# CIS 371 Web Application Programming

## TypeScript III


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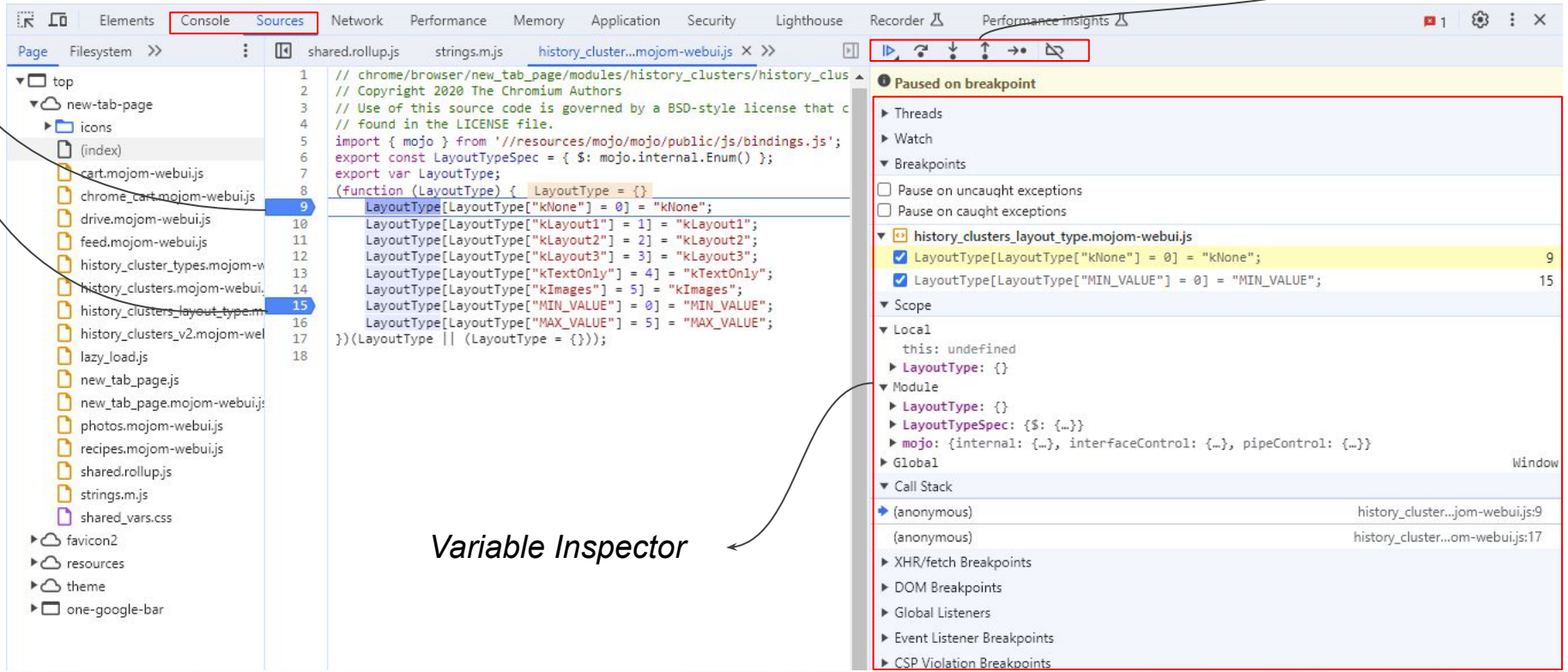
Based on the original version by Professor Hans Dulimarta.

