

JavaScript: Objects and Functions

The language of the Web

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page 2

JavaScript Cheat Sheet Programming Language of Web JS

Math	Object()	Set()
<ul style="list-style-type: none"> n.E Euler's constant n.LN2 natural logarithm of 2 n.LOG10E base 10 logarithm of E n.LOG2E base 2 logarithm of E n.PI ratio circumference/diameter n.SQRT1_2 square root of 1/2 n.SQRT2 square root of 2 	<ul style="list-style-type: none"> o.Object() return ref. to object func. o.constructor return ref. to object func. o.assign(<i>dst, src1, src2...</i>) copy values o.create(<i>proto, prop</i>) create obj w/prop o.defineProperties(<i>obj, prop</i>) o.defineProperty(<i>obj, prop, desc</i>) o.freeze(<i>obj</i>) avoid properties changes o.getOwnPropertyDescriptor(<i>obj, prop</i>) o.getOwnPropertyNames(<i>obj</i>) o.getOwnPropertySymbols(<i>obj</i>) o.getPrototypeOf(<i>obj</i>) o.keys(<i>obj</i>) return only keys of object o.preventExtensions(<i>obj</i>) avoid extend o.seal(<i>obj</i>) prop are non-configurable o.setPrototypeOf(<i>obj, prot</i>) change prot 	<ul style="list-style-type: none"> n.size return number of items s.add(<i>item</i>) add item to set b.has(<i>item</i>) check if item exists b.delete(<i>item</i>) del item & return if del b.clear() remove all items from set
METHODS	ITERATION METHODS	CALLBACK FOR EACH METHODS
<ul style="list-style-type: none"> n.abs(<i>x</i>) absolute value n.cbrt(<i>x</i>) cube root n.clz32(<i>x</i>) return leading zero bits (32) n.exp(<i>x</i>) return e^x n.expm1(<i>x</i>) return $e^x - 1$ n.hypot(<i>x1, x2...</i>) length of hypotenuse n.imul(<i>a, b</i>) signed multiply n.log(<i>x</i>) natural logarithm (base e) n.log1p(<i>x</i>) natural logarithm ($1+x$) n.log10(<i>x</i>) base 10 logarithm n.log2(<i>x</i>) base 2 logarithm n.max(<i>x1, x2...</i>) return max number n.min(<i>x1, x2...</i>) return min number n.pow(<i>base, exp</i>) return $base^{exp}$ n.random() float random number [0,1) n.sign(<i>x</i>) return sign of number n.sqrt(<i>x</i>) square root of number 	<ul style="list-style-type: none"> s.entries(<i>object</i>) iterate items s.values(<i>object</i>) iterate only value of items 	<ul style="list-style-type: none"> z.forEach(<i>cb(e,i,a), arg</i>) exec for each
ROUND METHODS	INSTANCE METHODS	Map()
<ul style="list-style-type: none"> n.ceil(<i>x</i>) superior round (smallest) n.floor(<i>x</i>) inferior round (largest) n.fround(<i>x</i>) nearest single precision n.round(<i>x</i>) round (nearest integer) n.trunc(<i>x</i>) remove fractional digits 	<ul style="list-style-type: none"> o.hasOwnProperty(<i>prop</i>) check if exist o.isPrototypeOf(<i>obj</i>) test in another obj o.propertyIsEnumerable(<i>prop</i>) o.toString() return equivalent string o.toLocaleString() return locale version o.valueOf() return primitive value 	<ul style="list-style-type: none"> m.Map() n.size return number of elements m.set(<i>key, value</i>) add pair key:value m.get(<i>key</i>) return value of key b.has(<i>key</i>) check if key exist b.delete(<i>key</i>) del elem. & return if ok m.clear() remove all elements from map
TRIGONOMETRIC METHODS	ITERATION METHODS	Symbol()
<ul style="list-style-type: none"> n.acos(<i>x</i>) arccosine n.acosh(<i>x</i>) hyperbolic arccosine n.asin(<i>x</i>) arcsine n.asinh(<i>x</i>) hyperbolic arcsine n.atan(<i>x</i>) arctangent n.atan2(<i>x, y</i>) arctangent of quotient x/y n.atanh(<i>x</i>) hyperbolic arctangent n.cos(<i>x</i>) cosine n.cosh(<i>x</i>) hyperbolic cosine n.sin(<i>x</i>) sine n.sinh(<i>x</i>) hyperbolic sine n.tan(<i>x</i>) tangent n.tanh(<i>x</i>) hyperbolic tangent 	<ul style="list-style-type: none"> m.entries(<i>object</i>) iterate elements m.keys(<i>object</i>) iterate only keys m.values(<i>object</i>) iterate only values 	<ul style="list-style-type: none"> p.Promise() n.size return number of elements p.all(<i>obj</i>) return promise p.catch(<i>onRejected(s)</i>) = .then(<i>undefined</i>, <i>s</i>) p.then(<i>onFulfilled(v), onRejected(s)</i>) p.race(<i>obj</i>) return greedy promise (res/rej) p.resolve(<i>obj</i>) return resolved promise p.reject(<i>reason</i>) return rejected promise
JSON	Methods	Proxy()
<ul style="list-style-type: none"> n.parse(<i>str, tf(k,v)</i>) parse string to object n.stringify(<i>obj, replfwl, sp</i>) convert to str 	<ul style="list-style-type: none"> o.apply(<i>obj, arg, arglist</i>) trap function call o.construct(<i>obj, arglist</i>) trap new operator o.defineProperty(<i>obj, prop, desc</i>) o.deleteProperty(<i>obj, prop</i>) trap delete o.enumerate(<i>obj</i>) trap for...in o.get(<i>obj, prop, rec</i>) trap get property o.getOwnPropertyDescriptor(<i>obj, prop</i>) o.getPrototypeOf(<i>obj</i>) o.has(<i>obj, prop</i>) trap in operator o.ownKeys(<i>obj</i>) o.preventExtensions(<i>obj</i>) o.set(<i>obj, prop, value</i>) trap set property o.setPrototypeOf(<i>obj, proto</i>) 	<ul style="list-style-type: none"> p.for(<i>key</i>) search existing symbols p.keyFor(<i>sym</i>) return key from global reg
Others	Generator()	Others
	<ul style="list-style-type: none"> o.next(<i>value</i>) return obj w/({value, done}) o.return(<i>value</i>) return value & true done o.throw(<i>except</i>) throw an error 	<ul style="list-style-type: none"> var declare variable let declare block scope local variable const declare constant (read-only) func(a=1) default parameter value func(...a) rest argument (spread operator) (a) => ... function equivalent (fat arrow) 'string \$({a})' template with variables Obn binary (2) number n to decimal Onn octal (8) number n to decimal Onx hexadecimal (16) number n to decimal for (<i>i</i> in <i>array</i>) { ... } iterate array, i = index for (<i>e</i> of <i>array</i>) { ... } iterate array, e = value class <i>B</i> extends <i>A</i> () {} class sugar syntax
		

