Video 2.1
Chris Murphy

Motivation

- HTML and CSS only allow for **static** content
- HTML/CSS do not allow for generating **dynamic** content that can change based on user input, activity, etc.
- However, recall that the browser has an engine for generating dynamic content using **JavaScript**

JavaScript

- Developed at Netscape Communications in mid-1990s as a way of adding dynamic elements to HTML
- Originally known as "LiveScript"; changed to "JavaScript" soon after its release
- Now one of the most popular programming languages in the world

Developing in JavaScript

1. JavaScript can be embedded directly in the HTML inside `<script>` tags and/or using `<link>` tags to external .js files

2. Browsers such as Chrome provide a JavaScript "REPL" console for writing and evaluating code
   - Can also see output generated by JavaScript in HTML

3. You can also develop JavaScript in a .js file and execute it in a runtime environment such as Node.js

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<html>
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  <body>
    This is my first JavaScript web page.
    <p>

      <script>
        document.write('The current date and time is ');
        var time = new Date();
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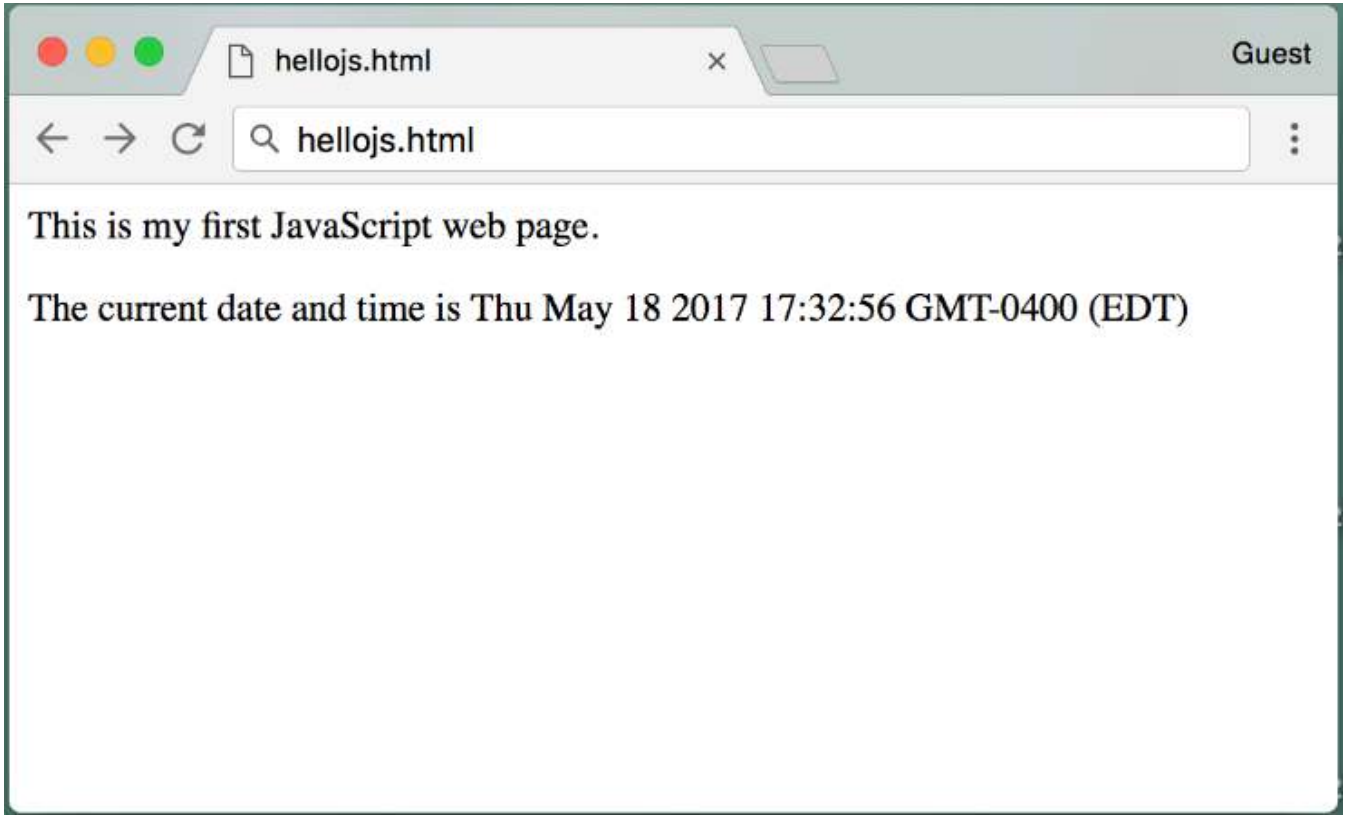
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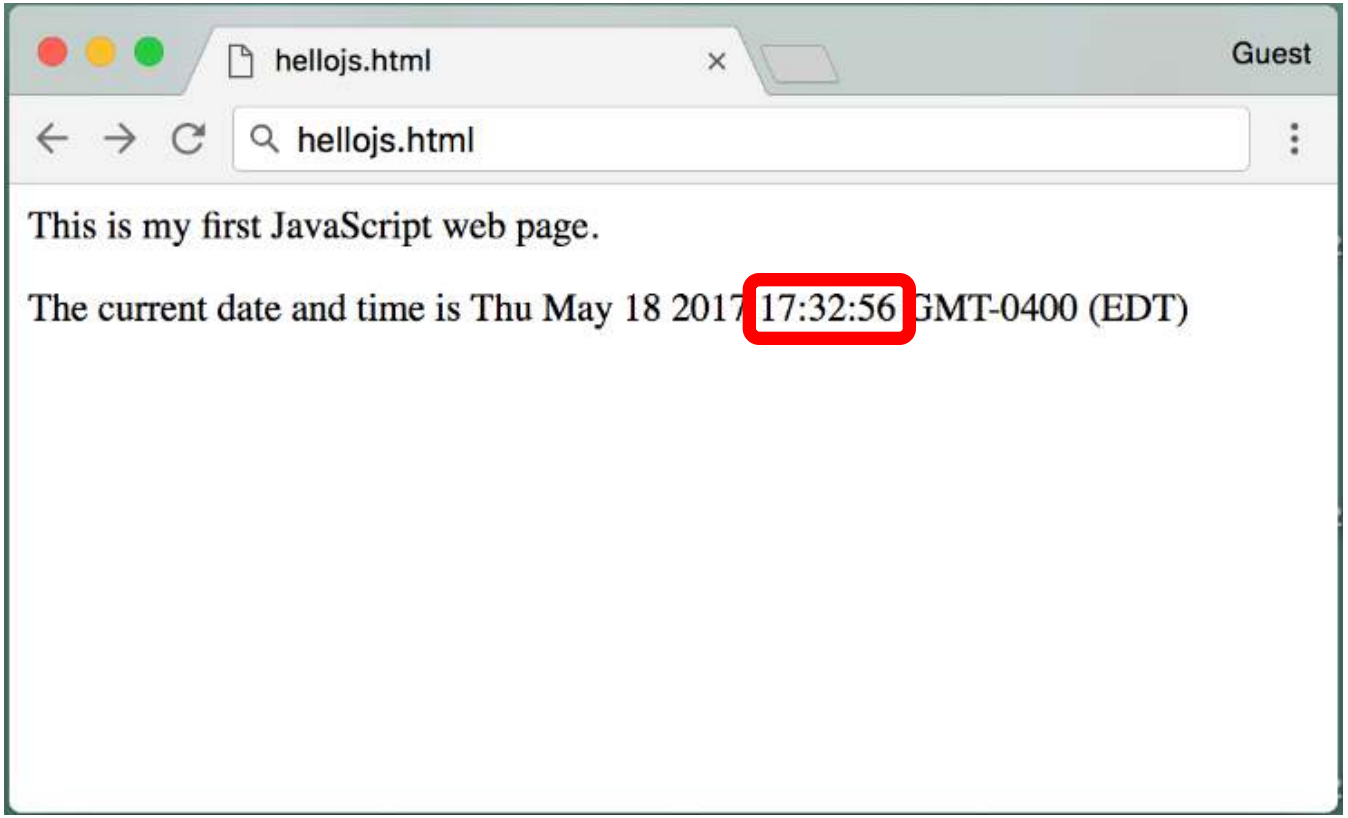
The current date and time is Thu May 18 2017 17:32:56 GMT-0400 (EDT)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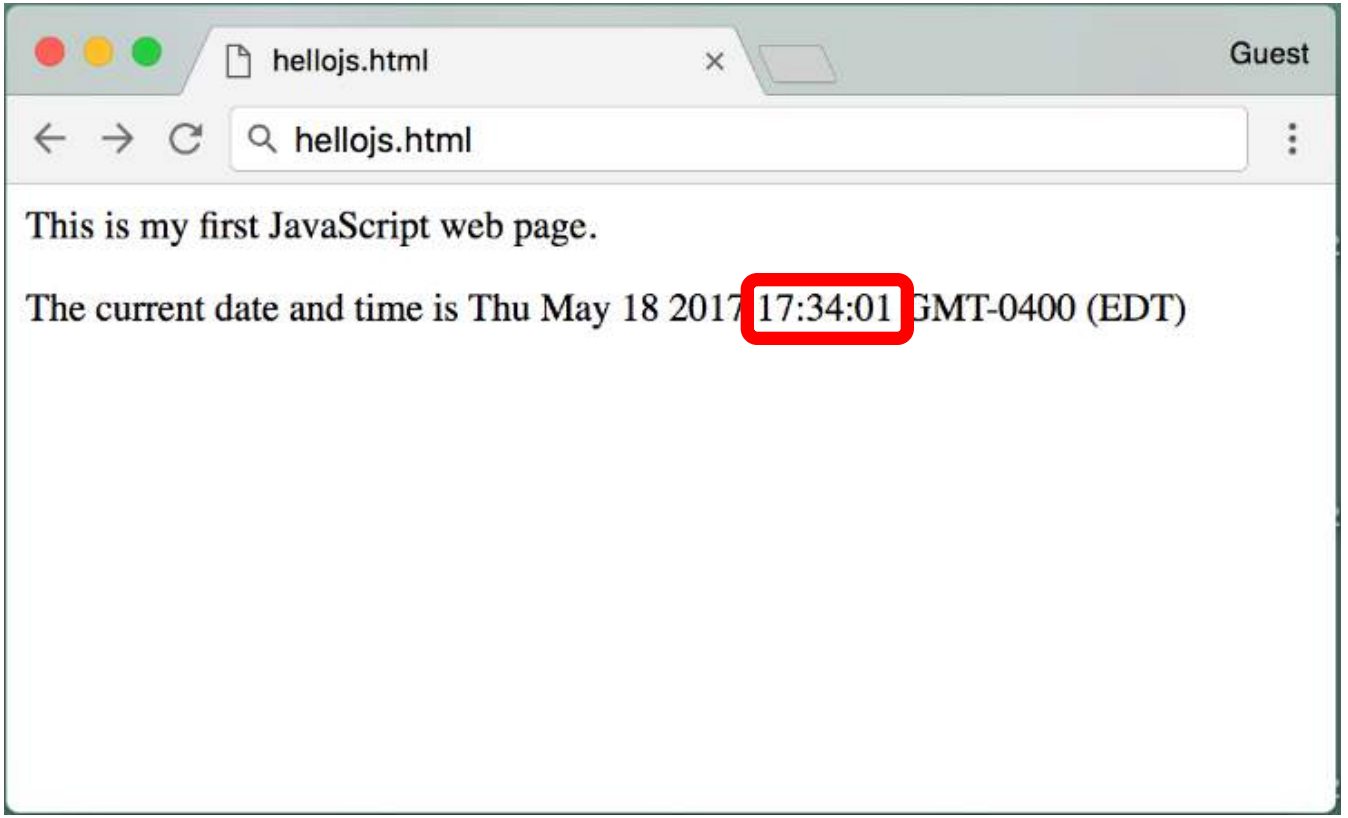
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Looking Ahead

- JavaScript basics
- How JavaScript code interacts with HTML elements
- Frameworks for developing "client-side" JavaScript (i.e., in the browser)
- Frameworks for developing "server-side" JavaScript (i.e., on a server)

Disclaimer!

- The code an examples for this part of the course have been developed using:
  - JavaScript 1.7
  - Google Chrome 58.0
  - Mac OSX 10.11.5

- You may observe slight differences on your own platform

Video 2.2
Chris Murphy

JavaScript Basics

- Like many other programming languages, JavaScript includes:
  - variables, arrays, and objects
  - loops and conditional statements
  - functions

- Even if you know Java, there are still some important differences
  - defining functions and objects
  - interacting with HTML

Declaring a Variable

- The basic syntax for declaring any JavaScript variable is `var variableName = ...`

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var age = 22;

var name = 'Jane Doe';

var isMale = false;
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My age is:
<script>
   var age = 12;
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My age is: 12

- However, this approach is discouraged
- We will see better alternatives later!

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- You can also use **`console.log(var)`** to print a variable's value in the browser's JavaScript console

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Changing a variable's type

- The type of each variable does not need to be specified and can be changed at any time.

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id = 'secret';
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Primitive Types

Type	Example values
Number	`5, 1.25, 1.1e5, +Infinity, -Infinity, NaN`

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String	`'hello'`
Boolean	`true, false`
Null	`null`
Undefined	`undefined`

Numbers

- All JavaScript numbers are stored using floating-point notation
  - i.e. 5 is stored internally as 0.5e1
- `+infinity` represents all numbers greater than `Number.MAX_VALUE` (around 10^{308})
- `-infinity` represents all numbers less than `Number.MIN_VALUE` (around 10^{-324})
- `NaN` represents any non-number value
  - `Number('tree')` would return `NaN`

Number Operations

- Basic arithmetic (+, -, *, /, %) can be used on JavaScript numbers
- Precedence will follow MDAS unless parentheses are used
- ++ and -- can be used to increment/decrement JavaScript numbers

```
var a = 4;
a++;                          // a = 5
var c = a - 3;                // 2
var d = c + 3 * a;            // 17
var e = ( c + 3 ) * a;        // 25
```

Strings

- JavaScript strings are series of 16-bit unsigned integers, each integer representing a character
- Convention is to use single quotes for strings unless single quotes exist within the string
  - `'I am a dolphin'` **vs.** `"I'm a dolphin"`
- Escape characters use backslash: `'\n \t \\'`
- All JavaScript strings are immutable
  - Any manipulation results in a new string

String Functions

- `+` or `.concat(`*`otherString`*`)` can be used to concatenate strings (add them together)

```
var firstName = 'John';
var lastName = 'doe';
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var firstName = 'John';
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var fullName= firstName.concat(' ', lastName); // 'John doe'
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var fullName= firstName.concat(' ', lastName); // 'John doe'
var greeting = 'HELLO, ' + fullName;
```

String Functions

- `+` or `.concat(`*`otherString`*`)` can be used to concatenate strings (add them together)
- `.toUpperCase()` and `.toLowerCase()` change the case of every character in a string

```
var firstName = 'John';
var lastName = 'doe';

var fullName= firstName.concat(' ', lastName); // 'John doe'
var greeting = 'HELLO, ' + fullName;

console.log(greeting.toUpperCase());     // 'HELLO, JOHN DOE'
console.log(greeting.toLowerCase());     // 'hello, john doe'
```

String Functions

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- *`var`*`.length` gets the length of a string

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var greeting = 'HELLO, ' + fullName;

console.log(greeting.toUpperCase());     // 'HELLO, JOHN DOE'
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console.log(greeting.length);            // 15
```

Booleans

- Booleans are logical values that can only be `true` or `false`

- Any value can be used as a boolean in JavaScript
  - "Falsy" values: `null, undefined, 0, NaN, ''`
  - "Truthy" values: `'cow', 'false', 5`, etc...

- Any variable type can become a boolean when used with logical operators

Null and Undefined

- **Null** is a value that can be assigned to variables to represent "no value"

```
var occupation = null;
console.log(occupation); // null
```

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var occupation = null;
console.log(occupation); // null
```

- **Undefined** means that a variable was declared but no value has been assigned

```
var salary;
console.log(salary);  // undefined
```

Summary

- JavaScript variables do not need to have their types specified when they are declared
- Variable types are allowed to change

- Five primitive types: number, string, boolean, null, undefined

Video 2.3
Chris Murphy

Variables in JavaScript

- Five primitive types: number, string, boolean, null, undefined
- Sometimes we may want to have a collection of ordered values
- Sometimes we may want to have a collection of associated values with semantically meaningful names/keys

Arrays

- Arrays are used to store a list of values in a single variable
- Values can be of any type, and are split with commas and wrapped in square brackets

```
var myArray = [‘cars’, 12, false];
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var age = myArray[1];
console.log(age);              // 12
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var age = myArray[1];
console.log(age);           // 12
myArray[2] = true;
console.log(myArray[2]);    // true
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Arrays

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- Values can be of any type, and are split with commas and wrapped in square brackets
- Values can be accessed with `arrayVar[index]`
- The length of an array can be found with `.length`

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var myArray = ['cars', 12, false];

var age = myArray[1];
console.log(age);           // 12
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console.log(myArray.length); //3
```

Array Indices

- When **reading** an array value by its index, *`arrayVar[index]`* **will return** `undefined` **if the index is out of bounds**

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var a = ['cat', 'dog', 'banana'];

console.log(a[4]);  // undefined

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a[4] = 'panda';
console.log(a[4]);   // "panda"
console.log(a[3]);   // undefined

a[-5] = 'elephant';
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- Elements can be added to arrays using **`push()`** and **`unshift()`**
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var myArray = ['car', 'bike'];

myArray.push('scooter');
console.log(myArray);          // car,bike,scooter

myArray.unshift('train');
console.log(myArray);          // train,car,bike,scooter
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myArray.push('scooter');
console.log(myArray);          // car,bike,scooter

myArray.unshift('train');
console.log(myArray);          // train,car,bike,scooter
```

Removing from an Array

- Elements can be removed from arrays using **`pop()`** and **`shift()`**
  - **`pop()`** will remove and return an element from the end of the array
  - **`shift()`** will remove and return an element from the beginning

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var myArray = ['train', 'car', 'bike', 'scooter'];

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Objects

- JavaScript objects are used to store key-value pairs
- Values can be of any type, including arrays and objects!
- Values can be accessed by ***myObject.property*** or ***myObject['property']***

```
var person = {
    name: 'John Doe',
    age: 25,
    isMale: true,
    personality: ['patient', 'loyal', 'happy'],
    company: { name: 'edX', id: 2984 }
}

console.log(person.age);              // 25
console.log(person['company'].id)     // 2984
```

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Modifying Objects

- Key-value pairs can be added to objects, even after their initial declaration

```
var pet = {
   name: 'Cooper',
   type: 'dog'
}

console.log(pet.age);        // undefined
pet.age = 11;
console.log(pet.age);        // 11

pet['status'] = 'good boy';
console.log(pet.status);     // "good boy"
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Summary

- JavaScript **arrays** let us create ordered collections of values with numeric indices

- JavaScript **objects** are collections of associated values with semantically meaningful names/keys

Video 2.4
Chris Murphy

Conditional Statements

```
var a = . . .

var b = . . .

var max; // undefined

if (a > b) {
   max = a;
}
else {
   max = b;
}

console.log(max);
```

Conditional Statements

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Comparison and Logical Operators

Comparison Operators

Operator	Description
==	equal to
===	equal to and same type
!=	not equal to
!==	not equal to or different type
>	greater than
>=	greater than or equal to
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Logical Operators

Operator	Description
||	logical OR
&&	logical AND
!	logical NOT

Double-equals vs. Triple-equals

- Use double-equals (==) when you only want to compare **values**

```
1 == '1' // true
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- Use double-equals (==) when you only want to compare **values**
- Use triple-equals (===) when you want to compare values **and** type

```
1 == '1' // true

1 === '1' // false! different types
```

Comparing Truthy/Falsy Values

- Recall that any value can be used as a boolean
  - "Falsy" values: `null, undefined, 0, NaN, ''`
  - "Truthy" values: `'cow', 'false', 5`, etc...

```
var x; // undefined
if (x) { . . . } // false! undefined is falsy

x = 0;
if (x) { . . . } // false! 0 is falsy

x = 39;
if (x) { . . . } // true! 39 is truthy


var y = null;
var z; // undefined

if (y == z) { . . . } // true! falsy equals falsy

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5 < '20' // true
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- Non-numeric strings are converted to NaN

```
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```

- Non-numeric strings are converted to NaN

```
5 > 'alligator' // false
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- Non-numeric strings are compared alphabetically

```
'zebra' > 'giraffe' // true
```

Comparing Objects

- Objects are only considered equal if the variables are **aliases**, i.e. refer to the same object

```
var cooper = { age: 11 }
var flanders = { age: 11 }

if (cooper == flanders) { . . . } // false!



var myDog = cooper;

if (myDog == cooper) { . . . } // true!
```

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var factorial = 1;
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Loops

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var factorial = 1;
```

```
for (var i = 1; i <= n; i++) {
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}
```

```
var i = 1;
while (i <= n) {
    factorial *= i;
    i++;
}
```

```
var i = 1;
do {
    factorial *= i;
    i++;
}
while (i <= n);
```

Summary

- JavaScript supports conditional statements and loops

- Comparison operators can be used to compare by value and also by type

Video 2.5
Chris Murphy

Declaring and Using Functions

```
function factorial(n) {
   var product = 1;
   for (var i = 1; i <= n; i++) {
       product *= i;
   }
   return product;
}

var x = . . .

var f = factorial(x);

console.log(f);
```

Declaring and Using Functions

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function changeMe(obj) {
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console.log(p.age); // now 31
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Functions in Objects

- JavaScript functions can also be declared and used in objects

```
var johnDoe = {
   name: 'John Doe',
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console.log(johnDoe.greeting());
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Object Prototypes

- Every object in JavaScript has a **prototype,** accessed from the `__proto__` property in the object.
- The `__proto__` property is also an object, with its own `__proto__` property, and so on
- The root prototype of all objects is `Object.prototype`
- An object inherits the properties of its prototype

Creating a Prototype

- Prototypes are created like any other JavaScript function or object
- The **`this`** keyword refers to the current object
- The **`new`** keyword can be used to create new objects from the same prototype

```
function Person (name, age) { // prototype
    this.name = name;
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var johnDoe = new Person('John Doe', 32);
johnDoe.greeting(); // Hello! My name is John Doe

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Extending a Prototype

- Prototypes can extend another prototype with more functionality
- To inherit a prototype, set the __proto__ property of an object to the parent prototype

```
function Student (name, age, school) {
   this.__proto__ = new Person(name, age);
   this.school = school;
}

var sarahBrown = new Student('Sarah Brown', 17, 'PennX');

sarahBrown.greeting();           //Hello! My name is Sarah Brown
sarahBrown instanceof Person;    //true
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Prototype Properties

- Properties and methods can be added to prototypes by adding them to the prototype property

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var Person = function (name, age, occupation) {
   this.name = name;
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   this.occupation = occupation;
}

Person.prototype.planet = 'Earth';
Person.prototype.introduction = function () {
   return 'I am a ' + this.occupation;
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var johnDoe = new Person('John Doe', 32, 'Dentist');

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Summary

- JavaScript supports functions
  - Primitives are passed by value
  - Objects are passed by reference
- Functions are objects and can be used to create objects
- JavaScript prototypes can be used to create "blueprints" for objects and can be modified dynamically

Video 2.6
Chris Murphy

Review

- JavaScript strings are sequences of characters
- JavaScript strings are immutable
- Strings are objects and have their own functions

Strings and Characters

- We can get the number of characters in a string using the **`length`** property
- We can access each character by its (0-based) index using **`charAt`** or array notation

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var name = 'toucan';

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- Remember! JavaScript strings are immutable!

