JavaScript

ES6

EcmaScript 2015

let operator

```
function func() {
    if (true) {
        let tmp = 123;
    }
    console.log(tmp); // ReferenceError: tmp is not defined
  }


function func() {
    if (true) {
        var tmp = 123;
    }
    console.log(tmp); // 123
  }
```

let operator

```
function func() {
    let foo = 5;
    if (···) {
        let foo = 10; // shadows outer `foo`
        console.log(foo); // 10
    }
    console.log(foo); // 5
 }
```

const

```
let foo = 'abc';
foo = 'def';
console.log(foo); // def

const foo2 = 'abc';
foo2 = 'def'; // TypeError
```

Arrow function

f = v **=>** v **+** 1;   var f = function (v) { return v + 1; })

Usage example:
var arr = [1,2,3];
arr.forEach(i=>console.log(i));

Arrow function with multiple parameters

f = (x,y) => x+y;
f(1,2) === 3;

Arrow function with function body

```
f = (x,y) => {
  console.log(x,y);
  return x+y;
}
```

Property Shorthand

```
obj = { x, y }
```

same as obj **= {** x: x, y: y **};**

Computed Property Names

```
obj = {
  foo: "bar",
  [ "prop_" + foo() ]: 42
}
```

```
obj = { foo: "bar" };
obj[ "prop_" + foo() ] = 42;
```

Method Properties

```
obj = {
  foo (a, b) { … },
  bar (x, y) { … },
  *quux (x, y) { … }
}
```

```
obj = {
  foo: function (a, b) { … },
  bar: function (x, y) { … },
  // quux: no equivalent in ES5 …
};
```

Array matching

```
var list = [ 1, 2, 3 ]
var [ a, , b ] = list
[ b, a ] = [ a, b ]
```

```
var list = [ 1, 2, 3 ];
var a = list[0], b = list[2];
var tmp = a; a = b; b = tmp;
```

Object matching

```
var { op, lhs, rhs } = getASTNode()
```

```
var tmp = getASTNode();
var op = tmp.op;
var lhs = tmp.lhs;
var rhs = tmp.rhs;
```

Fail-soft matching

```
var list = [ 7, 42 ]
var [ a = 1, b = 2, c = 3, d ] = list
// a === 7 b === 42
// c === 3 d === undefined
```

```
var list = [ 7, 42 ];
var a = list[0] !== undefined ? list[0] : 1;
var b = list[1] !== undefined ? list[1] : 2;
var c = list[2] !== undefined ? list[2] : 3;
var d = list[3] !== undefined ? list[3]
        : undefined;
```

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Array: new functions

```
[ 1, 3, 4, 2 ].find(x => x > 3) // 4
```

```
[ 1, 3, 4, 2 ].filter(function (x) {
    return x > 3; })[0]; // 4
```

Object assigning

```
var dst = { quux: 0 }
var src1 = { foo: 1, bar: 2 }
var src2 = { foo: 3, baz: 4 }
Object.assign(dst, src1, src2)

dst.quux === 0
dst.foo === 3
dst.bar === 2
dst.baz === 4
```

```
var dst = { quux: 0 };
var src1 = { foo: 1, bar: 2 };
var src2 = { foo: 3, baz: 4 };
Object.keys(src1).forEach(function(k) {
    dst[k] = src1[k]; });
Object.keys(src2).forEach(function(e) {
    dst[k] = src2[k]; });
```

String searching

```
"hello".startsWith("ello", 1) // true
"hello".endsWith("hell", 4) // true
"hello".includes("ell") // true
"hello".includes("ell", 1) // true
"hello".includes("ell", 2) // false
```

```
"hello".indexOf("ello") === 1; // true
"hello".indexOf("hell") === (4 - "hell".length);
"hello".indexOf("ell") !== -1; // true
"hello".indexOf("ell", 1) !== -1; // true
"hello".indexOf("ell", 2) !== -1; // false
```

