CS 2033

Multimedia & Communications II

LECTURE 6 – JAVASCRIPT

JavaScript

- So far our websites have been static. What if we want to make the website dynamic and interactive?
- HTML and CSS are limited.
- We can do so much more by adding JavaScript code.
- It is simple to incorporate JS (JavaScript) in websites.

JavaScript

- Benefits of JavaScript:
  - User input (mouse, keyboard, etc.)
  - Modify HTML elements and CSS dynamically (change styles, etc.)
  - Analyze data like user input (validating form input, etc.)
  - Change content based on specific conditions (different message for students vs. teachers, etc.)

JavaScript

- First JavaScript commands:
- alert("Hello world");
  - alert(_____) will open a popup window to display the given text.
- document.write("Hello world");
  - document.write(_____) will add the given text directly in the webpage.

JavaScript

- Variables make it easy to store items that are reused.
  - var course = "CS2033";
- Now we can use this variable by using its name.
  - alert(course);
  - document.write(course);

JavaScript

- Variable values can be changed after they are first created.
- var course = "CS1033";
  document.write(course);
  course = "CS2033";
  document.write(course);
- Code is executed in top-to-bottom order, so this would first write "CS1033" and then "CS2033".

JavaScript

- There are several types of variables:
  - String – text, surrounded by quotations
    - x = "hello";
  - Integer – whole number
    - x = 13;
  - Float/Double – decimal number
    - x = 7.3
  - Array – list of multiple items
    - x = [2, 7, 4, 8, 1];

JavaScript

- Arrays are indexed such that each item has a position, starting at 0.
- Access individual elements using square brackets and an index.
- x = [2, 7, 4, 8, 1];
  alert(x[0]); // Displays 2.
  x[4] = 3; // Changes last item to 3.

JS and CSS

- A major benefit of JS is its ability to interact with HTML and CSS.
- Directly change elements' styles.
- Change classes or IDs.
- Advanced animations / transitions.
- Content can also be changed.
- And more!

JS and CSS

- How do we change a style?
- First, we must select/get the HTML element(s) in JS.
- Several ways to do this:
  - document.getElementById(id);
  - document.getElementsByTagName(tag);
  - document.getElementsByClassName(class);

Notice the id getter is singular while the tag and class getters are plural.

JS and CSS

- The ID element getter is typically the best one to use since it returns one specific object.
- Getting elements by tag or class may be helpful in specific cases in which an array of elements need to be accessed at once.

JS and CSS

- Suppose you have an HTML div with the ID "mydiv".
- Access that element in JS with:
  - document.getElementById("mydiv");
- Simplify the code by storing this element in a variable.
  - var md = document.getElementById("mydiv");

JS and CSS

- Now the styles can be modified.
- JS uses dot notation for accessing levels of properties.
  - style is a property in HTML elements.
  - CSS styles are properties within style.
- Type the element (dot) style (dot), then a style property to access it.
  - i.e. md.style.width

JS and CSS

- To modify a style, use the dot notation on the element.
- After specifying a style, simply use an equal sign and set the new value in quotation marks.
  - md.style.width = "100px";
  - md.style.margin = "5px";
  - md.style.color = "red";

JS and CSS

- Style properties that contained a hyphen in CSS are defined differently in JavaScript.
- Instead, the words are back to back and the initial of each word (except the first) is capitalized.
  - i.e. backgroundColor (not background-color)
- This is called camel case.

JS and CSS

- box.style.backgroundColor = "red";
- box.style.color = "rgb(100,78,19)";
- mydiv.style.width = "400px";
- mydiv.style.borderColor = "black";
- mydiv.style.borderWidth = "3px";
- mydiv.style.left = "50%";
- tb.style.display = "block";
- tb.style.display = "none";

JS and CSS

- If several styles need to be changed, it's inefficient to do each one individually.
- A better option is to change the class on the object within JS.
- In CSS, an element can have multiple classes. It's the same in JS.

JS and CSS

- Get the element the same way:
  - var tb = document.getElementById("topbox");
- Use dot notation to access className or id on the object.
- It's safer to leave the id alone and just change classes.

JS and CSS

- HTML:
  -
- JS:
  - var tb = document.getElementById("tb");
  - tb.className = "newbox"; // Single class.
  - tb.className = "box newbox"; // 2 classes.

JS and CSS

- Notice the difference between the two class change options.
  - Single class is usually a replacement.
  - Multiple classes are usually additions.
    - Retain original class styles.
    - Additional class(es) provide new or modified styles.

JS and CSS

- We can now add and remove CSS animations dynamically with JS.
- Create a CSS class selector that triggers an animation.
- Use JS to add/remove the class to an element.
  - Adding the class starts the animation.
  - Removing the class stops it.

JS and CSS

- JS can also change the content within an HTML element.
- Use dot notation to access the innerHTML property of an element.
- tb.innerHTML = "Text shown in div.";
- As its name suggests, this supports HTML as well.
- tb.innerHTML = " Hi there! ";

Event handling

- Style/content changes will typically be done as a result of an event.
- Events are a huge part of JS!
  - User input events
    - Mouse-based
    - Keyboard-based
  - Load event
  - Timer events

Event handling

- Events are handled with event listeners applied to HTML elements.
- Event listeners are always watching for specific events to occur.
- When an awaited event occurs, the listener detects it and triggers the event's code.