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- Remember! JavaScript strings are immutable!

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var animal = 'cat';
```

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name[3];            // 'c'
```

- Remember! JavaScript strings are immutable!

```
var animal = 'cat';

animal[0] = 'r';
```

Strings and Characters

- We can get the number of characters in a string using the **`length`** property
- We can access each character by its (0-based) index using **`charAt`** or array notation

```
var name = 'toucan';

name.length;       // 6

name.charAt(3);    // 'c'
name[3];           // 'c'
```

- Remember! JavaScript strings are immutable!

```
var animal = 'cat';

animal[0] = 'r';

console.log(animal); // still 'cat'
```

Modifying Strings

- We can modify a string but these functions return a **new** string (since strings are immutable!)

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```
var message = `hello everyone`;
```

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var message = ' hello everyone ';
message = message.trim(); // 'hello everyone'
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```
var myAnimal = 'cat'.concat('mouse');
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var message = ' hello everyone ';
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```

```
var myAnimal = 'cat'.concat('mouse');
console.log(myAnimal);  // 'catmouse'
```

Searching Strings

- We can determine whether a string starts with, ends with, or includes other strings

```
var msg = 'programming in JavaScript is fun';

msg.startsWith('programming');    // true
msg.startsWith('PROGRAMMING');    // false

msg.endsWith('is fun');           // true

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- We can also get the starting index of a contained substring

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var title = 'the title of my book';
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Regular Expressions

- A **regular expression** is a pattern of characters
- A string **matches** a regular expression if it adheres to the same pattern
- Example: "consists of exactly three digits (0-9)"
  - '123' matches
  - 'abc' does not match
  - '12' does not match
  - '12345' does not match

Simple Regular Expression Matching

- We can pass a regular expression to the string's **`search`** function to see if it matches the pattern
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var numbers = '5 8 2 5 7 6';
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- Or ranges of characters or special characters

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var password = 'password4real';
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- Or ranges of characters or special characters

```
var password = 'password4real';
password.search(/[a-z]/);       // 0
password.search(/\d/);          // 8
```

Using Ranges

- We can combine different ranges

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var code = 'abc123d4e5';
code.search(/[0-9][a-z][0-9]/);
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var chars = 'abc123K456';
chars.search(/[^0-9a-z]/);
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chars.search(/[^0-9a-z]/);     // 6
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Quantifiers

- We may want to know whether the string contains an optional **single** occurrence

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/[a-z][0-9]?[a-z]/.test('a1b');

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- Or optional **multiple** occurrences

```
/[a-z][0-9]*[a-z]/.test('a123b');
```

Quantifiers

- We may want to know whether the string contains an optional **single** occurrence

```
/[a-z][0-9]?[a-z]/.test('a1b');  // true

/[a-z][0-9]?[a-z]/.test('abc');  // true

/[a-z][0-9]?[a-z]/.test('a123b');// false
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- Or optional **multiple** occurrences

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startsWith and endsWith Matches

- Regular expressions can tell us if a string **contains** a pattern, but we may want to know if the string **starts** or **ends** with the pattern

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/^[a-z][0-9]/.test('a1b');
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```

- This lets us detect **exact** matches

```
/^[a-z][0-9][a-z]$/.test('a1b');

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```

Summary

- JavaScript strings are immutable but provide functions that allow us to create new, modified versions of them

- Strings have **`startsWith`**, **`endsWith`**, **`includes`**, and **`search`** functions

- We can also use regular expressions' **`test`** function to check for matches in a string

Video 2.7
Chris Murphy

How do we use JavaScript and HTML?

- We motivated this part of the course by saying that we wanted a way to dynamically generate HTML
- Now that we've seen JavaScript, how can we use it to access/modify HTML elements?
- This is done by using the **DOM**

What is the DOM?

- The **D**ocument **O**bject **M**odel is a structured tree representation of a web page

- The HTML of every web page is turned into a DOM representation by the browser

What does the DOM look like?

- HTML

```
<!DOCTYPE html>
<html>
  <body>
    <div id="header">
        PennX at edX Home
    </div>
    <div id="content">
        Welcome to PennX!
    </div>
    <div id="footer">
      <a href="/contact">
         Contact Us!
       </a>
    </div>
</html>
```

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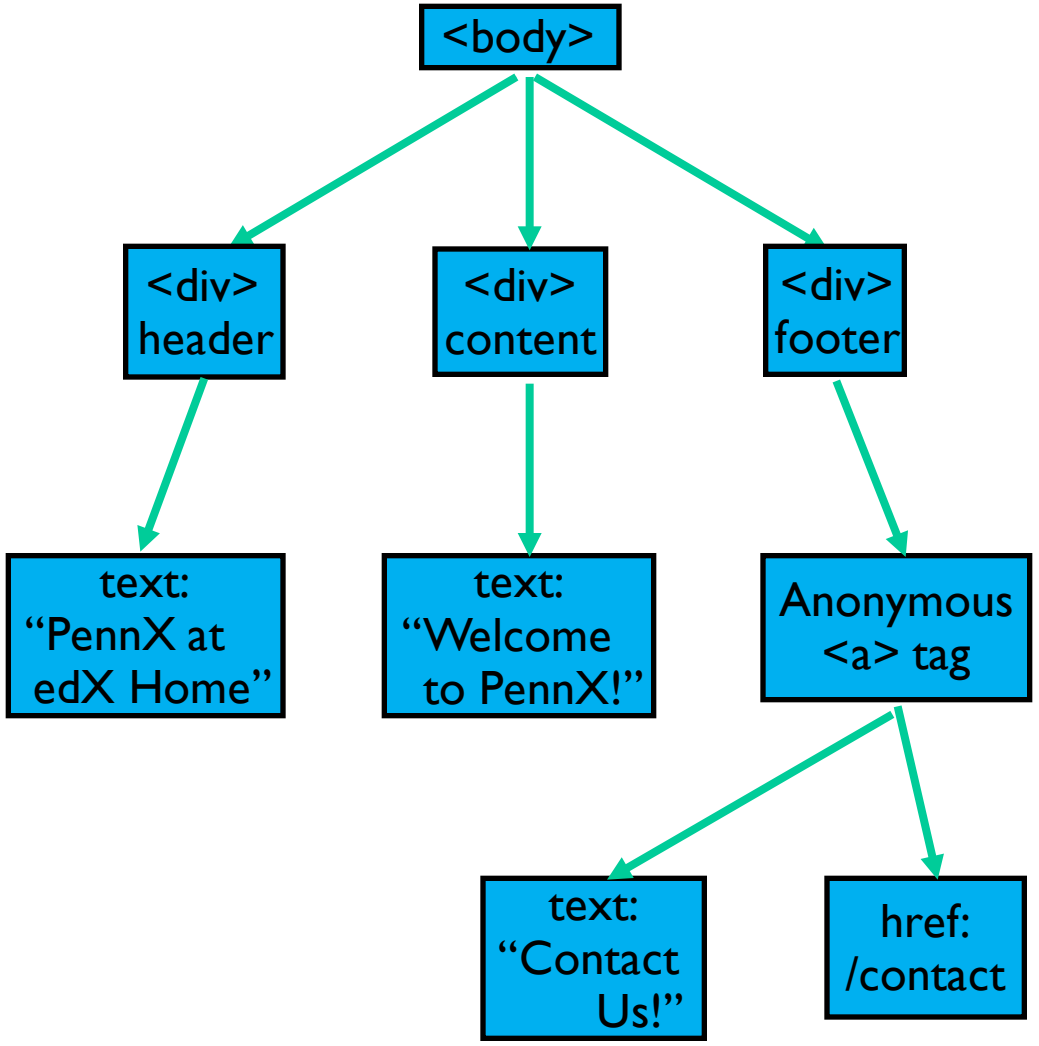
- DOM tree



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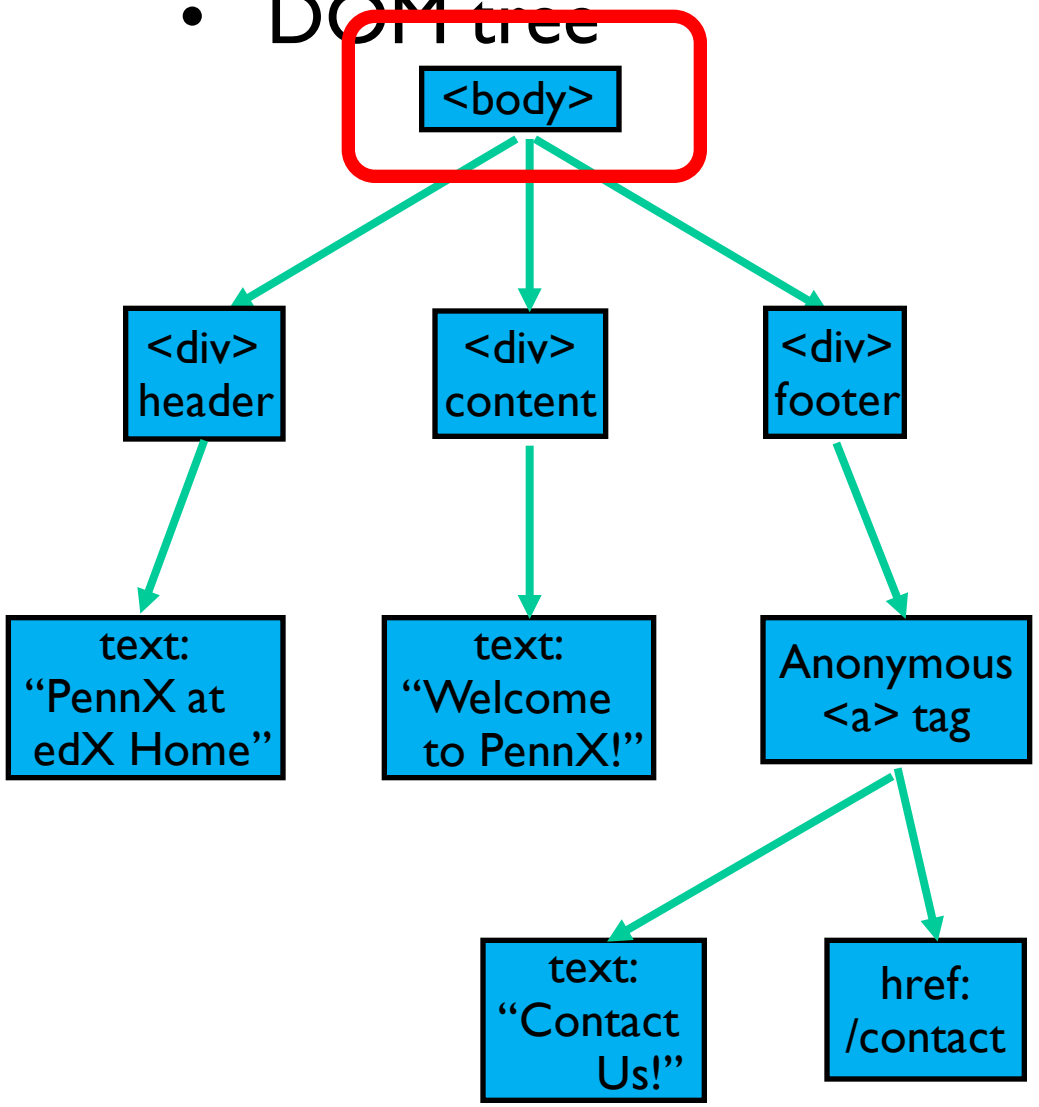
- DOM tree



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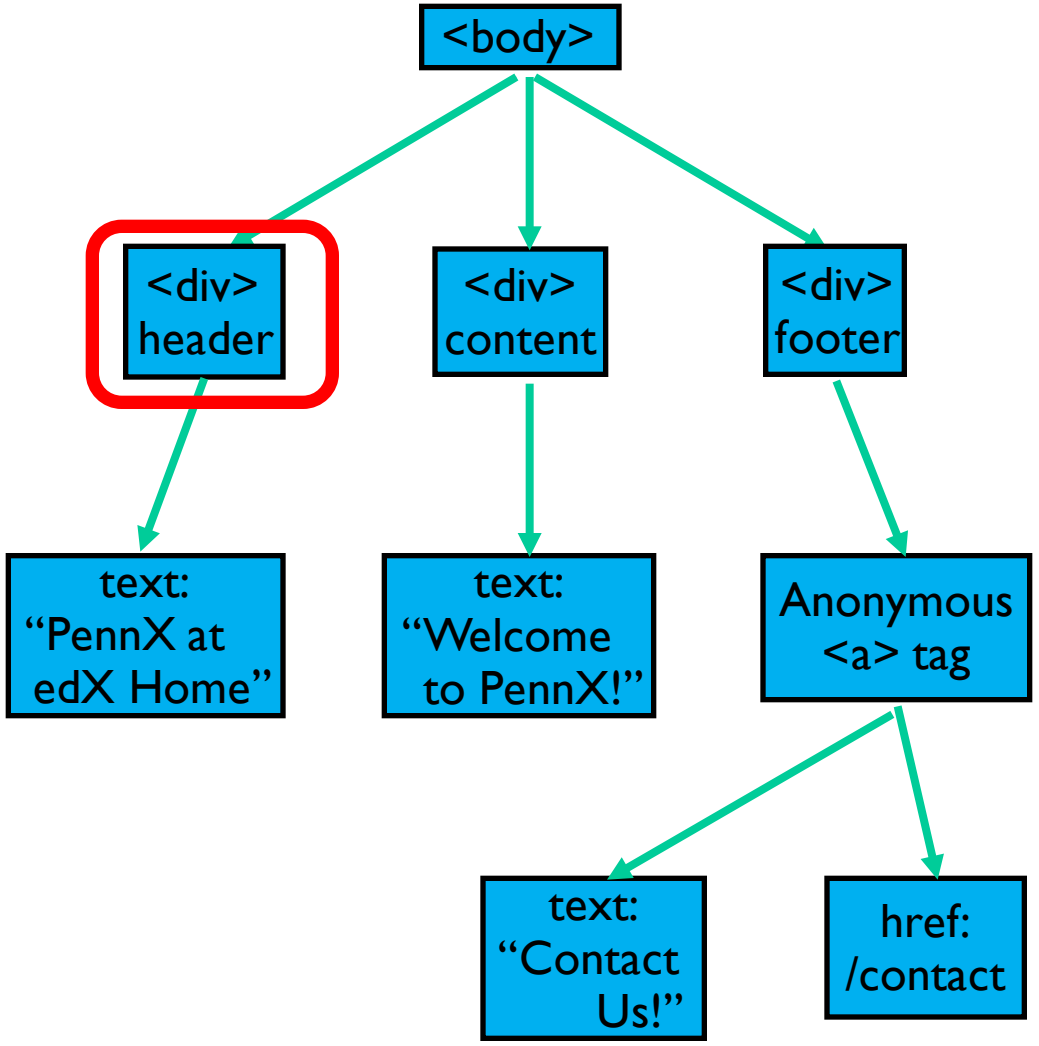

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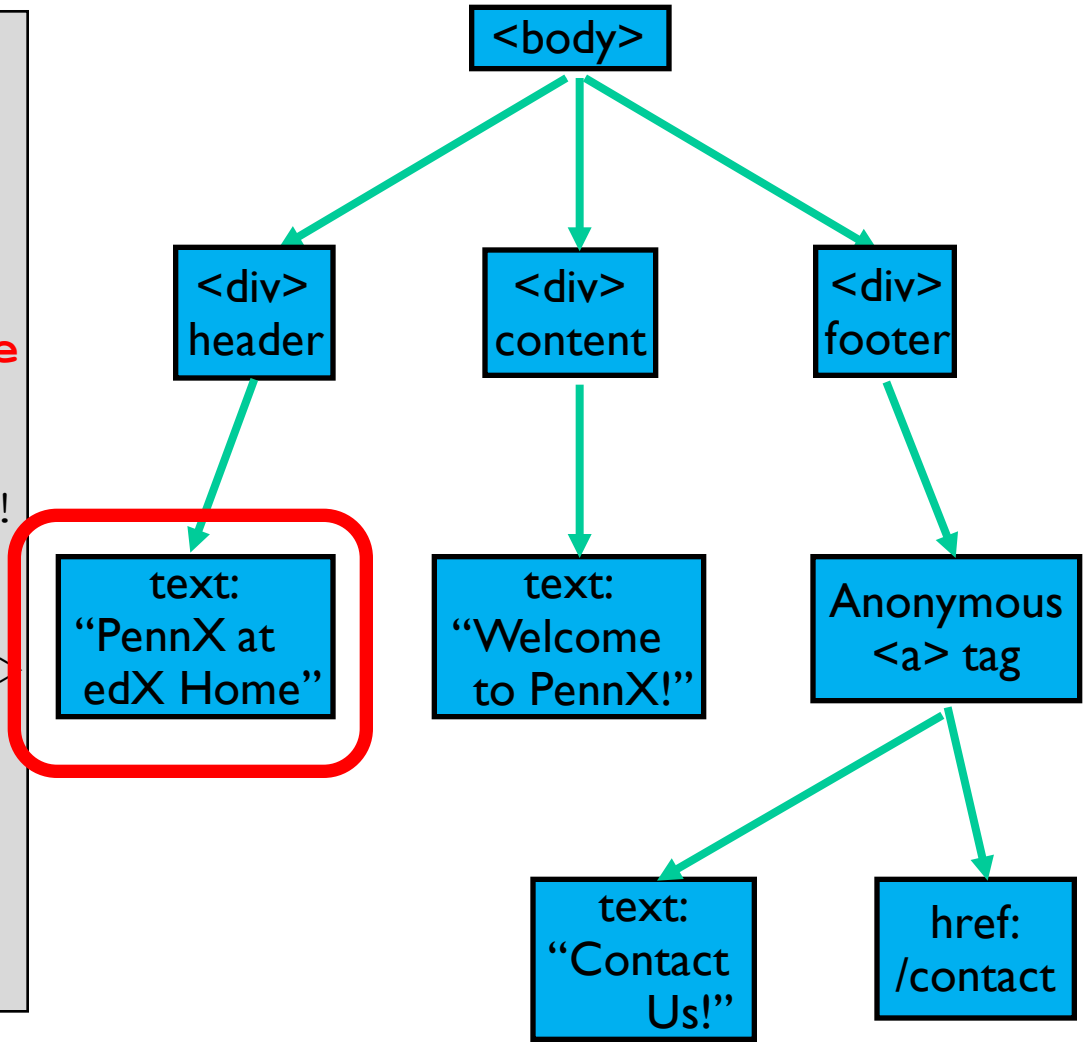

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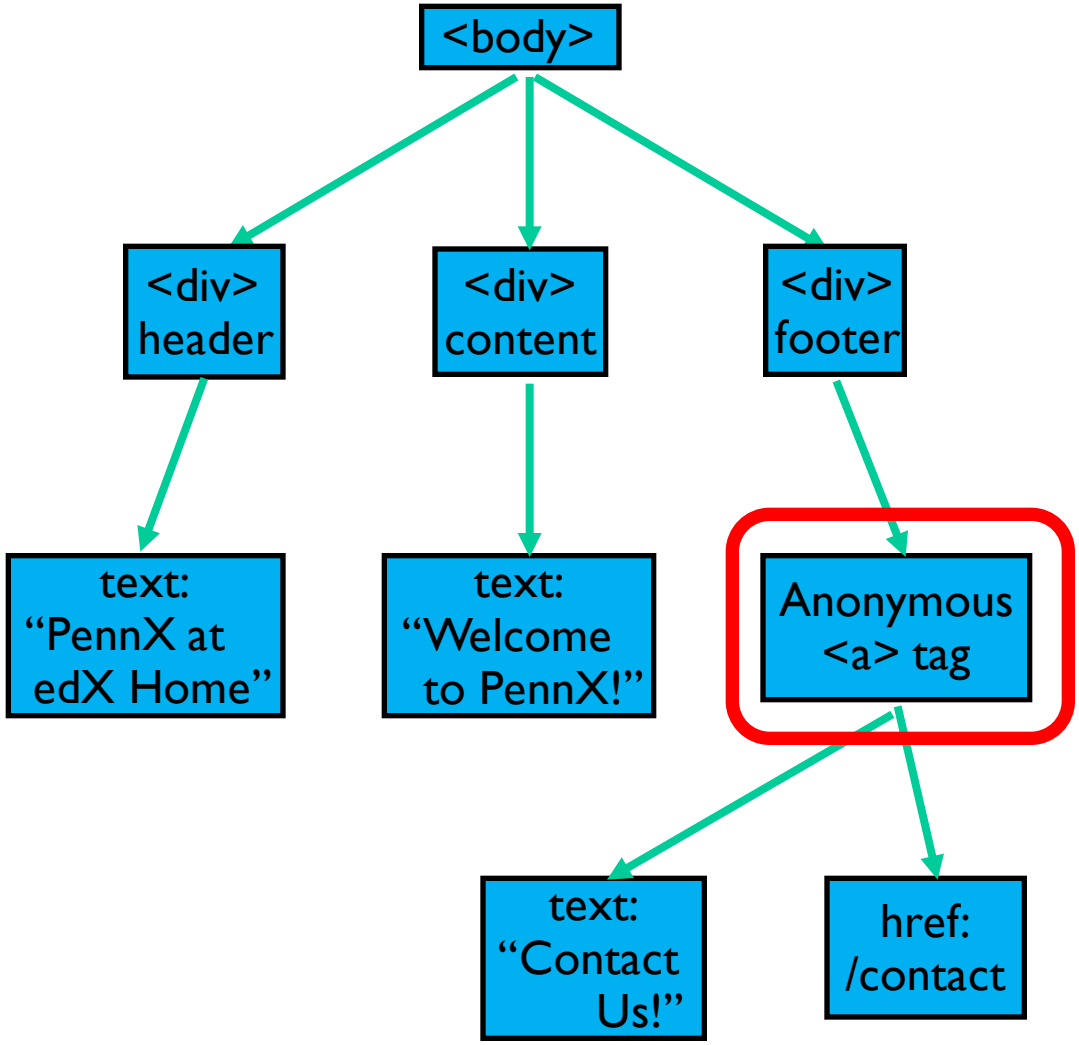

