Tutorial : Javascript in the Browser

Using JavaScript with HTML

Basics

JavaScript allows webpages to be more interactive. JavaScript can execute in response to user interactions and alter the contents of the webpage. Ex: A user clicks on a button, and JavaScript executes and changes the color of the webpage.

The Document Object Model (or DOM) is a data structure that represents all parts of an HTML document. The JavaScript object document represents the entire DOM and is created from the document's HTML. Changes made to `document` are reflected in the browser presentation and/or behavior.

Webpages add JavaScript code by using the `<script>` tag. JavaScript code between `<script></script>` tags is executed by the browser's JavaScript engine.

Writing JavaScript within the body of an HTML file.

The JavaScript code below uses the document.writeln() method, which outputs HTML into the document and alters the DOM.

1. Read the HTML and JavaScript below.
2. Render the webpage to run the JavaScript code that displays a randomly generated response.
3. Add more responses to the `responses` array, and render the webpage a few times until one of your new responses is displayed.

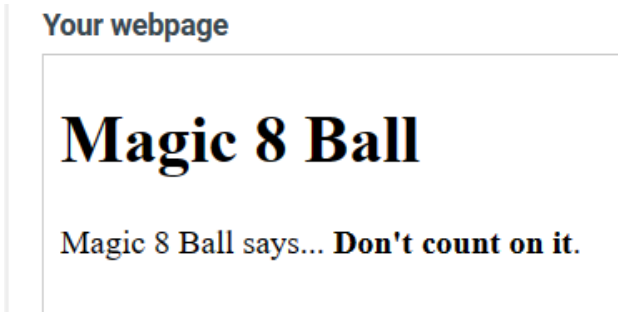
You can download and run the code from the following link :

https://replit.com/join/uytdobtkem-pragaticoder (https://replit.com/join/uytdobtkem-pragaticoder)

CODE :

```
<!DOCTYPE html>
<html>
<head>
<title>Magic 8 Ball</title>
<meta charset="UTF-8">
</head>
<body>
<h1>Magic 8 Ball</h1>
```

```
<script>
// Possible 8 Ball responses
let responses = [ "Without a doubt", "Ask again later", "Don't count on it" ];
// Display a randomly chosen response
let randomNum = Math.floor(Math.random() * responses.length);
document.writeln("<p>Magic 8 Ball says... <strong>" + responses[randomNum] + "</strong>.
</p>");
</script>
</body>
</html>
```



Magic 8 Ball

Magic 8 Ball says... **Don't count on it.**

Window object

JavaScript running in a web browser has access to the window object, which represents an open browser window. In a tabbed browser, each tab has a `window` object. The `document` object is a property of the `window` object and can be accessed as `window.document` or just `document`. Other properties of the `window` object include:

- window.location is a location object that contains information about the window's current URL. Ex: `window.location.hostname` is the URL's hostname.
- window.navigator is a navigator object that contains information about the browser. Ex: `window.navigator.userAgent` returns the browser's user agent string.
- window.innerHeight and window.innerWidth are the height and width in pixels of the window's content area. Ex: `window.innerWidth` returns 600 if the browser's content area is 600 pixels wide.

The `window` object defines some useful methods:

- window.alert() displays an alert dialog box. Ex: `window.alert("Hello")` displays a dialog box with the message "Hello".
- window.confirm() displays a confirmation dialog box with OK and Cancel buttons. `confirm()` returns true if OK is pressed and false if Cancel is pressed. Ex: `window.confirm("Are you sure?")` displays a dialog box with the question.

- window.open() opens a new browser window. Ex: `window.open("http://www.twitter.com/")` opens a new browser that loads the Twitter webpage.

Example :

Using the window object.

Use the `window.confirm()` method to ask if the user would like to see a popup window:

let okPressed = window.confirm("Would you like to see a popup window?");

Then render the webpage, and click the OK button when prompted to see a small browser window created by `window.open()`. You may need to give your browser permission to show the popup window since many browsers prevent popups from displaying by default.

```
<!DOCTYPE html>
<html>
<head>
   <title>JavaScript Demo</title>
   <meta charset="UTF-8">
</head>
<body>
   <h1>Popup Demo</h1>
   <script>

   let okPressed = window.confirm("Would you like to see a popup window?");
   if (okPressed) {
      let myWindow = window.open("", "", "width=250, height=100");
      myWindow.document.writeln("<h1>Hello, Popup!</h1>");
   }

   </script>
</body>
</html>
```