Outline

- Objects
- Functions
 - Closures
- Dates



JavaScript: The Definitive Guide, 7th Edition Chapter 5. Objects

Mozilla Developer Network

- [Learn web development JavaScript » Dynamic client-side scripting » Introducing JavaScript objects](#)
- [Web technology for developers » JavaScript » JavaScript reference » Standard built-in objects » Object](#)
- [Web technology for developers » JavaScript » JavaScript reference » Expressions and operators » in operator](#)

JavaScript – The language of the Web

OBJECTS

Big Warnings (a.k.a., *forget Java objects*)

- In JavaScript, Objects may exist without Classes
 - Usually, Objects are **created directly**, without deriving them from a Class definition
- In JavaScript, Objects are dynamic
 - You may **add, delete, redefine** a *property* at any time
 - You may add, delete, redefine a *method* at any time
- In JavaScript, there are no access control methods
 - Every property and every method is always **public** (private/protected don't exist)
- There is no real difference between **properties and methods** (because of how JS functions work)

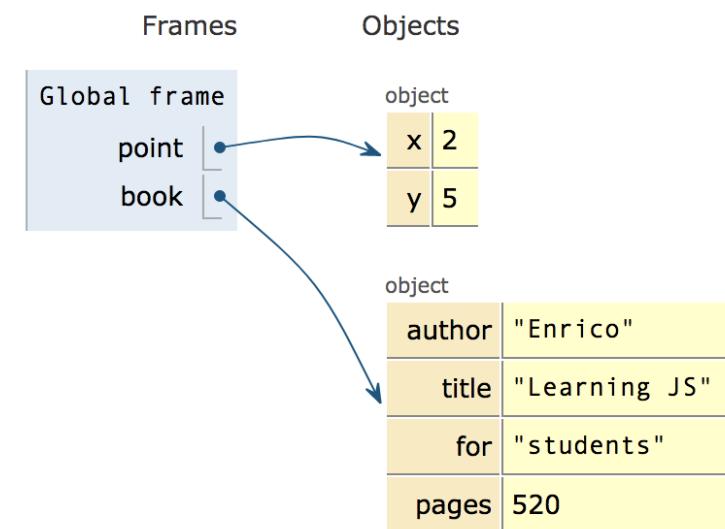
Object

- An object is an **unordered collection of properties**
 - Each property has a **name** (key), and a **value**
- You store and retrieve *property values*, through the *property names*
- Object creation and initialization:

```
let point = { x: 2, y: 5 };

let book = {
    author : "Enrico",
    title : "Learning JS",
    for: "students",
    pages: 520,
};
```

Object literals syntax:
{"name": value,
"name": value, }
or:
{name: value,
name: value, }



Object Properties

Property names are ...

- Identified as a **string**
- Must be unique in each object
- Created at object initialization
- Added after object creation
 - With assignment
- Deleted after object creation
 - With **delete** operator

Property values are ...

- Reference to any **JS value**
- Stored inside the object
- May be **primitive types**
- May be **arrays**, **other objects**, ...
 - Beware: the object stores the reference, the value is *outside*
- May also be **functions** (*methods*)

Accessing Properties

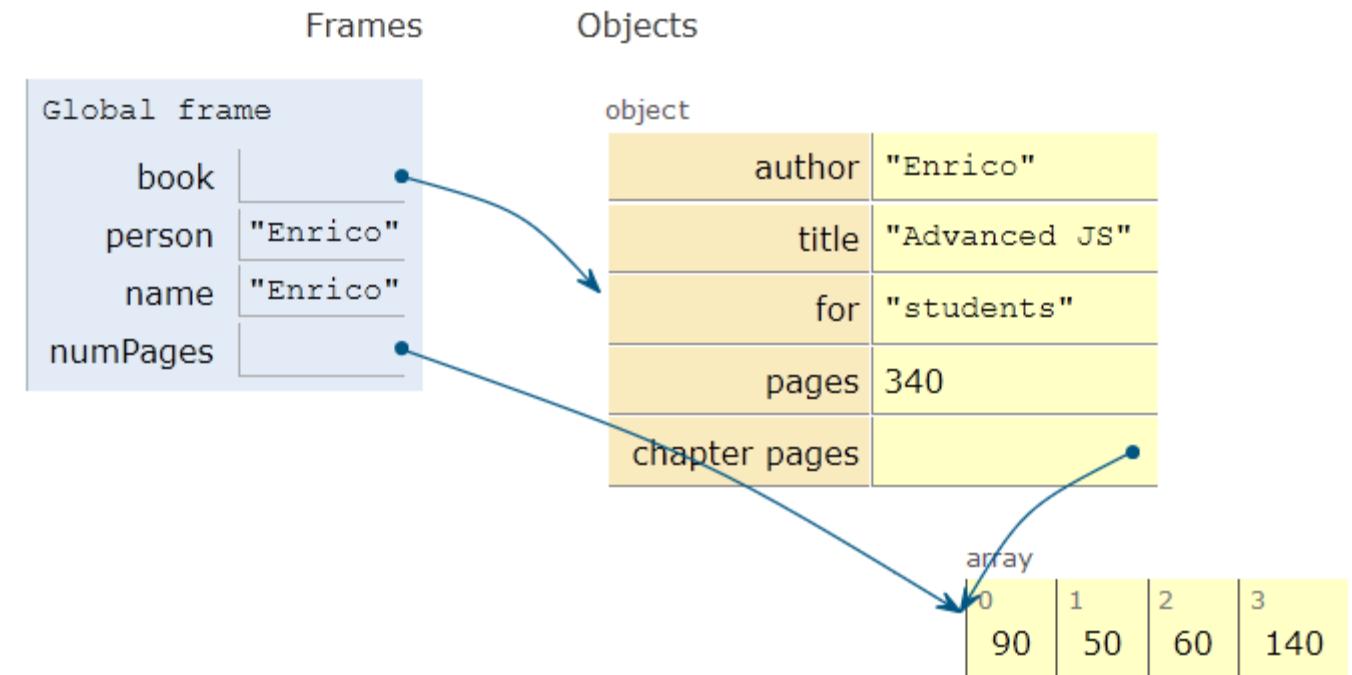
- Dot (.) or square brackets [] notation

```
let book = {  
    author : "Enrico",  
    title : "Learning JS",  
    for: "students",  
    pages: 340,  
    "chapter pages": [90,50,60,140]  
};  
  
let person = book.author;  
let name = book["author"];  
let numPages =  
    book["chapter pages"];  
book.title = "Advanced JS";  
book["pages"] = 340;
```