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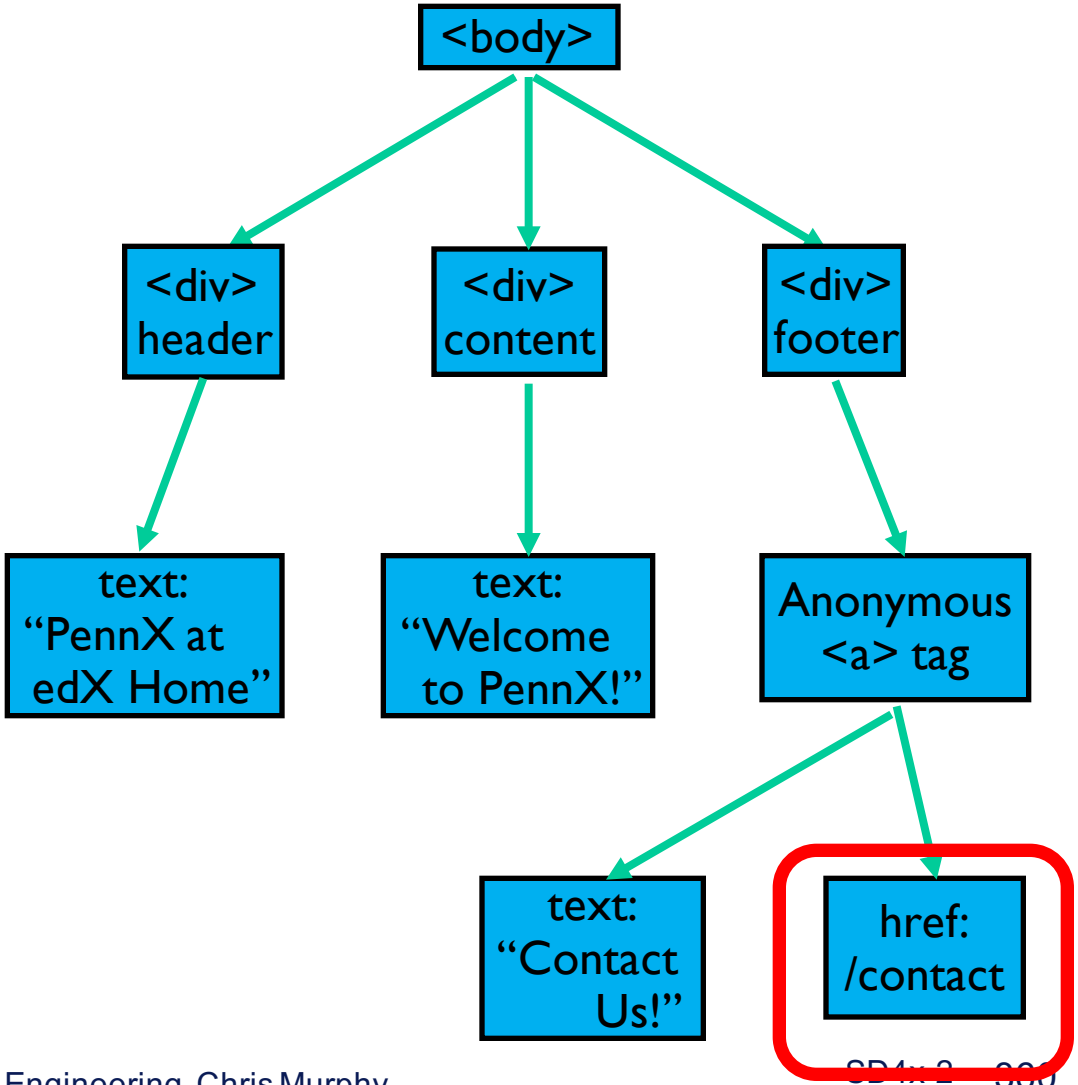

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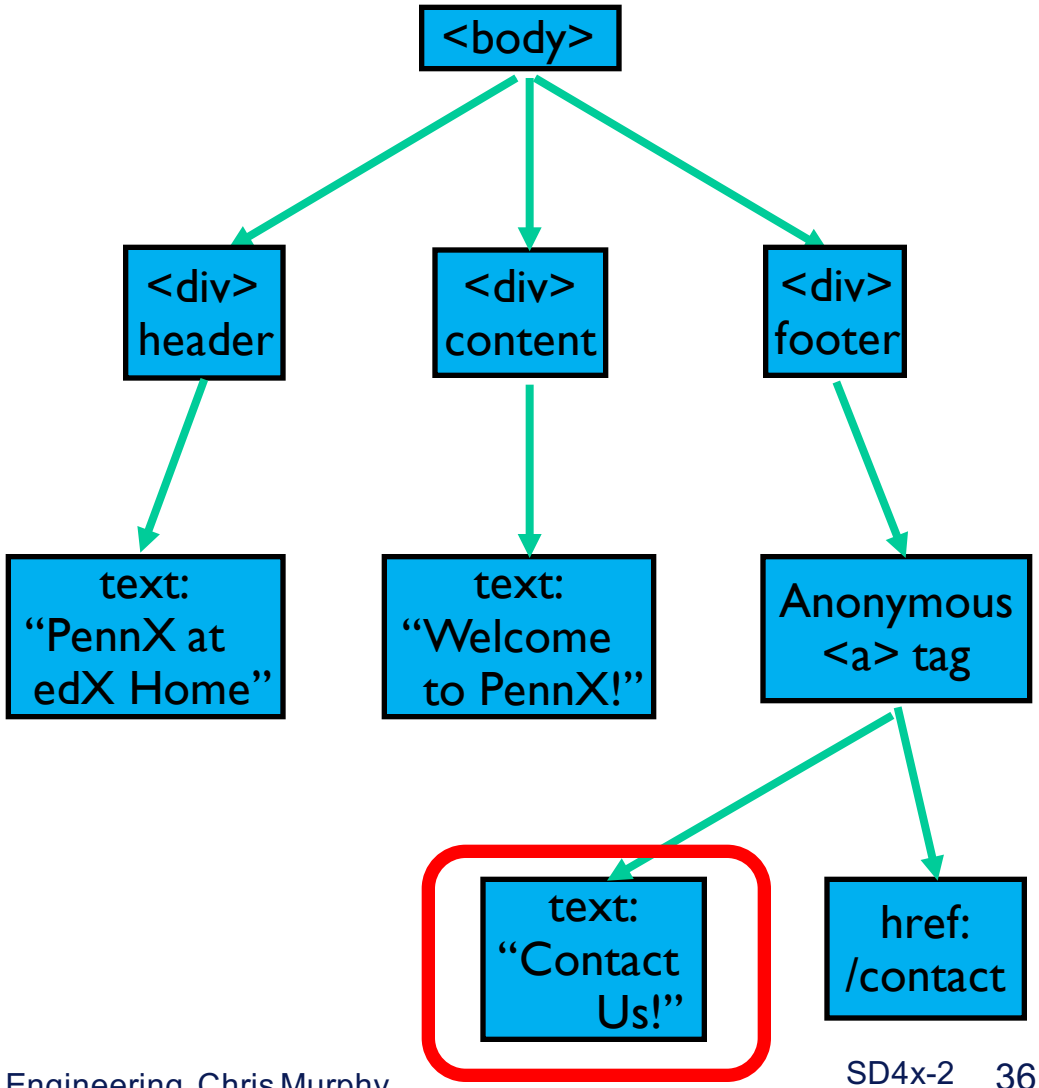

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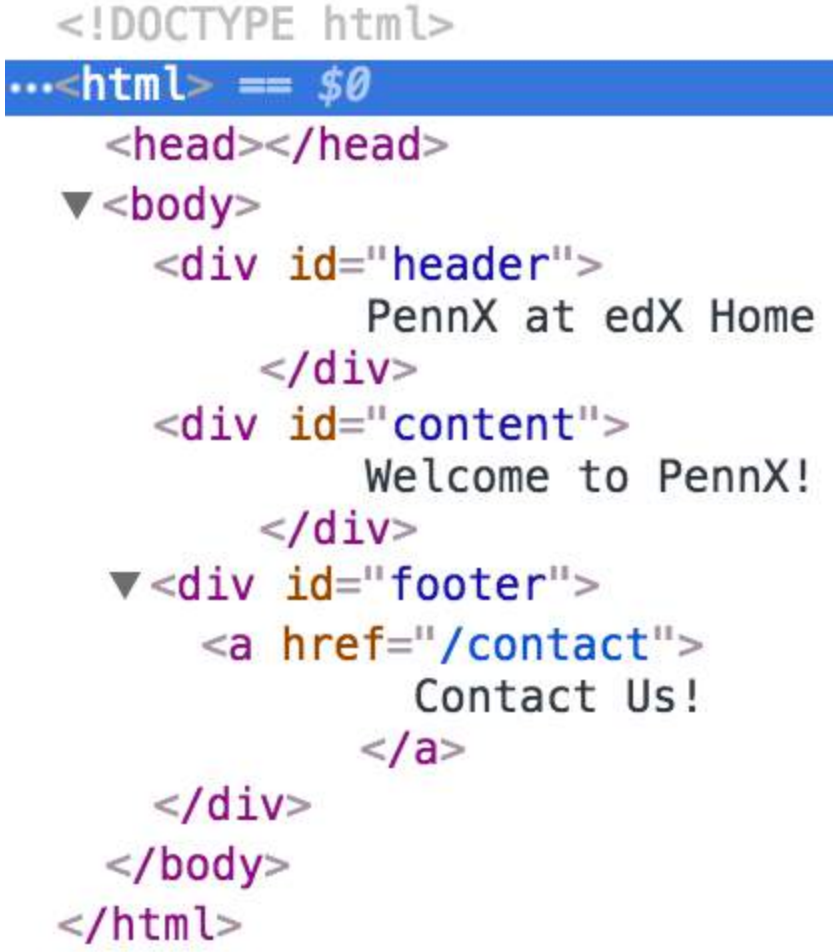

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- DOM in console

Why the DOM?

- Remember, HTML specifies the **structure** of the content on the Web page

- The DOM provides a way for us to programmatically access that structure in JavaScript

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- The root DOM object can be accessed by the object called **`document`**
- Elements in this DOM tree can be retrieved and manipulated

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  var report = document.getElementById('report');
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Objects as JSON

- JSON = **J**ava**S**cript **O**bject **N**otation
- JSON is a **textual** representation of a JavaScript Object that can be stored as a string, in a .json file, or be exchanged between programs
- A sample JSON file or string might look like this:

```
{
   "name": "John Doe",
   "age": 25,
   "isMale": true,
   "personality": ["patient", "loyal", "happy"],
   "company": { "name": "EdX", "id": 2984 }
}
```

Converting between JSON and Objects

- JavaScript objects can be converted to a JSON string via `JSON.stringify(myObject)`

- String representations can be converted back to an object via `JSON.parse(jsonString)`

- All values must be a string, number, array, boolean, null, or another valid JSON object

Storing JSON

- A great application of JSON usage is to store JSON strings in local browser storage:

```
localStorage.myJSON = JSON.stringify(myObject);

// … in a later session
myObject = JSON.parse(localStorage.myJSON);
```

- Later on, as you learn about server-side JavaScript, you will also learn how to use JSON data to communicate with a server or API.

DOM and JSON

```
You have accessed this page <span id="report"></span> times.
<p>
Your last visit was <span id="lastVisitDate"></span>.

<script>
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}

document.getElementById('lastVisitDate').innerHTML = lastVisitDate;

timesVisited++;
document.getElementById('report').innerHTML = timesVisited;

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localStorage.lastVisit = JSON.stringify(myLastVisit);
</script>
```

DOM and JSON

```
You have accessed this page <span id="report"></span> times.
<p>
Your last visit was <span id="lastVisitDate"></span>.

<script>
var timesVisited = 0;
var lastVisitDate = 'never';

if (localStorage.lastVisit) {
   var lastVisit = JSON.parse(localStorage.lastVisit);
   timesVisited = lastVisit.numVisits;
   lastVisitDate = lastVisit.date;
}

document.getElementById('lastVisitDate').innerHTML = lastVisitDate;

timesVisited++;
document.getElementById('report').innerHTML = timesVisited;

var myLastVisit = { }
myLastVisit.date = new Date();
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Summary

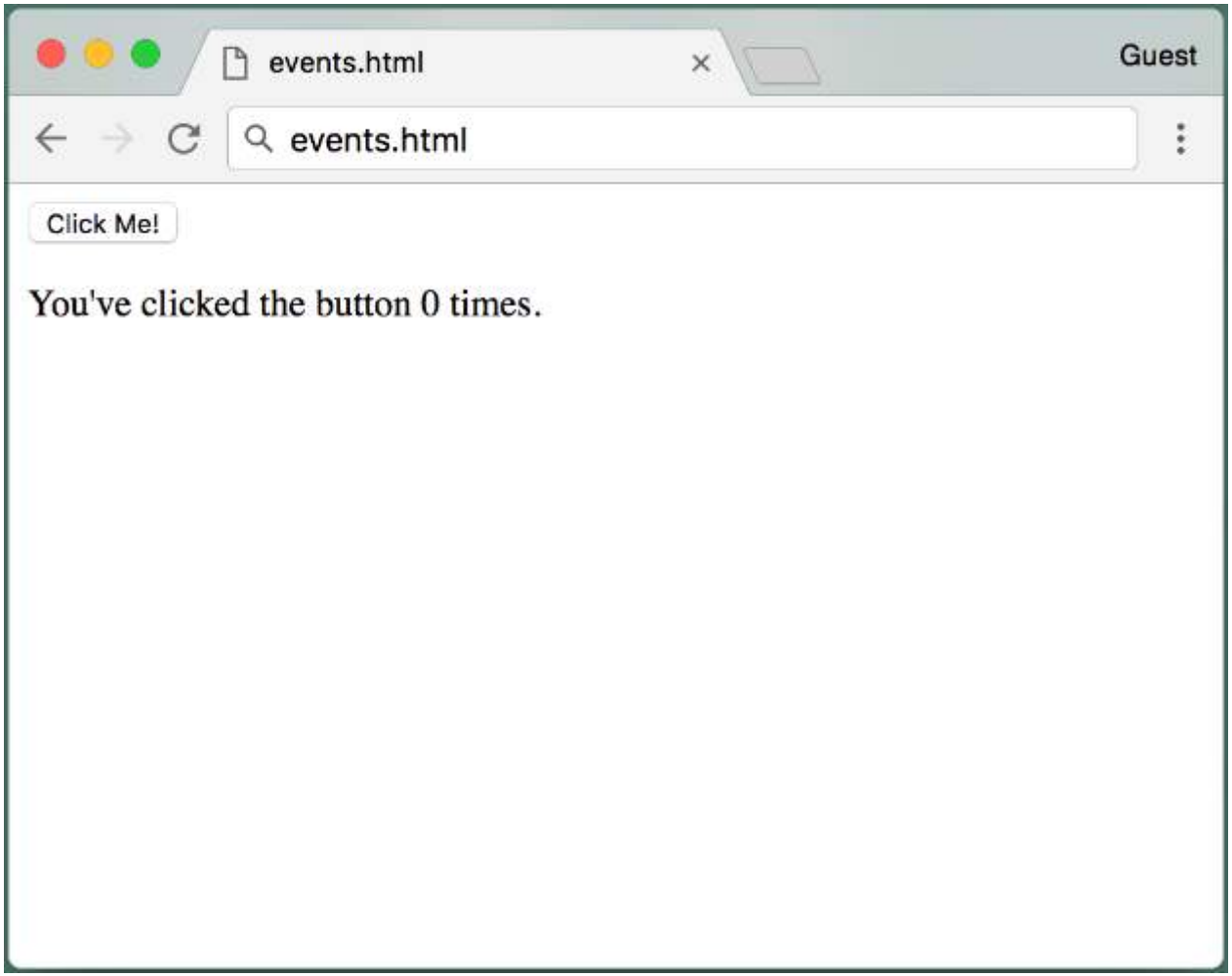
- JavaScript can use the DOM to retrieve/modify HTML elements
  - `document.getElementById('id')` returns the specific HTML element with that ID
  - `element.innerHTML` can be modified to change the element's HTML/content
  - `element.style` can be modified to change the element's CSS/appearance
- We can use `localStorage` to save values across page requests
- Objects can be converted to string representations known as JSON

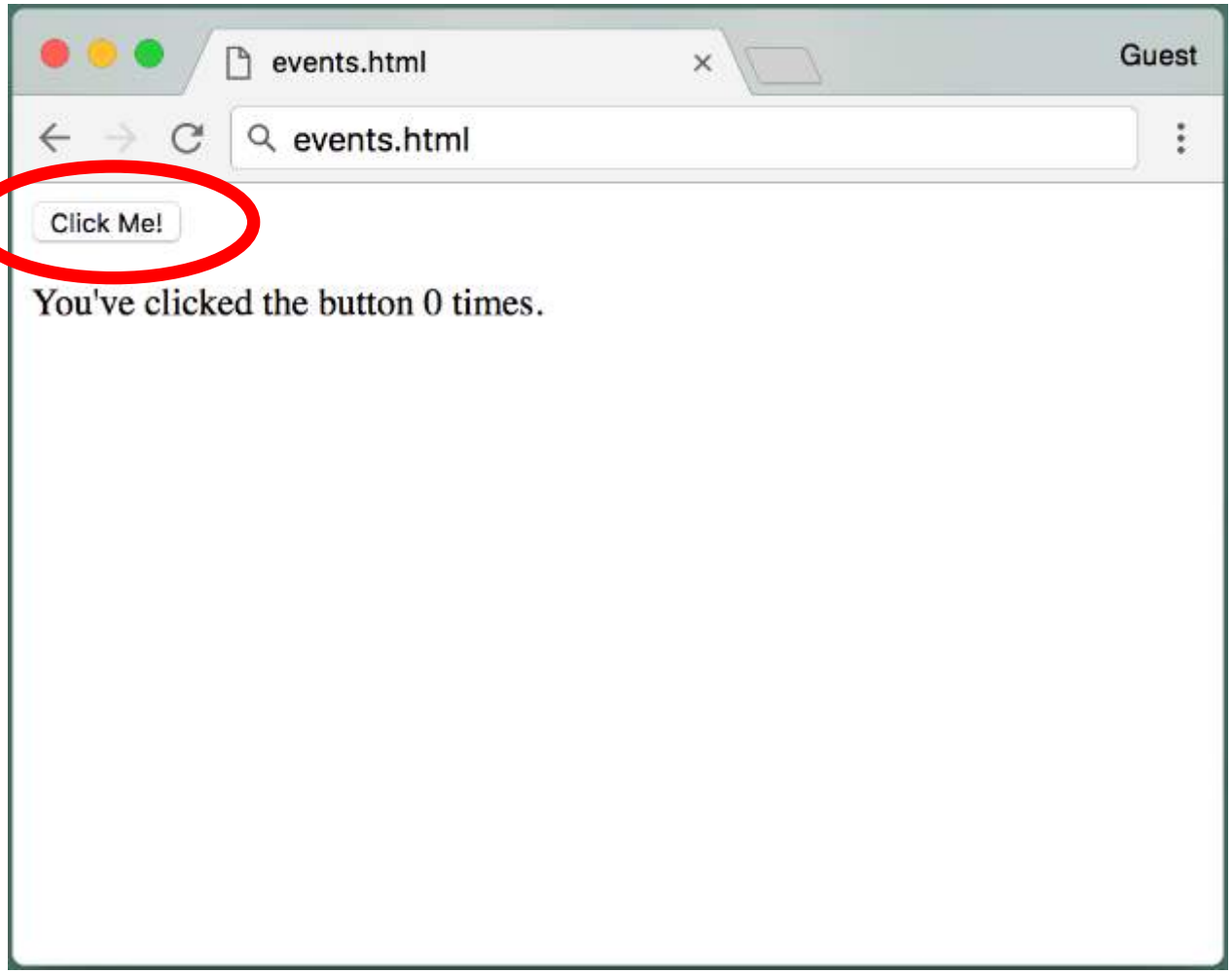
Video 2.8
Chris Murphy

Review: HTML, JavaScript, DOM

- Previously we saw that JavaScript can use the DOM to retrieve/modify HTML elements
  - `document.getElementById('id')` returns the specific HTML element with that ID
  - `element.innerHTML` can be modified to change the element's HTML/content
  - `element.style` can be modified to change the element's CSS/appearance

- How can we do this in response to user events?


events.html
Guest
events.html
Click Me!
You've clicked the button 0 times.


events.html
Guest
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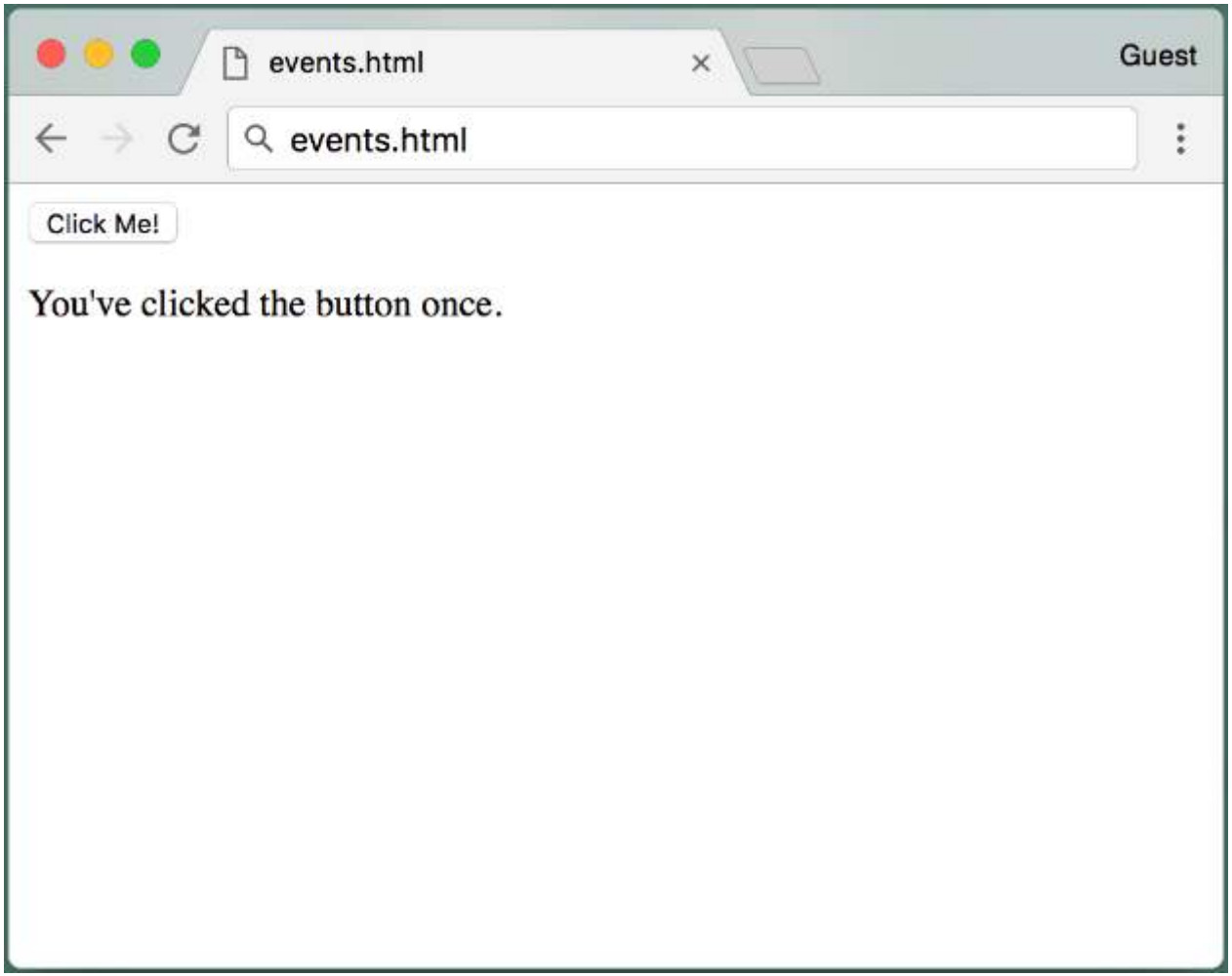
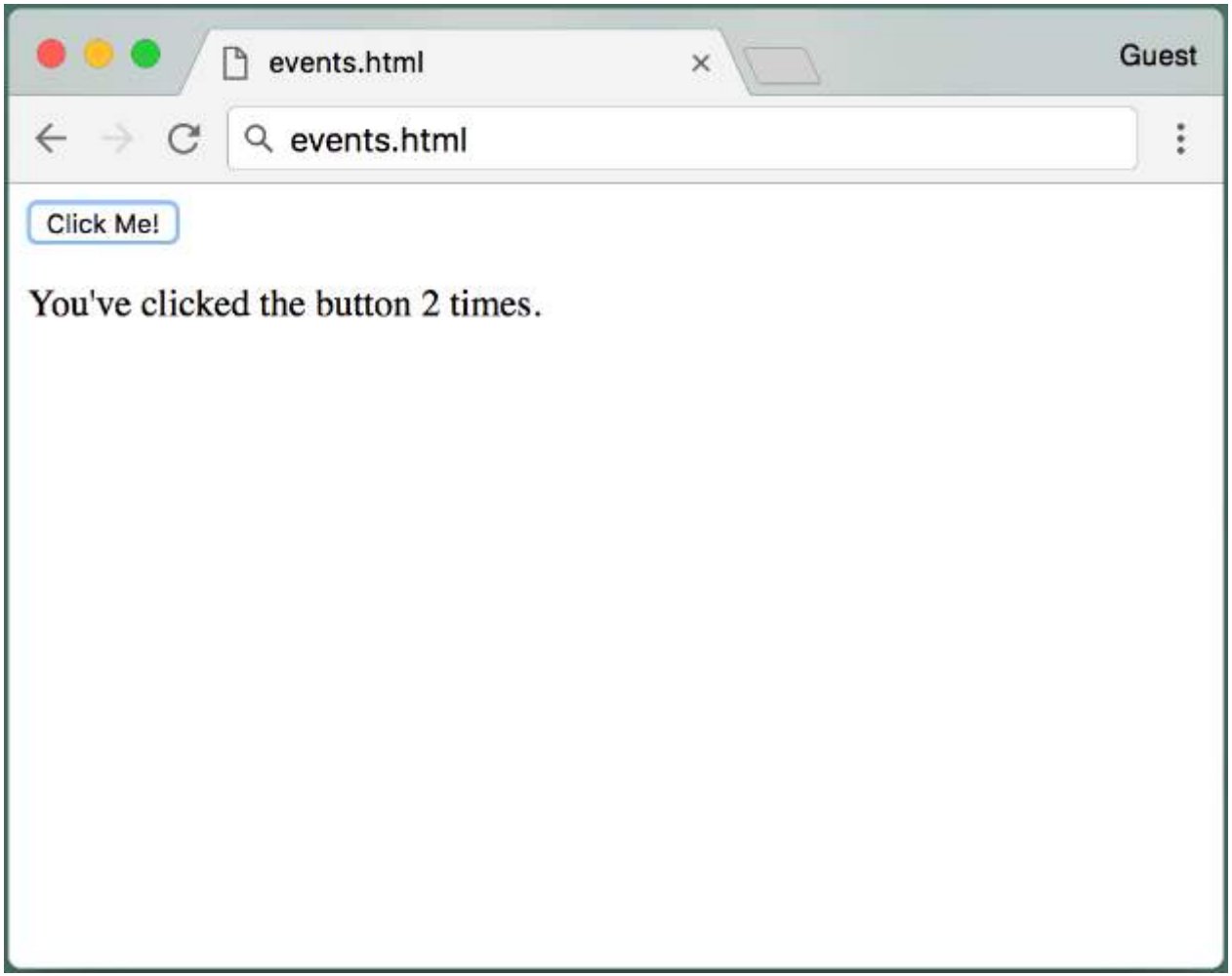
Click Me!
You've clicked the button 0 times.


events.html
Guest
events.html
Click Me!
You've clicked the button once.


events.html
Guest
events.html
Click Me!
You've clicked the button 2 times.