You can download and run the solution of this code by clicking on the following link :

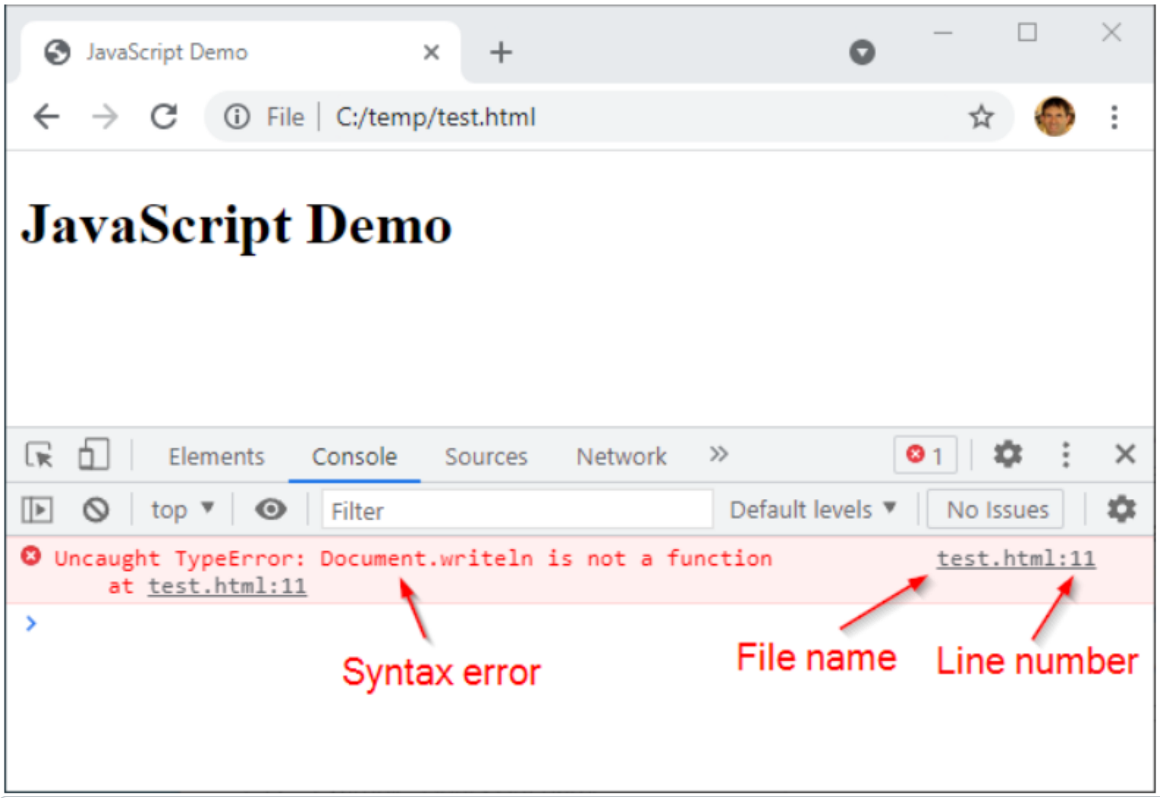
https://replit.com/join/dwuruinnrw-pragaticoder (https://replit.com/join/dwuruinnrw-pragaticoder)

Using the console

Modern browsers provide a console that allows the JavaScript code to produce informational and debugging output for the web developer, which does not affect the functionality or presentation of the webpage. By default, the console is not visible. The console is viewable in Chrome by pressing Ctrl+Shift+J in Windows/Linux or Cmd+Opt+J on a Mac.

When a syntax error is present in JavaScript code or a run-time error occurs, the error is only made visible in the console. The figure below shows the syntax error created when the developer accidentally typed `Document.writeln()` with a capital "D". The console appears underneath the webpage. Good practice is to leave the console open while writing and testing JavaScript code.