The . dot notation and omitting the quotes are allowed **when the property name is a valid identifier, only.**

book.title or book['title']

book['my title'] and not ~~book.my title~~



Objects as Associative Arrays

- The **[]** syntax looks like array access, but the index is *a string*
 - Generally known as *associative arrays*
- Setting a non-existing property creates it:
 - `person["telephone"] = "0110901234";`
 - `person.telephone = "0110901234";`
- Deleting properties
 - `delete person.telephone;`
 - `delete person["telephone"] ;`

Computed Property Names

- Flexibility in creating object properties
 - `{[prop]:value}` -> creates an object with property name equal to *the value of the variable prop*
 - `[]` can contain more complex expressions: e.g., `i`-th line of an object with multiple "address" properties (`address1, address2, ...`):
`person["address"+i]`
 - Using expressions is not recommended...
- Beware of quotes:
 - `book["title"]` -> property called `title`
 - Equivalent to `book.title`
 - `book[title]` -> property called with the value of variable `title` (if exists)
 - If `title=="author"`, then equivalent to `book["author"]`
 - No equivalent in dot-notation

Property Access Errors

- If a property is not defined, the (attempted) access returns `undefined`
- If unsure, must check before accessing
 - Remember: `undefined` is *falsy*, you may use it in Boolean expressions

```
let surname = undefined;  
if (book) {  
    if (book.author) {  
        surname = book.author.surname;  
    }  
}
```

```
surname = book && book.author && book.author.surname;
```

Iterating over properties

- **for .. in** iterates over the properties

```
for( let a in {x: 0, y:3}) {  
    console.log(a) ;  
}
```

```
x  
y
```

```
let book = {  
    author : "Enrico",  
    pages: 340,  
    chapterPages: [90,50,60,140],  
};
```

```
for (const prop in book)  
    console.log(` ${prop} = ${book[prop]}`);
```

```
author = Enrico  
pages = 340  
chapterPages = 90,50,60,140
```

Iterating over properties

- All the (enumerable) properties names (keys) of an object can be accessed as an array, with:

– `let keys = Object.keys(my_object) ;`

['author', 'pages']

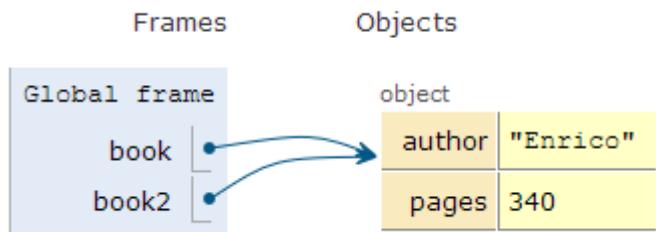
- All pairs [key, value] are returned as an array with:

– `let keys_values = Object.entries(my_object)`

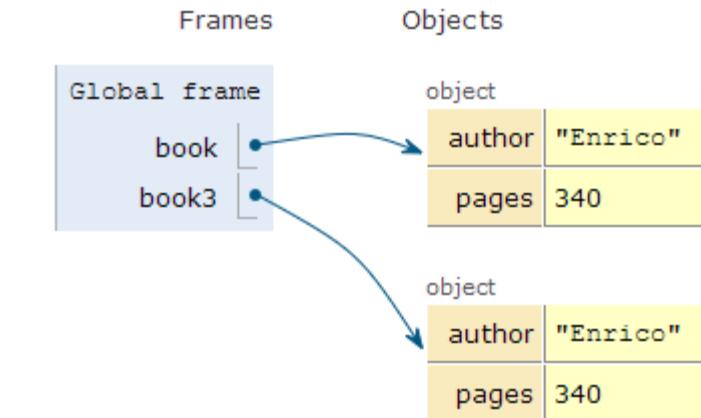
[['author', 'Enrico'], ['pages', 340]]

Copying Objects

```
let book = {  
    author : "Enrico",  
    pages: 340,  
};  
  
let book2 = book; // ALIAS
```



```
let book = {  
    author : "Enrico",  
    pages: 340,  
};  
  
let book3 = // COPY  
Object.assign({}, book);
```



