Web Development Technologies: The DOM and JavaScript functions to modify the DOM

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CSE316: Fundamentals of Software Development

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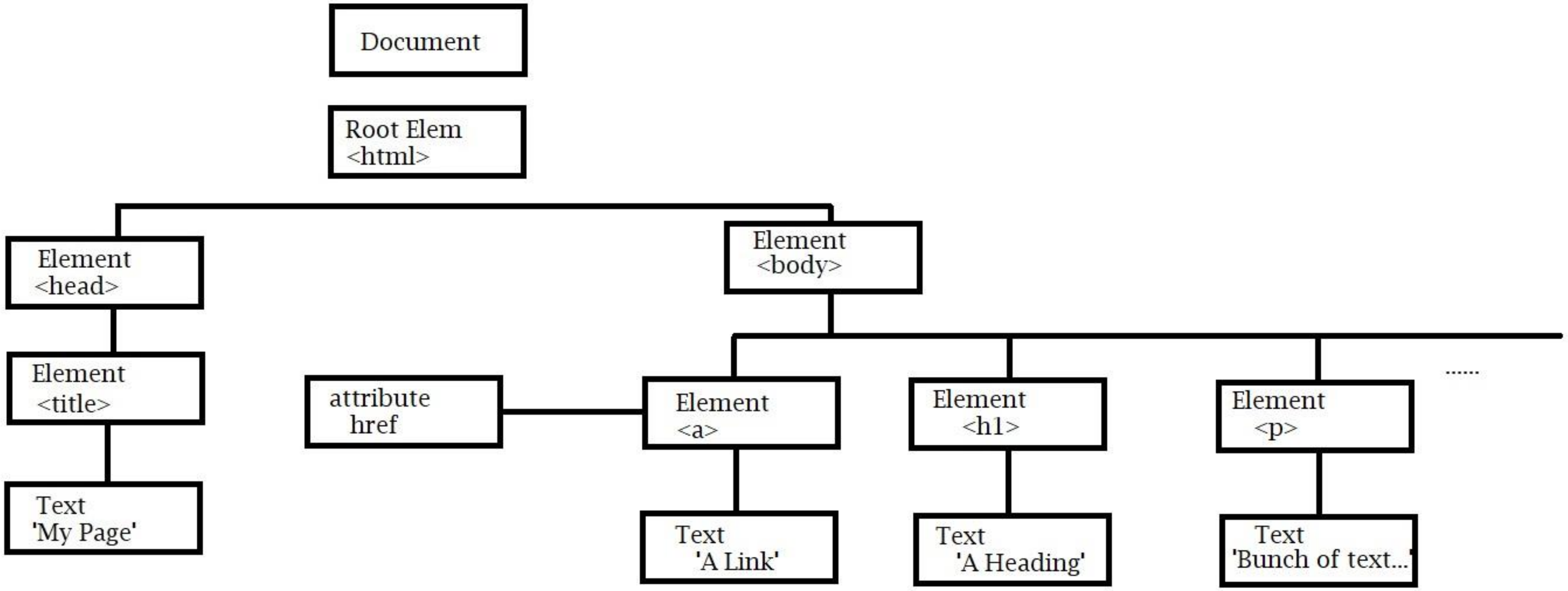
http://www.cs.stonybrook.edu/~cse316

Topics

- The DOM
- JavaScript functions to modify the DOM

The DOM

- The Document Object Model (DOM)
  - Tree of objects and attributes created by web browser from structure of web page



The DOM

- JavaScript can:
  - Change any HTML element
  - Change any HTML attribute
  - Change any CSS Style
  - Remove any HTML element or attribute
  - Add new HTML elements and attributes
  - React to all existing HTML events
  - Create new HTML events

