SWINBURNE UNIVERSITY OF TECHNOLOGY

COS10005 Web Development

Module 9 – Document Object Model

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- JavaScript Objects
- Document Object Model (DOM)
  - Predefined Objects
  - Document
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  - Specific Elements
  - Class and Style
- Array Object
- Date Object
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- Validating Form Values

JAVASCRIPT OBJECTS

JavaScript Objects

- JavaScript is an **object-based language** and

JavaScript Principle 1:

All the elements on a webpage are objects!

- nd

encapsulation.

- It can access objects such as
  - browser objects such as window, navigator

JavaScript Principle 2:

Get access to the right elements/objects, use the right properties and the right functions.

nd

buttons, etc., within forms.

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Introduction_to_Object-Oriented_JavaScript

JavaScript Objects (continued)

An **object** has

- **properties** which **describe** the object **Principle 1!**
  - A form `<input>` object has properties: `id`, *`value`*, etc.
  - Usually *nouns* as they *describe things*.
- **functions** which **describe actions** that the object can do.
  - A form element can submit: `myForm.submit()`.
  - A image change its `href` attribute:
    `myImage.setAttribute("href", "image2.png")`
  - Usually *verbs* as they *describe actions*.

Principle 2!

Intrinsic Object Types

- Array
- Boolean
- Date
- Math
- Number
- String
- etc.

Examples

- allows you to create an object

```
// creates a date object with the current date
var today = new Date();
alert(today);
```

Must be capitalised.

- provides related functions

```
// returns PI
var x = Math.PI;
```

There are also predefined **global** functions

DOCUMENT OBJECT MODEL

- DOM HISTORY

Document Object Model (DOM)

- a platform and language neutral interface that will allow programs and scripts to dynamically access and update the content, structure and style of a document [W3C]

  http://www.w3.org/DOM/

- a way to represent and navigate an HTML or XML document as a tree

Document Object Model (DOM)

- The W3C has developed DOM "levels" to represent the different features that may be supported
  - DOM Level 0: The earlier *vendor specific* intermediate DOMs
  - **DOM Level 1:** HTML & XML document tree structures, including HTML specific elements and node add / move / delete.
  - **DOM Level 2:** XML namespaces, styles, views, and events
  - **DOM Level 3:** Divided into specific modular sections

    http://www.w3.org/DOM/DOMTR

How well are the Core and HTML DOMs implemented in browsers?

http://quirksmode.org/dom/core/

http://quirksmode.org/dom/w3c_html.html

Document Object Model (DOM)

- Current standard is DOM Level 3, released in 2004
- DOM is not part of core JavaScript, but JavaScript uses the DOM to interact with the Web browser. This technique is referred to as **DOM manipulation**
- DOM does use JavaScript's Intrinsic Objects, such as Array, Boolean, Date, Math, Number, RegExp, String, …

DOM Support

- There were many problems related to browser specific DOM implementation! ☹
  Code-writers had to create “browser detection” code and “browser-specific” routines to get around the different DOM.
- W3C DOM Level 1 (rec. Oct 1998) and DOM Level 2 (rec. Nov 2000) are now largely supported by recent browsers.
- See what DOM your browser supports
  http://www.w3.org/2003/02/06-dom-support.html
- See the DOM compatibility tests
  http://www.quirksmode.org/compatibility.html

DOCUMENT OBJECT MODEL
- PREDEFINED OBJECTS

Predefined Objects

- *window*
- ***document***
- *navigator*
- *screen*
- *history*
- *location*

Examples

```
window.close();
window.alert();

document.getElementById("myID");

navigator.platform;
navigator.language;

screen.height;
screen.width;

history.back();
history.forward();

location.href;
```

DOCUMENT OBJECT MODEL

- `window`

Window Object – `window`

- **Methods** *(this is **not** a complete list of its methods)*

`alert(`*`text`*`)`	- pops up an alert box
`confirm(`*`text`*`)`	- pops up a box with 'OK' or 'Cancel'
`prompt(`*`text,def`*`)`	- retrieves a line of text from the user
`open(`*`url,[ops]`*`)`	- opens up a new window
`close()`	- closes a window
`focus()`	- gives focus to a window
`blur()`	- removes focus from a window

- **Window HTML Event Handling**

`onload`	- occurs when the page has completed the loading process.

