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## New Tools

The course begins with tools to be downloaded.

* Node.js – refer to **My Documents\Current Pixel\Node\_js**. Node.js is a JavaScript runtime built on Chrome’s V8 JavaScript engine.
* Git – refer to **My Documents\Current Pixel\SourceControl**.Git is a [free and open source](https://git-scm.com/about/free-and-open-source) distributed version control system
* Editor – refer to **My Documents\Current Pixel\VisualStudioEditor**. To download this type “code.VisualStudio.com” as a browser URL

## Introductory Project

The introductory project displays “Hello, World”. The Java-Script code is retrieved from Git Hub using the command prompt. From the command prompt the command to retrieve the code is

**git clone https://github.com/pluralsight/web-dev-starter.git**

This command copies the code to a folder -- **web-dev-starter--** under the starting folder of the command prompt – in my case this is

**C:\users\sncole\source\GitRepositories\VSAndOtherPlatformProjects\JavaScript\_GettingStarted**

The next step was to start the Visual Studio Editor, which I did -- not via the command prompt -- but by clicking its button pinned to the task bar. First I navigated to **c:\users\sncole\** **Pluralsight\_js\web-dev-starter** by invoking Visual Studio Editor’s pull-down menu **File > Open Folder… > *file\_browser***. Next I shut down the welcome page by clicking the ‘x’ next to ***Getting Started*** (in the upper left corner of the large pane). The JavaScript is in **index.html**, which is accessible from Visual Studio Editor’s explorer panel on the left edge.

Visual Studio Editor has a built-in command prompt, and you can invoke it by typing <ctrl>` (the character after <ctrl> is sometimes called an “accent” or a “backward apostrophe”).

Before invoking this – and any node.js project - for the 1st time, it is necessary to install the npm packages that belong to the project. From the command prompt which has navigated to the same folder

**c:\users\sncole\Pluralsight\_js\web-dev-starter**

I used the command

**npm install**

This did not work at the outset. I noticed that the folder **node\_modules** had not been loaded. To correct the error, I started the Git Bash command-line interpreter, and I navigated to

**c:\users\sncole\Pluralsight\_js\web-dev-starter**

Then I typed

**npm install**

again, and it worked by loading the folder **node\_modules**.

The Pluralsight instructor advised that it is safer to type **npm install** from an external command prompt – not from the command prompt in the Visual Studio Editor. Another action triggered by **npm install** was to look at package.json, which is listed in **EXPLORER** - in Visual Studio Editor’s left pane.

* Open package.json by clicking the name in the left pane.
* **npm install** noted the dependency item **lite-server** (version 2.5.4); this is indicated by the text in package.json immediate after “devDependencies”:, and it did – indeed – install **lite-server**. (Open node\_modules by clicking the name in the left pane, and scroll down the list, where you will find **lite-server**.)
* You can invoke **lite-server** from **Windows PowerShell**, and you can invoke **Windows PowerShell** by typing <ctrl>`. The command prompt is “PS”, and by default the current folder is the folder, web-dev-starter, the folder that contains this JavaScript code.
* To start **lite-server** type the command at the **PS** prompt

**npm run start**

and the browser shows “Hello World”.

To make development easy to use, it is useful to have the Visual Studio Editor displayed side-by-side with the Browser (which is now displaying “Hello World!”. Resize both windows – Visual Studio Code and the Browser, and move them so that they share the screen (e.g Visual Studio Code occupying 60% of the terminal, and the Browser to the right of Visual Studio Code occupying 40% of the terminal). You can gain more real-estate in Visual Studio Code by hiding the explorer in the left pane; the icon in the upper-left corner (with 2 cascaded sheets) is a toggle switch that alternately hides and displays the explorer.

Try making a small change to “Hello World!”. For example, delete “World”. Save the text change by typing <ctrl>s. After a couple of seconds you will see the change reflected in the browser.

## Sample Website

The downloaded Exercise Files is a zip file titled javascript-getting-started.zip. When you expand javascript-getting-started.zip, you will see a list of folders titled “02”, “03”, . . . , “10”. The folder “02” for section 2 of this Pluralsight course contains the files that we need for this clip. (Do not follow the instructor’s example of expanding “05”.) When you drill down into “02”, then “demos”, then “after”, then “Js-demo”, you will see a set of files that are similar to those in [Introductory Project](#_First_Project).

