Comp 125 - Visual Information Processing

Spring Semester 2019 - Week 3 - Monday

Dr Nick Hayward

JS Basics - data types - extras

- two more data types to consider, e.g. `undefined` and `null`
  - *undefined*
  - *a variable declared or updated without a value is **undefined***
    - its data type will also be **undefined**
    - e.g.

```
// variable declared without value and data type
var greeting;
// update variable to empty - specify value and type as `undefined`
greeting = undefined;
```

- `null`
  - *sets the value of a variable to **nothing***
    - data type will be set to **object** (this is known bug in JavaScript)
    - e.g.

```
// declare varible with value set to nothing - type will be `object`
var greeting = null;
```
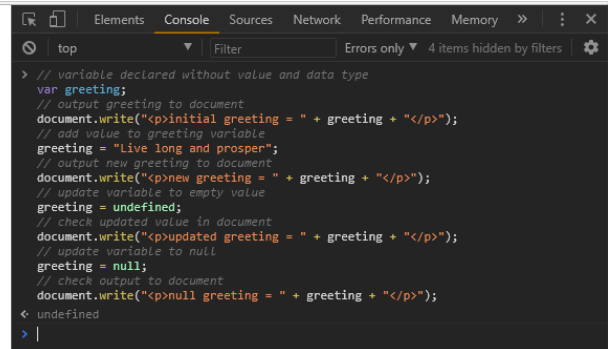
JS Basics - data types - undefined vs null

- there is a difference between `undefined` and `null`
- difference is the **data type**
- `undefined` data type = **undefined**
- `null` data type = **object**
- both values will return nothing - i.e. they will be **empty**
- data types will return different results

JS Basics - data types - extras

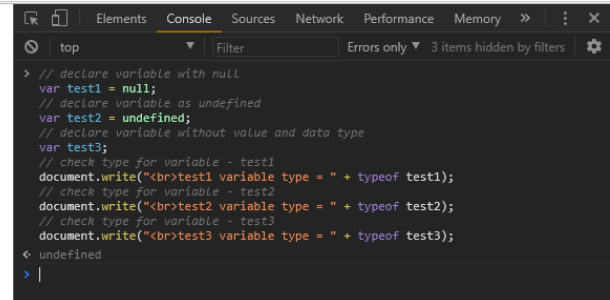## Declare variables with `undefined` and `null`...

JavaScript - undefined and null

JS Basics - data types - check `typeof`

Use `typeof` operator to check data type...


```
test1 variable type = object
test2 variable type = undefined
test3 variable type = undefined
```

```
Elements  Console  Sources  Network  Performance  Memory  »  ⋮  ✕
⊘  top                    ▼    Filter          Errors only ▼  3 items hidden by filters  ⚙
>  // declare variable with null
   var test1 = null;
   // declare variable as undefined
   var test2 = undefined;
   // declare variable without value and data type
   var test3;
   // check type for variable - test1
   document.write("<br>test1 variable type = " + typeof test1);
   // check type for variable - test2
   document.write("<br>test2 variable type = " + typeof test2);
   // check type for variable - test3
   document.write("<br>test3 variable type = " + typeof test3);
<  undefined
>  |
```

JavaScript - check data type

JS Basics - naming variables

- we need to be careful as we enter variable names
  - *misspell a variable name and JavaScript will return an error*
    - known as a `ReferenceError`

- variable names may not contain spaces
  - *a basic use of multiple words, e.g.*

```js
var travelbook = "Hannibal's Footsteps";
var noofwords = 1997;
```

- difficult to read variable name with this style
  - ***camel case** is preferred style for multiple word variable names, e.g.*

- each word's first character is capitalised
  - *convention for variable names is lowercase for first character*
  - *using **camelCase** we can write our variables as follows,*

```js
var travelBook = "Hannibal's Footsteps";
var noOfWords = 1997;
```

Fun exercise - using variables and operators

- calculate the **number of seconds in an hour**

- using the **number of seconds in an hour**, calculate the **number of seconds in a day**

- using **number of seconds in a day**, calculate the **number of seconds in a year**

- using **number of seconds in a year**, calculate the **number of seconds in your current age** in years, e.g. 22 years

Output each answer to the document with a line break between each result.