The HTML DOM

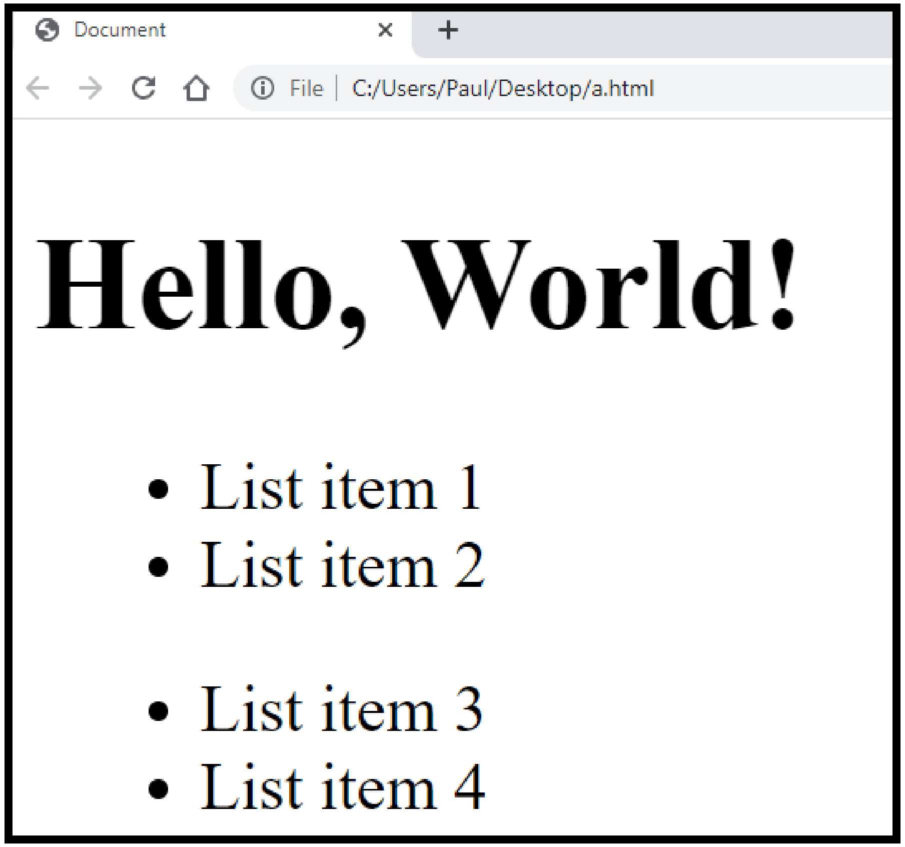
- In this model:
  - HTML elements are objects
  - HTML elements have properties (like members) that can be altered
  - The DOM provides methods that can access all HTML elements
  - The DOM defines events for all HTML elements
- As with OO Paradigm
  - **Methods** are **actions** that can be performed
  - **Properties** are **values** that can be altered

The HTML DOM

- References to any element or the below get methods start with *document*.
  - This represents the document itself.
- Finding elements:
  - **getElementById(id)** – Finds elements with an id matching the argument **(id='id')**
  - **getElementByTagName(name)** – Finds elements based on their tag name **<tag>** matches **<name>**
  - **getElementByClass(name)** – Finds elements with a class matching the argument **(class = 'name')**
    - **Note: getElementXXX()** calls may return more than 1 object. We will use subscripts to access a specific object.
- Key Properties – 'element' is a variable holding an object returned by one of the above get methods
  - **element.innerHTML** – This is the HTML content of an element
  - **element.**attribute – (where 'attribute' is an attribute name)
  - **element.style.**property – (where 'property' is the name of a style setting)