# Using TypeScript in Browser

# Browser Debugger (Chrome)

*Debugging breakpoints*

*Debugger Controls (step over, step into, ...)*




*Variable Inspector*

# Including JS code in HTML

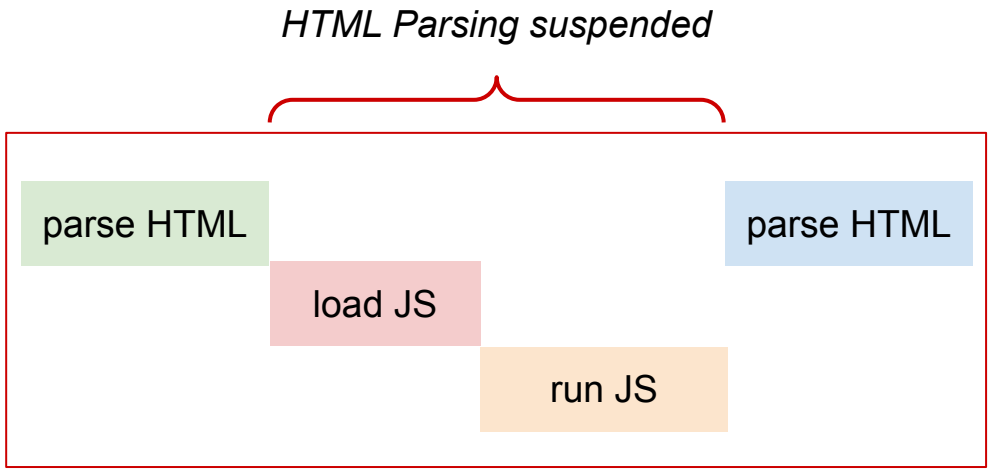
```
<!DOCTYPE html>
<html lang="en">
    <head>
        <script src="code1.js"></script>
    </head>
    <body>
        <!--    other HTML contents go here    -->
        <script src="code2.js"></script>
    </body>
</html>
```

*Scripts that do not modify page contents are placed in <head>*

Scripts that do are placed towards the end of <body>

# Script: Loading & Running

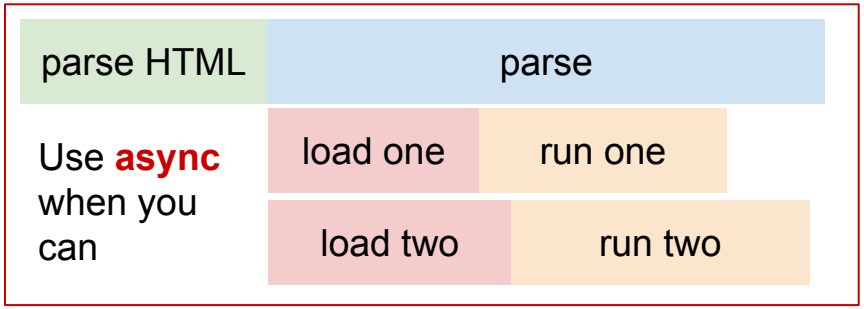
```
<!DOCTYPE html>
<html lang="en">
    <head>
        <title>
    </head>
    <body>
        <!--    some HTML here    -->
        <script src="....js"></script>
        <!--    more HTML here    -->
    </body>
</html>
```

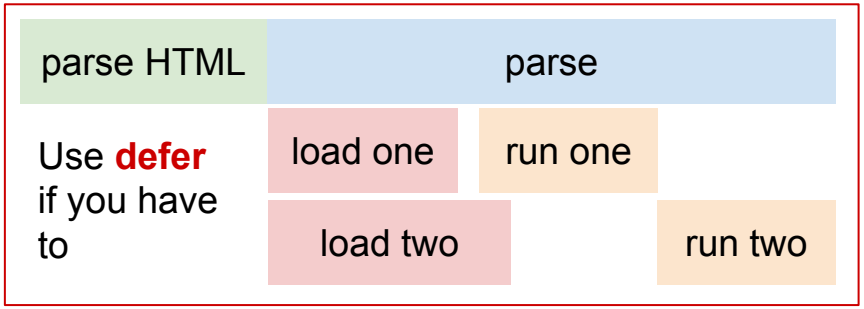


# Defer vs. Async

```
<html>
    <body>
        <!-- some HTML here -->
        <script src="one" async></script>
        <script src="two" async></script>
        <!-- more HTML here -->
    </body>
</html>
```

```
<html>
    <body>
        <!-- some HTML here -->
        <script src="one" defer></script>
        <script src="two" defer></script>
        <!-- more HTML here -->
    </body>
</html>
```