Figure 7.1.1: Chrome console showing a syntax error on line 11 of test.html.



```
Uncaught TypeError: Document.writeln is not a function          test.html:11
    at test.html:11
```

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <title>JavaScript Demo</title>
</head>
<body>
   <h1>JavaScript Demo</h1>
   <script>

   Document.writeln("<p>Hello, JavaScript!</p>");

   </script>
</body>
</html>
```

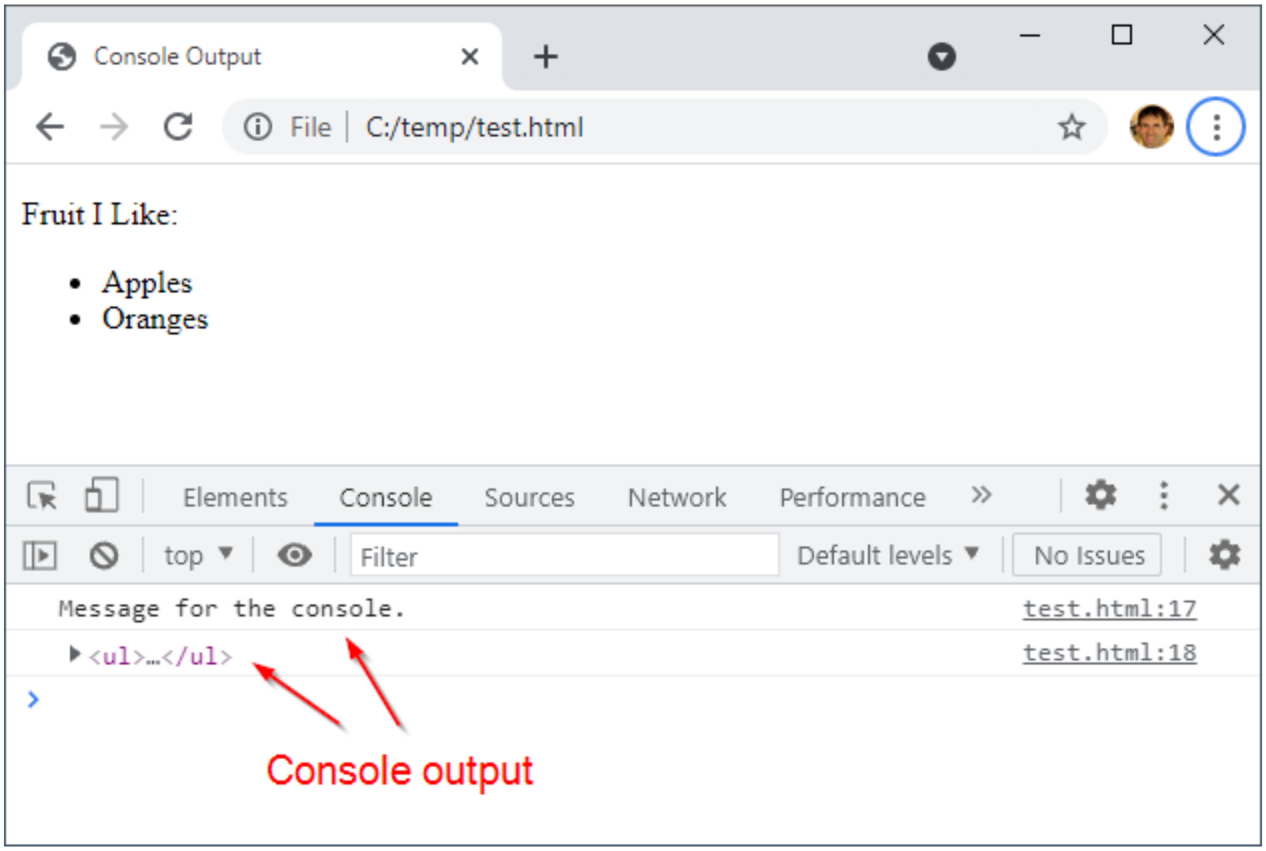
The browser provides a `console` object with a defined set of methods, or API, that the `console` object supports. An API (Application Programming Interface) is a specification of the methods and objects that defines how a programmer should interact with software components. The console API includes the following methods:

- console.log() displays informational data to the console.
- console.warn() displays warnings to the console. The browser usually has a special indicator to differentiate a warning from the standard log message. Ex: A yellow warning box.

- console.error() displays errors to the console. The browser usually has a special indicator to differentiate an error from a warning or the standard log message. Ex: A red error box.
- console.dir() displays a JavaScript object to the console. The browser usually supports a method for compactly representing the object. Ex: a hierarchical tree representation allowing a developer to expand and collapse the object contents.

console.log() output example.

When the web browser console is open, both the webpage and the console are simultaneously visible.



```
Message for the console.                    test.html:17
▸<ul>…</ul>                                 test.html:18
```

console.log() can print both strings and concise representations of HTML elements.