The HTML DOM Example

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>Document</title>
</head>
<body>
<h1>Hello, World!</h1>
<ul>
<li>List item 1</li>
<li>List item 2</li>
</ul>
<ul>
<li>List item 3</li>
<li>List item 4</li>
</ul>
<p id="demo"></p>
</body>
</html>
```



Hello, World!

- List item 1
- List item 2

- List item 3
- List item 4

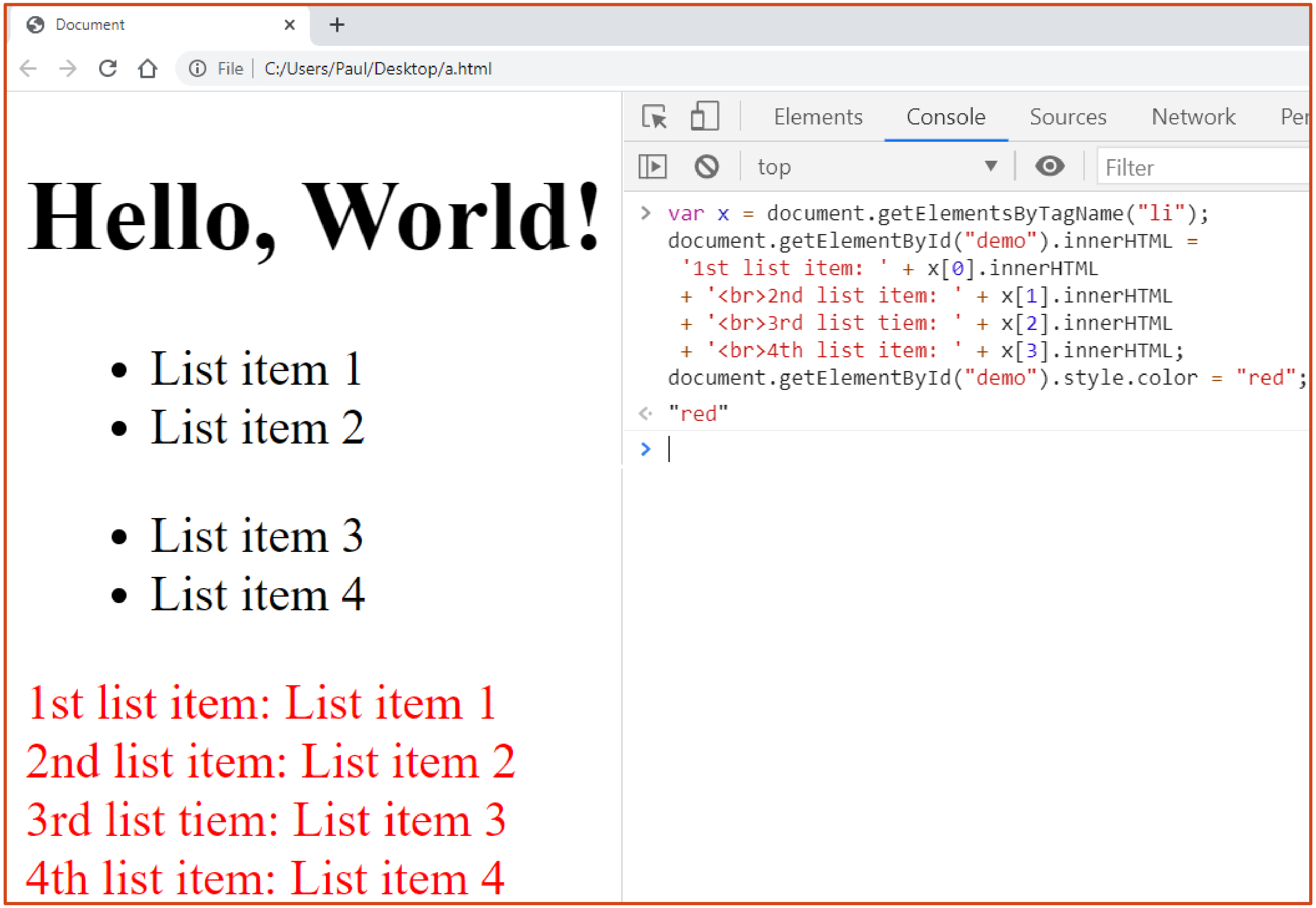
The HTML DOM Example