```
<html>
<body>

<button id="clickMe">Click Me!</button>
<p>
You've clicked the button <span id="numClicks">0 times</span>.

<script>
var clicks = 0;

function clickHandler() {
  clicks++;
  var numClicksSpan = document.getElementById('numClicks');
  if (clicks == 1)
    numClicksSpan.innerHTML = 'once';
  else
    numClicksSpan.innerHTML = clicks + ' times';
}

var button = document.getElementById('clickMe');
button.addEventListener('click', clickHandler);

</script>

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```

Event-Driven Programming

- Ordinarily we think of a program as a sequence of instructions and function calls
- **Event-Driven programming** is when a program's behavior is based on *events*
- In web programming, these events are generally user actions
- Different events/actions invoke different **callback functions** which handle that event/action

Event-Driven Programming

- Event-Driven programming is a form of asynchronous programming

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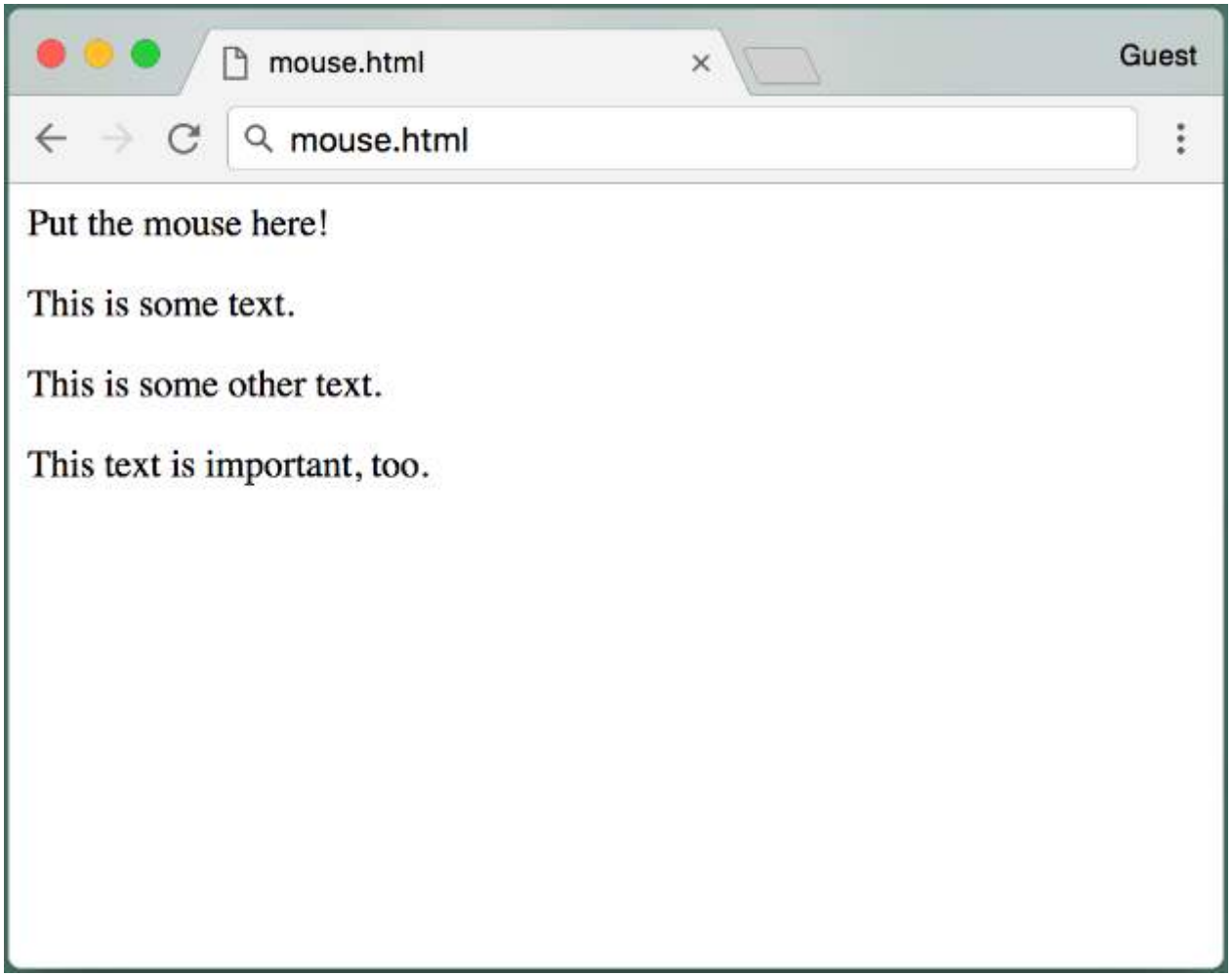
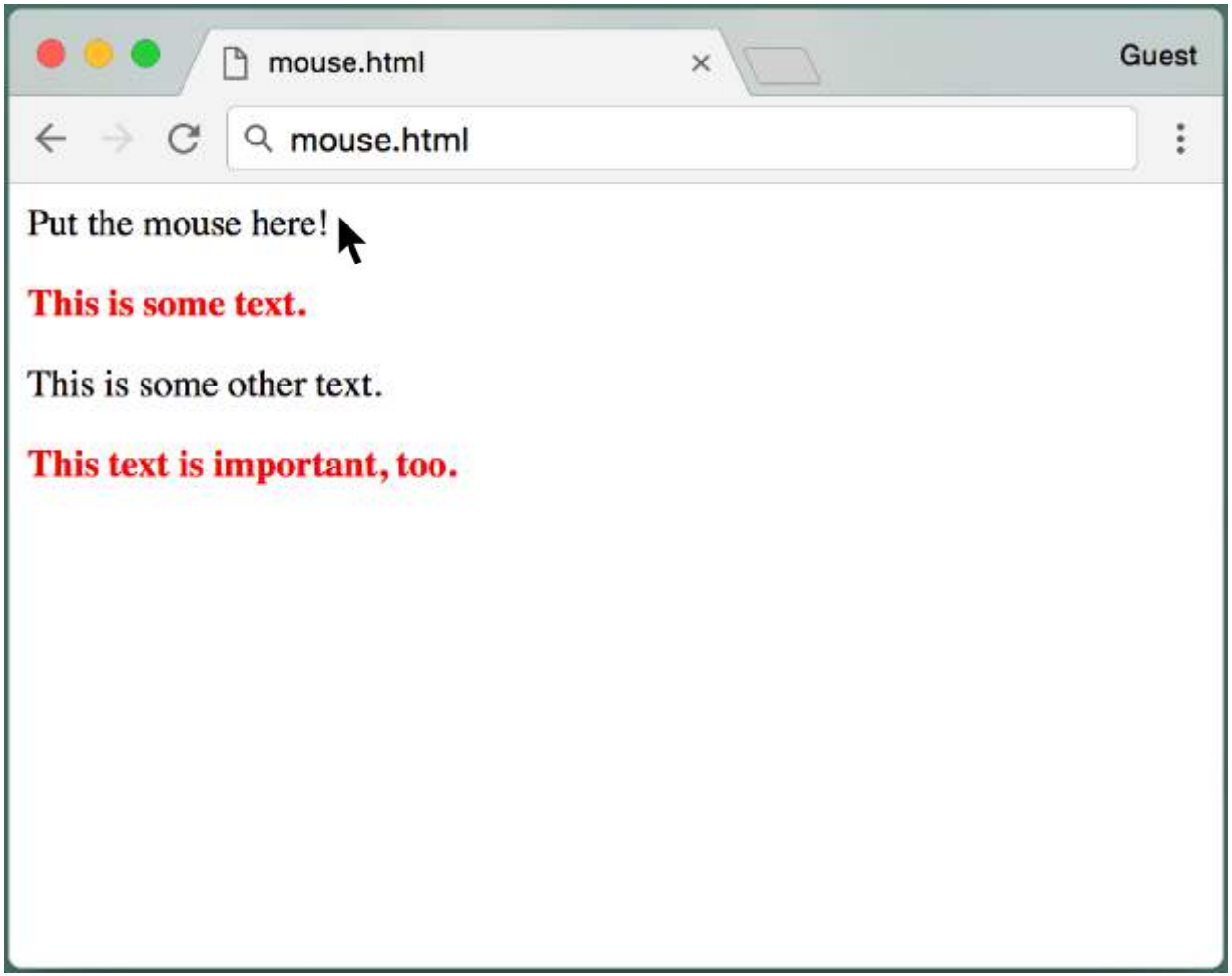
  - Synchronous Way:
    - You are expecting a user input
    - You continuously re-check a text field until the user has put in the required information
    - You run some code on the user input

Event-Driven Programming

- Event-Driven programming is a form of asynchronous programming
  - Synchronous Way:
    - You are expecting a user input
    - You continuously re-check a text field until the user has put in the required information
    - You run some code on the user input
  - Event-Driven/Asynchronous Way:
    - You are expecting a user input
    - You tell your browser to let your program know when the user has put in the required information
    - You (possibly) run other code until your browser notifies you
    - When the user has entered the information, you run the associated callback function


mouse.html
Guest
mouse.html
Put the mouse here!
This is some text.
This is some other text.
This text is important, too.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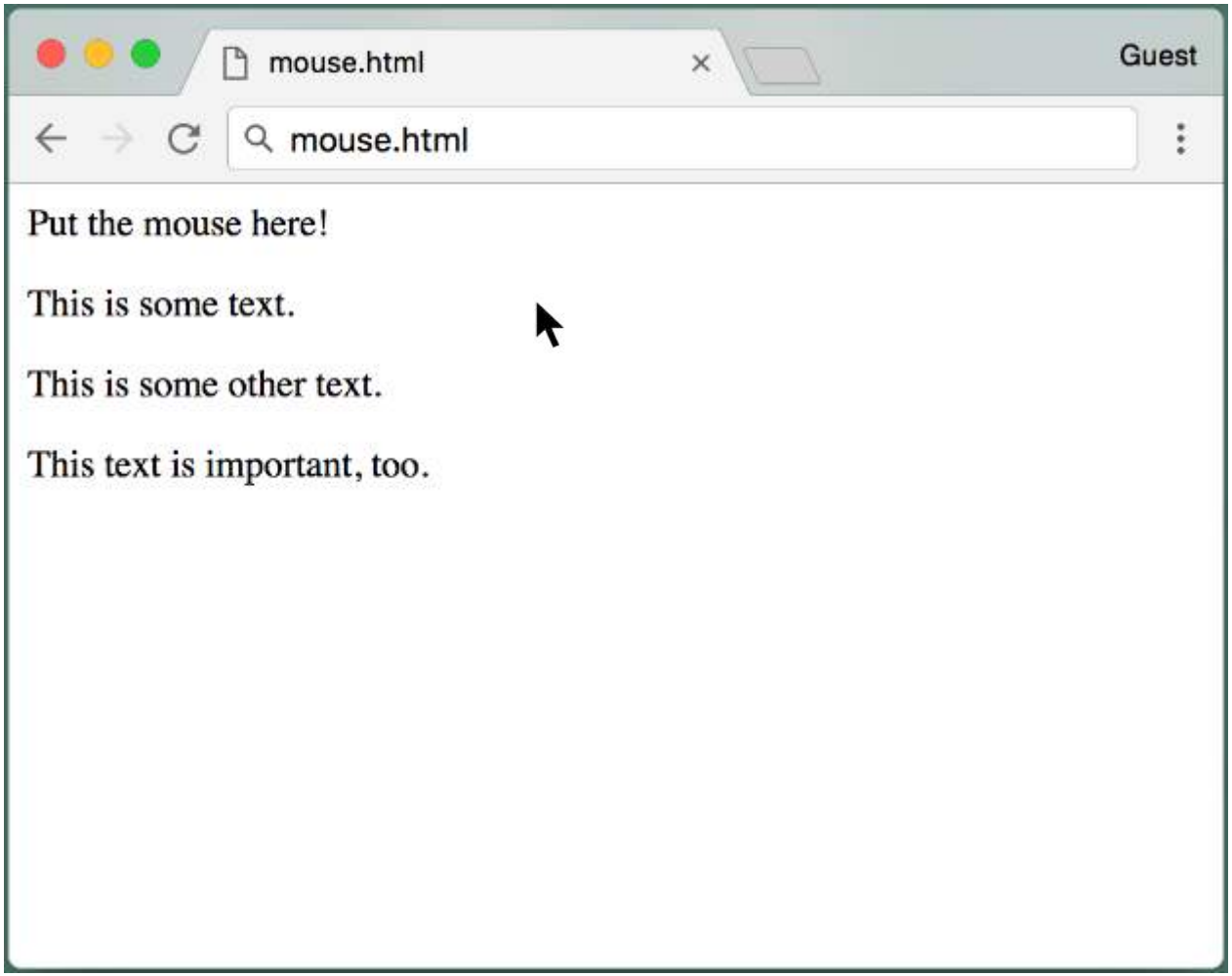
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<div id="mouseOverMe"> Put the mouse here! </div> <p>
<div class="highlightText"> This is some text. </div> <p>
<div> This is some other text. </div> <p>
<div class="highlightText"> This text is important, too.</div>

<script>
 function makeBold() {
   var divs = document.getElementsByClassName('highlightText');
   for (var i = 0; i < divs.length; i++) {
       divs[i].style.color = 'red';
       divs[i].style.fontWeight = 'bold';
   }
 }