```
<body>
   <p>
      Fruit I Like:
   </p>
   <ul>
      <li>Apples</li>
      <li>Oranges</li>
   </ul>

   <script>
console.log("Message for the console.");
console.log(document.getElementsByTagName("ul")[0]);
   </script>
</body>

Checkpoint :
```

log()	Helping determine why code isn't working as expected. console.log() is useful for printing debugging messages that help the programmer. console.log() is also helpful for seeing simplified visualizations of JavaScript data or parts of the DOM.
dir()	Displaying a structured JavaScript object. console.dir() is useful for displaying an object's properties for debug purposes.
warn()	Checking that assumptions in code are correct. Sometimes a developer may assume a variable has a certain value. The console.warn() method can be placed in strategic places in the code to indicate when those assumptions are not true.
error()	Reporting unexpected problems. The console.error() method can be called to display the state of the code for debugging. A well-written error message can be used by the developer to reproduce the problem and fix the bug.

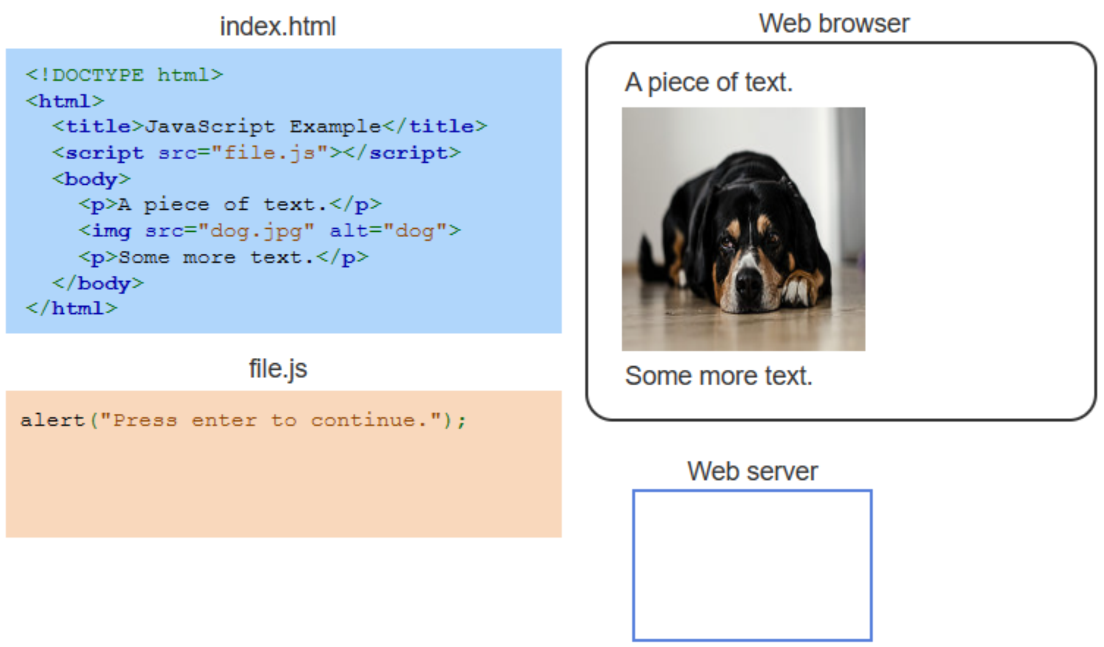
Loading JavaScript from an external file

Including JavaScript directly within an HTML file is common practice when using small amounts of JavaScript. However, writing JavaScript directly within the document may lead to problems as a webpage or website gets larger.

Good practice is to use `<script>` tags to load JavaScript from an external file rather than writing the JavaScript directly within the HTML file. The `<script>` tag's `src` attribute specifies a JavaScript file to load.

Example 7.1.1: Loading JavaScript from an external file.

```
<script src="bootstrap.js"></script>
```



index.html

```
<!DOCTYPE html>
<html>
  <title>JavaScript Example</title>
  <script src="file.js"></script>
  <body>
    <p>A piece of text.</p>
    <img src="dog.jpg" alt="dog">
    <p>Some more text.</p>
  </body>
</html>
```

file.js

