Weather Assignment

- Due Thurs April 25 10pm.

Using an API

- Goal 1 - Using a remote server with an API
- OpenWeatherMap Hourly Weather forecasts. We send a city, in a specially-formatted URL. It sends back JSON-formatted data.
- Need to register and get an API key to try it out. Free.
- Demo of request and response on assignment page.

Animation

- The doppler radar weather map is a combination of images, a topomap on the bottom, and partially transparent overlay images on top.
- The doppler radar changes every ten minutes.
- We can combine a series of images to make an animation showing last two hours.
- Sadly, weather here is often boring.

Design

(see design slides)

Objects

- Objects organize collections of data (properties) and functions (methods) that act on that data.
- Organization of code and data is part of the eternal battle against bugs.
- In object-oriented programming, almost all data is in objects and code is in object methods.
- Virtually all of the systems we interact with in Web programming are object-oriented.
Object

```javascript
let car = {
    "name": "tesla",
    "range": 310,
    "price": "$44,000"
};
```

- This defines the object by giving a literal—the text representation of its contents—and putting those contents into a variable.

Literal

- A literal is the string used for writing down a value. It is not the value itself.
  - '2' is a number literal: `let x = 2;`
  - 'true' is a Boolean literal: `if (done == true) {}`
  - "cow" is a string literal: `let x = "cow";`
  - {"cow":2} is an object literal: `let x = {"cow":2};`

Accessing properties

```javascript
let car = {
    "name": "tesla",
    "range": 310,
    "price": "$44,000"
};
```

- We access the properties as usual, with the dot, e.g., `car.name`.

Adding properties

```javascript
let car = {
    "name": "tesla",
    "range": 310,
    "price": "$44,000"
};
```

- We access the properties as usual, with the dot, e.g., `car.name`.

- To add a new property, just give it a value:
  ```javascript
  car.dateAvailable = "Jan 15, 2019"
  ```

Adding properties

```javascript
let car = {
    "name": "tesla",
    "range": 310,
    "price": "$44,000"
};
```

- Adding a method with a function expression:
  ```javascript
  car.getRange = function (temp) { return 200+temp; }
  ```

What are objects “really”?

- A Javascript object is ...
  - a Python dictionary!
  - a C or C++ hashtable!
  - a dictionary data structure that lets you look up data using a string.
- Can use Python dictionary notation for properties:
  ```javascript
  car["name"] = "tesla"
  ```
- How is this different from a struct in C? A class in C++ or Java?
Hierarchical objects

```javascript
var weatherForecast = {
    "description": "sunny",
    "temp": {
        "high": 76,
        "low": 48,
        "hourly": [48, 53, 65, 76, 66, 63]
    }
};
```

Hierarchical objects

```javascript
let weatherForecast = {
    "description": "sunny",
    "temp": {
        "high": 76,
        "low": 48,
        "hourly": [48, 53, 65, 76, 66, 63]
    }
};
```

```javascript
let temp2 = weatherForecast.temp.hourly[2];
```

The DOM is a hierarchical object

```javascript
let par = document.getElementById("caption");
par.textContent = "Bananas, 1968";
```

The DOM is a complex object

```javascript
let par = document.getElementById("caption");
par.textContent = "Bananas, 1968";
```

```javascript
What are the types of par? document? getElementById? textContent?
```

```javascript
document is an object, getElementById is a method, par is a object (which is also part of document), and textContent is a string property of par.
```

```javascript
let a = '{ "veg": "beet", "color": "purple" }'
```

```javascript
What is the data type of a?
```

```javascript
String! The string contains an object literal, but it is still just a string. This turns out to be so useful, it has a name: JSON.
```
JSON

- JSON is a widely popular way to pass data between the different computers involved in a Web application.
- That is, they transmit strings back and forth.
- It’s a concise and very flexible format.
- Early days XML, which was HTML-like, with tags, was used more, but JSON is now standard.

Details I am glossing over

- JSON cannot include methods.
- Also the strings in JSON have to be given with double quotes, although they can contain single quotes.
- So these object literals are not JSON:
  
  ```js
  { "addOne": function (x) { return x+1;}  }
  { 'car': 'tesla' }
  ```

JSON.parse method JSON->object

```js
let aJSON = '{ "veg": "beet", "color": "purple" }'
let aObj = JSON.parse(aJSON);
```

- aJSON is a string, aObj is an object.
- JSON.parse() is a built-in function that takes JSON as input. Produces the corresponding object. What does “parse” mean?
- This is typically the first thing you do when you receive JSON data from another computer.
- You get easy access the parts of a complex object.

JSON.stringify for obj->JSON

```js
let bObj = {"cow": "herford", "num": 2};
bJSON = JSON.stringify(bObj);
```

- What do you do when you have a complex object and you want to pack it up into a JSON string to send to another computer?
- JSON.stringify() takes object as input. Produces the corresponding JSON string.

Demo CORS request, response

- XMLHttpRequest object is Javascript's interface for sending an HTTP request to a server.
- Most often, a Web page makes requests, using Javascript, to the server from which the page was downloaded (same origin).
- CORS (Cross-Origin Resource Sharing) is a method for a browser to get data from a different server.
- Only some servers support CORS.

What is HTTP?

- HyperText Transfer Protocol
- The format of the messages that get passed from one computer to another on the WWW.
- Messages might be all text, or might contain binary data (e.g. an image).
- Almost all communication is via HTTP messages.
- HTTP messages are either requests, or responses.
Typical traffic with server

HTTP request

HTTP response

URLs

Accessing an API

Network traffic