 function restore() {
   var divs = document.getElementsByClassName('highlightText');
   for (var i = 0; i < divs.length; i++) {
       divs[i].style.color = 'black';
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 var mouseOverMeDiv = document.getElementById('mouseOverMe');
 mouseOverMeDiv.addEventListener('mouseover', makeBold);
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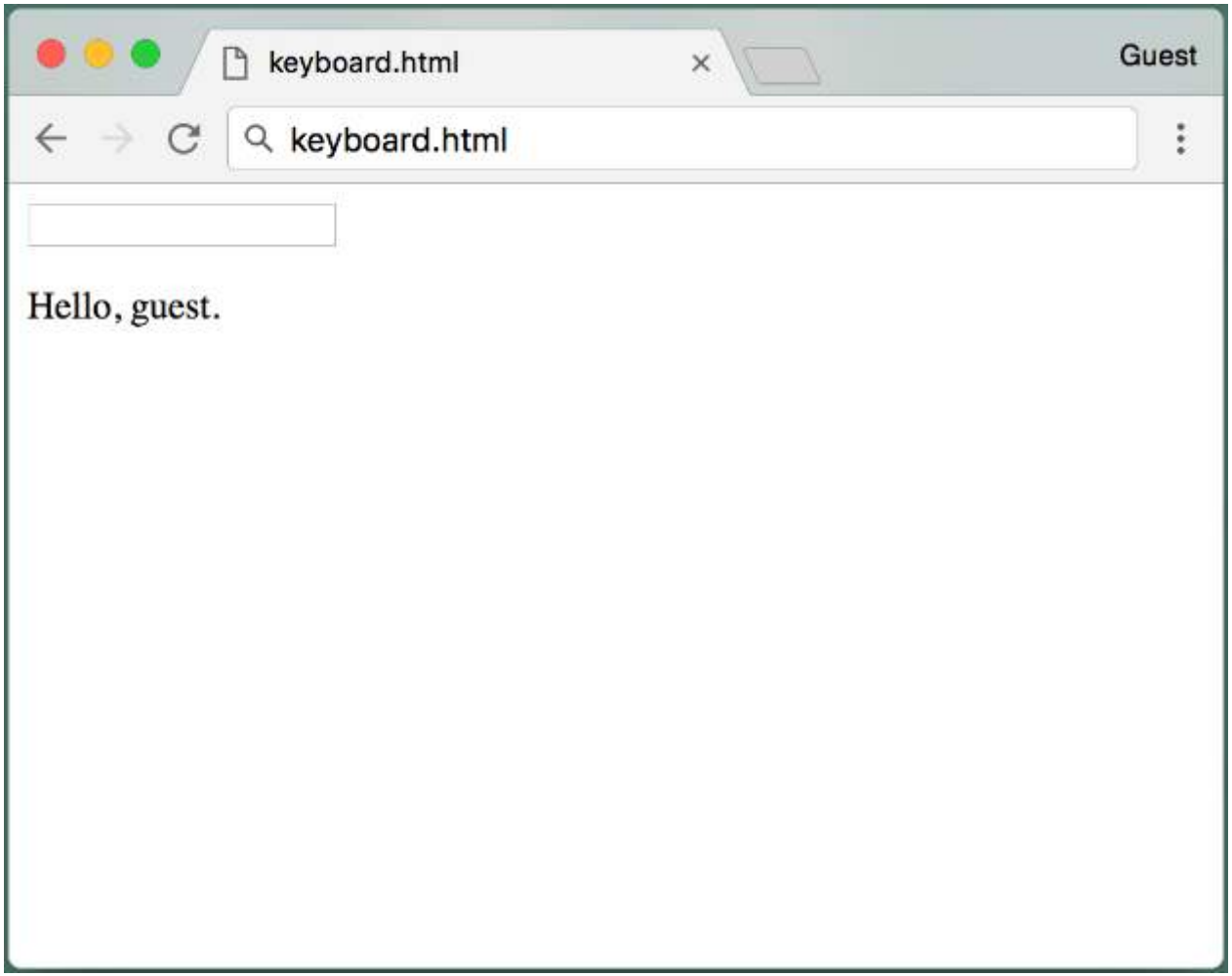
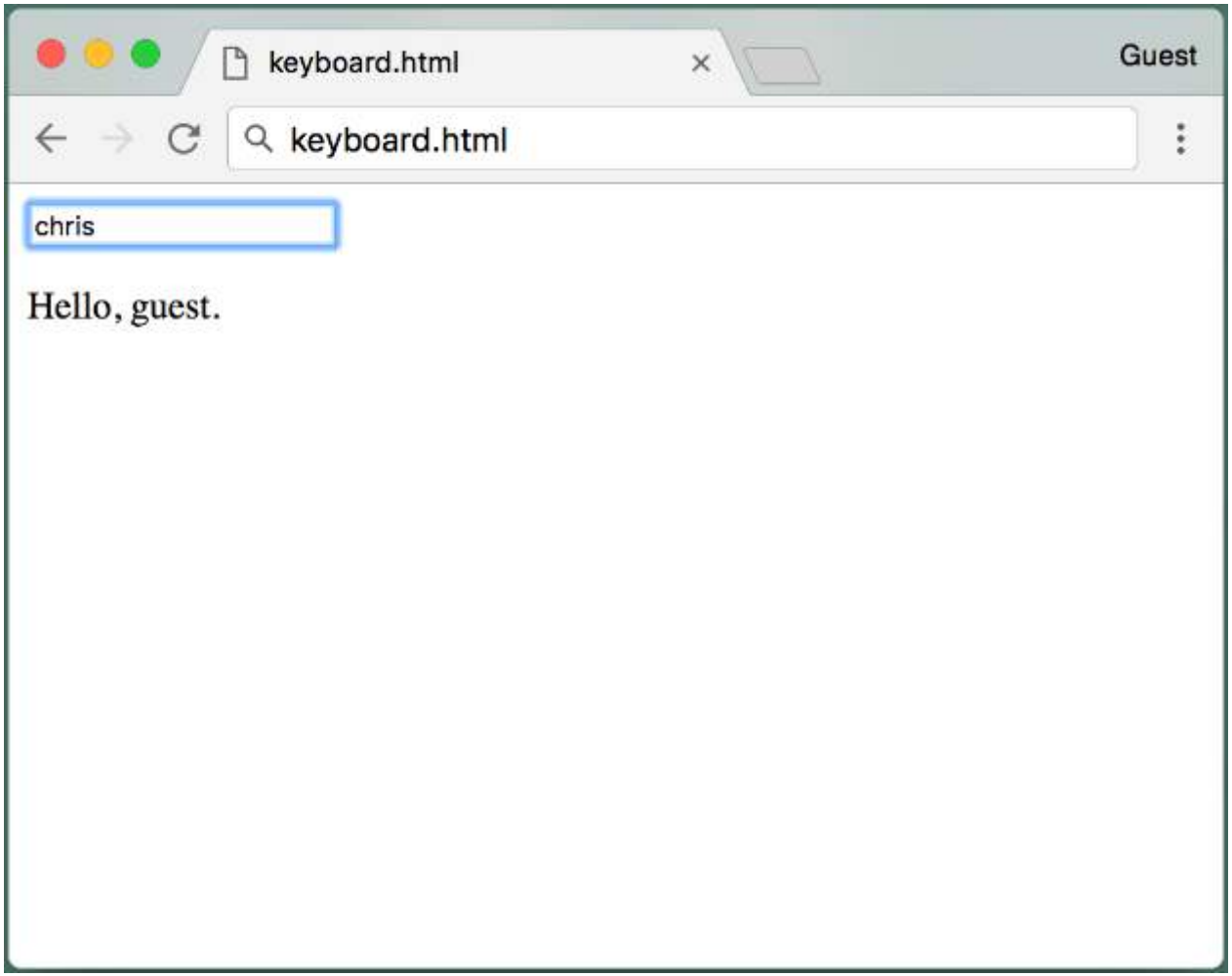

keyboard.html
Guest
keyboard.html
Hello, guest.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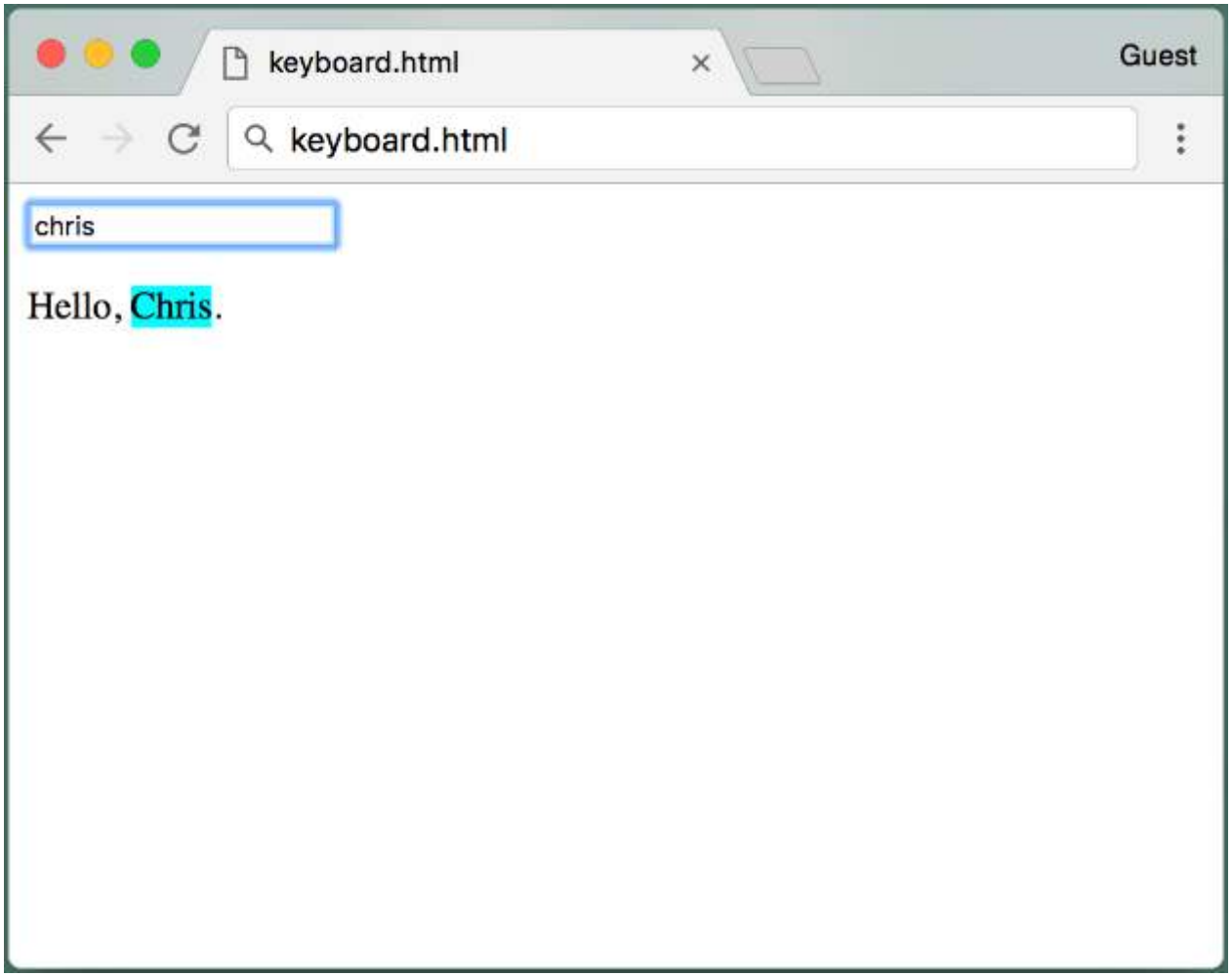
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Guest
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Hello, Chris.

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<html>
<body>

<input id="nameInput"></input>
<p>
Hello, <span id="nameField">guest</span>.

<script>

function nameHandler(e) {
  if (e.keyCode == 13) {
    var nameInput = document.getElementById('nameInput');
    var nameField = document.getElementById('nameField');
    nameField.innerHTML = nameInput.value;
    nameField.style.backgroundColor = 'cyan';
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document.addEventListener('keyup', nameHandler);

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Summary

- We can use **event-driven programming** in JavaScript to modify HTML based on user activity

- We do this by defining **callback functions** and associating them with various events by adding event listeners
  - *element*.addEventListener(*event*, *function*)
  - Events: ‘click’, ‘mouseover’, ‘mouseout’, ‘keyup’

Video 2.9
Chris Murphy

Review

- Previously we've seen how to use JavaScript, the DOM, and event-driven programming to modify HTML based on user activity

- However…
  - different browsers may work in different manners
  - the syntax can be a bit clunky
  - many features are hard to implement

- Is there an easier way?

jQuery

- Simplifies JavaScript usage on webapps
- More intuitive way of DOM manipulation
- Great cross-browser support (Except IE6)
- Additional Utilities
- Effects and Animations
- Customizable plugins

Using jQuery

- Download the latest version of jQuery from jquery.com

- Add the downloaded .js file to your HTML webpage using a script tag
  - `<script src="jQueryFile.js"></script>`

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  - `$("div")` selects all elements
  - **`$(".title")` selects all elements with class="title"**

Selecting DOM Elements

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  - `$("*")` selects all elements
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  - `$("div")` selects all elements
  - `$(".title")` selects all elements with class="title"
  - **`$("#name")` selects the element with id="name"**

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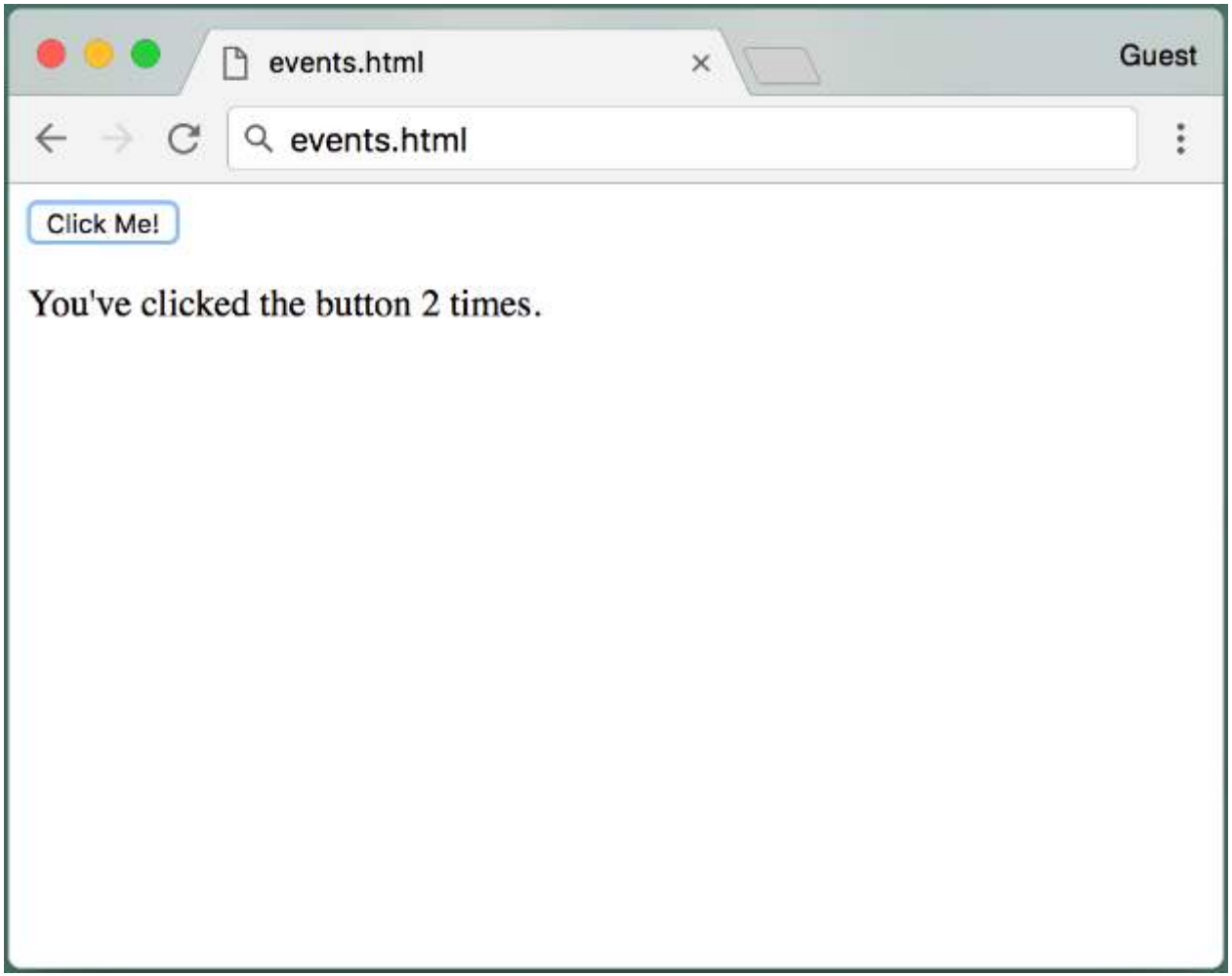
- To add an event listener to an element, the general format is `$(selector).event(callback)`