```
alert("Press enter to continue.");
```

```
Explanation
```

1. The web server sends index.html to the web browser.
2. Web browser reads the HTML file. The <script> tag with src attribute indicates the browser should load JavaScript from an external file.
3. Web browser requests file.js from the web server.
4. Web browser reads and executes the JavaScript file. The alert() function displays a dialog box and waits for the user to press enter.
5. After the user presses enter, web browser finishes reading the JavaScript file and continues reading the HTML file.
6. Web browser requests the image file, and the web server responds with the image file.
7. Web browser finishes reading HTML file.

Loading JavaScript with async and defer

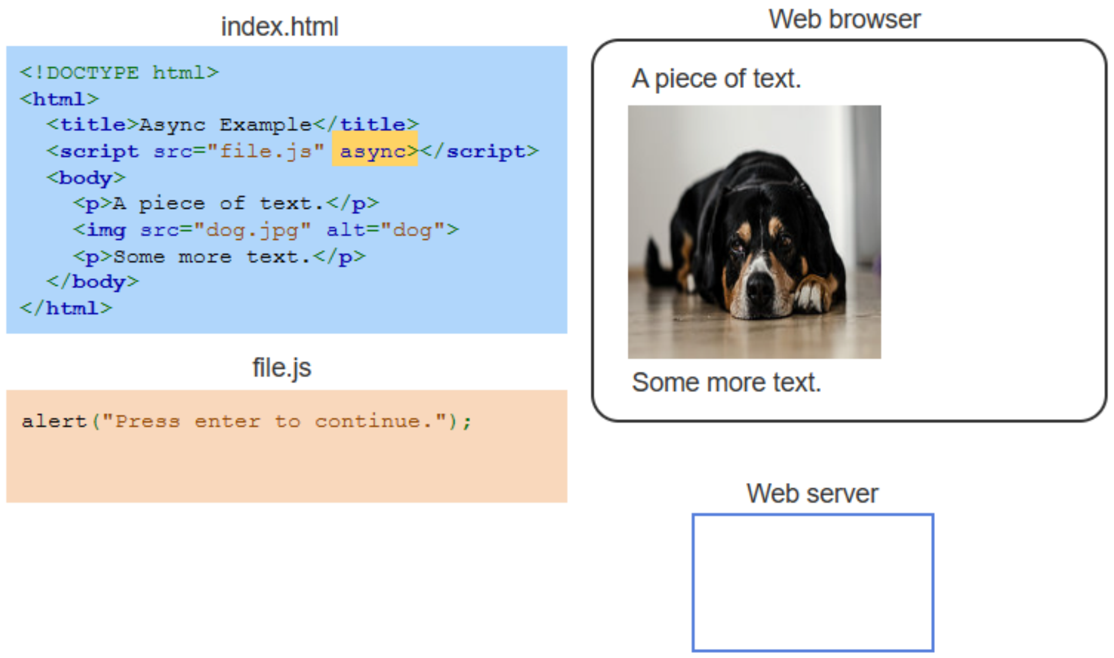
Although the `<script>` tag can be included anywhere in the head or body, good practice is to include the `<script>` tag in the head with the `async` or `defer` attributes set.

The `<script>` tag's async attribute allows the browser to process the webpage concurrently with loading and processing the JavaScript.

The `<script>` tag's defer attribute allows the browser to load the webpage concurrently with loading the JavaScript, but the JavaScript is not processed until the webpage is completely loaded.

Example :

Using the async attribute with the <script> tag.



