2022/info/tree/main/
exercises/python/flask1

Routing

examples/python/flask/1_routing/app.py

- The **`route()`** decorator is used to bind a function to a URL
- Add variable parts to the URL by marking them as **`<varname>`**

```python
@app.route("/")
def index():
    return "Index Page"

@app.route("/info")
def hello():
    return "This is a static info page"

@app.route("/user/<username>")
def user(username):
    return "Showing the profile page for user {}".format(username)
```

Careful. This variable is user controlled.
It can be abused.

Variable rules

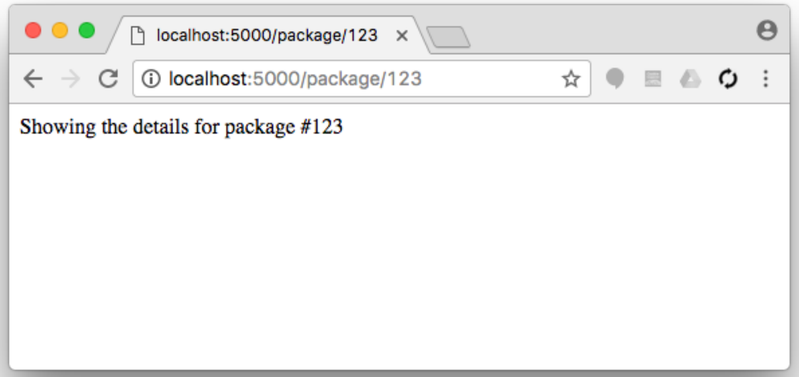
- **`<converter:varname>`** — optionally, a converter may be used to convert the input variable to the specified format
- Converters:
  - string (default)
  - int
  - float
  - path (same as the default, but also accepts slashes)
  - …

Example

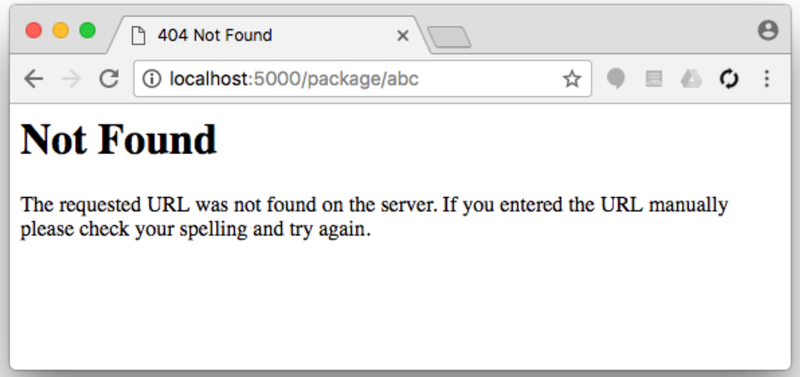
examples/flask/1_routing/app.py

```python
@app.route("/package/<int:package_id>")
def package(package_id):
    return "Showing the details for package #{}".format(package_id)
```

http://localhost:5000/package/123



http://localhost:5000/package/abc



URL Building

- **`url_for()`** — generates a URL for a specific function
  - first argument is the function name, optionally a number of additional arguments corresponding to the variable part of the URL rule

```
@app.route("/")
def index():
   # ...

@app.route("/user/<username>")
def user(username):
   # ...
```

```
from flask import url_for

print(url_for("index"))  # /
print(url_for("user", username="JohnDoe"))  # /user/JohnDoe
```

Exercise #1

https://github.com/dat310-2022/info/tree/main/
exercises/python/flask1

Serving Static Files

- Dynamic web applications also need static files (css, javascript, images, etc.)
- Keep them under a folder called **`static`**
- To generate URLs for them use the special **`static`** endpoint name

```
url_for("static", filename="style.css")
```

Example

examples/flask/2_static/app.py

```
HTML_FRAME_TOP = "<!DOCTYPE HTML>\n<html>\n<head>\n<title>My site</title>\n" \
                 "<link rel=\"stylesheet\" href=\"{css}\"/>\n</head>\n<body>\n"
HTML_FRAME_BOTTOM = "</body>\n</html>\n"


@app.route("/")
def index():
    html = HTML_FRAME_TOP.replace("{css}", url_for("static", filename="style.css"))
    html += "<h1>Hello world</h1>"
    html += HTML_FRAME_BOTTOM
    return html
```

we replace the string {css} with the URL generated for the static "style.css" file