Object.assign

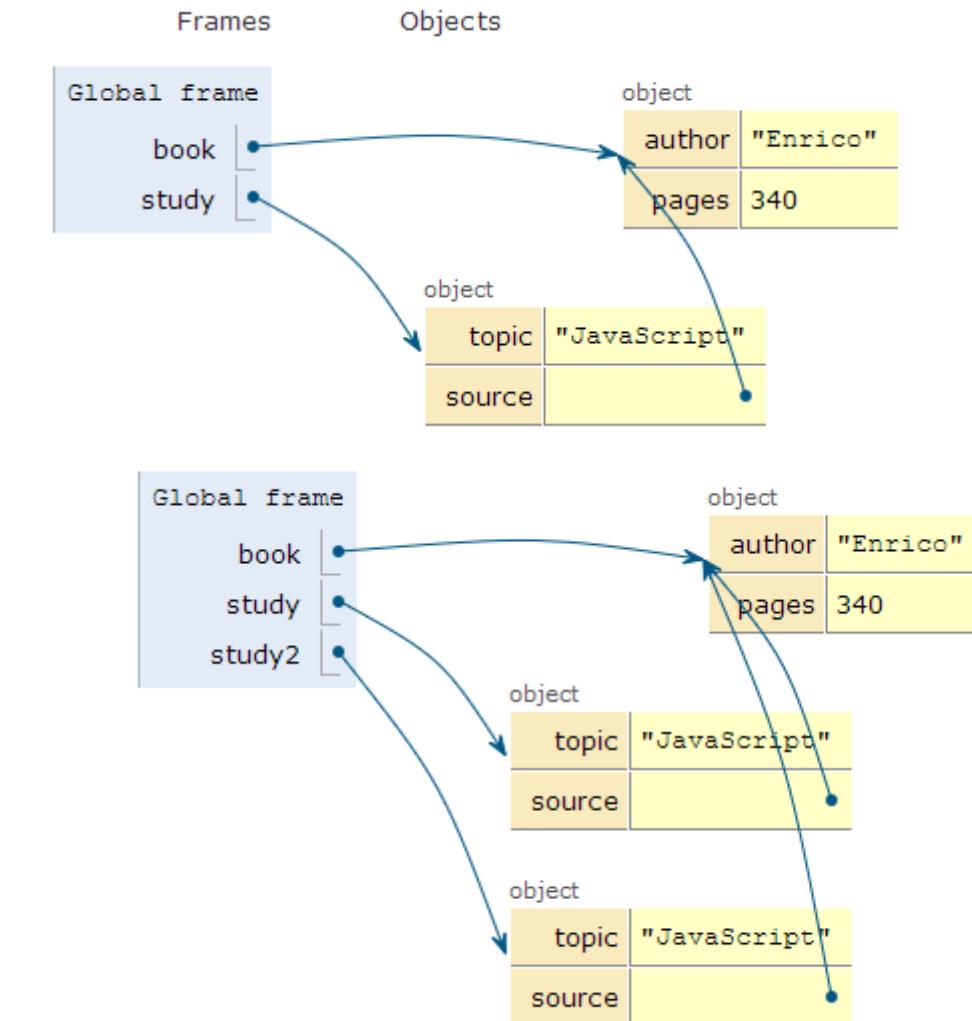
- `let new_object = Object.assign(target, source);`
- Assigns all the properties from the `source` object to the `target` one
- The target may be an existing object
- The target may be a new object: `{}`
- Returns the target object (after modification)

Beware! Shallow copy, only

```
let book = {  
    author : "Enrico",  
    pages: 340,  
};
```

```
let study = {  
    topic: "JavaScript",  
    source: book,  
};
```

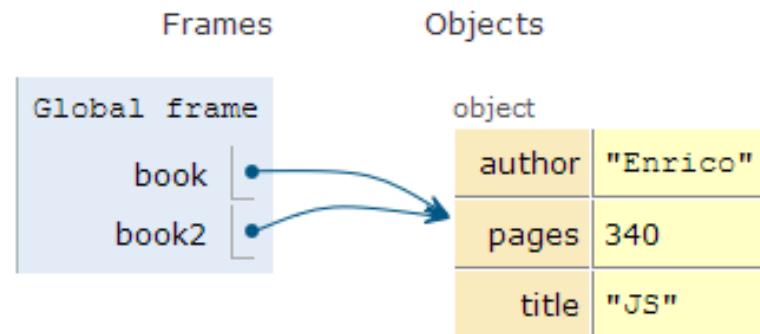
```
let study2 = Object.assign({},  
study);
```



Merge properties (on existing object)

- `Object.assign(target, source, default values, ...);`

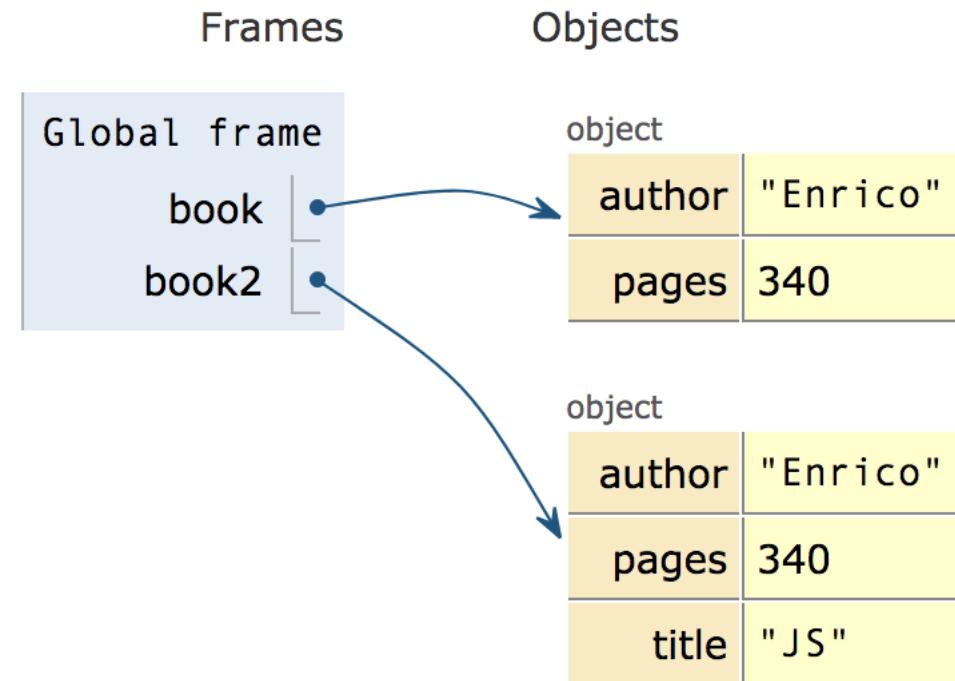
```
let book = {  
    author : "Enrico",  
    pages: 340,  
};  
  
let book2 = Object.assign(  
    book, {title: "JS"}  
);
```



Merge properties (on new object)