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Set

```
let s = new Set()
s.add("hello").add("goodbye").add("hello")
s.size === 2
s.has("hello") === true
for (let key of s.values()) // insertion order console.log(key)
```

Map

```
let m = new Map()
m.set("hello", 42)
m.set(s, 34)
m.get(s) === 34
m.size === 2
for (let [ key, val ] of m.entries()) console.log(key + " = " + val)
```

WeakSet/WeakMap

```
var weakSet = new WeakSet()
a = {}; // only objects allowed
weakSet.add(a);
weakSet.has(a); // true
a = null; // now a can be garbage collected
for (e in weakSet) console.log(e); // not working: WeakSet is not itarable
```

String Interpolation

```javascript
var customer = { name: "Foo" }
var card = { amount: 7,
  product: "Bar",
  unitprice: 42 }
message = `Hello $
{customer.name}, want to buy $
{card.amount} ${card.product}
for a total of ${card.amount *
card.unitprice} bucks?`
```

```javascript
var customer = { name: "Foo" };
var card = { amount: 7,
    product: "Bar",
    unitprice: 42 };
message = "Hello " + customer.name
+ ",\n" + "want to buy " +
card.amount + " " + card.product +
" for\n" + "a total of " +
(card.amount * card.unitprice) + "
bucks?";
```

New number functions

```
Number.isNaN(42) === false
Number.isNaN(NaN) === true

Number.isFinite(Infinity) === false
Number.isFinite(-Infinity) === false
Number.isFinite(NaN) === false
Number.isFinite(123) === true

Number.isSafeInteger(42) === true
Number.isSafeInteger(9007199254740992) === false

console.log(0.1 + 0.2 === 0.3) // false
console.log(Math.abs((0.1 + 0.2) - 0.3) < Number.EPSILON)
// true
```

Default Parameter Values

```
function f (x, y = 7, z = 42) {
   return x + y + z
}
f(1) === 50
```

```
function f (x, y, z) {
   if (y === undefined) y = 7;
   if (z === undefined) z = 42;
   return x + y + z;
}
f(1) === 50;
```

Rest Parameters

```
function f (x, y, ...a) {
   return (x + y) * a.length
}


f(1, 2, "hello", true, 7) === 9
```

```
function f (x, y) {
   return (x + y) * (a.length-2);
}


f(1, 2, "hello", true, 7) === 9;
```

Spread Operator

```
var params = [ "hello", true, 7 ]
var other = [ 1, 2, ...params ] // [ 1, 2, "hello", true, 7 ]
f(1, 2, ...params) === 9
```

Using this in callbacks

```
arr = [1,2,3];
arr.summarize = function() {
    this.sum = 0;
    this.forEach(function(e) { this.sum = this.sum+e; } );
    // Callbacks are executed in their own context, this points to function, not arr
}
```

workaround:

```
arr.summarize = function() {
    this.sum = 0;
    var self = this;
    this.forEach(function(e) { self.sum = self.sum+e; } );
}
```

another workaround:

```
    this.forEach(function(e) { this.sum = this.sum+e; }.bind(this) );
```

lexical scoping "this"

```
arr.summarize = function() {
    this.sum = 0;
    this.forEach(e=>{ this.sum = this.sum+e; });
}
```

Using classes

```
class Shape {
    constructor (id, x, y) {
        this.id = id
        this.move(x, y)
    }

    move (x, y) {
        this.x = x
        this.y = y
    }
}
```

```
var Shape = function (id, x, y) {
    this.id = id;
    this.move(x, y);
};
Shape.prototype.move = function (x, y) {
    this.x = x;
    this.y = y;
};
```

Inheritance

```
class Rectangle extends Shape {
    constructor (id, x, y, width, height) {
        super(id, x, y)
        this.width  = width
        this.height = height
    }
}
class Circle extends Shape {
    constructor (id, x, y, radius) {
        super(id, x, y)
        this.radius = radius
```