Accessing Request Data

- In Flask, this information is provided by the global **`request`** object

```
from flask import request
```

```
@app.route("/login", methods=["POST", "GET"])
def login():
    error = None
    if request.method == "POST":
        if valid_login(request.form["username"],
                       request.form["password"]):
            # do something
        else:
            error = "Invalid username/password"
```

Accessing Request Data

- Accessing parameters submitted in the URL
- These are contained in **`request.args`** (dict)
  - Checking if a param has been provided

```
if "name" in request.args:
    print(request.args["name"])
```

  - Getting param with default value

```
print(request.args.get("name", ""))
```

  - Iterating all parameters

```
for k, v in request.args.items():
    print("{:20} : {}".format(k, v))
```

Redirects and Errors

- Redirect the user to another endpoint

```
@app.route('/')
def index():
    return redirect(url_for('login'))
```

- Abort a request with an early error code

```
from flask import abort

@app.route('/login')
def login():
    abort(401)
    # this_is_never_executed()
```

Custom Error Pages

- Use the **`errorhandler()`** decorator

```
from flask import render_template

@app.errorhandler(404)
def page_not_found(error):
    return render_template('page_not_found.html'), 404
```

Example

examples/flask/3_forms/app.py

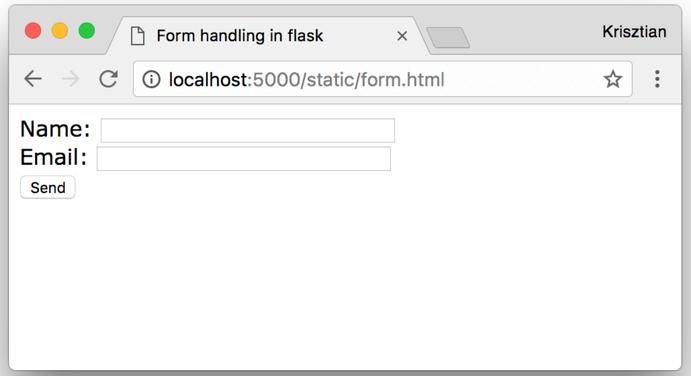
```
from flask import Flask, url_for, redirect, request

@app.route("/")
def index():
    return redirect(url_for("static", filename="form.html"))
```

localhost:5000/

redirect to static form page from web root

localhost:5000/static/form.html

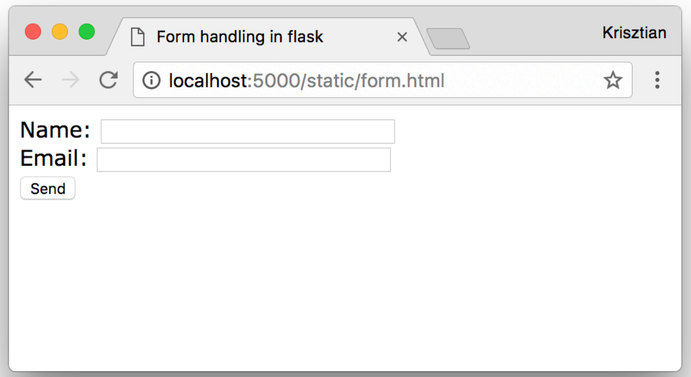


Example

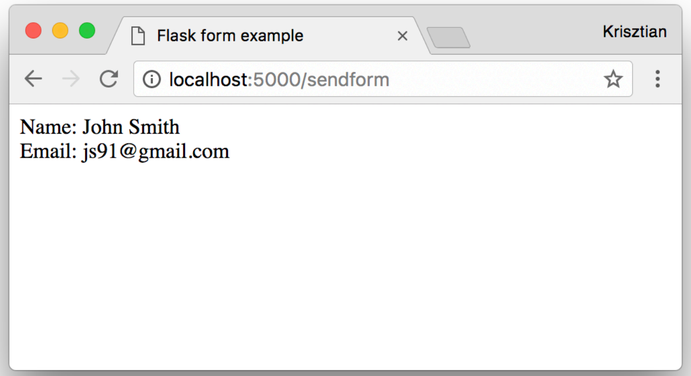
examples/flask/3_forms/app.py

```
@app.route("/sendform", methods=["POST"])
def sendform():
    html = HTML_FRAME_TOP.replace("{css}", url_for("static", filename="style.css"))
    html += "Name: " + request.form["name"] \
            + "<br />" \
            + "Email: " + request.form["email"]
    html += HTML_FRAME_BOTTOM
    return html
```

localhost:5000/static/form.html



http://localhost:5000/sendform



Exercise #2

https://github.com/dat310-2022/info/tree/main/
exercises/python/flask1