* I chose to copy the files from js-demo to **c:\users\sncole\source\GitRepositories\VSAndOtherPlatformProjects\JavaScript\_GettingStarted\SectionModule2**
* I started a Git Bash command prompt, and I navigated to the folder containing the copied files.
* Type the command **npm install**. You may have to wait a few seconds to get a response. Among other things **npm** has brought several files into folder node\_modules.
* Type the command **code .** to invoke Visual Studio Code.
* Expand index.html in the **Explorer** pane, and note that this example contains considerably more code than our Hello, World example. In fact, the only two differences are this index.html file and the inclusion of main.css in the css folder.
* Start the internal command prompt by typing <ctrl>`.
* Type **npm run start** to invoke lite-server. lite-server, in turn, starts the browser, where one can view the HTML and Java Script in action.
* Resize both windows – Visual Studio Code and the Browser, and move them so that they share the screen (e.g Visual Studio Code occupying 60% of the terminal, and the Browser - to the right of Visual Studio Code - occupying 40% of the terminal). You can gain more real-estate in Visual Studio Code by hiding the explorer in the left pane; the icon in the upper-left corner (with 2 cascaded sheets) is a toggle switch that alternately hides and displays the explorer.

In subsequent sections we will be adding JavaScript to the code in index.html, and we’ll observe the effect by looking at particular portions of what is displayed by the Browser. Also, we may want to look at console output.

* Right click in the browser, and click **Inspect** in the pop-up menu. The result will be a smaller window that occupies part of the browser window. At the top of this smaller window is a horizontal list of tabs.
* Click the tab titled **Console**. The console window will (evidently) accept commands; additionally it can be used to display output.
* You can dock this smaller window in different places. The Pluralsight instructor recommends docking it at the bottom of the browser window. To do this click the icon to the right of the horizontal tabs that shows 3 vertical bullets. Then click the dock-side icon that indicates “bottom”.

## Adding JavaScript Code to a Web Page

A very common use of JavaScript is to enhance the markup in an HTML page.

The **<script>** tag separates HTML code from JavaScript code.

. . .

<script>

// JavaScript goes here

</script>

. . .

The closing tag </script> is important. (The syntax <script “src=./*filename*.js” /> may work with some browsers, but not necessarily all browsers.)

A convenient place to put JavaScript is immediately before the closing **</body>** in index.html, and the JavaScript example in this case is

alert(‘Hello World!’);

In summary the end of index.html - in our sample web site – should look like

<script>

alert(‘Hello World!’);

</script>

</body>

</html>

Before typing <ctrl>s (to save the code changes) make certain that the Browser is running. If Visual Studio Code is not showing a command prompt, type <ctrl>`. Then to start the browser type

**npm start**

(Evidently “run” is optional in **npm run start.**) Finally type <ctrl>s to start (or restart) executing the code in index.html. You will see “Hello, World!” displayed on the browser; click the **OK** command button to dismiss the alert message. You can change the JavaScript, and see the results immediately. For example, add a 2nd **alert()** function call immediately after alert(‘Hello World!’);. In response to <ctrl>s, we get 2 messages in succession (as expected).

## Working with JavaScript Files

Even though <script> can be used to set off JavaScript in an HTML file, it’s better practice to put this code into a file (suffix .js).

<script “src=./*filename*.js”></script> // ./ means that the file is in the current folder

A recommended place to insert JavaScript is close to the end of the HTML – after the last closing </div> and before the closing </body>.

Camel notation – as in **accountName** is common in JavaScript.

To modify web-site text – specified by identifier – examine the function in utils.js. The identifier in this function is “message”, and you can see how it is used by searching index.html for an instance where “message” appears as an **id** of markup.

JavaScript is case sensitive.

DEBUGGING TIPS

If you believe that you have a JavaScript error . . .

* Right click on the web page to get Chrome’s attention. Chrome displays a pop-up menu.
* Click **Inspect**. Chrome displays a pop-up dialog.
* By default the **Element** tag is selected. Instead, click the **Console** tag. You may see diagnostic text displayed with red text. Sometimes it may not be obvious where the error occurred. Look at the far-right edge of the diagnostic, where the module name and line number will probably be shown.

We have seen that alert() can be used to show diagnostic information on the web-page output. You can similarly use

console.log (*any\_string*);

to place text in the information shown on the browser’s console.

## JavaScript Language

DECLARATIONS

* “var” – to introduce a variable is deprecated. It may still be present in some old JavaScript, but it is inadvisable to use it.
* A variable is declared and set to its initial value at the same time. For example . . .

Let price = 23.45;

Let accountName = ‘Sales’;

Let discounted = true;

* To change the value of a variable, the syntax is the same as the declaration but with “Let” omitted.
* A constant declaration uses the keyword “const” instead of “let”.

A variable name consists of letters, decimal digits, ‘\_’, and ‘$’. But the 1st letter of a variable must not be a decimal digit.

OPERATORS

**typeof** is a unary JavaScript operator that – when applied to a variable or constant – yields the type (number, string, etc.) of that variable or constant. For example

let price = 49.99;

Then the value of (typeof price) is “number”.