JS Data Structures - intro

- store data values as individual values in a single variable
  - *strings, numbers...*
  - *useful for storing a word, phrase...*

- we also need to be able to store large amounts of data
  - *e.g. multiple values in a single variable*

- large amounts of data will need to be organised, e.g.
  - *a numerical index of values*
  - *a key/value pair to reference and search values*

- large amounts of data can be stored in **data structures**

- data structures in JavaScript
  - *indexed collections - **arrays**...*
  - *keyed collections - **maps**, **sets**...*

Further details,

- MDN - JavaScript data types and data structure

JS Data Structures - arrays - intro

- an array allows us to store multiple values in a single variable
  - *includes associated index, and various object properties such as length*

- arrays are one of the most common data types and structures in programming
- using an array, we may now handle various collections of items
- e.g. names in a sports team in an array instead of separate variables
- the size of an array is also dynamic, e.g.
  - *add a new player's name to the array*
  - *remove an existing name from the array*

- arrays are **objects** in JavaScript
  - *provides access to functions (methods) to work with arrays*
  - *arrays include their own properties as well, e.g.* `length`

Further details,

- W3Schools - Arrays
  - *MDN - Array*

JS Data Structures - arrays - creating an array

- create an array in JavaScript using two options,
  - *using the built-in Array constructor*
  - *using array literals* [ ]

```javascript
// using array literals to create new array
var players = ["Amelia", "Emma", "Daisy", "Yvaine"];
// using Array constructpr tp create new array
var places = new Array("Paris", "Nice", "Marseille");
```

- array literals are more common option for creating new array
  - *Array constructor useful for extending and customising array properties &c.*
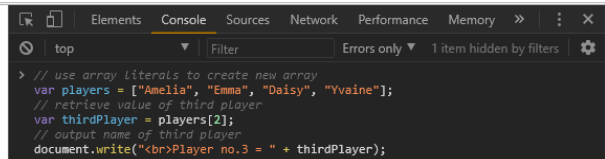 - *offers advanced options for customisation...*

JS Data Structures - arrays - access

- use **index** of an array to retrieve stored values, e.g.

```
players[0];
"Amelia"
places[1];
"Nice"
```


JavaScript - array access

JS Data Structures - arrays - set, change, add elements

- modify data in an array using a specific index number, e.g.

```
players[3] = "Rose";
```

- updates value in `players` array from `Yvaine` to `Rose`
- if we specify an index position beyond the current bounds of the array, e.g.

```
players[5] = "Violet";
```

- array will dynamically expand to add this new value
- index position 4 will now be set to `undefined`
- array's `length` property will also be updated to record new size

JS Data Structures - arrays - set, change, add elements

Modify an array by adding or updating values...

Player no.3 = Rose
New player no.5 = Violet
Player no.4 = undefined

```javascript
// use array literals to create new array
var players = ["Amelia", "Emma", "Daisy", "Yvaine"];
// update player name
players[3] = "Rose";
// add new player to the array
players[5] = "Violet";
// output name of third player
document.write("<br>Player no.3 = " + players[3]);
// output new player's name
document.write("<br>New player no.5 = " + players[5]);
// check player 4
document.write("<br>Player no.4 = " + players[4]);
```

JavaScript - array access

JS Data Structures - arrays - set, change, add elements

add new items to array - dynamically expand...


```
>  // use array literals to create new array
   var players = ["Amelia", "Emma", "Daisy", "Yvaine"];
   // update player name
   players[3] = "Rose";
   // add new player to the array
   players[5] = "Violet";
   // check updated array
   players;
<  ▼(6) ["Amelia", "Emma", "Daisy", "Rose", empty, "Violet"] ⓘ
        0: "Amelia"
        1: "Emma"
        2: "Daisy"
        3: "Rose"
        5: "Violet"
        length: 6
      ▶__proto__: Array(0)
```

JavaScript - array access

JS Data Structures - arrays - mix data types

- another benefit of storing data in an array is mixed data types
  - *e.g. we can store numbers with strings...*

```
var players = [1, "Amelia", 42, "Yvaine", "Daisy"];
```

- we can also store an array in an array
  - *creates a **multi-dimensional array***
  - *store a number, string, and an inner array*

```
var players = [6, "names", ["Amelia", "Emma", "Daisy", "Yvaine", "Rose", "Violet"
```

JS Data Structures - arrays - multi-dimensional access

- then access value in an inner array using familiar pattern of index positions, e.g.

```javascript
// create new multi-dimensional array
var players = [6, "names", ["Amelia", "Emma", "Rose", "Yvaine", "Daisy", "Violet"
// get value from inner array - fifth name
var fifthName = players[2][4];
```

JS Data Structures - arrays - multi-dimensional access

access the inner array of a multi-dimensional array...

JavaScript - array access