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Base class access

```
class Shape {
    …
    toString () {
        return `Shape(${this.id})`
    }
}
class Rectangle extends Shape {
    constructor (id, x, y, width, height) {
        super(id, x, y)
        ...
    }
    toString () {
        return "Rectangle > " + super.toString()
    }
}
class Circle extends Shape {
    constructor (id, x, y, radius) {
        super(id, x, y)
        ...
    }
    toString () {
        return "Circle > " + super.toString()
```

Static members

```
class Circle extends Shape {
    static defaultCircle () {
        return new Circle("default", 0, 0, 100)
    }
}
var defRectangle = Rectangle.defaultRectangle()
var defCircle    = Circle.defaultCircle()
```

Getters/setters

```
class Rectangle {
    constructor (width, height) {
        this._width  = width
        this._height = height
    }
    set width  (width)  { this._width = width               }
    get width  ()       { return this._width                }
    set height (height) { this._height = height             }
    get height ()       { return this._height               }
    get area   ()       { return this._width * this._height }
}
var r = new Rectangle(50, 20)
r.area === 1000
```

Modules import/export

```js
//lib/math.js
export function sum (x, y) { return x + y }
export var pi = 3.141593

//  someApp.js
import * as math from "lib/math"
console.log("2π = " + math.sum(math.pi, math.pi))

//  otherApp.js
import { sum, pi } from "lib/math"
console.log("2π = " + sum(pi, pi))
```

Marking a value as the default exported value

```js
//  lib/mathplusplus.js
export * from "lib/math"
export var e = 2.71828182846
export default (x) => Math.exp(x)

//  someApp.js
import exp, { pi, e } from "lib/mathplusplus"
console.log("e^{π} = " + exp(pi))
```

Practice

Exercise 1, 2

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Promises: built-in support

```javascript
function msgAfterTimeout (msg, who, timeout) {
  return new Promise((resolve, reject) => {
    setTimeout(() => resolve(`${msg} Hello ${who}!`), timeout)
  })
}

msgAfterTimeout("", "Foo", 100).then((msg) =>
    msgAfterTimeout(msg, "Bar", 200)
).then((msg) => {
    console.log(`done after 300ms:${msg}`)
});
```

Practice

Exercise 3

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Generators

```javascript
function* range (start, end, step) {
    while (start < end) {
        yield start
        start += step
    }
}

for (let i of range(0, 10, 2)) {
    console.log(i) // 0, 2, 4, 6, 8
}
function* genFunc() {
    yield 'a';
    yield 'b';
    return 1;
  }
genObj = genFunc();
genObj.next() // {value: "a", done: false}
genObj.next() // {value: "b", done: false}
genObj.next() //  {value: 1, done: true}
arr = [...genFunc()]; // ['a', 'b']
```

Generators: example of use

```javascript
function* objectEntries(obj) {
    // In ES6, you can use strings
    // or symbols as property keys,
    // Reflect.ownKeys() retrieves both
    let propKeys = Reflect.ownKeys(obj);

    for (let propKey of propKeys) {
        yield [propKey, obj[propKey]];
    }
}

let jane = { first: 'Jane', last: 'Doe' };
for (let [key,value] of objectEntries(jane)) {
    console.log(`${key}: ${value}`);
}
// Output:
// first: Jane
// last: Doe
```

Generators: recursion

```javascript
function* foo() {
    yield 'a';
    yield 'b';
}
function* bar() {
    yield 'x';
    yield* foo();
    yield 'y';
}

// Collect all values yielded by
bar() in an array
let arr = [...bar()];
// ['x', 'a', 'b', 'y']
```

Generators: yielding arrays

```javascript
function* bla() {
    yield 'sequence';
    yield* ['of', 'yielded'];
    yield 'values';
}

let arr = [...bla()];
// ['sequence', 'of', 'yielded', 'values']
```

throw() signals an error

```
function* genFunc1() {
    try {
        console.log('Started');
        yield; // (A)
    } catch (error) {
        console.log('Caught: ' + error);
    }
}

> let genObj1 = genFunc1();

> genObj1.next()
Started
{ value: undefined, done: false }

> genObj1.throw(new Error('Problem!'))
Caught: Error: Problem!
{ value: undefined, done: true }
```