Event handling

- There are two main ways to add event listeners to elements.
  - Inline: attach the event listener as an attribute in the HTML element tag.
  - Dot Notation: use the addEventListener function as a property on the element using dot notation.

Event handling

- Inline event listeners are the easiest.
- Although inline CSS and JS is generally frowned upon, event listeners are a different story!
- Inline event listeners start with "on" followed by an event name (sometimes abbreviated).
  - All lowercase, no spaces or hyphens.

Event handling

- Common mouse events:
  - Click: onclick
  - Double click: ondblclick
  - Mouse over: onmouseover
  - Mouse out: onmouseout
  - Focus a form field: onfocus
  - Leave a form field: onblur
  - Change a form value: onchange

Event handlers

- Keyboard events:
  - Key press: onkeypress
  - Key down: onkeydown
  - Key up: onkeyup
- Differentiate keypress, keydown, and keyup events.

Event handlers

-
- In this example, the style change applies to the element itself, so we can use a shortcut: this
-

Event handlers

- Dot notation is the other method for creating event listeners.
- This can go in internal or external JavaScript code (after the element is created!)
- box.addEventListener("click", function() { this.style.width = "300px" });

Other events

- We talked about mouse events and keyboard events already.
- There are two other common event types in JS: the loading of the webpage and custom timers.
- The loading is simple. Just attach an onload listener to the body and it will trigger when everything loads.

Other events

- There are two types of timers.
- Timeout: trigger a function once after a specified time has elapsed.
- Interval: trigger a function repeatedly in intervals of the specified time.
- Start them with setTimeout(*function, ms*) or setInterval(*function, ms*)

Other events

- Examples of various events:
- https://www.csd.uwo.ca/courses/CS2033b/samples/lec6/

JavaScript

- Most lines of code end with a semi-colon ;
- There are structures of code that may contain multiple lines in a sequence.
- The first and last line of those structures end with a curly bracket { or } instead of a semi-colon.

Conditionals

- Conditionals are an important structure in programming.
- Portions of code will only execute if specific conditions are met.
- For example, checking if a number is less than 10
- The if-else statement is used for conditionals in JavaScript.

Conditionals

- if (condition) {
  // do stuff;
  }
- The condition can be anything that boils down to a True or False value (this is called a Boolean variable).
  - x > 5 (*greater than*)
  - x == 1 (*note the double equal signs*)
  - course != "CS2033" (*not equal*)

Conditionals

- We can add multiple conditionals using the else if operator.
-
```
if (x == 1) {
    // do stuff.
} else if (x == 2) {
    // do different stuff.
} else if (x == 3) {
    // do other different stuff.
}
```

Conditionals

- The else operator is a catch-all for any cases not yet accounted for.
-
```
if (x == 1) {
    // do stuff.
} else if (x == 2) {
    // do different stuff.
} else {
    // do other different stuff.
}
```

Conditionals

- Note that once a condition is satisfied, the "else-if" statements below it will not be checked.
- ```
  x = 2;
  if (x < 5) {
      // do stuff.
  } else if (x < 10) {
      // do different stuff.
  }
  ```
  ```

Conditionals

- Suppose we received the user's age online and then checked if the user was allowed to buy booze…
- ```
  if (age >= 19) {
      canDrink = true;
  } else {
      canDrink = false;
  }
  ```
  ```

Conditionals

- Conditionals might be composed of multiple sub-conditions that all have to be met.
- We combine them with the && (and) operator.
- if (age >= 19 && pregnant != true) {
  canDrink = true;
  } else {
  canDrink = false;
  }

Conditionals

- There also might be sub-conditions such that *at least one* must be met.
- In this case, use the || (or) operator.
-
```
if (age >= 19 || allowed == true) {
    canDrink = true;
} else {
    canDrink = false;
}
```

Functions

- Another common structure in code is a function.
- A function is a process that can be executed at any time, and any number of times.
- Great for routine processes that need to be used multiple times.

Functions

- function myFunction() {
  // code here.
  // code here.
  }
- The above code creates a function but does not actually call (run) the function. Calling it looks like this:
  - myFunction();

Functions

- Many functions have input parameters which are placed within the parentheses.
- Parameters make the function reusable and flexible to work in different scenarios.
- To call a function with parameters, include the parameter values in the function call parentheses.

Functions

- function average(x, y) {
  var z = (x + y) / 2;
  document.write("Result: " + z);
  }
- This has 2 parameters: x and y.
- Call this function:
  - average(5,9); // Result: 7
  - average(10,20); // Result: 15

Loops

- Another special code structure is the loop. This is used to run code repeatedly in a row.
- There are two main types of loops: while-loop and for-loop but we will focus on the for-loop.
- They contain 3 parts: variable initialization, condition, increment.

Loops

- for (x = 0; x < 5; x++) {
  alert(x);
  }
- They also work great with arrays.
- data = [9, 4, 7, 3];
  for (x = 0; x < data.length; x++) {
  alert(data[x]);
  }