In addition to the standard arithmetic operators [+, -, \*, /], JavaScript also supports the **modulo** operator ‘%’; 4 % 3 equals 1; 15 % 5 equals 0; etc.

Operators can be combined with assignment (=) for abbreviation. After

prince += 2;

price contains 51.99. ++ and -- can be used as a prefix or as a suffix to increment or decrement by 1.

Use the keywords **“mdn operator precedence”** with Google to find an article that describes JavaScript operator precedence rules.

NUMBERS

Numbers in JavaScript contain floating-point values. Therefore, there is always the possibility that a number – obtained as a result of some arithmetic – could be very slightly inexact as a consequence of floating-point inaccuracies.

STRINGS

A string literal is enclosed in quotation marks (“) , (‘), or (`). To embed a quotation mark in the string, one could use a different quotation mark for delimiters, which would prevent the embedded quotation mark from appearing to be a delimiter. Another possibility is to use the “escape” character {\) as a prefix of the embedded quotation mark. Thus “Hello \”World\”” would produce

Hello “World”

To get more information about the escape character, keywords **“mdn string”** with Google. The **mdn String** article contains a section on **Escape notation**.

String concatenation is expressed by the (+) binary operator.

To convert a number to a string, use the ToString() method. For example

let price = 49.99; // numeric form starts with a lower-case letter

let Price = price.toString(); // string form starts with an upper-case letter

alert('$' + Price); // $49.99 is displayed

To convert a number to a string, use the parseFloat() function. For example

let Price = 49.99; // string form starts with an upper-case letter

let price = Number.parseFloat(Price); // numeric form starts with a lower-case letter

alert(price - 3); // 46.99 is displayed

OBJECTS

A person usually has a first name and a last name. In JavaScript we express this by

let person = {

firstName: ‘John’,

lastName: ‘Adams’

};

**firstName** and **lastName** are properties of the object **person**. Properties are accessible via the (.) operator.

alert(person.lastName); // displays Adams

Instead of **person.lastName** to retrieve the property, there is also the notation **person[‘lastName’]**.

ARRAYS

A 3-element array is declared . . .

let *array\_name* = [ *value\_of\_1st\_element*, *value\_of\_2nd\_element*, *value\_of\_3rd\_element*  ];

A constant array is similar, with “const” in place of “let”.

The indexes start at 0; thus the 3 indexes of the array above are 0, 1, and 2.

(typeof array0)

Is always “object”. To test whether **array0** is an array use the fact that

Array.isArray(array0)

has the value **true** if and only if **array0** is an array.

Use the keywords **“mdn array”** with Google to find an article that describes JavaScript array – properties, methods, etc. Some frequently used methods are push(), pop(), shift(), unshift(), slice(), and splice().

**array0.push(x)** appends the element x to the end of **array0.**

**array0.pop()** removes the largest-indexed item from **array0** and returns that element to the calling function.

**unshift()** and **shift()** are analogous to **push()** and **pop()**, except that they work with the 0th element of the array.

**array0.slice(*begin, end*)** returns the sub-array starting from index *begin* and going up to but not including index *end*. a**rray0** is not affected by **slice()**.

**array0.splice(*begin, count, new\_element*)** removes ***count*** elements from **array0**, starting from index *begin*, and inserts the element ***new\_element*** in place of the deleted elements. **c*ount*** may be 0 (if you only wanted to insert, not delete). ***new\_element*** is optional and may be omitted (if you only wanted to delete, not insert).

In addition refer to **indexof()**, **filter()**, **find()**, and **forEach()** for searching, replacing, etc.

CONTROL FLOW

Comparison operators are similar to c, c++, and c#, except in the following cases.

* The comparison for equality is expressed by ===.
* The comparison for inequality is expressed by !==.

The more common == and != comparison operators are available in JavaScript, and they permit comparisons between items (variables, constants, or literals) that are of different types. This can lead to confusion, and it is recommended that these operators be avoided.

When you are working with non integers, floating-point inaccuracies can make comparisons tricky. One way to resolve this problem is to truncate floating point numbers to a fixed number of digits. The syntax for truncating to 2 digits is

+*floating-point-value*.toFixed(2)

If you omit the ‘+’, the truncation is still performed, but the result is a string, instead of a number. ‘+’ does not imply truncation for positive values. I tried it for a negative value, the truncation occurs as one would expect.

The syntax for a list of several consecutive **if** statements – an alternative to **case** statements - uses **else if**.

If (*condition1*) {

*Code\_block\_1*

}

else if (*condition2*) {

*Code\_block\_2*

}

else if (*condition3*) {

*Code\_block\_3*

}

etc.