- `Object.assign(target, source, default values, ..);`

```
let book = {  
    author : "Enrico",  
    pages: 340,  
};  
  
let book2 = Object.assign(  
    {}, book, {title: "JS"}  
);
```



Copying with spread operator (ES9 – ES2018)

```
let book = {  
    author : "Enrico",  
    pages: 340,  
};  
  
let book2 = {...book, title: "JS"};  
let book3 = { ...book2 } ;  
console.log(book2);
```

```
{ author: 'Enrico', pages: 340, title: 'JS' }
```

```
const {a,b,...others} =  
    {a:1, b:2, c:3, d:4};  
  
console.log(a);  
console.log(b);  
console.log(others);
```

```
1  
2  
{ c: 3, d: 4 }
```

Checking if properties exist

- Operator **in**
 - Returns true if property is in the object. Do not use with Array

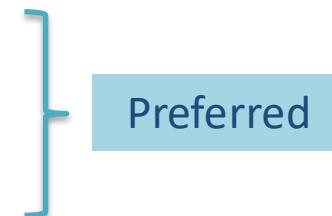
```
let book = {  
    author : "Enrico",  
    pages: 340,  
};  
  
console.log('author' in book);  
delete book.author;  
console.log('author' in book);
```

true
false

```
const v=[ 'a','b','c' ];  
  
console.log('b' in v);  
  
console.log('PI' in Math);
```

false
true

Object creation (equivalent methods)

- By object literal: `const point = {x:2, y:5} ;`
 - By object literal (empty object): `const point = {} ;`
 - By constructor: `const point = new Object() ;`
 - By object static method `create`:
`const point = Object.create({x:2,y:5}) ;`
 - Using a *constructor function*
- 

Preferred



JavaScript – The language of the Web

FUNCTIONS

Functions

- One of the most important elements in JavaScript
- Delimits a block of code with a private scope
- Can accept parameters and returns one value
 - Can also be an object
- Functions themselves are objects in JavaScript
 - They can be assigned to a variable
 - Can be passed as an argument
 - Used as a return value

Declaring functions: 3 ways

1) Classic

```
function do(params) {  
    /* do something */  
}
```

Classic functions

```
function square(x) {  
    let y = x * x ;  
    return y ;  
}  
  
let n = square(4) ;
```

During execution

After execution

Frames

Objects

Global frame

square

```
function square(x) {  
    let y = x * x ;  
    return y ;  
}
```

square

x	4
y	16
Return value	16

Frames

Objects

Global frame

square

```
function square(x) {  
    let y = x * x ;  
    return y ;  
}
```

n

Parameters

- Comma-separated list of parameter names
 - May assign a default value, e.g., `function(a, b=1) {}`
- Parameters are passed **by-value**
 - Copies of the **reference** to the object
- Parameters that are not passed in the function call get the value ‘**undefined**’
- Check missing/optional parameters with:
 - `if(p==undefined) p = default_value ;`
 - `p = p || default_value ;`

Variable number of parameters

- Syntax for functions with variable number of parameters, using the `...` operator (called “rest”)
`function fun (par1, par2, ...arr) { }`
- The “rest” parameter must be the last, and will deposit all extra arguments into an array

```
function sumAll(initVal, ...arr) {  
    let sum = initVal;  
    for (let a of arr) sum += a;  
    return sum;  
}  
sumAll(0, 2, 4, 5); // 11
```

Declaring functions: 3 ways

1) Classic

```
function do(params) {  
  /* do something */  
}
```

2a) Function expression

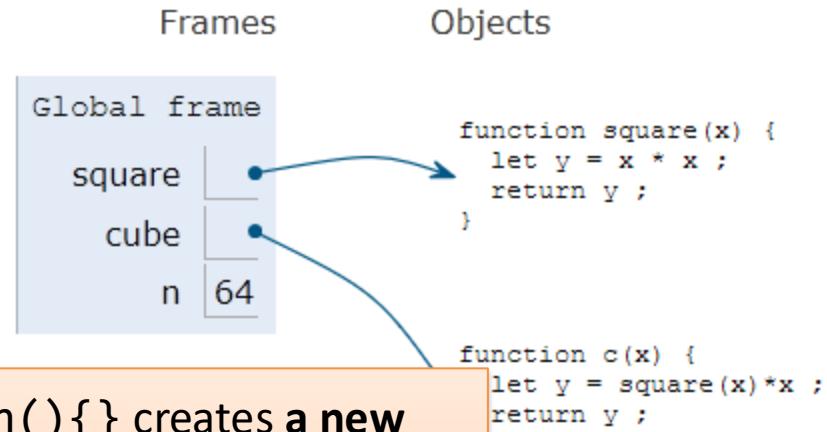
```
const fn = function(params) {  
  /* do something */  
}
```

2b) Named function expression

```
const fn = function do(params) {  
  /* do something */  
}
```

Function expression: indistinguishable

```
function square(x) {  
    let y = x * x ;  
    return y ;  
}  
  
let cube = function c(x) {  
    let y = square(x)*x ;  
    return y ;  
}  
  
let n = cube(4) ;
```



The *expression* `function(){} creates a new object of type ‘function’ and returns the result.`

Any variable may “refer” to the function and call it.
You can also store that reference into an array, an object property, pass it as a parameter to a function, redefine it, ...

method

callback

Declaring functions: 3 ways

1) Classic

```
function do(params) {  
  /* do something */  
}
```

2a) Function expression

```
const fn = function(params) {  
  /* do something */  
}
```