events.html
Guest
events.html
Click Me!
You've clicked the button 2 times.

```
<html>
<head><script src="jquery.js"></script></head>
<body>
<button id="clickMe">Click Me!</button>
<p>
You've clicked the button <span id="numClicks">0 times</span>.

<script>
var clicks = 0;

function clickHandler() {
  clicks++;
  var numClicksSpan = document.getElementById('numClicks');
  if (clicks == 1)
    numClicksSpan.innerHTML = 'once';
  else
    numClicksSpan.innerHTML = clicks + ' times';
}

var button = document.getElementById('clickMe');
button.addEventListener('click', clickHandler);

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var clicks = 0;

function clickHandler() {
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  var numClicksSpan = document.getElementById('numClicks');
  if (clicks == 1)
    numClicksSpan.innerHTML = 'once';
  else
    numClicksSpan.innerHTML = clicks + ' times';
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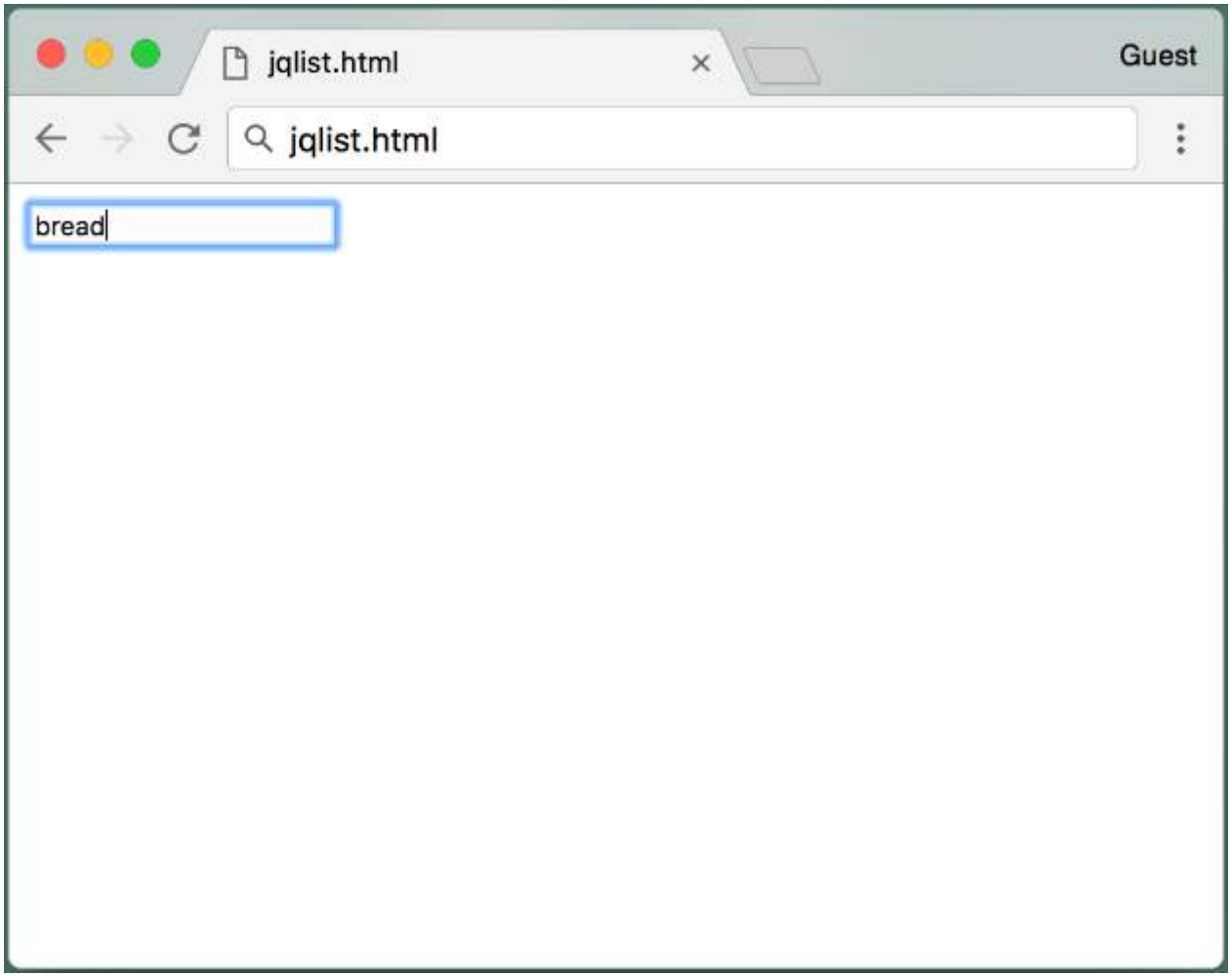
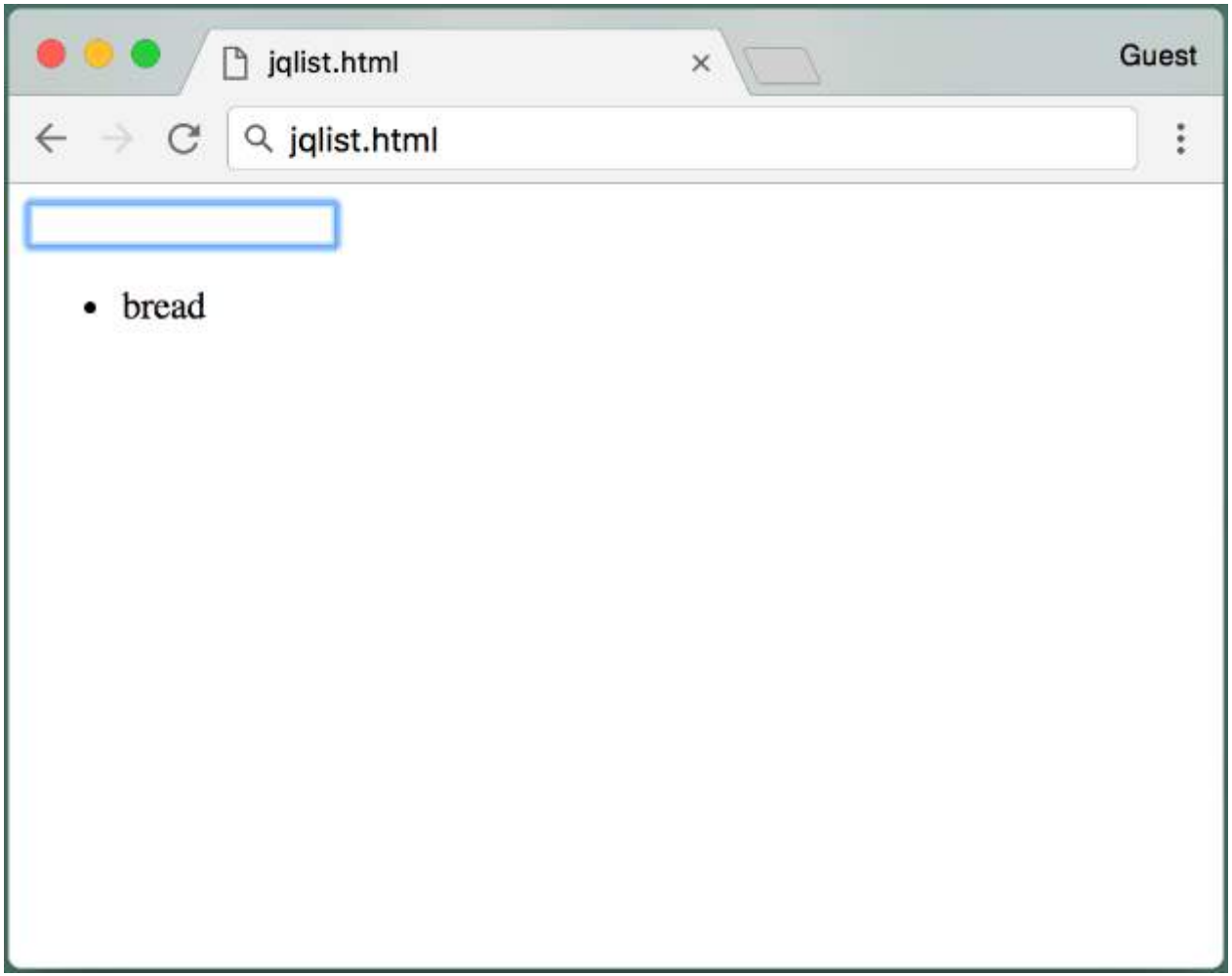

jqlist.html
Guest
jqlist.html
bread


jqlist.html
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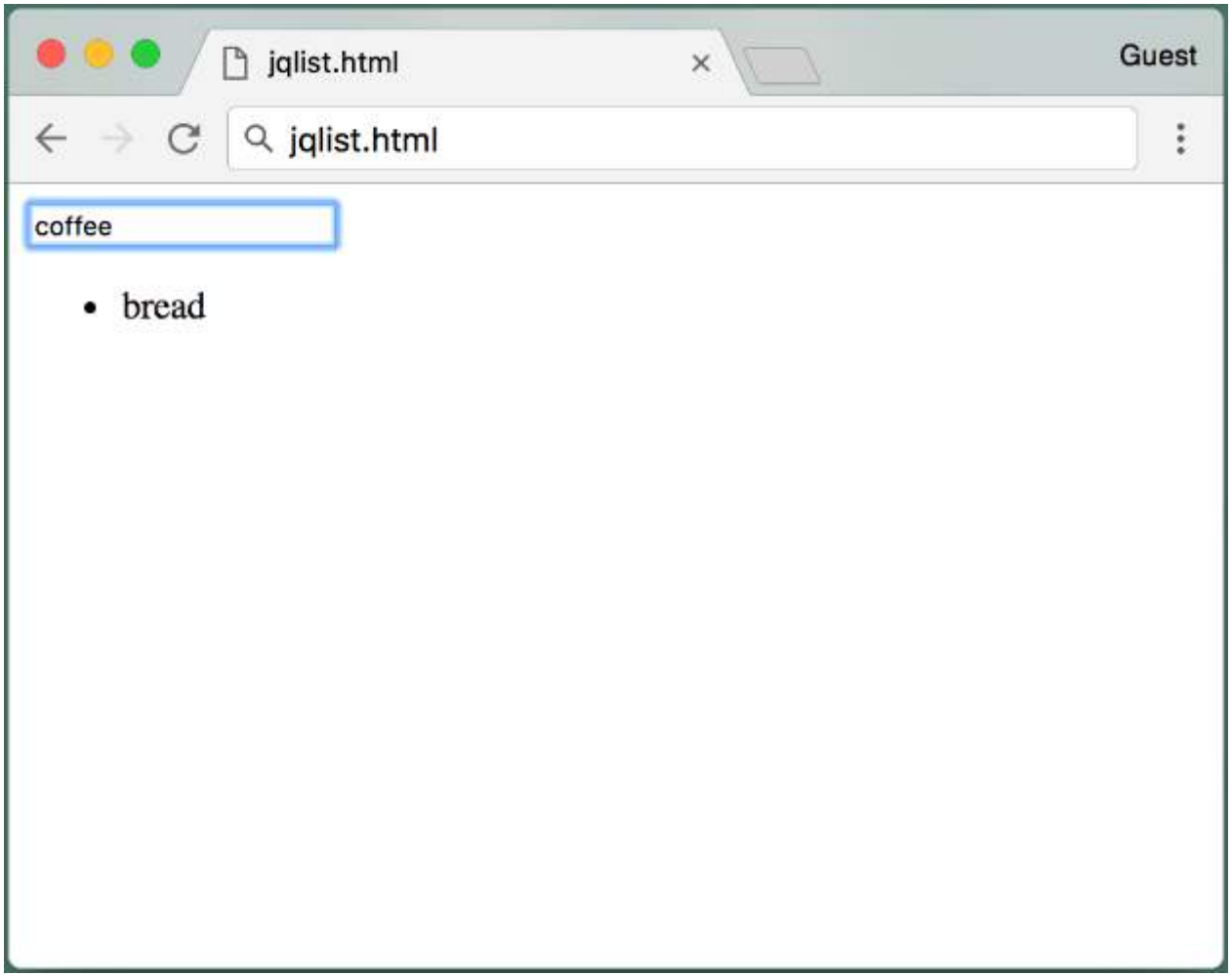
jqlist.html
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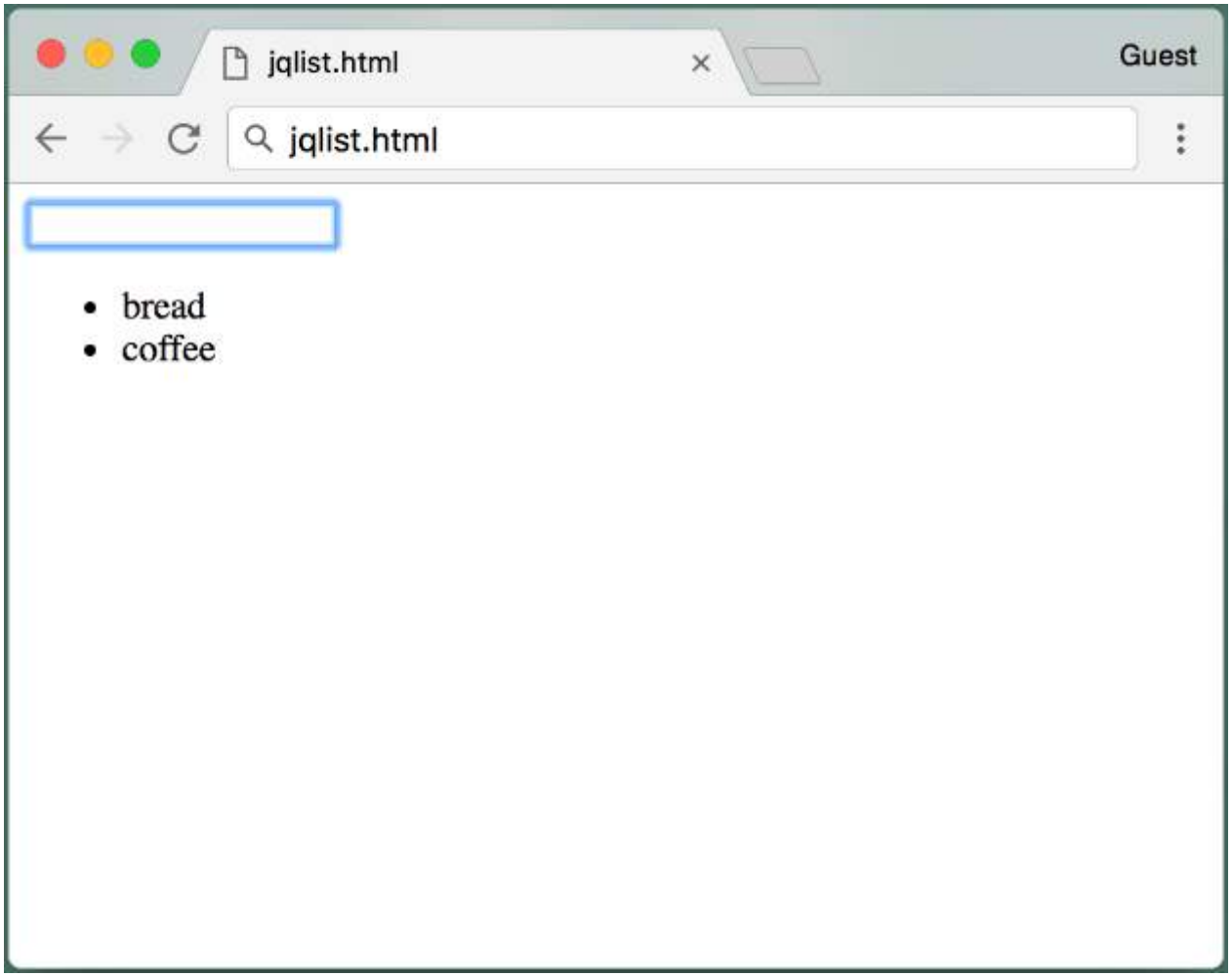
jqlist.html
Guest
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bread
coffee

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<html>
<head><script src="jquery.js"></script></head>

<body>
<input id="itemField"></input>
<p>

<ul>
<span id="list"></span>
</ul>

<script>
function keyPressHandler(e) {
  if (e.keyCode == 13) {
    $('#list').append('<li>'  + $('#itemField').val() + '</li>');
    $('#itemField').val('');
  }
}

$('#itemField').keyup(keyPressHandler);

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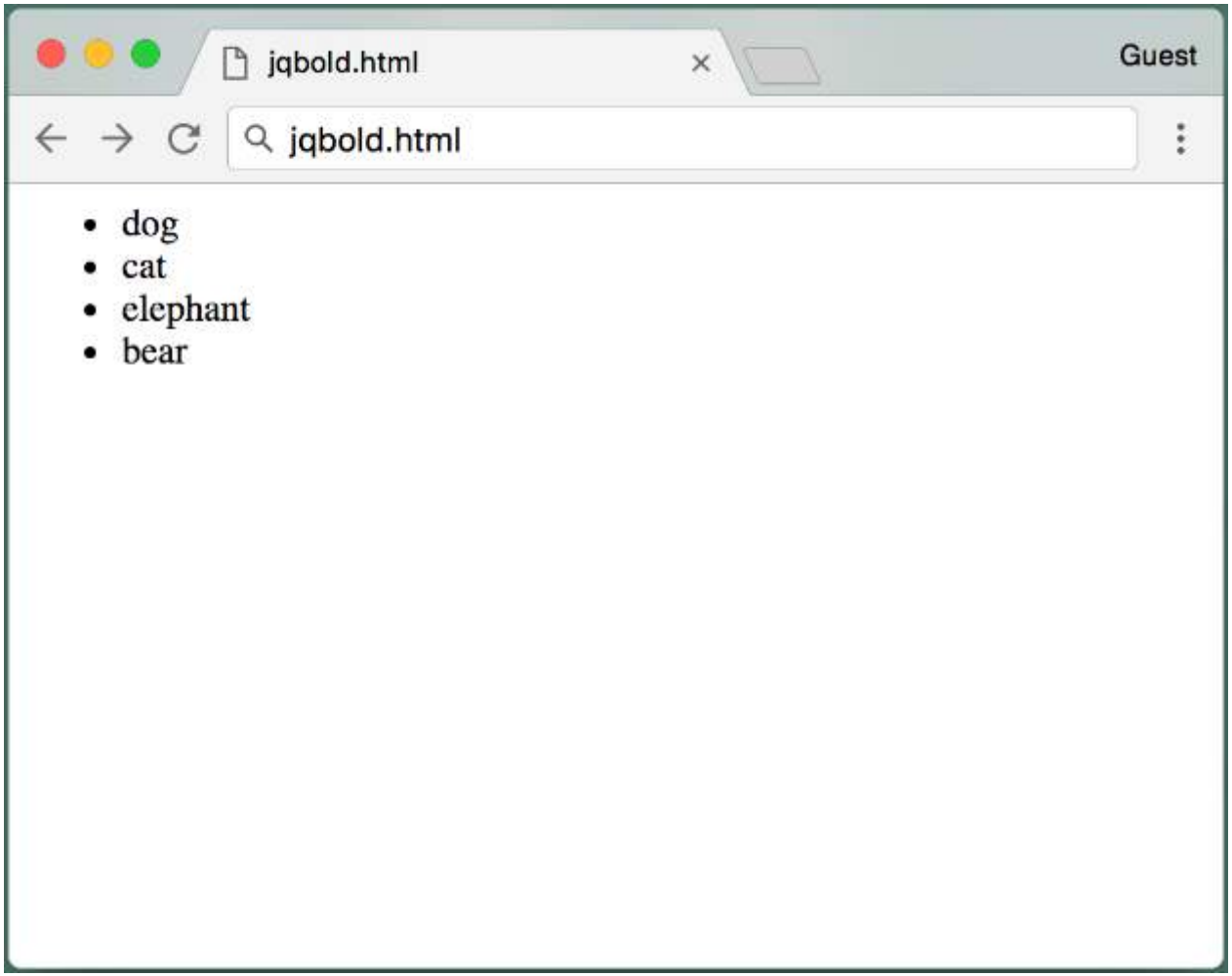
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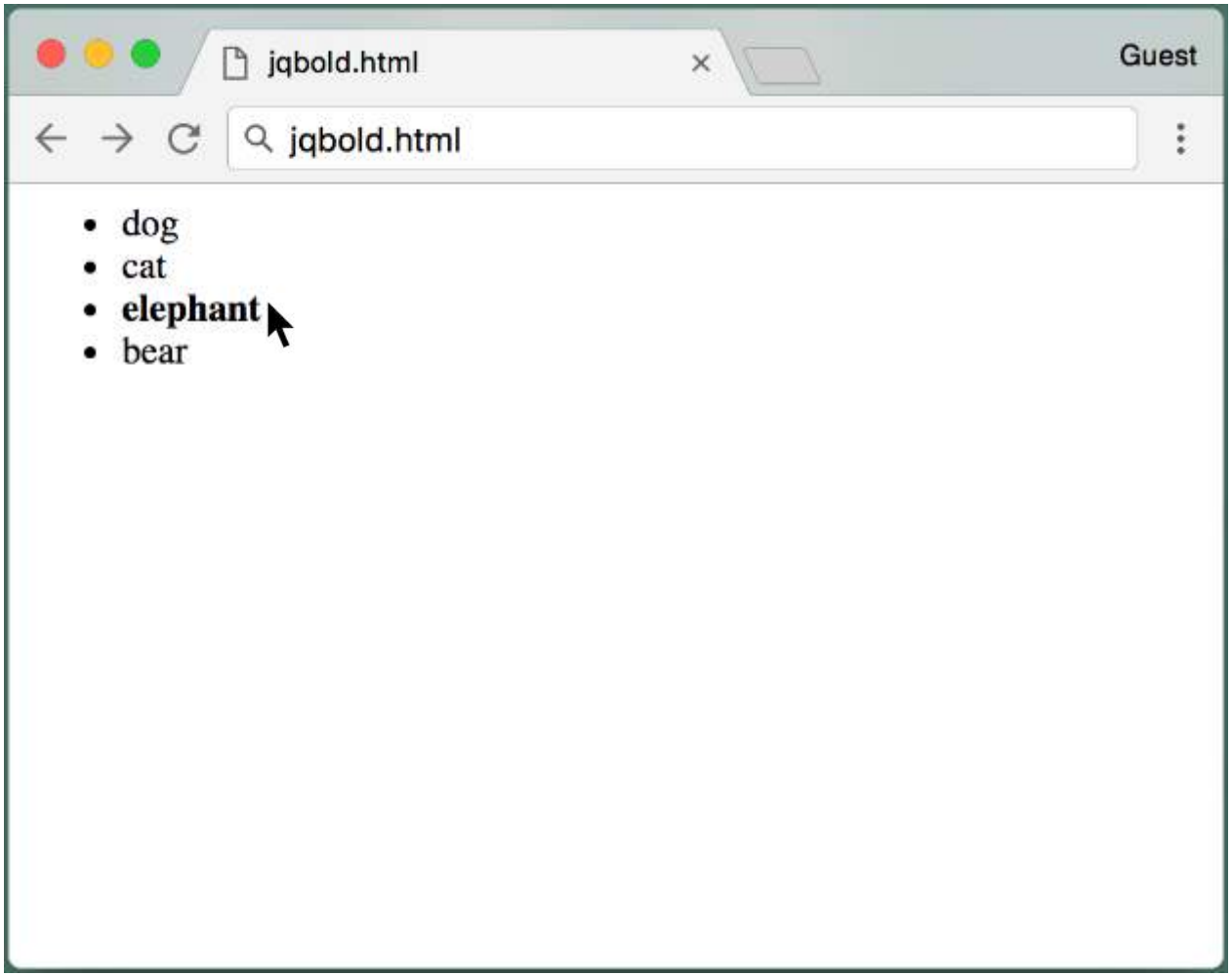
Guest
jqbold.html
dog
cat
elephant
bear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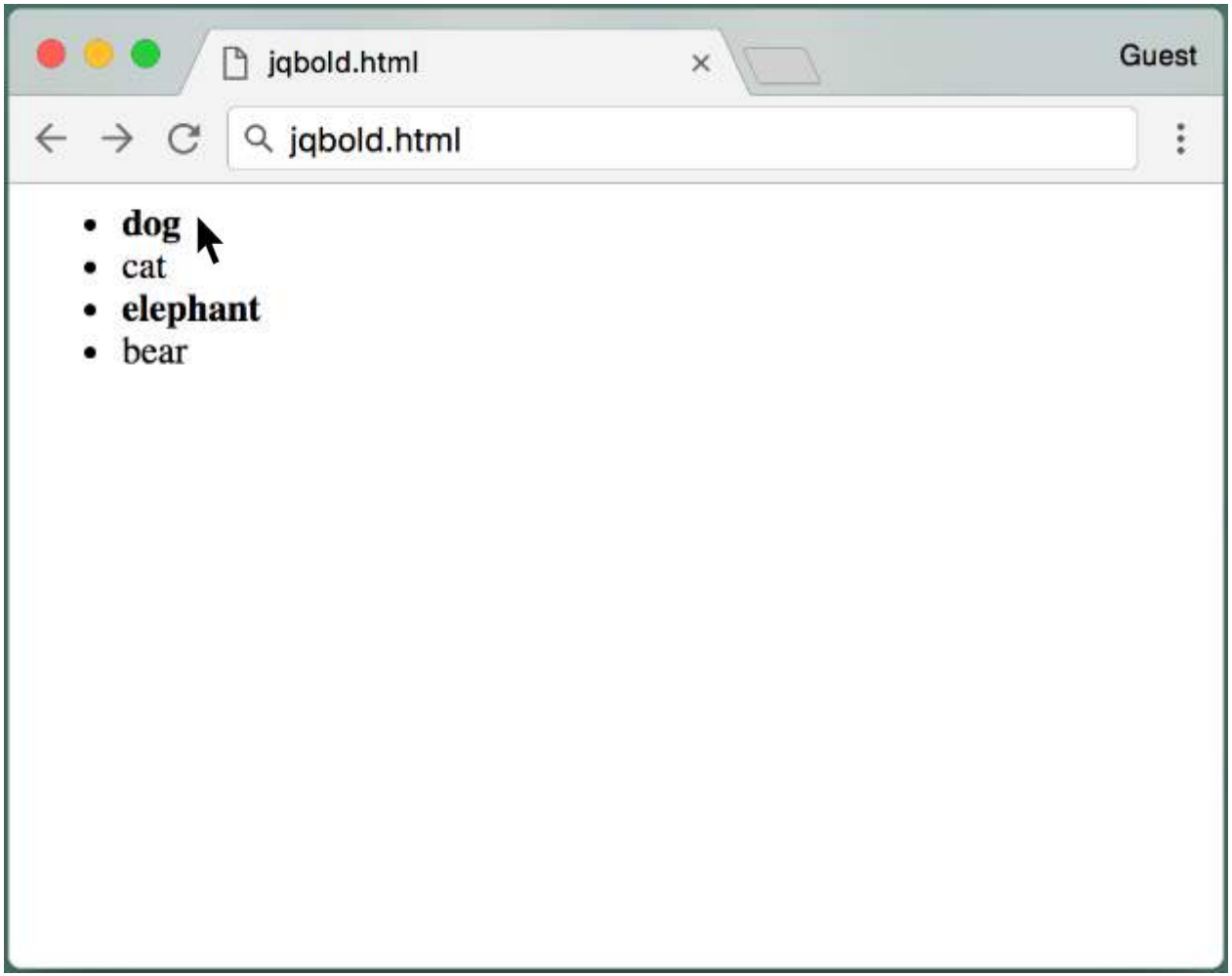
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<body>

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<li>cat</li>
<li>elephant</li>
<li>bear</li>
</ul>

<script>

$('li').click(function() {
  $(this).css('font-weight', 'bold');
});

</script>

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Summary

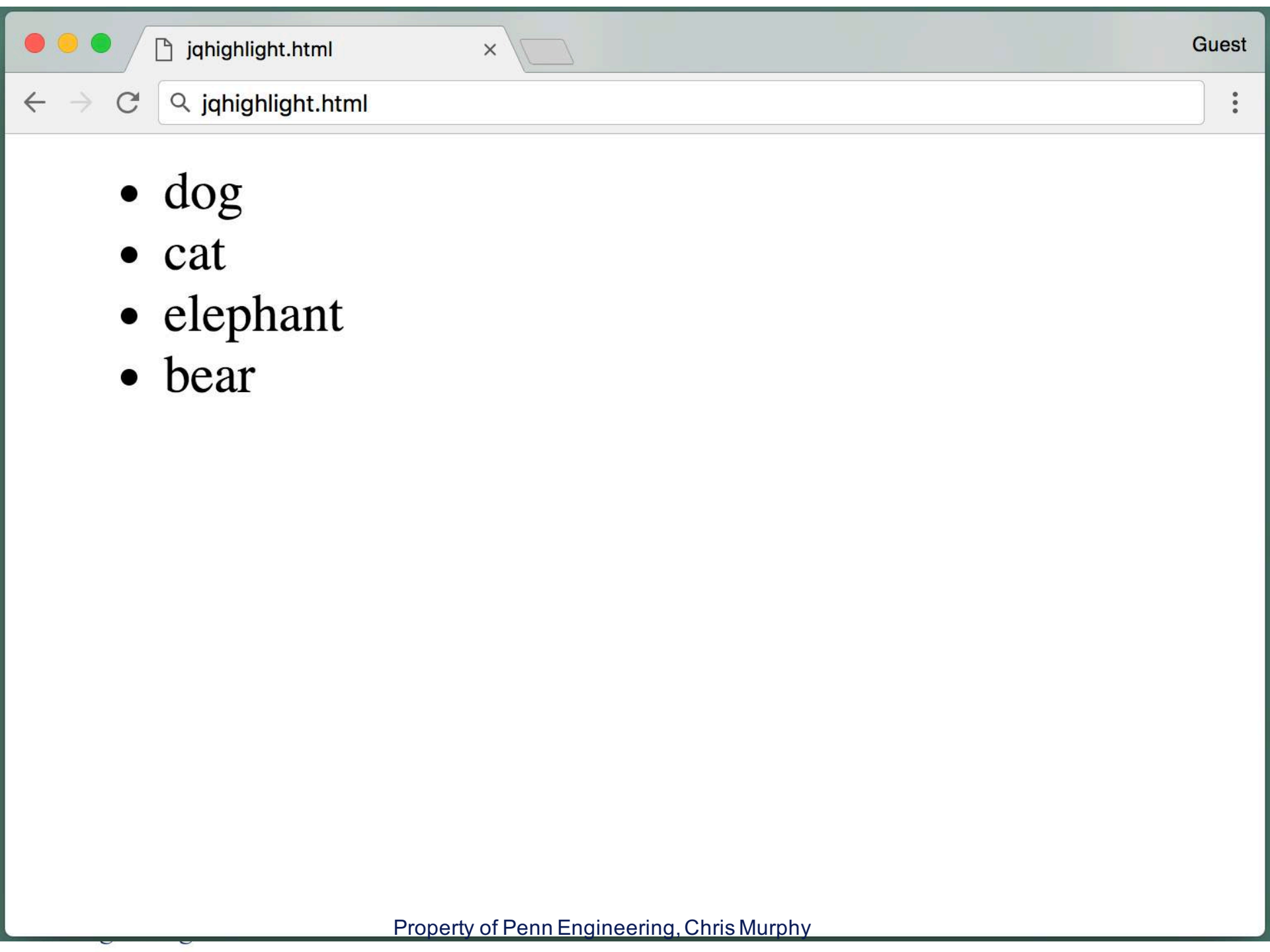
- jQuery is a powerful library that allows us to select DOM elements using CSS notation
- We can then modify their content and appearance programmatically
- We can also register event listeners for different elements

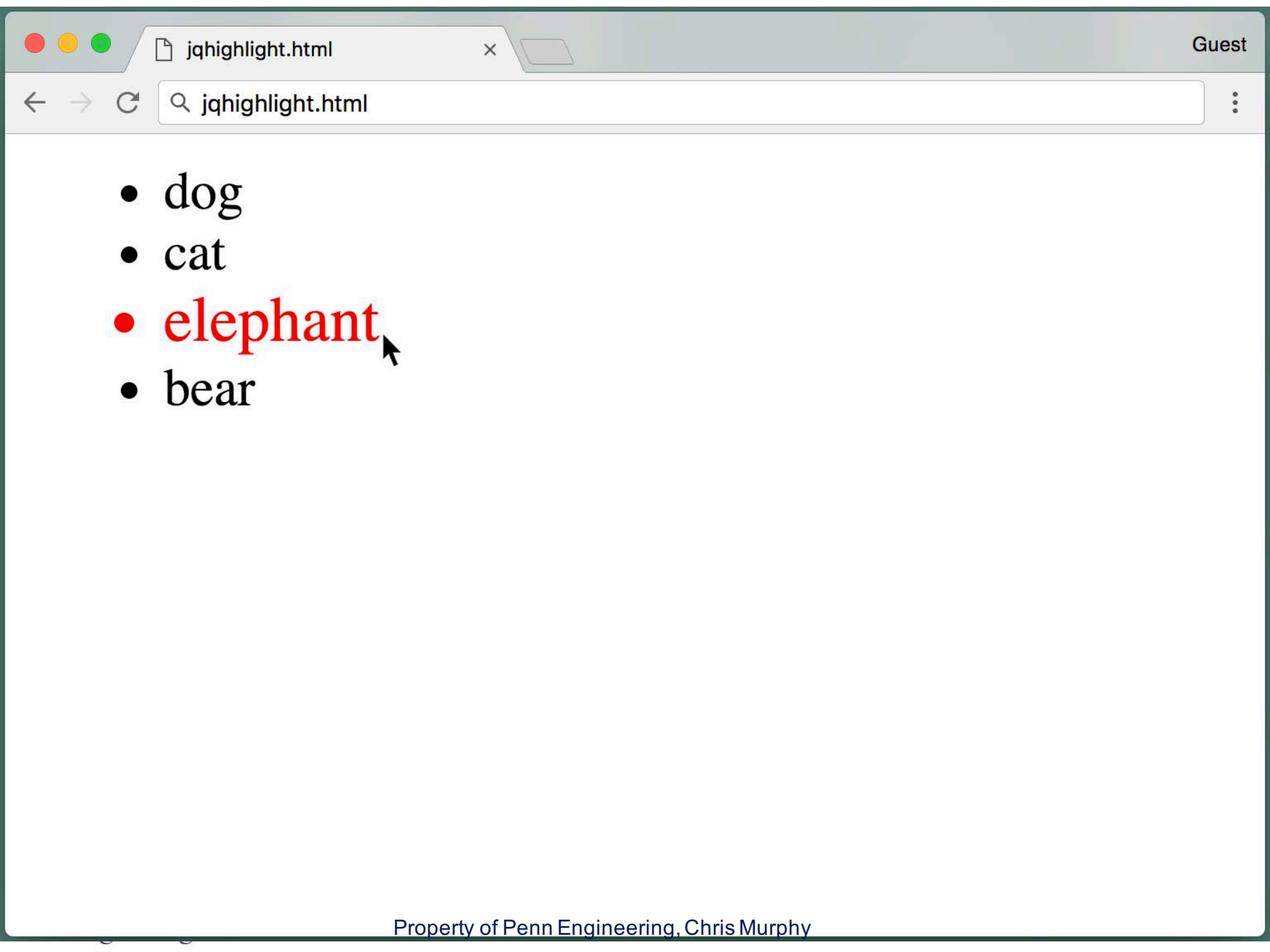
Video 2.10
Chris Murphy

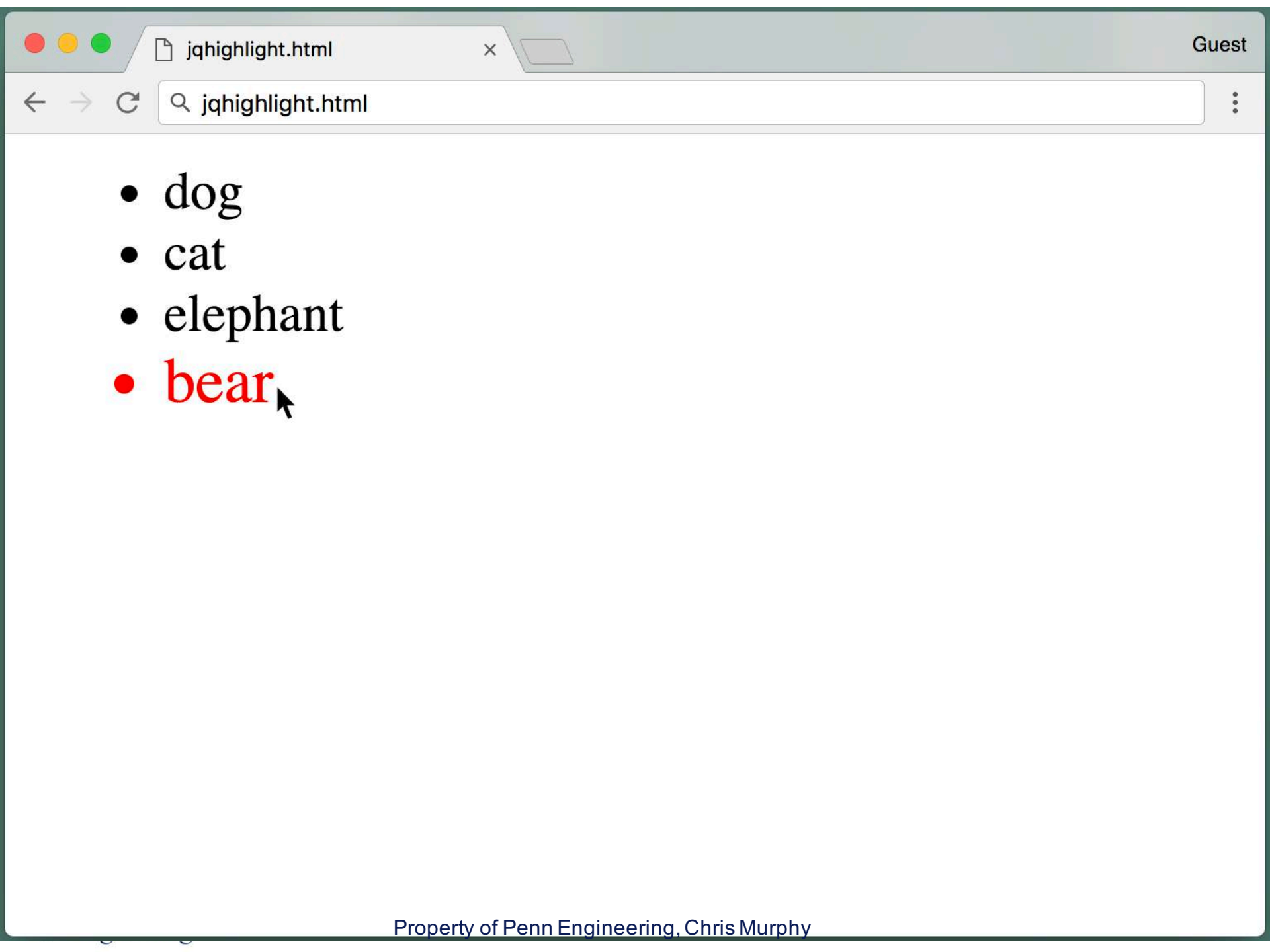
Review

- Previously we saw how to use jQuery to select and modify DOM elements and add event listeners

- How else can we specify selectors and add event listeners?