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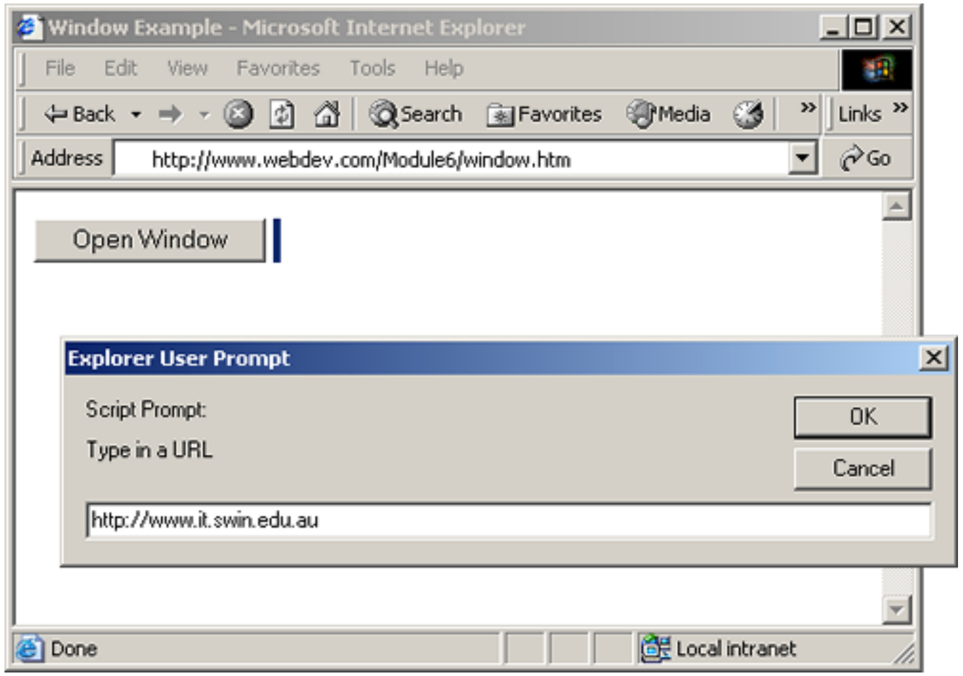
Window Object – Example

```
function newWindow() {
    theUrl = window.prompt("Type in a URL",
                                          window.location);
    window.open(theUrl);
}
```


Window Example - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media Links
Address
Go
Open Window
Explorer User Prompt
OK
Cancel
Done
Local intranet