3) Arrow function

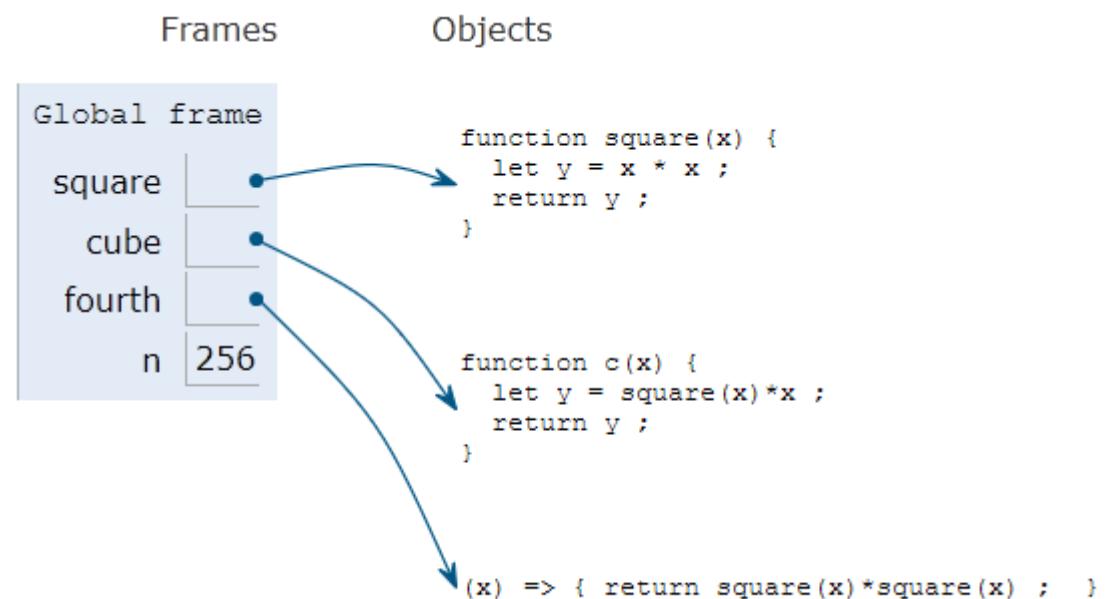
```
const fn = (params) => {  
  /* do something */  
}
```

2b) Named function expression

```
const fn = function do(params) {  
  /* do something */  
}
```

Arrow Function: just a shortcut

```
function square(x) {  
    let y = x * x ;  
    return y ;  
}  
  
let cube = function c(x) {  
    let y = square(x)*x ;  
    return y ;  
}  
  
let fourth = (x) => { return  
square(x)*square(x) ;  }  
  
let n = fourth(4) ;
```



Parameters in arrow functions

```
const fun = () => { /* do something */ }           // no params
```

```
const fun = param => { /* do something */ }         // 1 param
```

```
const fun = (param) => { /* do something */ }        // 1 param
```

```
const fun = (par1, par2) => { /* smtg */ } // 2 params
```

```
const fun = (par1 = 1, par2 = 'abc') => { /* smtg */ } // default values
```

Return value

- Default: `undefined`
- Use `return` to return a value
- Only one value can be returned
- However, objects (or arrays) can be returned

```
const fun = () => { return ['hello', 5] ; }
const [ str, num ] = fun() ;
console.log(str) ;
```

- Arrow functions have `implicit return` if there is only one value

```
let fourth = (x) => { return square(x)*square(x) ; }
let fourth = x => square(x)*square(x) ;
```

Nested functions

- Function can be nested, i.e., defined within another function

```
function hypotenuse(a, b) {  
    const square = x => x*x ;  
    return Math.sqrt(square(a) + square(b));  
}
```



=> Preferred in nested functions

```
function hypotenuse(a, b) {  
    function square(x) { return x*x; }  
    return Math.sqrt(square(a) + square(b));  
}
```

- The inner function is *scoped within* the external function and cannot be called outside
- The inner function might *access variables declared* in the *outside* function

Closure: definition (somewhat cryptic)

A **closure** is a name given to a feature in the language by which a **nested** function executed **after** the execution of the outer function can still access **outer function's scope**.

Really: an important concepts in JS

<https://medium.com/@vvkchandra/learn-javascript-closures-through-the-laws-of-karma-49d32d35b3f7>

Closures

- JS uses *lexical scoping*
 - Each new function defines a *scope* for the variables declared inside
 - Nested functions may access the scope of *all enclosing* functions
- Every function object **remembers the scope** where it is defined, even after the external function is no longer active → Closure

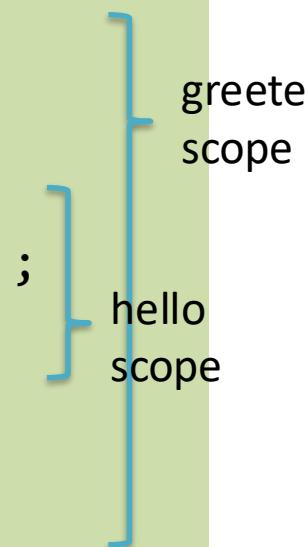
```
"use strict" ;  
  
function greeter(name) {  
    const myname = name ;  
  
    const hello = function () {  
        return "Hello " + myname ;  
    }  
  
    return hello ;  
}  
  
const helloTom = greeter("Tom") ;  
const helloJerry = greeter("Jerry") ;  
  
console.log(helloTom()) ;  
console.log(helloJerry()) ;
```

Warning: not
return hello() ;

Closures

- `hello` accesses the variable `myname`, defined in the outer scope
- The function is returned (as `helloTom` or `helloJerry`)
- Each of the functions “remembers” the reference to `myname`, when it was defined
- The variable `myname` goes out of scope, but is not destroyed
 - Still accessible (referred) by the `hello` functions.

```
"use strict" ;  
  
function greeter(name) {  
    const myname = name ;  
  
    const hello = function () {  
        return "Hello " + myname ;  
    }  
  
    return hello ;  
}  
  
const helloTom = greeter("Tom") ;  
const helloJerry = greeter("Jerry") ;  
  
console.log(helloTom()) ;  
console.log(helloJerry()) ;
```



Using closures to emulate objects

```
"use strict" ;  
  
function counter() {  
    let value = 0 ;  
  
    const getNext = () => {  
        value++;  
        return value;  
    }  
  
    return getNext ;  
}
```

```
const count1 = counter() ;  
console.log(count1()) ;  
console.log(count1()) ;  
console.log(count1()) ;
```

```
const count2 = counter() ;  
console.log(count2()) ;  
console.log(count2()) ;  
console.log(count2()) ;
```

```
1  
2  
3  
1  
2  
3
```