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<script>

$('li').hover(
  function() {
    $(this).css('color', 'red');
    $(this).css('font-size', '120%');
  },
  function() {
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    $(this).css('font-size', '100%');
});

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<li>bear</li>
</ul>

<script>
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    $(this).css('font-size', '120%');
  },
  mouseleave: function() {
    $(this).css('color', 'black');
    $(this).css('font-size', '100%');
  },
  click: function() {
    $(this).css('background-color', 'yellow');
  }
});
</script>

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```

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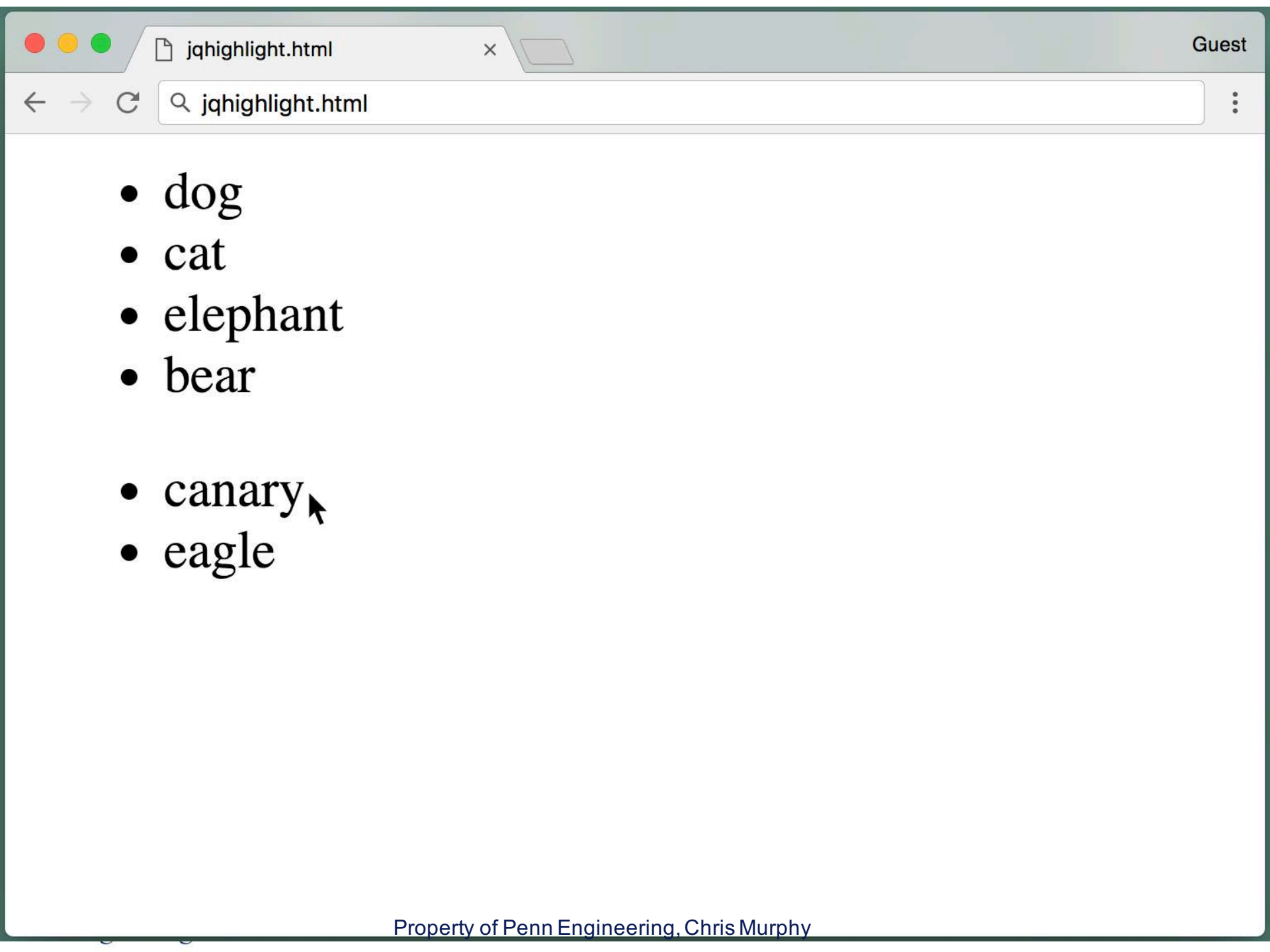

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<body>
<ul>
<li class="highlight">dog</li>
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</ul>

<ul>
<li>canary</li>
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</ul>

<script>

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- `$(someNodes).find(selector)` will search *someNodes*' children for selector.

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Advanced Selectors

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  - `$("div.book")` selects the div with class="book"
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  - `$("p:hidden")` selects all `<p>` elements that are visually hidden

Advanced Selectors

- `$(someNodes).find(selector)` will search *someNodes*' children for selector.
- **$** selectors can be chained
  - `$("div.book")` selects the div with class="book"
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- : can be used to specify element properties
  - `$("p:hidden")` selects all `<p>` elements that are visually hidden
- These selectors are all CSS selectors!
  - All other CSS selectors also work in **$**

Summary

- jQuery can be used to retrieve and modify DOM elements and add event listeners

- We can use advanced selectors and handlers to simplify functionality

Video 2.11
Chris Murphy

Review

- Previously we saw how to use jQuery to retrieve and modify DOM elements and add event listeners

- What other types of events can we handle?

User Events in the Browser

Event Type	Events
Mouse	click, dblclick, mousedown, mouseup, mouseover, mouseout

User Events in the Browser

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Mouse	click, dblclick, mousedown, mouseup, mouseover, mouseout
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User Events in the Browser

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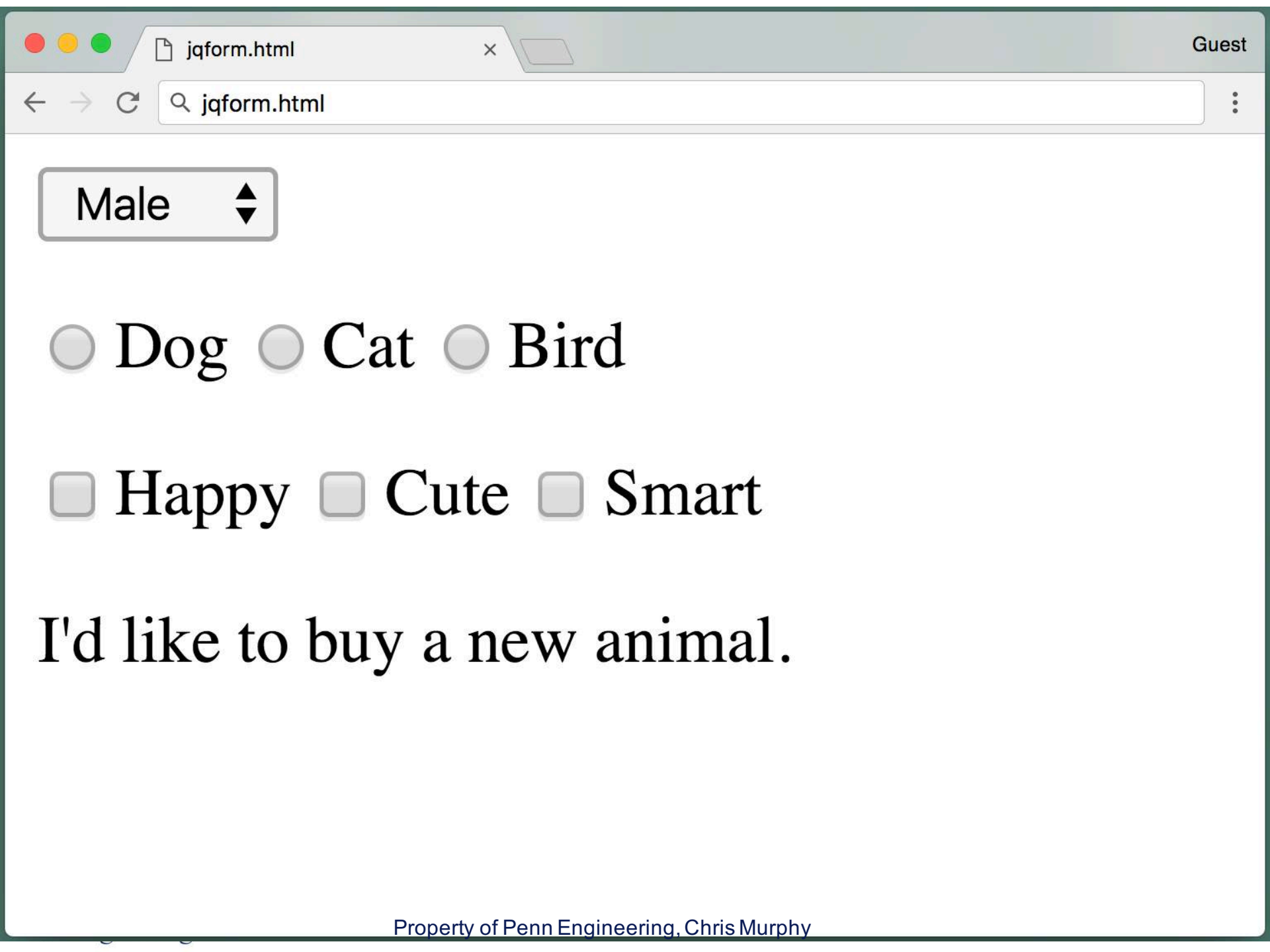
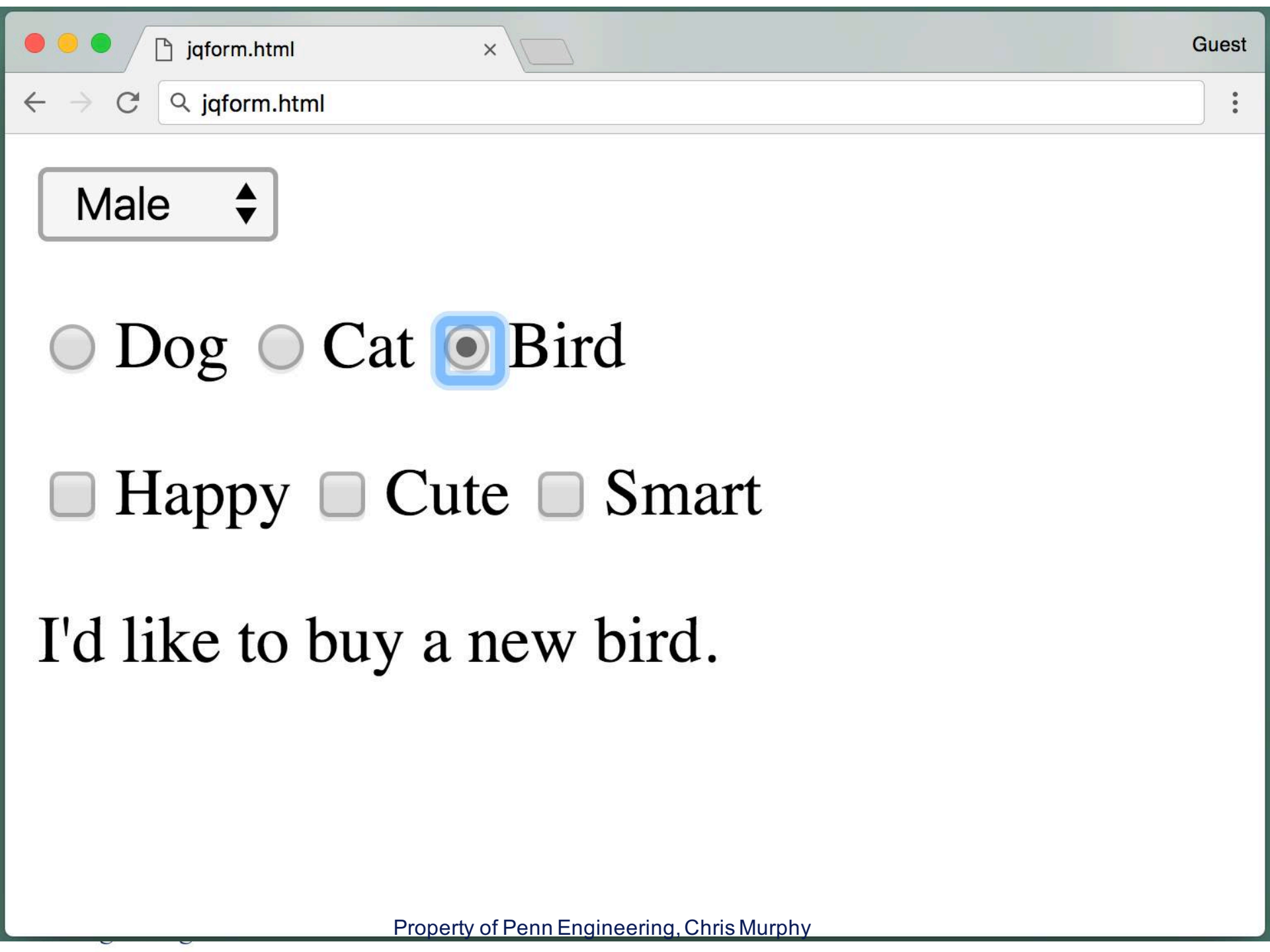
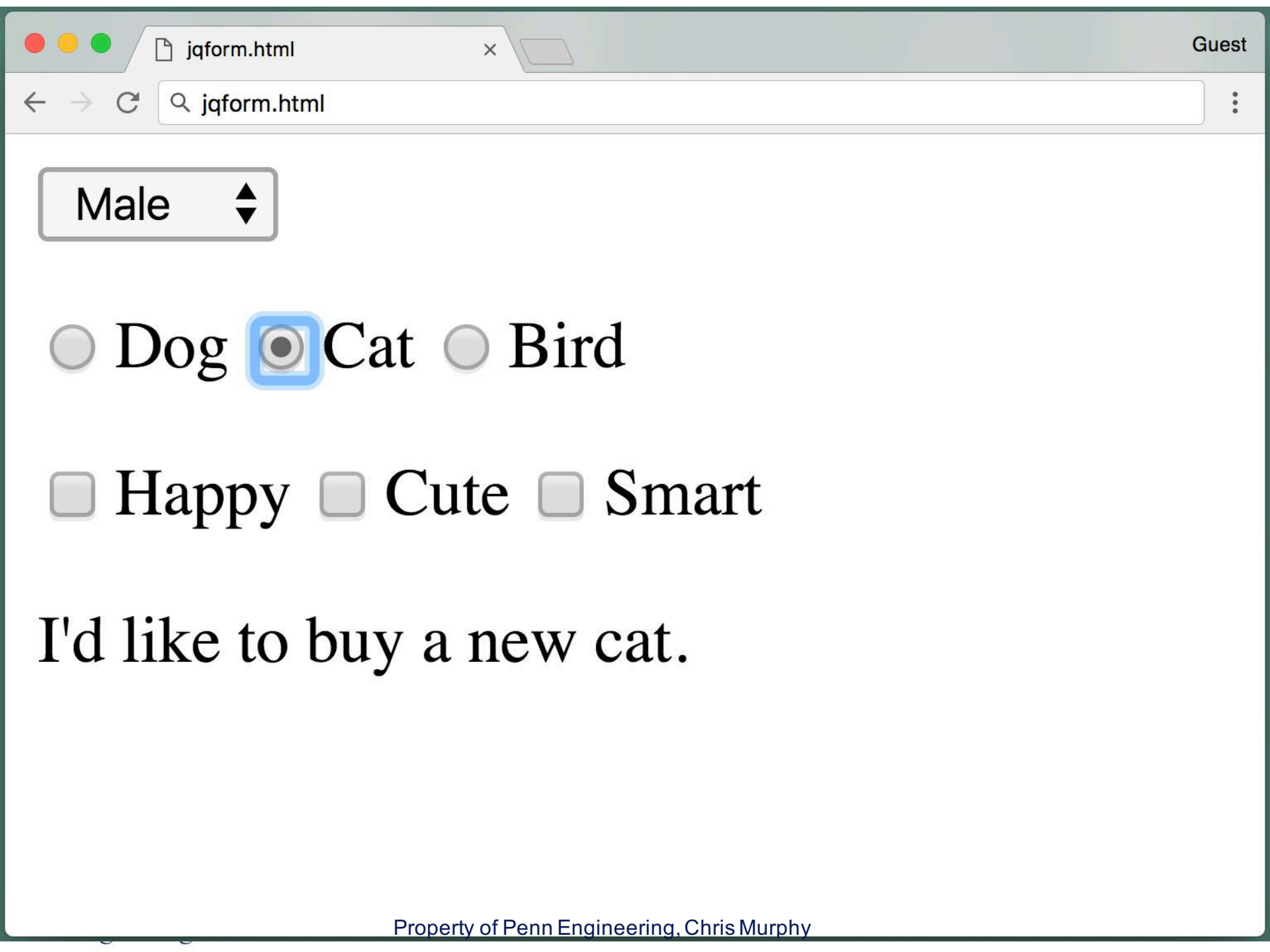
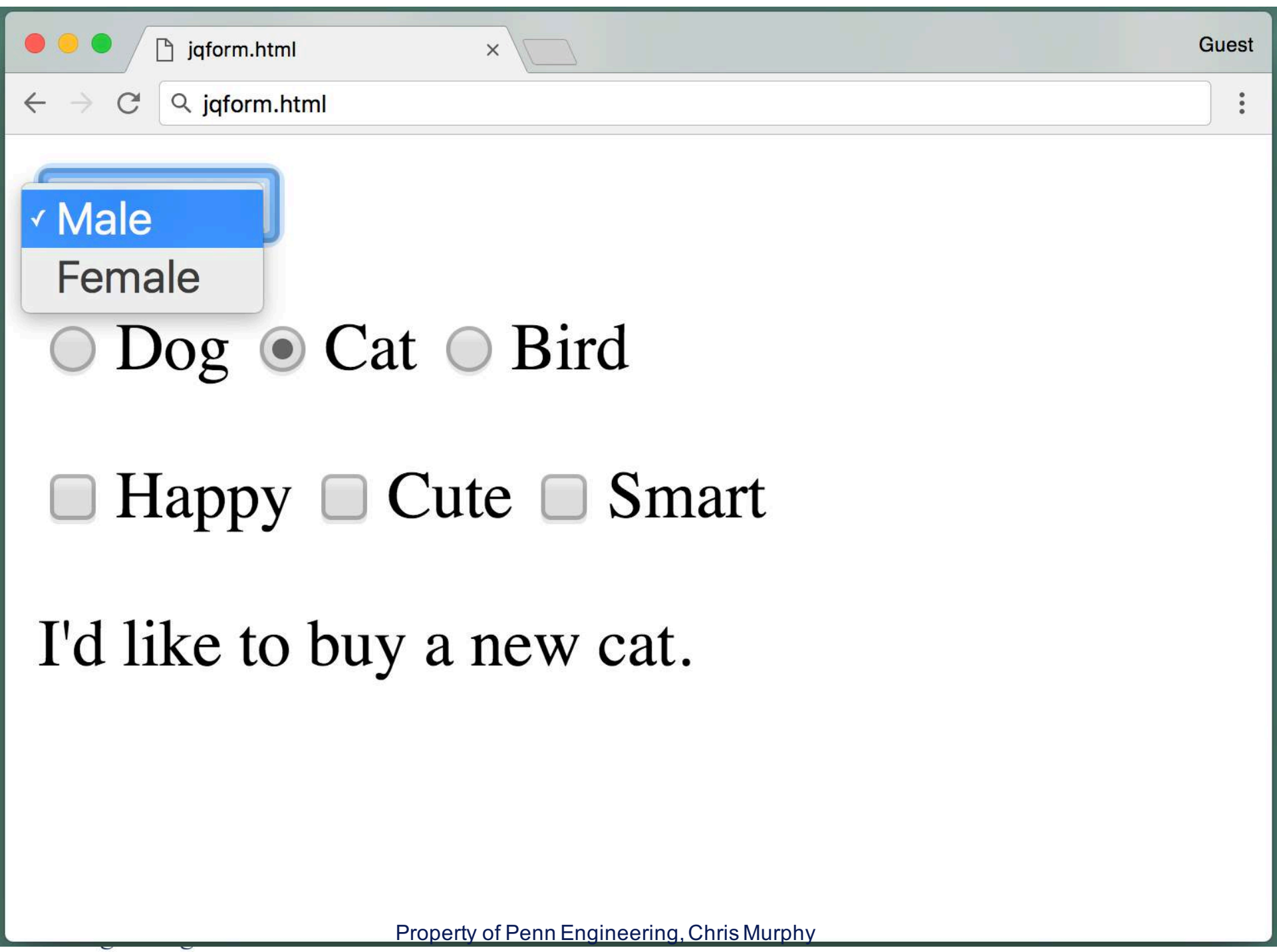
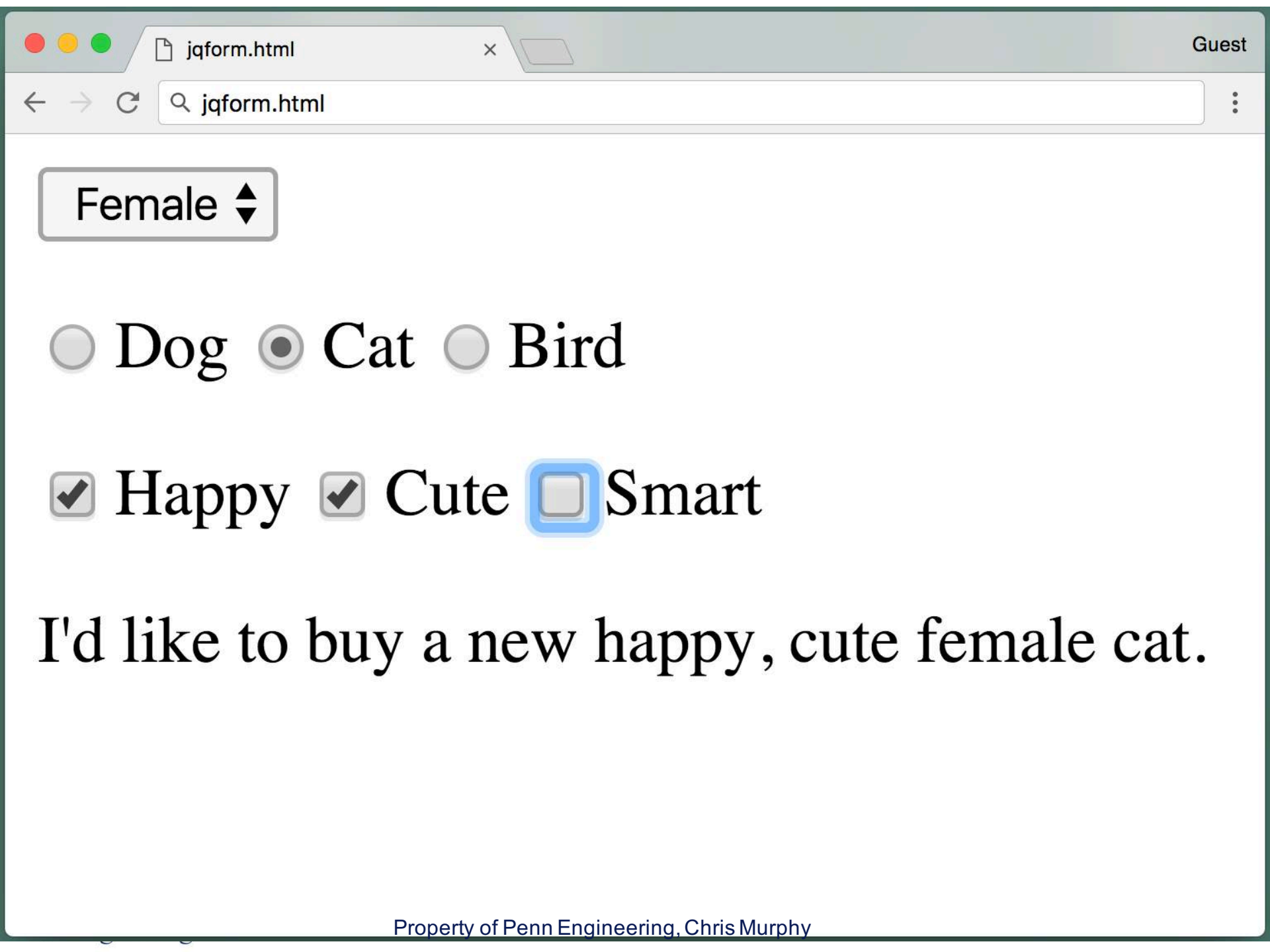
Keyboard	keydown, keypress, keyup
Form	focus, blur, change, reset, submit
Window / Element	load, resize, scroll, unload