Address: http://www.webdev.com/Module6/window.htm

Script Prompt:
Type in a URL

http://www.it.swin.edu.au

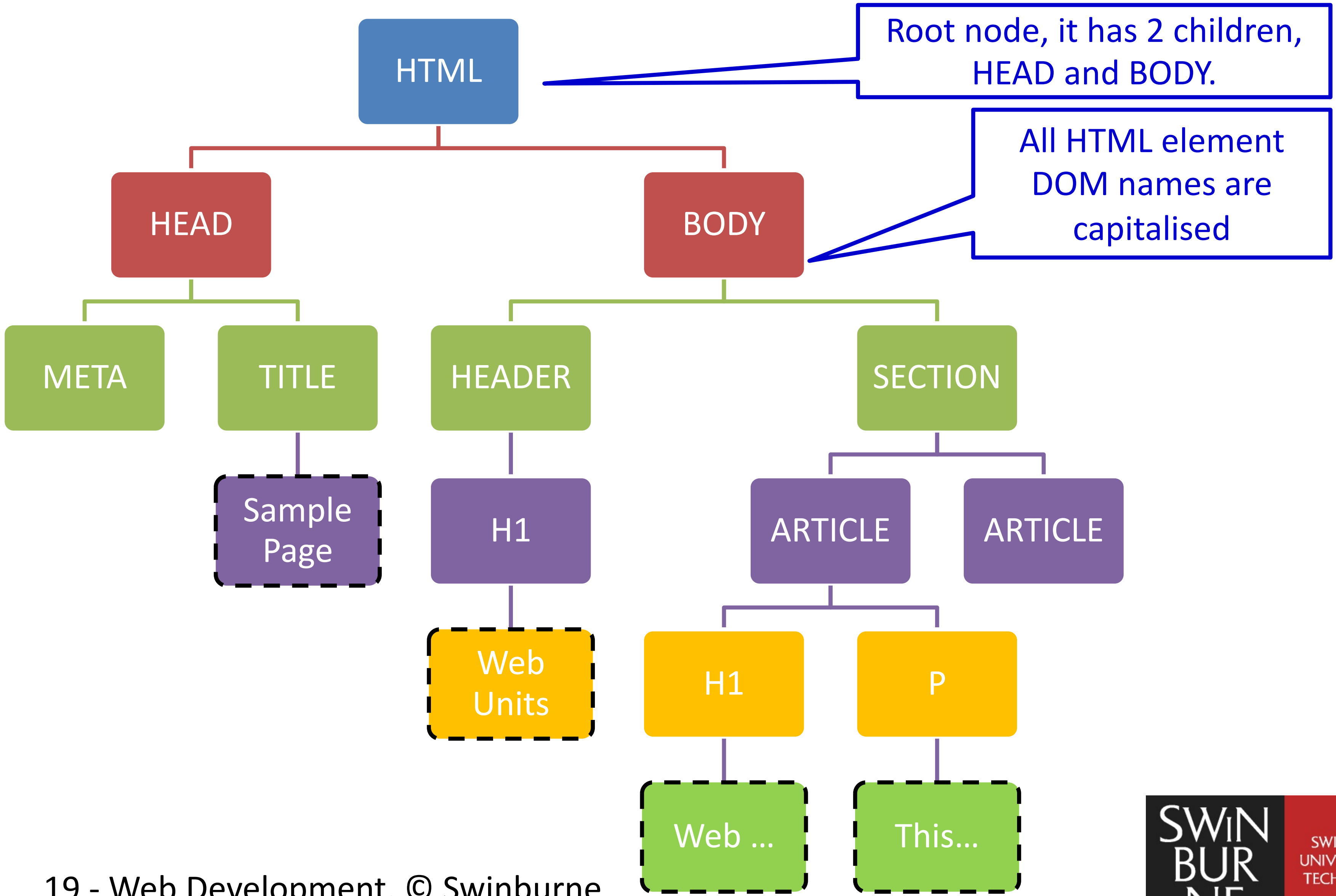
DOCUMENT OBJECT MODEL
- `document`

DOM Object - Example

- A **HTML document** is represented as a tree of nodes.
- The first node is referred to as the **root node.**
- Each node can have **children.**
- Node with no children is referred to as **leaf node.**

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="utf-8" />
  <title>Sample Page</title>
</head>
<body>
  <header>
    <h1>Web Units</h1>
  </header>
  <section>
     <article>
       <h1>Web Development</h1>
       <p>This unit covers…</p>
     </article>
     <article>
     </article>
  </section>
</body>
</html>
```

DOM Object – Tree Structure


HTML
Root node, it has 2 children, HEAD and BODY.
HEAD
BODY
All HTML element DOM names are capitalised
META
TITLE
HEADER
SECTION
Sample Page
H1
ARTICLE
ARTICLE
Web Units
H1
P
Web …
This…

Document Objects

Where are the objects?

- The entire HTML page is made up of **objects**
- Using the tree representation, each node is an **object.**
- In our example, we have 16 objects.

Document Object – Property/Function

- A frequently used **function** of the `document` object is

```
document.getElementById(<id>)
```

It returns the reference to a specific HTML element using the ID attribute specified in the HTML document. Sample use:

```
var x = document.getElementById("intro");
x.innerHTML = "This is introduction.";
x.style.color = "red";
x.style.backgroundColor = "blue";
```

Principle 1! **Principle 2!**

Document Object – Property/Function

- Some useful properties and functions of the `document` object:

`document.`

- `documentElement`
- **`getElementById()`**
- `getElementsByTagName()`
- `createElement()`
- `createTextNode()`
- `createAttribute()`

DOCUMENT OBJECT MODEL - ELEMENTS

Accessing Elements

- Three most frequently-used way to access HTML elements using JavaScript

An individual element.

```
var element1 = document.documentElement;
```

An individual element.

```
var element2 =
    document.getElementById("btnExecute");
```

An array of multiple elements.

```
var elements =
    document.getElementsByTagName("a");
```

Principle 1! **Principle 2!**

Accessing Elements (Examples)

- Get the body element (get all tags named "body")

Question:
How many `<body>` elements will be obtained?

```
var bodyElements =
document.getElementsByTagName("body");
```

- Get all images from the `<body>` element

```
var imgElements =
bodyElement[0].getElementsByTagName("img"
);
```

`bodyElement` is an array of only one `<body>` element. Thus, `bodyElement[0]` returns that only `<body>` element.

Accessing Elements (Examples)

- Get the element with `id="intro"`:

```
var introElement =
document.getElementById("intro");
```

- Get all `<p>` elements that are descendants of the element with `id="main"`

```
var mainElement =
document.getElementById("main")

var mainParagraphElements =
mainElement.getElementsByTagName("p
");
```

Using Properties and Functions

```
element.
        id
        className
        tagName
        getAttribute()
        setAttribute()
        removeAttribute()
```

```
<input
type="button"
id="btnExecute"
value="Execute"
class="myClass" />
```

- For example: `var element = document.getElementById("btnExecute");`
  - `element.id` → `"btnExecute"`
  - `element.tagName` → `"INPUT"`
  - `element.getAttribute("type")` → `"button"`

Using Properties and Functions

- How do you check the type of an element?
  - Property `tagName`
  - Example:

```
var tagName =
document.getElementById("btnExecute
").tagName;
if(tagName == "INPUT") {
   alert("This is an input element.");
}
```

Principle 2!

Using Properties and Functions

- Other properties

```
parentNode
firstChild
lastChild
previousSibling
nextSibling
```

```html
<article>
  <header id="h">
    Header!
  </header>
  <section>
    Section!
  </section>
</article>
```

- Examples `var element=document.getElementById("h");`
  - `element.parentNode` $\rightarrow$ The `article` element.
  - `element.firstChild` $\rightarrow$ The `Header!` text node.
  - `element.nextSibling` $\rightarrow$ The `section` element.

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DOCUMENT OBJECT MODEL
- SPECIFIC ELEMENTS

Specific Elements

- The following HTML elements will have specific properties
  - Links `<a …>…</a>`
  - Forms `<form …>…</form>`
  - Select / Option elements `<select …>… </select>`
  - Input (text, radio, checkbox, password, hidden, submit …) `<input … />`
  - Textarea `<textarea … >… </textarea>`
  - Images `<img … />`

Specific Elements – `<a>`

Anchor Element `<a href="…">…</a>`

- **`anchorElement.`**

  `href`

  `<a href="ads.html" id="s">`

- Examples

```
var myLink=document.getElementById("s");
```

  – `myLink.href`

  ↓

  The absolute URL of `ads.html`.

Specific Elements – `<form>`

Form Element `<form …>…</form>`

- `myForm.`

```
    elements[]
    action
    method
    submit()
    reset()
    length
```

An array of all the elements in the form.

- For example
  - `myForm.length`
  - `myForm.reset()`
  - `myForm.submit()`

Specific Elements – `<select>`

Select Element `<select …>…</select>`

- **`selectElement.`**

type	multiple
selectedIndex	name
value	options[]
disabled	add()
size	remove()

- For example
  - `mySelect.value`
  - `mySelect.options[0]`

```
<select>
  <option
value="iPhone4">iPhone
4</option>
  <option
value="iPhone5">iPhone
5</option>
  <option
value="iPhone6">iPhone
6</option>
</select>
```

Specific Elements – `<option>`

Option Element `<option …>…</option>`

- **`optionElement.`**

  ```
  text
  disabled
  selected
  value, …
  ```

- For example
  - `myOption.text`

Specific Elements – `<input>`

Input Element `<input … >`

- **`inputElement.`**

`form`	`readOnly`
`checked`	`value`
`disabled`	`select()`
`name`	`click(), …`

- For example
  - `myInput.checked`

Specific Elements – `<textarea>`

Text Area Element

`<textarea … >…</textarea>`

- **`textAreaElement.`**
  ```
  form
  disabled
  name
  readOnly
  value
  select(), …
  ```
- For example
  - `myTextArea.value`

Specific Elements – `<img>`

Image Element `<img … >`

- **`imgElement.`**

  `src`

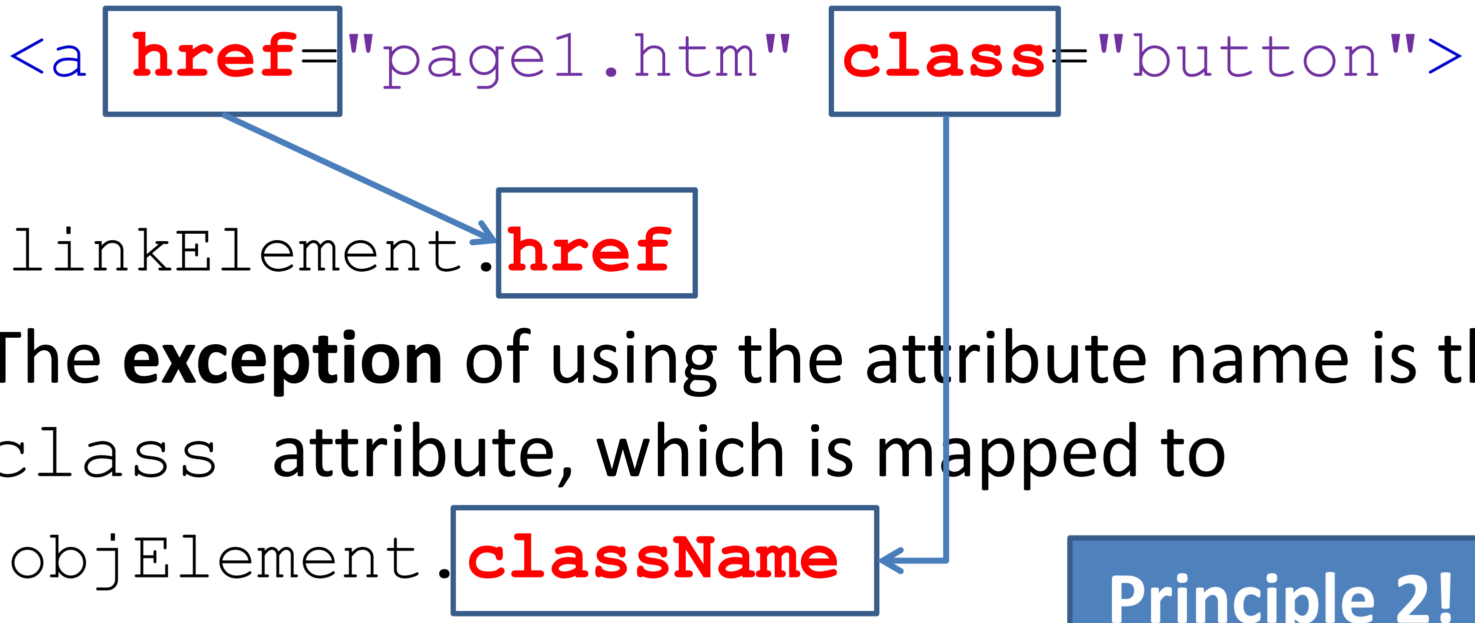
  `alt, …`

- For example
  - `myImg.src`
  - `myImg.alt`

DOCUMENT OBJECT MODEL
- CLASS AND STYLE

Document Object (Class and Style)

- Element attribute names are directly matched to DOM property names. For example,