Using closures to emulate objects (with methods)

```
"use strict";

function counter() {
    let n = 0;

    // return an object,
    // containing two function-valued
    // properties
    return {
        count: function() {
            return n++;
        },
        reset: function() { n = 0; }
    };
}
```

```
let c = counter(), d = counter();
// Create two counters

c.count()
// => 0

d.count()
// => 0: they count independently

c.reset()
// reset() and count() methods

c.count()
// => 0: because we reset c

d.count()
// => 1: d was not reset
```

Immediately Invoked Function Expressions (IIFE)

- Functions may protect the *scope* of variables and inner functions
- May declare a function
 - With internal variables
 - With inner functions
 - Call it only once, and discard everything

```
( function() {  
  let a = 3 ;  
  console.log(a) ;  
} ) () ;
```

```
let num = ( function() {  
  let a = 3 ;  
  return a ;  
} ) () ;
```

<https://flaviocopes.com/javascript-iife/>
<https://medium.com/@vvkchandra/essential-javascript-mastering-immediately-invoked-function-expressions-67791338ddc6>

Using IIFE to emulate objects (with methods)

```
"use strict";

const c = (
  function () {
    let n = 0;

    return {
      count: function () {
        return n++; },
      reset: function () {
        n = 0; }
    };
  })();
```

```
console.log(c.count());
console.log(c.count());
c.reset();
console.log(c.count());
console.log(c.count());
```

```
0
1
0
1
```

Construction functions

- Define the object type
 - Use a capital initial letter
 - Set the properties with the keyword **this**
- Create an instance of the object with **new**

```
function Car(make, model, year) {  
    this.make = make;  
    this.model = model;  
    this.year = year;  
    this.isNew = ()=>(year>2000);  
}
```

```
let mycar = new Car('Eagle',  
    'Talon TSi', 1993);
```



JavaScript: The Definitive Guide, 7th Edition
Chapter 9.4 Dates and Times

Mozilla Developer Network
Web technology for developers » JavaScript »
JavaScript reference »
Standard built-in objects » Date

Day.js
<https://day.js.org/en/>

JavaScript – The language of the Web

DATES

Date object

- Store a time instant with *millisecond* precision, counted from Jan 1, 1970 UTC (Unix Epoch)
- Careful with time zones
 - Most methods work in local time (not UTC) the computer is set to

UTC vs Local time zone are confusing.

```
> new Date('2020-03-18')  
2020-03-18T00:00:00.000Z  
> new Date('18 March 2020')  
2020-03-17T23:00:00.000Z
```



Formatting is locale and implementation dependent



Once the [Temporal API](#) will be stable, the Date object will be a *legacy* feature.

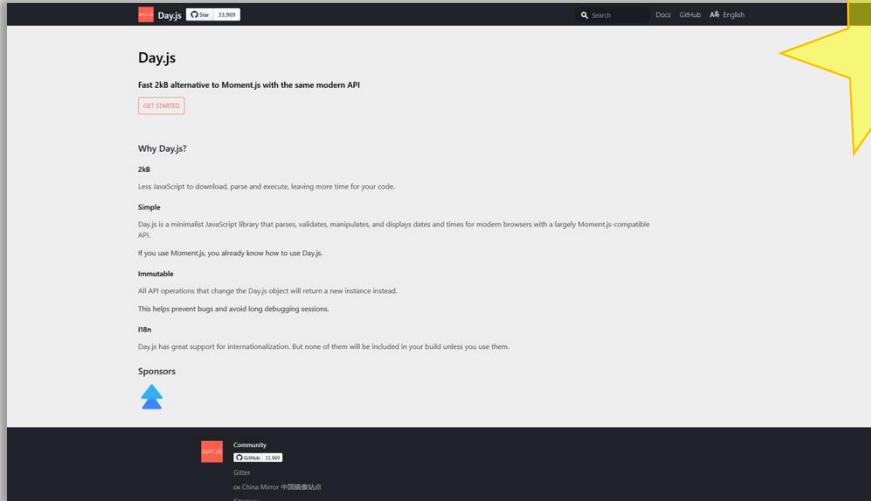
```
let now = new Date();
```

```
let newYearMorning = new Date(  
 2021, // Year 2021  
 0, // January (from 0)  
 1, // 1st  
 18, 15, 10, 743);  
 // 18:15:10.743, local time
```

Comparisons are difficult (no way to specify which fields you want, must set them to zero explicitly)

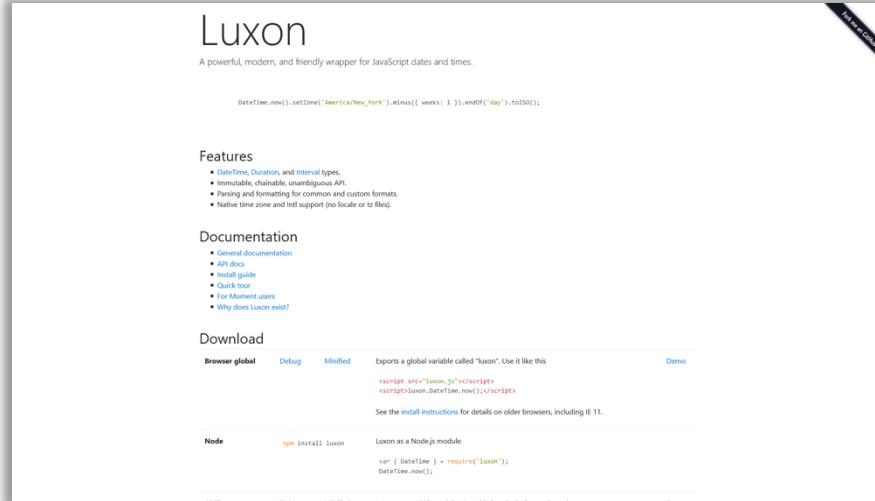


Serious JS date/time handling libraries



A screenshot of the Day.js website. The page features a dark header with the Day.js logo and navigation links for 'Doc', 'GitHub', and 'English'. Below the header, there's a section titled 'Why Day.js?' with a 'GET STARTED' button. The main content area includes sections for 'Simple', 'Immutable', and 'I18n'. A large yellow star graphic is overlaid on the right side of the page.