```
// in the Console
var x = document.getElementsByTagName("li");
// gets all the li elements
console.log(x);

document.getElementById("demo").innerHTML =
 '1st list item: ' + x[0].innerHTML
 + '<br>2nd list item: ' + x[1].innerHTML
 + '<br>3rd list item: ' + x[2].innerHTML
 + '<br>4th list item: ' + x[3].innerHTML;

document.getElementById("demo").style.color = "red";
```

The HTML DOM Example



Hello, World!

- List item 1
- List item 2

- List item 3
- List item 4

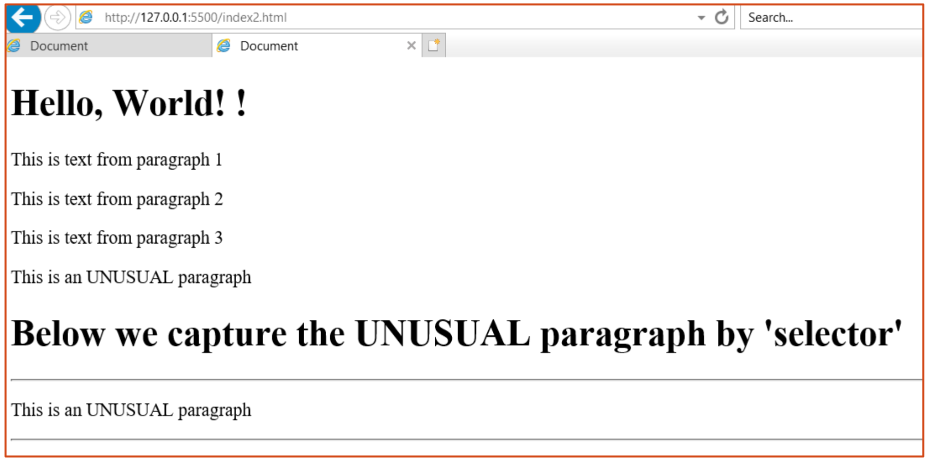
1st list item: List item 1
2nd list item: List item 2
3rd list tiem: List item 3
4th list item: List item 4

```
> var x = document.getElementsByTagName("li");
  document.getElementById("demo").innerHTML =
   '1st list item: ' + x[0].innerHTML
   + '<br>2nd list item: ' + x[1].innerHTML
   + '<br>3rd list tiem: ' + x[2].innerHTML
   + '<br>4th list item: ' + x[3].innerHTML;
  document.getElementById("demo").style.color = "red";
< "red"
>
```

The HTML DOM Example

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width,
initial-scale=1.0">
<meta http-equiv="X-UA-Compatible"
content="ie=edge">
<title>Document</title>
</head>
<body>
<h1>Hello, World! !</h1>
<p id="one">This is text from paragraph 1</p>
<p id="two">This is text from paragraph 2</p>
<p id="three">This is text from paragraph 3</p>
<p class="unusual">This is an UNUSUAL
paragraph</p>
<h1>Below we capture the UNUSUAL paragraph by
A'selector'</h1>
<hr>
<p id="demo"></p>
<hr>
</body>
</html>
```

```
// in the console:
var x = document.querySelectorAll("p.unusual");
document.getElementById("demo").innerHTML =
   x[0].innerHTML;
```


http://127.0.0.1:5500/index2.html

Document | Document

Hello, World! !

This is text from paragraph 1

This is text from paragraph 2

This is text from paragraph 3

This is an UNUSUAL paragraph

Below we capture the UNUSUAL paragraph by 'selector'

This is an UNUSUAL paragraph

The HTML DOM Example

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width,
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<meta http-equiv="X-UA-Compatible"
content="ie=edge">
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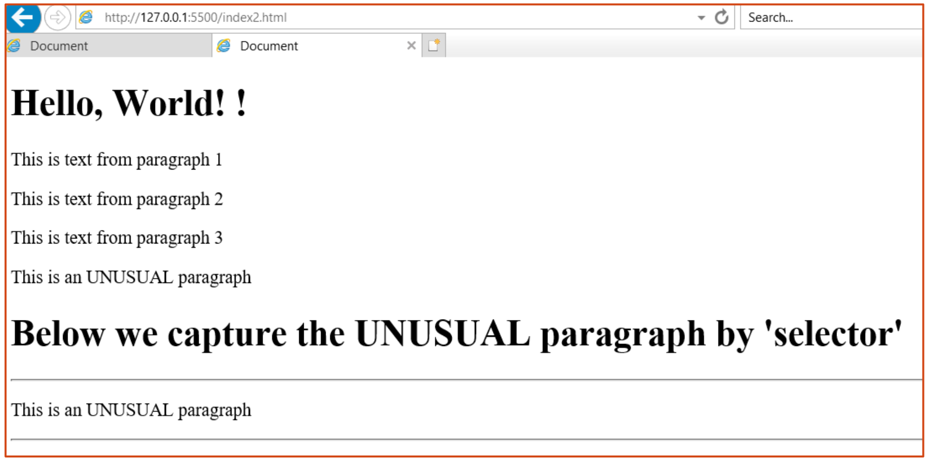
<p id="two">This is text from paragraph 2</p>
<p id="three">This is text from paragraph 3</p>
<p class="unusual">This is an UNUSUAL
paragraph</p>
<h1>Below we capture the UNUSUAL paragraph by
A'selector'</h1>
<hr>
<p id="demo"></p>
<hr>
<script src="demo.js"></script>
</body>
</html>
```