```
<a href="page1.htm" class="button">

linkElement.href
```

- The **exception** of using the attribute name is the `class` attribute, which is mapped to

```
objElement.className
```

Principle 2!

Not "`class`", as "`class`" is a *reserved word* in JavaScript

Document Object (Class and Style)

- **Class** is often used to associate style with elements. If we change the class of an element in JavaScript, the browser changes the associated presentation of that element.

```
    if (objElement.className == "blue") {
            objElement.className = "red";
    }
<h1 class="blue">    ->    <h1 class="red">
```

- **Style** properties are typically hyphenated words, but this *does not work* in JavaScript, so CSS style properties are joined together using ‘camel’ case

    `some-css-property` becomes

    `someCssProperty`

Document Object (Class and Style)

- **`objElement.style.`**

```
color                        border
background                   borderCollapse
backgroundAttachment         borderColor
backgroundColor              borderSpacing
backgroundImage              borderStyle
backgroundPosition           borderTop
backgroundPositionX          borderRightColor
backgroundPositionY          borderLeftStyle
backgroundRepeat             borderBottomWidth
```

Principle 2!

- For example,

```
   if(objElement.style.color == "blue") {
        objElement.style.color = "red"
   }
CSS:   color:blue;   ->  color:blue;
```

DOCUMENT OBJECT MODEL
- ARRAY OBJECT

Array Object

- An indexed collection of **variables**
- A particular variable in an array is referenced by the array name and the **index** of the variable.
- For example:

index

```
var marks=[80, 75, 85, 95, 70, 65, 90];
```

marks	80	75	85	95	70	65	90
index:	0	1	2	3	4	5	6

– `marks[0]` contains 80 e.g., `alert(marks[0]);`

– `marks[4]` contains 70 e.g., `marks[4]=0;`

– `marks.length` is 7

property

Array Object (continued)

- In JavaScript an **Array** is an object.
- The **new** keyword is used in JavaScript to create an instance of an Array object.

```
var marks;
marks = new Array(10);
                   // 10 variables [0]-[9]
// or
var marks = new Array(15);
                   // 15 variables, [0]-[14]
```

parenthesis

use plural form to indicate array

Array Object (continued)

- Values can be assigned to variables in the array after the array has been created:

```
var subjects = new Array(2);
subjects[0] = "WD";
subjects[1] = "WP";
```

parenthesis

Square brackets

- Variables in an array may be initialised when the array is created:

```
var subjects = new Array("WD","WP");
var numbers = new Array(1,1,2,3);
```

Array Object (continued)

- The length of the array can be accessed using the `length` property. e.g. `numbers.length;`
- Values can be set programmatically:

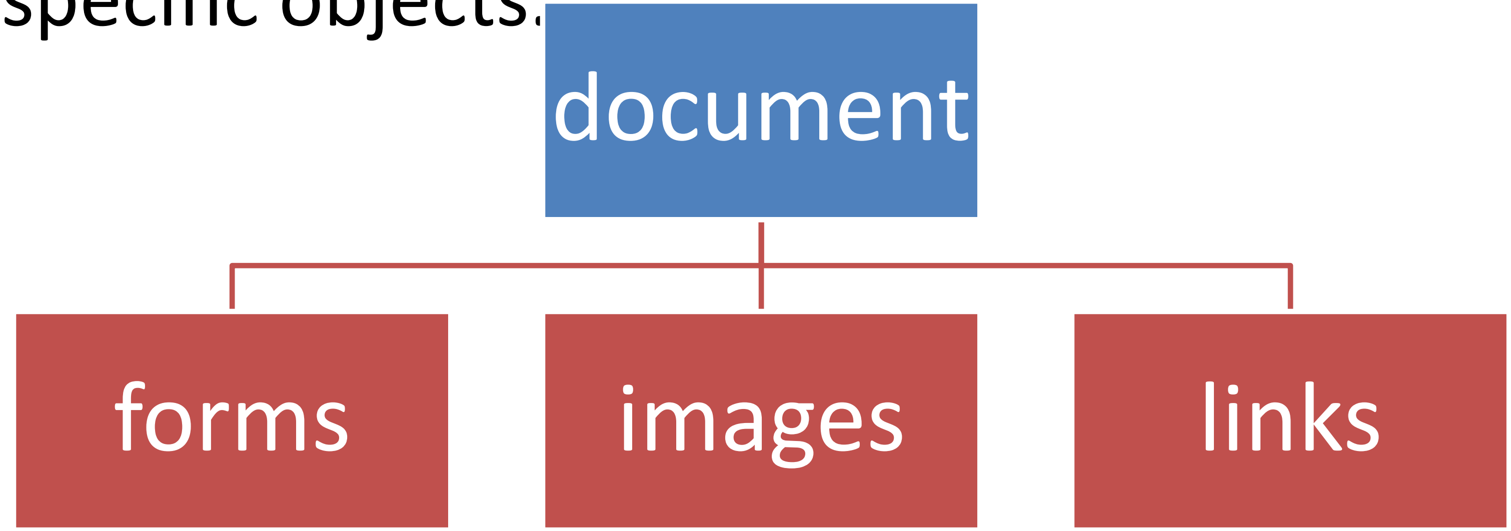
```
// create an array
var numbers = new Array(10);
// fill array with numbers
for (i=0; i < numbers.length; i++) {
    numbers[i] = i*2;
}
// display the last element
alert(numbers[numbers.length - 1]);
```

Why not subtract 1?

Why subtract 1?

Array Object (continued)

- The `document` object and its arrays of specific objects.



- These are **arrays** of specific objects, e.g. `forms` is an array of all the `<form>` objects on the webpage.

Array Object (continued)

- These arrays are created and initialised automatically.
- Use indexes to accessing the objects in those arrays :