# TS <script> option #1: Babel

*with babel-standalone*

```
<!DOCTYPE html>
<html lang="en">
    <head>
        <script src="https://unpkg.com/@babel/standalone/babel.min.js"></script>
        <script type="text/babel" src="code1.ts"></script>
    </head>
    <body>
        <!--  HTML contents go here -->
        <script type="text/babel" src="code2.ts"></script>
    </body>
</html>
```

*DO NOT use Babel standalone for production*
*Use transpiled JS for production with bundler (webpack, parcel, rollup, …)*

# TS <script> option #2: ParcelJS

```
npm init -y
npm install -save-dev parcel

# Create your-file.html with <script>
# Create one.ts and two.ts

npx parcel serve your-file.html

# Go to localhost:xxxx (in a browser)
```

```
<!DOCTYPE html>
<html lang="en">
    <head>
        <script src="code1.js"></script>
    </head>
    <body>
        <!--  HTML contents go here    -->
        <script src="code2.js"></script>
    </body>
</html>
```

```
// one.ts
console.debug("Hello from one");
```

```
// two.ts
console.debug("Hello from two");
```

# Browser predefined classes

- Classes associated with individual HTML tags

| Tag | Class |
|---|---|
| <a> | HTMLAnchorElement |
| <body> | HTMLBodyElement |
| <button> | HTMLButtonElement |
| <img> | HTMLImageElement |
| <p> | HTMLParagraphElement |
| ***and many more …*** | |

- Other classes: AudioBuffer, Bluetooth, ByteString, Promise, Request,...

# Browser (Predefined) Objects

- Frequently used
  - screen: the computer screen occupied by the browser
  - document: the current HTML document that hosts the script
    - Provides functions for manipulating the DOM tree
  - window: the current window where the HTML doc is rendered
- Less frequently used
  - history: page visit history stack
  - localStorage: the browser persistent storage
  - location: the browser input box
  - and many more ...

```
for (const z in window) {
    if (typeof window[z] === "object") {
        console.log(z);
    }
}
```

*Try this yourself*

# Browser window predefined functions

- alert(): show an info dialog on the browser
- addEventListener(): setup event listeners
- confirm(): show a yes/no dialog
- prompt(): show an input dialog
- setInterval(), setTimeout(): start a timer
- clearInterval(), clearTimeout(): reset existing timer
- ...
- and many more ...

```
for (const z in window) {
    if (typeof window[z] === "function") {
        console.log(z);
    }
}
```

*Try this yourself*

Complete documentations: Web Windows API (MDN: Mozilla Dev Network)

# HTML Document CRUD methods/functions

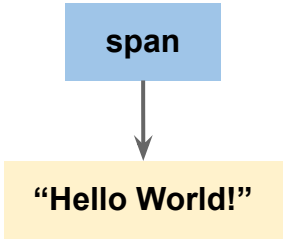
| | |
|---|---|
| **Create** | `document.createElement()`,<br>`document.createTextNode()` |
| **Read** | `___.getElementById()` // SINGULAR<br>`___.getElementsByTagName()`, // PLURAL<br>`___.getElementsByClassName()` // PLURAL<br>`___.querySelector()` // SINGULAR: search by CSS selectors<br>`___.querySelectorAll()` // PLURAL: search by CSS selectors |
| **Update** | `___.appendChild()` |
| **Delete** | `___.removeChild()` |
| *and many more …* | |

```
for (const z in document) {
    if (typeof document[z] === "function") {
        console.log(z);
    }
}
```

*Try this yourself*

# Create Text Nodes

```
<span>Hello world!</span>
```

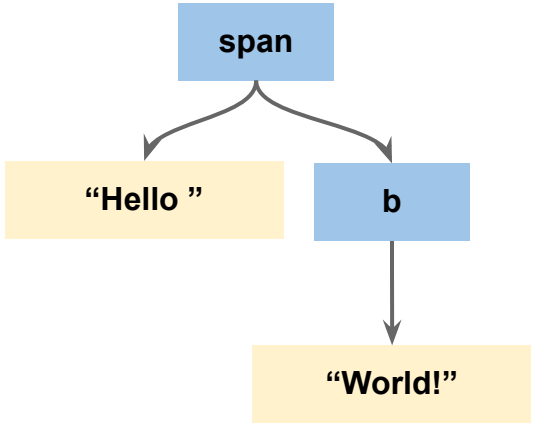



```
// Option 1
const spanParent = document.createElement("span");
const hello = document.createTextNode("Hello World");
spanParent.appendChild(hello);
```

```
// Option 2
const spanParent = document.createElement("span");
spanParent.innerText = "Hello World";
```