```
// demo.js:
var x = document.querySelectorAll("p.unusual");
document.getElementById("demo").innerHTML =
  x[0].innerHTML;
```



http://127.0.0.1:5500/index2.html

Hello, World! !

This is text from paragraph 1

This is text from paragraph 2

This is text from paragraph 3

This is an UNUSUAL paragraph

Below we capture the UNUSUAL paragraph by 'selector'

This is an UNUSUAL paragraph

The HTML DOM Example

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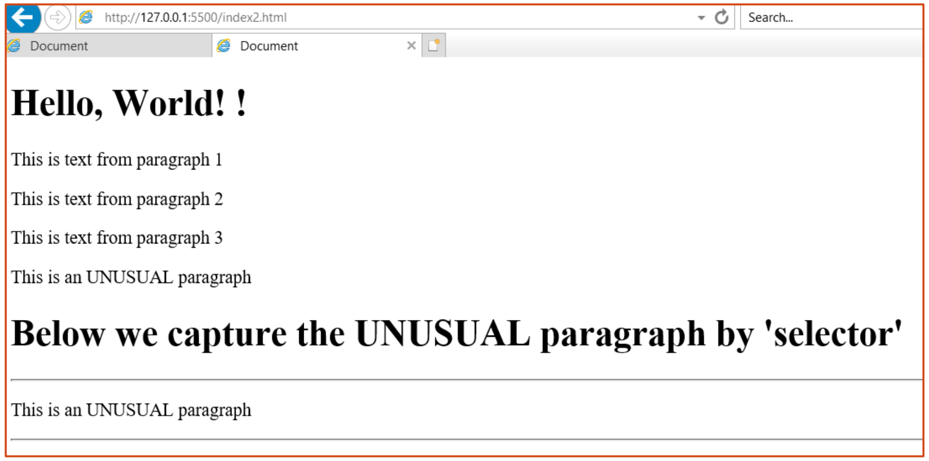
<p class="unusual">This is an UNUSUAL
paragraph</p>
<h1>Below we capture the UNUSUAL paragraph by
A'selector'</h1>
<hr>
<p id="demo"></p>
<hr>
<script>
var x = document.querySelectorAll("p.unusual");
document.getElementById("demo").innerHTML =
  x[0].innerHTML;
</script>
</body>
</html>
```



http://127.0.0.1:5500/index2.html

Hello, World! !