<https://day.js.org/>



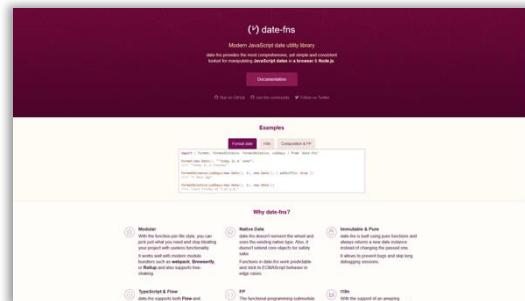
A screenshot of the Luxon website. The page has a dark header with the Luxon logo and navigation links for 'Documentation', 'Download', and 'Features'. The 'Features' section lists 'Date/Time, Duration, and Interval types.', 'Immutable, changeable, unresizable API.', 'Parsing and formatting for common and custom formats.', and 'Native time zone and Intl support (no locale or tz files.)'. The 'Download' section provides instructions for 'Browser global', 'Debug', and 'Minified' versions, along with Node.js and AMD installation details.

<https://moment.github.io/luxon/>



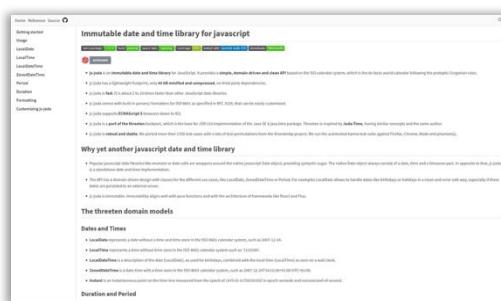
A screenshot of the moment.js website. The page has a dark header with the moment.js logo and navigation links for 'Home', 'Data', 'Gists', 'Test', and 'Contrib'. The main content area features a 'Black Lives Matter' banner and a 'Consider using Moment in your project?' section. It also includes sections for 'Format Dates', 'Relative Time', and 'Install' (with npm and GitHub links).

<https://momentjs.com/>



A screenshot of the date-fns website. The page has a dark header with the date-fns logo and navigation links for 'Home', 'Examples', 'API', 'FAQ', and 'Documentation'. The main content area includes sections for 'Modern Date', 'Modern Date API', 'Immutable & Pure', and 'Special & How'. It also features a 'Date Fns' logo and a 'GitHub' link.

<https://date-fns.org/>



A screenshot of the js-joda.github.io/js-joda/ website. The page has a dark header with the js-joda logo and navigation links for 'Home', 'Documentation', 'Examples', 'FAQ', and 'Customizing code'. The main content area includes sections for 'Why yet another javascript date and time library', 'The three domain models', and 'Dates and Times'. It also features a 'js-joda' logo and a 'GitHub' link.

<https://js-joda.github.io/js-joda/>

Day.js Library

- Goals
 - Compatible with moment.js
 - But very small (2kB)
 - Works in nodejs and in the browser
 - All objects are *immutable*
 - All API functions that modify a date, will always return a new object instance
 - Localization
 - Plugin system for extending functionality

DAY.JS <https://day.js.org/>

- Install

```
npm init # if not already done
npm install dayjs
```
- Import

```
const dayjs = require('dayjs')
```
- Use

```
let now = dayjs()
console.log(now.format())
```

Basic operations with Day.js

Creating date objects – dayjs() constructor

```
let now = dayjs() // today
let date1 = dayjs('2019-12-27T16:00');
    // from ISO 8601 format
let date2 = dayjs('20191227');
    // from 8-digit format
let date3 = dayjs(new Date(2019, 11, 27));
    // from JS Date object
let date5 = dayjs.unix(1530471537);
    // from Unix timestamp
```

By default, Day.js parses in local time

Displaying date objects – format()

```
console.log(now.format());
2021-03-02T16:38:38+01:00

console.log(now.format('YYYY-MM [on the] DD'));
2021-03 on the 02

console.log(now.toString());
Tue, 02 Mar 2021 15:43:46 GMT
```

By default, Day.js displays in local time

<https://day.js.org/docs/en/parse/parse>

Get/Set date/time components

```
# obj.unit() -> get  
# obj.unit(new_val) -> set  
  
let now2 = now.date(15);  
let now2 = now.set('date', 15);  
2021-03-15T16:50:26+01:00  
  
let now3 = now.minute(45);  
let now3 = now.set('minute',45);  
2021-03-02T16:45:26+01:00  
  
let today_day = now.day();  
let today_day = now.get('day');  
2
```

Unit	Shorthand	Description
date	D	Date of Month
day	d	Day of Week (Sunday as 0, Saturday as 6)
month	M	Month (January as 0, December as 11)
year	y	Year
hour	h	Hour
minute	m	Minute
second	s	Second
millisecond	ms	Millisecond

<https://day.js.org/docs/en/get-set/get-set>

Date Manipulation and Comparison

```
let wow = dayjs('2019-01-25').add(1, 'day').subtract(1, 'year').year(2009).toString() ;  
// "Sun, 25 Jan 2009 23:00:00 GMT"
```

- Methods to "modify" a date (and return a modified one)
- `.add / .subtract`
- `.startOf / .endOf`
- `d1.diff(d2, 'unit')`
- Specify the unit to be added/subtracted/rounded
- Can be easily *chained*
- Day.js objects can be compared
 - `.isBefore / .isSame / .isAfter`
 - `.isBetween`
 - `.isLeapYear / .daysInMonth`

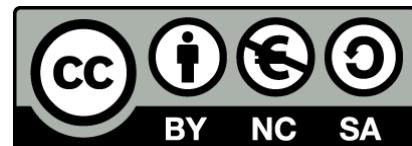
Day.js Plugins

- To keep install size minimal, several functions are only available in *plugins*
- Plugins must be
 - Loaded
 - Registered into the libraries
- Then, functions may be freely used

```
const isLeapYear =  
    require('dayjs/plugin/isLeapYear') ;  
    // load plugin  
  
dayjs.extend(isLeapYear) ;  
    // register plugin  
  
console.log(now.isLeapYear()) ;  
    // use function
```

Advanced Day.js Topics

- Localization / Internationalization
 - Language-aware and locale-aware parsing and formatting
 - Various formatting patterns for different locales/languages
- Durations
 - Measuring time intervals (the difference between two time instants)
 - Interval arithmetic
- Time Zones
 - Conversion between time zones



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