# Add Multiple Children

```
<span>Hello <b>world!</b></span>
```




```
const spanTop = document.createElement("span");
const txt1 = document.createTextNode("Hello");
spanTop.appendChild(txt1);

const bChild = document.createElement("b");
bChild.innerText = "World";
spanTop.appendChild(bChild);
```

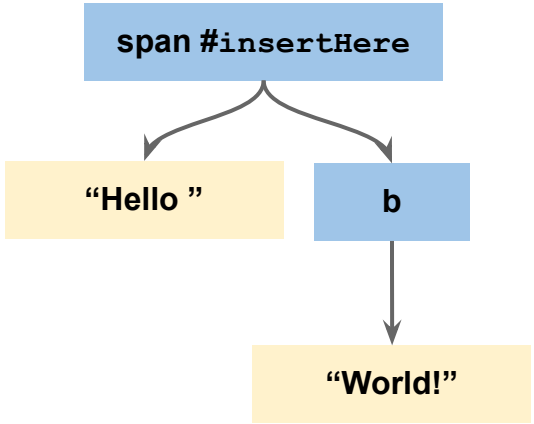
# Insert Contents into Existing DOM

*before*

```
<span id="insertHere"> </span>
```

*after*

```
<span id="insertHere">
    Hello <b>world!<b>
</span>
```

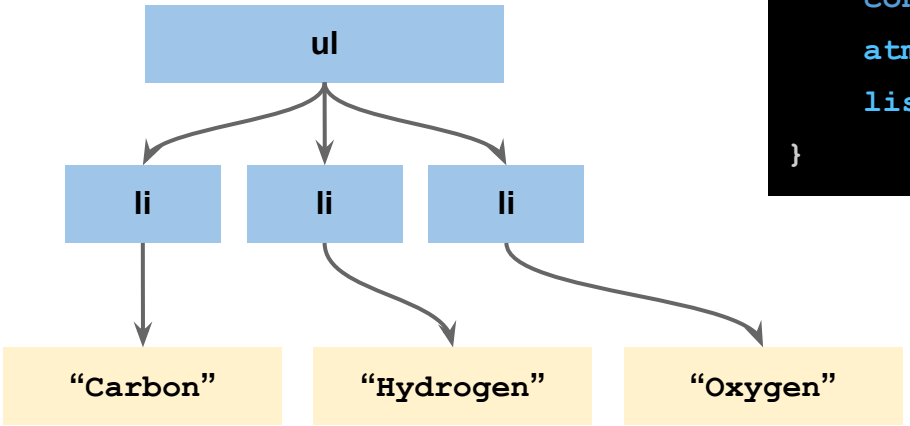



```
const spanTop = document.getElementById("insertHere");
const txt1 = document.createTextNode("Hello");
spanTop.appendChild(txt1);

const bChild = document.createElement("b");
bChild.innerText = "World";
spanTop.appendCHild(bChild);
```

# Add Multiple Children from Array

```
<ul>
    <li>Carbon</li>
    <li>Hydrogen</li>
    <li>Oxygen</li>
</ul>
```




```
const atoms = ["Carbon", "Hydrogen", "Oxygen"]
const listTop = document.createElement("ul");

for (let a of atoms) {
    const atm = document.createElement("li");
    atm.innerText = a;
    listTop.appendChild(atm);
}
```

# Setting attributes

```
<a id="intro" class="deepIndent noAds" href="http://go.org">
    Some text here
</a>
```

```
const sample = document.createElement("a");
sample.innerText = "Some text here";
sample.id = "intro"
sample.classList.add("deepIndent");
sample.classList.add("noAds");
sample.setAttribute("href", "http://go.org");
```

```
const sample = document.createElement("a");
sample.innerText = "Some text here";
sample.setAttribute("id", "intro");
sample.setAttribute("class", "deepIndent noAds");
sample.setAttribute("href", "http://go.org");
```