This is text from paragraph 1

This is text from paragraph 2

This is text from paragraph 3

This is an UNUSUAL paragraph

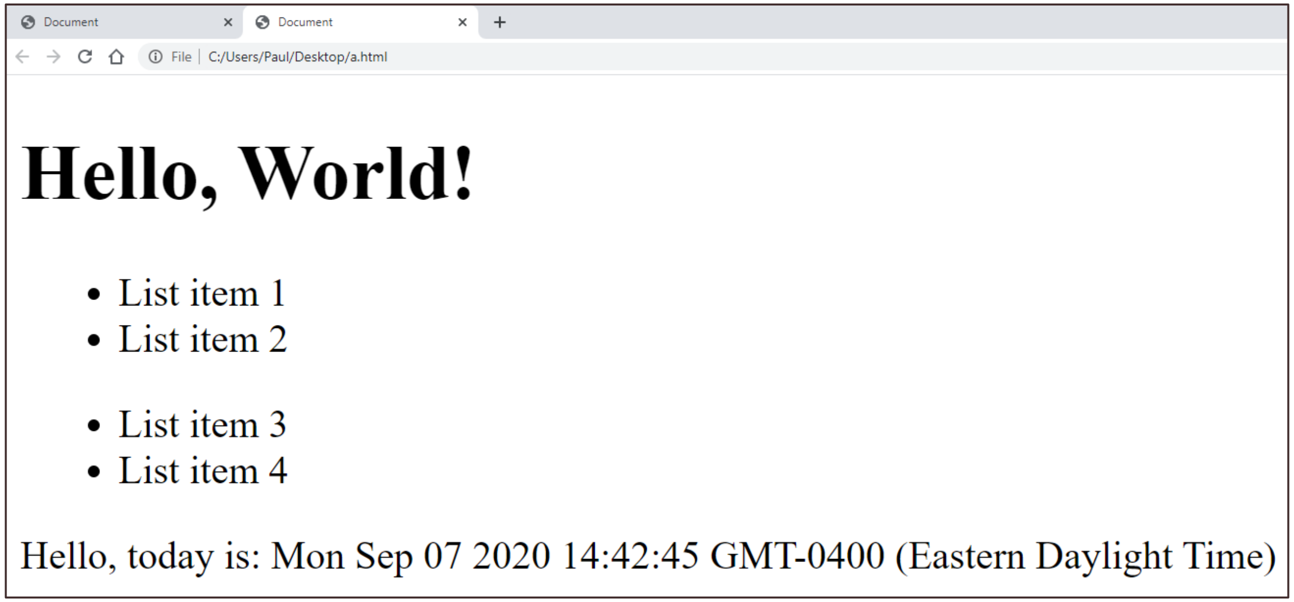
Below we capture the UNUSUAL paragraph by 'selector'

This is an UNUSUAL paragraph

The HTML DOM - Writing into the HTML Stream

JavaScript document.write() will add text directly into an HTML page

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-
scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>Document</title>
</head>
<body>
<h1>Hello, World!</h1>
<ul>
<li>List item 1</li>
<li>List item 2</li>
</ul>
<ul>
<li>List item 3</li>
<li>List item 4</li>
</ul>
<p id="demo"></p>
<script>document.write("Hello, today is: " + Date());</script>
</body>
</html>
```



Hello, World!

- List item 1
- List item 2

- List item 3
- List item 4

Hello, today is: Mon Sep 07 2020 14:42:45 GMT-0400 (Eastern Daylight Time)

The HTML DOM - Changing Attributes

- You can change an attribute by getting the element and assigning a value to the attribute

  <IMG id="image1" src="Paul1.jpg">

  - Can change the src attribute with:

```
document.getElementById("image1").src = "Paul2.jpg";
```

The HTML DOM – Changing Styles

- You can change style by assigning to any of the style properties on an element
- The format to access a style property is:

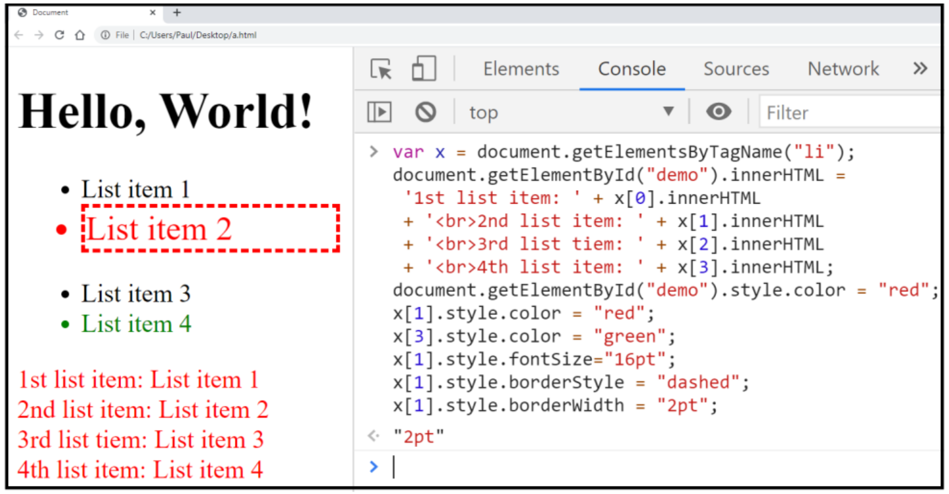
  <object>.style.<propertyname>

  - **<object>** is the object returned by getElementByXXX() call**s**
  - **style** is just a keyword to indicate the upcoming field is a style attribute
  - **<propertyname>** is the name of the CSS property

The HTML DOM – Changing Styles - Example

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-
width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible"
content="ie=edge">
<title>Document</title>
</head>
<body>
<h1>Hello, World!</h1>
<ul>
<li>List item 1</li>
<li>List item 2</li>
</ul>
<ul>
<li>List item 3</li>
<li>List item 4</li>
</ul>
<p id="demo"></p>
<script>document.write("Hello, today is: " +
Date());</script>
</body>
</html>
```

```
var x = document.getElementsByTagName("li");
document.getElementById("demo").innerHTML =
 '1st list item: ' + x[0].innerHTML
 + '<br>2nd list item: ' + x[1].innerHTML
 + '<br>3rd list tiem: ' + x[2].innerHTML
 + '<br>4th list item: ' + x[3].innerHTML;
document.getElementById("demo").style.color = "red";
x[1].style.color = "red";
x[3].style.color = "green";
x[1].style.fontSize="16pt";
x[1].style.borderStyle = "dashed";
x[1].style.borderWidth = "2pt";
```



Hello, World!

- List item 1
- List item 2

- List item 3
- List item 4

1st list item: List item 1
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```
> var x = document.getElementsByTagName("li");
  document.getElementById("demo").innerHTML =
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  document.getElementById("demo").style.color = "red";
  x[1].style.color = "red";
  x[3].style.color = "green";
  x[1].style.fontSize="16pt";
  x[1].style.borderStyle = "dashed";
  x[1].style.borderWidth = "2pt";
< "2pt"
>
```

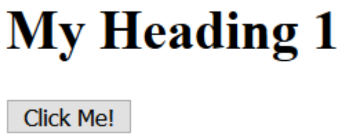
The HTML DOM - Events

- Can execute code when an *event* occurs.
  - Events include:
    - When a user clicks the mouse (onclick=)
    - When a web page has loaded (onload= , onunload=)
    - When an image has been loaded (onload=)
    - When the mouse moves over an element   (onmouseover= , onmouseout=)
    - When an input field is changed (onchange=)
    - When an HTML form is submitted (onsubmit=)
    - When a user strokes a key (onkeypress=)

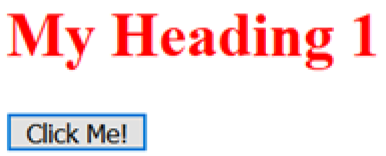
The HTML DOM – Events - Example

```
<!DOCTYPE html>
<html>
<body>
<h1 id="id1">My Heading 1</h1>
<!-- we can put JavaScript code in the onclick action -->
<button type="button" onclick="document.getElementById('id1').style.color = 'red'">Click Me!</button>
</body>
</html>
```

Before clicking the 'Click Me!' button



After clicking the 'Click Me!' button



The HTML DOM – Building HTML

- JavaScript can modify the DOM of a document and add or remove elements
- Use 'createXXX() methods:
  - **createElement()** – Creates and returns a new element node
  - **createTextNode()** – Creates a node that holds text
- Use various methods to add or remove nodes:
  - **addChild()** – Adds a child to a node
  - **insertBefore()** – Inserts a new node before a specific child
  - **removeChild()** – Removes a node from the DOM
  - **replaceChild()** – Replaces one child node with another

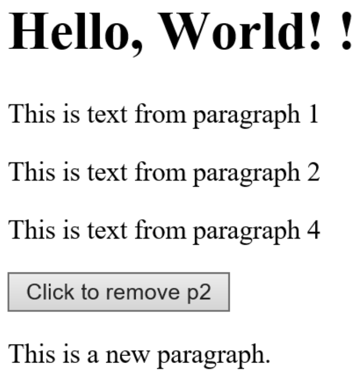
The HTML DOM – Building HTML Example

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<title>Document</title>
</head>
<body>
<div id="theDiv">
<h1>Hello, World! !</h1>
<p id="one">This is text from paragraph 1</p>
<p id="two">This is text from paragraph 2</p>
<p id="four">This is text from paragraph 4</p>
<button onclick="remv(document.getElementById('two'))">Click to remove p2</button>
</div>
<script src="demo.js"></script>
</body>
</html>
```