The for() statement is one way to express a loop.

for ( let i=*initial\_value*; *test\_whether\_to\_continue*; *increment\_statement*) {

*code\_block*

}

Another way to express a loop uses **while**.

while ( *condition* ) {

*code\_block*

}

The loop continues as long as *condition* evaluates to **true**. Therefore, *code\_block* must eventually change some value that causes *condition* evaluates to **false**; otherwise, you get an infinite loop.

A third way to express a loop uses **do … while**.

do {

*code\_block*

}

while ( *condition* )

As in c++ and c#, (for all 3 types of loop) the **break** statement can be used to exit the loop unconditionally, and the **continue** statement can be used to jump to the end of the of the *code\_block*.

SCOPE

Variables and constants introduced by **let** and **const** are limited in scope to the code in enclosing braces (if any). This is a very good reason to use **let** and **const** instead of **var**.

FUNCTIONS

The syntax of a function declaration is

function *name\_of\_function* ( *optional\_arguments* ) {

*body*

}

An alternative syntax is

let *name\_of\_function* = function *optional\_debugging\_function\_name*  ( *optional\_arguments* ) {

*body*

}

You invoke the function using *name\_of\_function*, not *optional\_debugging\_function\_name*. It is good practice to include *optional\_debugging\_name\_of\_function*, because the browser’s console can use that name to refer to the function in the event of an error.

A function can be declared within an object. Expanding the *person* object (introduced above), we could have

let person = {

firstName: ‘John’,

lastName: ‘Adams’,

showInfo: function() {

showMessage(“name is “ +this. firstName + “ “ + this.lastName);

}

};

When you pass a scalar (e.g. an ordinary variable) as an argument to a function, and when the function changes the value of that variable, this has no effect on that scalar (i.e. passing by value). But when you pass an object as an argument to a function, and when the function changes the value of one of the object’s properties, this is – indeed – a change that affects the object (i.e. passing by reference).

## Apply JavaScript to a Web Page

Objects on a web page have a protocol called the “Document Object Model” – or more briefly DOM. **document** is an object that refers to the entire web page. The word **Element** in DOM terminology is a string of HTML code, e.g.

<h1 class=”col-sm-12”>GET A GRIP</h1>

A way that JavaScript is frequently used is to change the text of some element. You can refer to the element’s identifier or its class. For example, the web page might contain

. . .

<h2 id="percent\_off">20% OFF</h2>

. . .

(We recently added **id="percent\_off"**, so that it would be possible to refer to this <h2> element in JavaScript.) We change the text with the statement

document.getElementById(‘percent\_off’).textContent = *new\_text*;

It is useful to work with the **class** or **classList** property when using a combination of JavaScript and CSS to change properties of HTML elements. Refer to the code in **home.js** that immediately follows the comment “Use JavaScript coupled with CSS to change the color of some text, and experiment with the classList object.”. Secondly refer to the code in **home.js** that immediately follows the comment “responding to a mouse button click”. (The button is toward the end with the title “SEE REVIEW”.) Finally refer to the console log after executing this code and clicking the button.

Note the syntax of adding an event to a DOM element.

*DOM\_element****.*addEventListener(***event\_name***,** **function() {**

*function\_body*

**}**

*event\_name* depends upon the type of DOM element; you can get a list and descriptions of events from Google; use the keyword “mdn” (Mozilla Development Network) plus a description of the element’s type.

Instead of getting a single HTML element (**document.getElementById()**), we can get a collection of HTML elements via

document. getElementsByClassName(*class\_name*);

This returns an object called an **HTMLCollection** – not exactly an array but similar enough, so that one can use array methods to manipulate the markup.

## Standard Built-in Objects

Use the keywords **“mdn built-in objects”** with Google to find an article that discusses objects that are automatically available. For example **Array**, **Date**, **Math**, **String**, . . .

Click on **Date** in the left –hand column for suggested methods that one could invoke to get information about the date. These methods apply not only to the date object (which contains current date/time), but also to date objects that one might obtain from a database.

let myDate = new Date("4/8/2020 11:35"); // or you could define it with year, month, day, etc.

showMessage (myDate.getFullYear());

Click on **String** in the left-hand column for suggested methods pertaining to strings. myString.charAt(*position*) returns a 1-character string in the indicated position (count starting from 0). myString.indexOf(*substring*) finds a particular substring. myString.substring() returns the substring specified by its starting and ending positions. Notice, also, the methods that begin with “.trim”.

## Less Disciplined JavaScript

JavaScript tends to be backward compatible with older standards. Undeclared variables or variables declared with “var” were previously permitted. If you want to detect and correct undisciplined JavaScript (possibly inherited), add the string literal

‘use string’;

Place the literal at the top of a script module (*name.*js) to catch undisciplined code for the entire module. Place the literal within a function to catch undisciplined code for the entire function.