```
var myForm = document.forms[1];
var myImage = document.images[2];
var myLink = document.links[0];
```

An alternative to using `document.getElementById()` to access individual elements.

Array Object (continued)

- display scores array as a horizontal chart

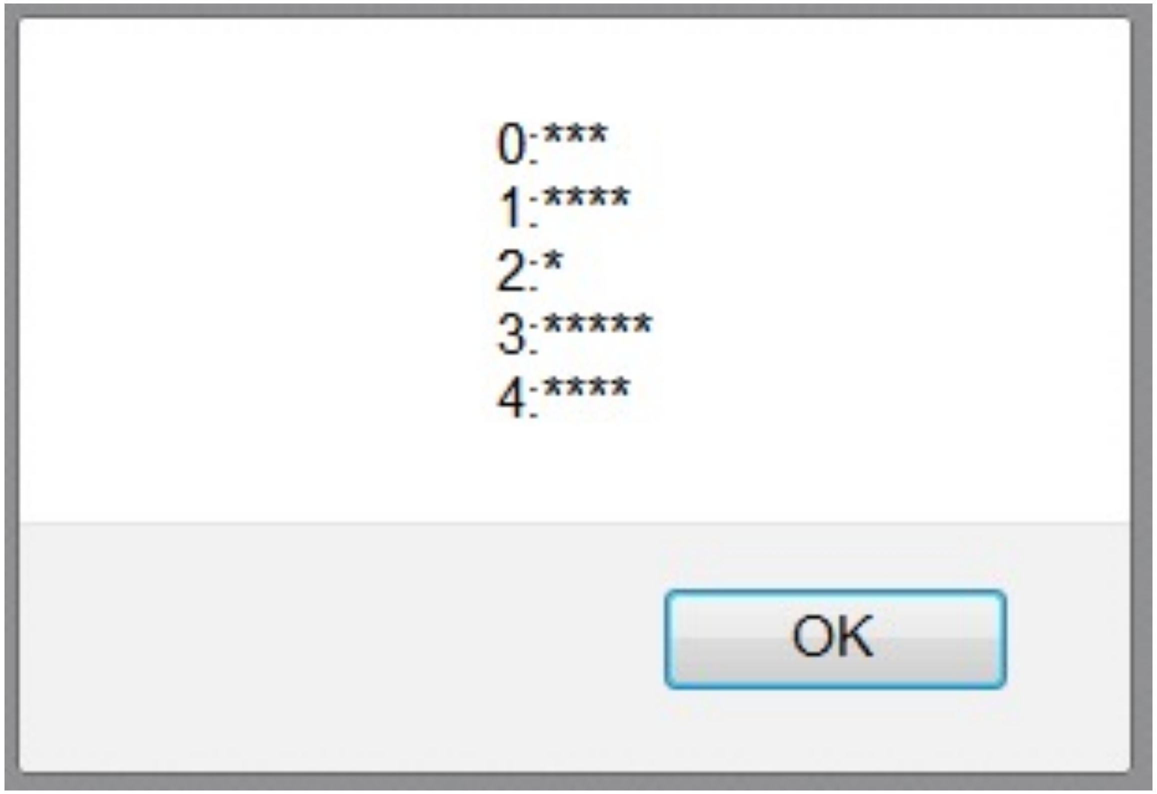
```
var scores = new Array(3,4,1,5,4);
var index;              // array index
var num;                // number
var ans = "";                 // string for output
// how to use for loop to traverse an array
for (index=0; index<scores.length; ++index) {
   num = scores[index];
   ans = ans + index.toString() + ": ";

   for (var i=0; i<num; i++) {
      ans = ans + "*";
   }
   ans = ans + "\n";
}
alert(ans);
```

Function to convert a number to a string

"\n" for line break

Array Object (continued)

The alert box will display:



```
0:***
1:****
2:*
3:*****
4:****
```

Array Object – Properties/Functions

Function	Description
`length`	returns length of the array
`join(delimiter)`	makes a string delimited with the items
`pop()`	removes the last item and return it
`push(item)`	Add item to the end of the array
`reverse()`	reverses the order of items
`shift()`	removes the first item and returns it
`slice(start,[end])`	returns a sub-array
`sort(fn)`	fn needs (a<b)==-1, (a==b)=0, (a>b)==1
`unshift(item)`	add item to start of array

https://developer.mozilla.org/en/JavaScript/Guide/Predefined_Core_Objects

DOCUMENT OBJECT MODEL
- DATE OBJECT

Date Object

- Represents a date
- Numeric value is expressed as millisecond

```
var d = new Date("May 8, 2013 17:30:00");
```

Full or 3-letter month

```
var d = new Date();
```

New instance of client's current date and time

- Functions can be used to obtain values within the date object