demo.js:

```
var newPara = document.createElement("p");
var content = document.createTextNode("This is a new paragraph.");
newPara.appendChild(content);
var divElem = document.getElementById("theDiv");
divElem.appendChild(newPara);
function remv(element) {
  element.parentNode.removeChild(element);
}
```

Before click



Hello, World! !

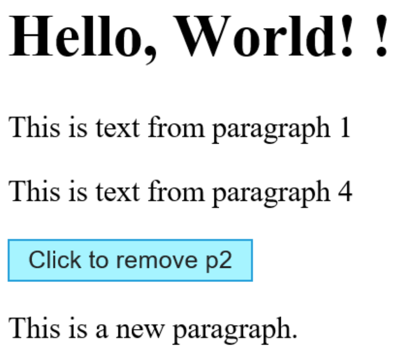
This is text from paragraph 1

This is text from paragraph 2

This is text from paragraph 4

This is a new paragraph.

After click



Hello, World! !

This is text from paragraph 1

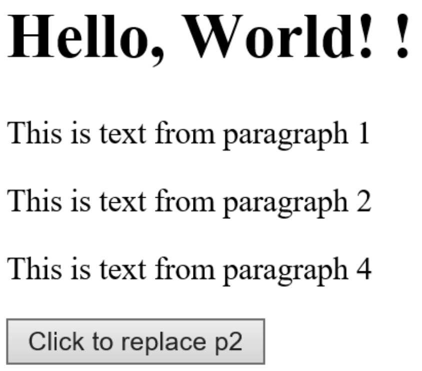
This is text from paragraph 4

This is a new paragraph.

The HTML DOM – Building HTML Example

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<title>Document</title>
</head>
<body>
<div id="theDiv">
<h1>Hello, World! !</h1>
<p id="one">This is text from paragraph 1</p>
<p id="two">This is text from paragraph 2</p>
<p id="four">This is text from paragraph 4</p>
<button onclick="repl(document.getElementById('two'))">Click to replace p2</button>
</div>
<script>
function repl(element) {
  var para = document.createElement("p");
  var node = document.createTextNode("This is a new paragraph!");
  para.appendChild(node);
  element.parentNode.replaceChild(para, element);
}
</script>
</body>
</html>
```

Before Click



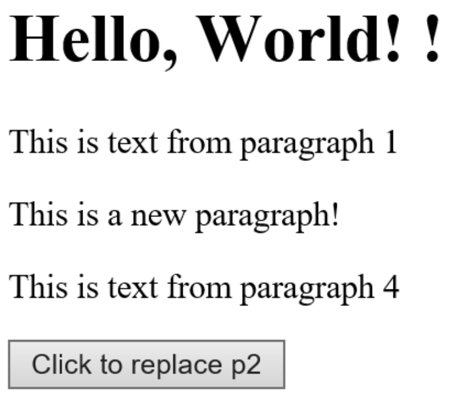
Hello, World! !

This is text from paragraph 1

This is text from paragraph 2

This is text from paragraph 4

After Click



Hello, World! !

This is text from paragraph 1

This is a new paragraph!

This is text from paragraph 4

The HTML DOM

- More HTML DOM actions: https://www.w3schools.com/js/js_htmldom.asp