```
<head>
<script src="jquery.js"></script>
</head>

<body>

<form>

<select name="choose">
  <option value="male">Male</option>
  <option value="female">Female</option>
</select>
<p>
<input type="radio" name="species" value="dog">Dog</input>
<input type="radio" name="species" value="cat">Cat</input>
<input type="radio" name="species" value="bird">Bird</input>
<p>
<input type="checkbox" value="happy">Happy</input>
<input type="checkbox" value="cute">Cute</input>
<input type="checkbox" value="smart">Smart</input>

</form>

<p>
I'd like to buy a new <span id="featureSpan"></span>
<span id="genderSpan"></span> <span id="speciesSpan">animal</span>.
```

```
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<input type="checkbox" value="cute">Cute</input>
<input type="checkbox" value="smart">Smart</input>

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    }
    else { // this element was unchecked
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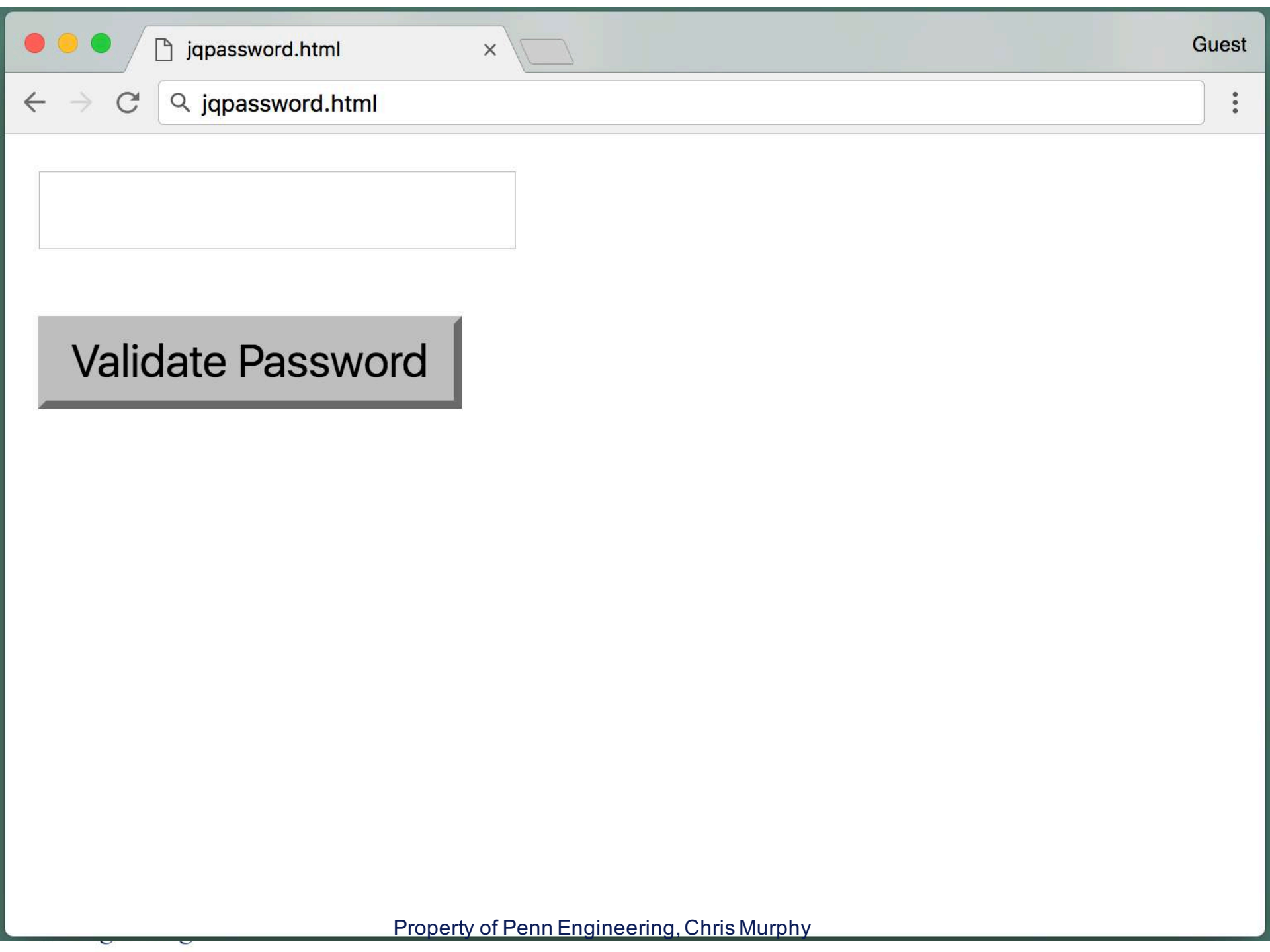

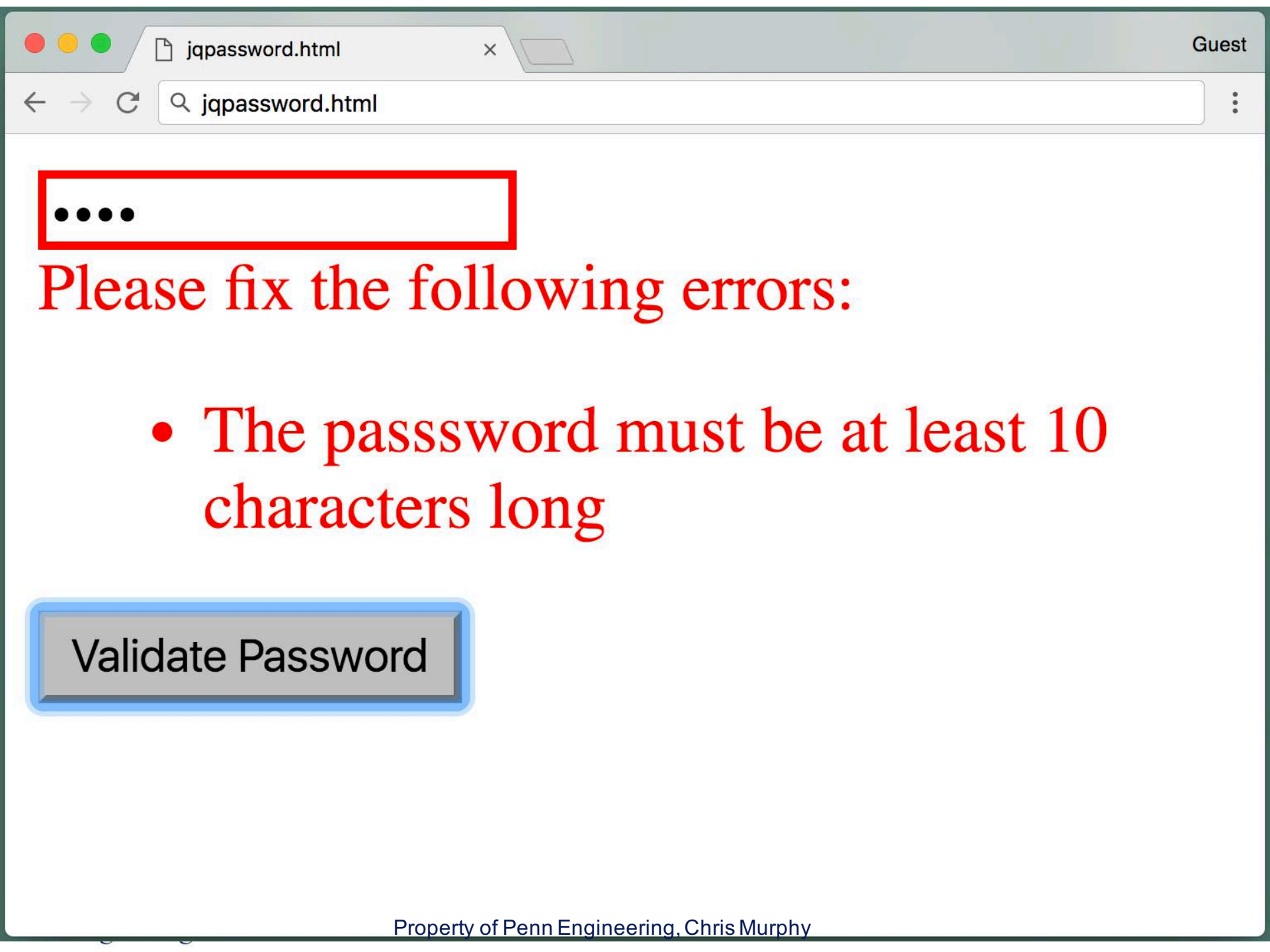

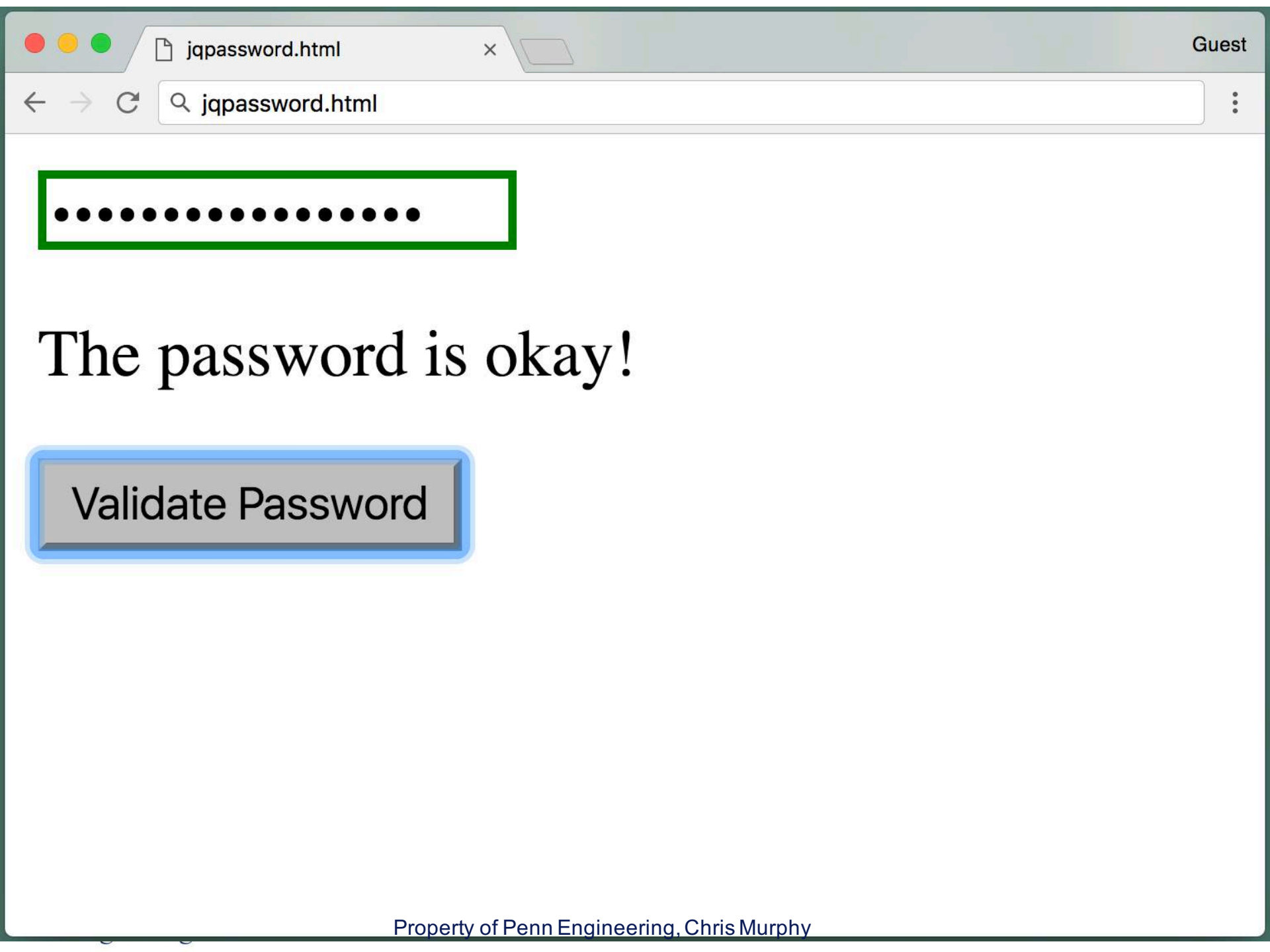

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<script src="jquery.js"></script>

<style>

.errorText {
color: red;
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.errorBox {
border: 2px solid red;
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<button name="submit">Validate Password</button>
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<script>

$("button[name='submit']").click(function() {
   var passwordField = $("input[name='password']");
   var password = passwordField.val();
   var isOkay = true;
   if (password.length < 10) {
     isOkay = false;
     $('#atLeast10Chars').show();
   }
   if (/\d/.test(password) == false) {
     isOkay = false;
     $('#needsNumber').show();
   }
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<input type="password" name="password"></input>

<br>

<span id="errorMessage" class="errorText" hidden>
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<ul>
<li id="needsNumber" class="errorText" hidden>
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Summary

- jQuery can be used to retrieve and modify DOM elements and add event listeners

- We have seen how to handle events from the mouse, keyboard, and forms

Review: Week 2

- **JavaScript:** a general-purpose, easy-to-use programming language

- **DOM:** representation of structure of HTML page, which can be manipulated using JavaScript

- **jQuery:** library that simplifies accessing/using the DOM