# querySelector(): select ONE element

```
<body>
    <p class="title">Ice Cream Flavor:</p>
    <ul>
        <li>Death by Chocolate</li>
        <li>Mint Chocolate Chip</li>
        <li>Strawberry</li>
    </ul>
    <script src="ice.ts">
</body>
```

```
const item:Element = document.querySelector("ul > li");
#the first one will be returned
item.textContent = "Too much Chocolate";
```

Ice Cream Flavors:

- Too much Chocolate
- Mint Chocolate Chip
- Strawberry

# querySelectorAll(): select MULTIPLE elements

```
<body>
    <p class="title">Ice Cream Flavor:</p>
    <ul>
        <li>Death by Chocolate</li>
        <li>Mint Chocolate Chip</li>
        <li>Strawberry</li>
    </ul>
    <script src="ice.ts">
</body>
```

```
let items:NodeListOf<Element>;
items = document.querySelectorAll("ul > li");
for (let flav of items) {
    if (flav.textContent.includes("Chocolate")){
        flav.textContent = flav.textContent + " (on sale)";
    }
}
```

Ice Cream Flavors:

- Death by Chocolate (on sale)
- Mint Chocolate Chip (on sale)
- Strawberry

# CSS Selector and querySelector(All)

```
const q1 = document.querySelector("h2 + p");
q1.classList.add("red");   // Affect "First paragraph"
const q2 = document.querySelector("h2 ~ ol > li:first-child");
q1.classList.add("red");   // Affect "Strawberry"
const q3 = document.querySelector("li:last-child");
q1.classList.add("red");   // Affect "Barry Manilow"
```

```
<body>
  <h2>Some heading</h2>
  <p>First paragraph</p>
  <ol>
    <li class="fruit">Strawberry</li>
    <li class="device">Raspberry Pi</li>
    <li class="singer">Barry Manilow</li>
  </ol>
  <p>Second paragraph</p>
</body>
```

```
const pars = document.querySelectorAll("h2 ~ p");
for (let x of pars) {
    // Apply to "First paragraph" and "Second paragraph"
    x.setAttribute("___", "___");
}
const who = document.querySelectorAll("ol > li.singer");
for (let x of who) {
   // Apply to "Barry Manilow"
}
```

# Using Timer

```
<body>
    <p>Ice Cream Flavor:</p>
    <ul>
        <li>Death by Chocolate</li>
        <li>Mint Chocolate Chip</li>
        <li>Strawberry</li>
        <li>Bluemoon</li>
    </ul>
    <script src="ice.ts">
</body>
```

Ice Cream Flavors:

- Too much Chocolate
- Mint Chocolate Chip
- Strawberry
- BlueMoon

*2 seconds later*

```
function choco() {
    const item:Element = document.querySelector("ul > li");
    item.textContent = "Too much Chocolate";
}
setTimeout(choco, 2000);
```

*setTimeout(someFunc, delayInMillisec)*

# JavaScript Events

| Source of Event | Events |
| --- | --- |
| Window | onload, onresize, onunload, ... |
| Document | onkeydown, onkeyup, onmousedown, onmouseup, onmouseenter, onmouseleave, ... |
| Input field | onblur, onfocus, onchange, …. |
| Button | onclick, ondblclick |
| Complete Reference: Event APIs | |

# Setting Up Event Handlers

- Which Event?
- Who is the event source?
  - Resize => window
  - Key presses => document
  - Load => document
  - Click => button, image, ….
  - Focus => input elements
  - Mouse => elements
- Details of the event object properties

  (MouseEvent, KeyboardEvent, ….).

  Refer to online API

```
function keyHandler(ev: KeyboardEvent): void {
    // put code here
}
function clickHandler(ev:MouseEvent): void {
    // put code here
}
document.addEventListener("keypress", keyHandler);
const myLogo = document.getElementById("myLogo");
myLogo.addEventListener("click", clickHandler);
```

*addEventListener*

*inline event attributes*

```
<button onclick="clickFunction()">Click Me</button>
```

```
function clickFunction() {
    // put code here
}
```

# CodePen: Event Handling Demo

## Counting Click