```
<!DOCTYPE html>
<html>
  <title>Async Example</title>
  <script src="file.js" async></script>
  <body>
    <p>A piece of text.</p>
    <img src="dog.jpg" alt="dog">
    <p>Some more text.</p>
  </body>
</html>
```

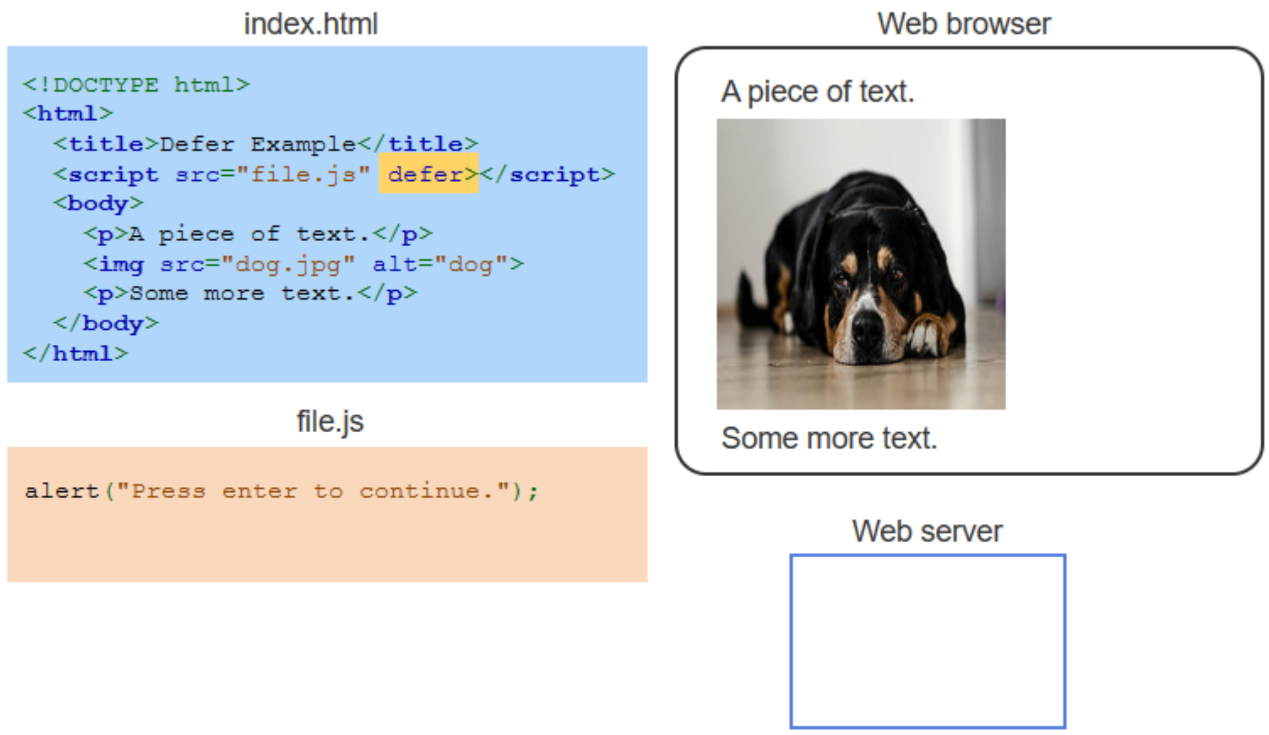
```
alert("Press enter to continue.");
```

Explanation :

1. Web browser reads index.html. <script> tag's async attribute causes browser to continue reading HTML without waiting for JavaScript file to load.
2. Web server responds with file.js while the browser requests the image file.
3. Web browser begins reading and executing the JavaScript file and pauses reading the HTML file. The web server concurrently responds to the image request.
4. After the user presses enter, web browser finishes reading the JavaScript file and continues processing the HTML file by displaying the dog.jpg image that was received.
5. Web browser finishes reading HTML file.

Example :

Using the defer attribute with the <script> tag.



```
<!DOCTYPE html>
<html>
  <title>Defer Example</title>
  <script src="file.js" defer></script>
  <body>
    <p>A piece of text.</p>
    <img src="dog.jpg" alt="dog">
    <p>Some more text.</p>
  </body>
</html>
```

```
alert("Press enter to continue.");
```

Explanation :

1. Web browser reads index.html. <script> tag's defer attribute causes browser to continue reading HTML without waiting for JavaScript file to load.
2. Web server responds with the JavaScript file while the browser requests the image file.
3. Web browser does not immediately process the JavaScript file due to the defer attribute. Instead, the browser continues to process the HTML.
4. After reading the HTML file, the web browser reads and executes the JavaScript file.
5. After the user presses enter, web browser finishes reading the JavaScript file.

Minification and obfuscation

To reduce the amount of JavaScript that must be downloaded from a web server, developers often minify a website's JavaScript. Minification or minimization is the process of removing unnecessary characters (like whitespace and comments) from JavaScript code so the code executes the same but with fewer characters. Minification software may also rename identifiers into shorter ones to reduce space. Ex: `let totalReturns = 10;` may be converted into `let a=10;`.

Minified JavaScript is typically stored in a file with a ".min.js" file extension. An example of minified code from the **Bootstrap project** **(http://getbootstrap.com/getting-started/)** is shown below.

```
// Excerpt from bootstrap.min.js
a.fn.button=b,a.fn.button.Constructor=c,a.fn.button.noConflict=function(){
return a.fn.button=d,this},a(document).on("click.bs.button.data-api",
'[data-toggle^="button"]',function(c){let d=a(c.target).closest(".btn");
b.call(d,"toggle"),a(c.target).is('input[type="radio"],
```

A JavaScript obfuscator is software that converts JavaScript into an unreadable form that is very difficult to convert back into readable JavaScript. Developers obfuscate a website's JavaScript to prevent the code from being read or re-purposed by others. Obfuscated code may also be minified and appear in a ".min.js" file.