```
var n = d.getDate();
```

Date Object - Some Functions

Function	**Description**
`getDate()`	Returns the day of the month (from 1-31)
`getDay()`	Returns the day of the week (from 0-6)
`getFullYear()`	Returns the year (four digits)
`getHours()`	Returns the hour (from 0-23)
`getMilliseconds()`	Returns the milliseconds (from 0-999)
`getMinutes()`	Returns the minutes (from 0-59)
`getMonth()`	Returns the month (from 0-11)
`getSeconds()`	Returns the seconds (from 0-59)

DOCUMENT OBJECT MODEL
- GLOBAL FUNCTIONS

Global Functions

Be careful of case

Function	Description
`eval()`	Evaluates a string and executes it as if it was script code
`isFinite()`	Determines whether a value is a finite, legal number
`isNaN()`	Determines whether a value is an illegal number
`Number()`	Converts an value to a number
`parseFloat()`	Parses a string and returns a floating point number
`parseInt()`	Parses a string and returns an integer
`String()`	Converts an object's value to a string

Global Functions (Examples)

Function	**Example**	**Result**
`eval()`	`eval("2 + 3")`	5

`isFinite()`	`isFinite(5)`
	`isFinite("Web")`
		true
		false

`isNaN()`	`isNaN(5)`
	`isNaN("Web")`
		false
		true

`Number()`	`Number("22")`
	`Number("2 2")`
		22
		NaN – invalid number

`parseFloat()`	`parseFloat("2")`
	`parseFloat("2.34")`
	`parseFloat("2 34")`
	`parseFloat("2 units)`
	`parseFloat("unit 2)`
		2
		2.34
		2
		2
		NaN

Global Functions (Examples)

Function	Example	Result

`parseInt()`	`parseInt("2")`
	`parseInt("2.34")`
	`parseInt("2 34")`
	`parseInt("2 units)`
	`parseInt("unit 2)`
		`2`
		`2`
		`2`
		`2`
		`NaN`

`String()`	`String(0)`
	`String(`**`true`**`)`
	`String("2")`
		`"0"`
		`"true"`
		`"2"`

JAVASCRIPT
- VALIDATING FORM VALUES
(CRITICAL PART IN ASSIGNMENT 2)

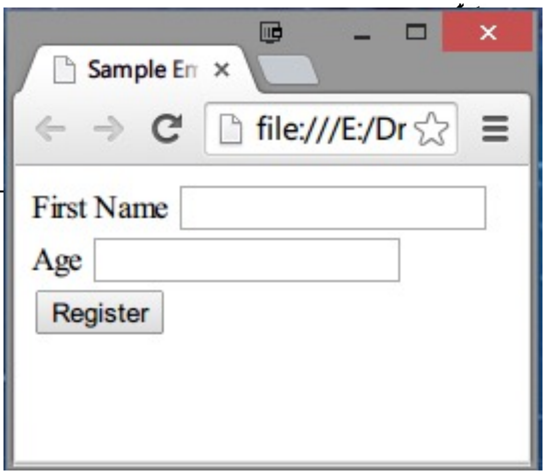
Forms and JavaScript

- JavaScript provides much greater **control** over the use of forms by:
  - **Checking form values** entered, before the form is submitted:
    - that **required** form values have been supplied
    - that values **conform to a type**
      (e.g., must be an integer, or a string, etc)
    - that values are **logical** or **constrained**
      (e.g., end date after start date, value in a range, etc)
  - **Alerting users** if invalid form values have been entered
  - **Pre-processing** form data before submission

Checking Form Data

Given the following HTML form, *take note of the **IDs***

```
<form id="regform" method="post"
   action="process.php">
   <div class="textinput">
      <label for="firstname">First Name</label>
      <input type="text" name="firstname"
                                 id="firstname" >
   </div>
   <div class="textinput">
      <label for="age">Age</label>
      <input type="text" name="age" id="age" >
   </div>
   <div class="buttoninput">
      <input type="submit" value="Register" >
   </div>
</form>
```



Checking Form Data (continued)

- Using the JavaScript template

Part 1

```
function validate() {
  /* validation code here */
  return true/false;
}
```

Write the data validation code, and return **`true`** if all valid, otherwise **`false`**

Part 2

```
function init() {
 var formElement =
   document.getElementById("regform");
   formElement.onsubmit = validate;
}
```

Link function `validate()` to the `onsubmit` event of the form

Part 3

```
window.onload = init;
```

Make sure function `init()` is executed when the page window is loaded.

Checking Form Data in Steps

- JavaScript validation Parts 2 and 3

Part 2

```
function init() {
  var regForm =
     document.getElementById("regform");
  regForm.onsubmit = validate;
}
```

Part 3

```
window.onload = init;
```

Checking Form Data (continued)

- JavaScript validation Part 1A

```
function validate() {
 var errMsg = "";
 var result;
 var firstName =
 document.getElementById("firstname").value;
 var age =
     document.getElementById("age").value;
```

value property of an HTML element

Checking Form Data (continued)

- JavaScript validation Part 1B

```
if (firstName == "") {
    errMsg = errMsg + "First Name cannot be
                                    empty.\n";
}
if (age == "") {
    errMsg += "Age cannot be empty.\n";
}
if (isNaN(age)) {
    errMsg += "Age is not a valid
                                    number.\n";
}
```

Concatenate error message

Add a new line for when displayed in the alert window

Use global function `isNaN()` to check if age contains a valid number.

Checking Form Data (continued)

- JavaScript validation Part 1C

```
if (errMsg != "") {
    alert(errMsg);
    result = false;
} else {
    result = true;
}
  return result;
}
```

Checks if any error messages

Error detected

Returns true is no errors detected, otherwise false

Checking Form Data (Regular Expressions)

- If you use **regular expressions**, define the regular expression pattern to be used, then use the `match()` function for checking, e.g.,

```
var ageRE = /^\d\d$/;
if (!age.match(ageRE)) {
     errMsg+="Invalid age.\n"
}
```

This regular expression allows only two digits for age, numbers only.
`/^[a-zA-Z ]+$/` allows letters and spaces only.

- http://www.w3schools.com/jsref/jsref_obj_regexp.asp

NEXT LECTURE:

JQUERY