Practice

Exercise 4

Generators for async calls

```javascript
function asyncAdd(x, y) {
  setTimeout(function() { it.next(x+y);},
1000);
}

function *process() {
  var res = yield asyncAdd(1,2);
  var res2 = yield asyncAdd(res,3);
  console.log(res2);
}

it = process();
it.next();
```

```javascript
function asyncAdd(x, y, f) {
  setTimeout(function() { f(x+y);},
1000);
}

asyncAdd(1, 2, function(res) {
  asyncAdd(res, 3, function(res) {
    console.log(res);
  })
});
```

Generators for async calls

```
function add(x,y) {
    return new Promise(function(resolve,reject) {
        setTimeout(()=>resolve(x+y), 1000);
    });
}

run(function *main() {
    var res1 = yield add(1,2);
    var res2 = yield add(res1, 3);
    console.log(res2);
});

function run(g) {
    var it = g(), ret;
    var iterate = (val)=>{
        ret = it.next(val);
        if (!ret.done) ret.value.then( iterate ); // wait on the promise
            else setTimeout(()=>iterate(ret.value), 0);  // avoid synchronous recursion
    }
    iterate();
}
```

Practice

Exercise 5

Generators for async calls: add reject processing

```
function run(g) {
    var it = g(), ret;
    var exception = (e)=>it.throw(e);
    var iterate = (val)=>{
        ret = it.next(val);
        if (!ret.done) ret.value.then( iterate, exception); // wait on the promise
            else setTimeout(()=>iterate(ret.value), 0);  // avoid synchronous recursion
    }
    iterate();
}
```

Generators for async calls with exceptions

```
function add(x,y) {
  return new Promise(function(resolve,reject) {
    setTimeout(()=>x>0?resolve(x+y):reject("x should be >0"), 1000);
  });
}

run(function *main() {
   try {
     var res1 = yield add(0,2);
   } catch(err) {
     console.log( "Error: " + err );
     return;
   }

   var res2 = yield add(res1, 3);
   console.log(res2);
});
```

Practice

Exercise 6

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Example: fetchJson with promises

```
function fetchJson(url) {
    return fetch(url)
    .then(request => request.text())
    .then(text => {
        return JSON.parse(text);
    })
    .catch(error => {
        console.log(`ERROR: ${error.stack}`);
    });
}

fetchJson('http://example.com/some_file.json')
.then(obj => console.log(obj));
```

Example: fetchJson with co library

```javascript
const fetchJson = co(function* () {
    try {
        let request = yield fetch(url);
        let text = yield request.text();
        return JSON.parse(text);
    }
    catch (error) {
        console.log(`ERROR: ${error.stack}`);
    }
});
```

**Poposed features of
EcmaScript 2017 / ES7+**

ES7 async/await

```javascript
function add(x,y) {
  return new Promise(function(resolve,reject) {
    setTimeout(()=>x>0?resolve(x+y):reject("x should be >0"), 1000);
  });
}

async function main() {
  var res = await add(1, 2);
  var res2 = await add (res, 3);
  console.log( res2 ); //6
}

main();
```

Example: fetchJson with async/await (ES7+)

```
async function fetchJson(url) {
    try {
        let request = await fetch(url);
        let text = await request.text();
        return JSON.parse(text);
    }
    catch (error) {
        console.log(`ERROR: ${error.stack}`);
    }
}
```

async declaration:
- Async function declarations: async function foo() {}
- Async function expressions: const foo = async function () {};
- Async method definitions: let obj = { async foo() {} }
- Async arrow functions: const foo = async () => {};

Practice

Exercise 7

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Exponentiation operator

x ** y

produce the same result as Math.pow(x,y)

Trailing commas in function parameters and arrays/objects

```javascript
let obj = {
  first: 'Jane',
  last: 'Doe',
};

let arr = [
          'red',
          'green',
          'blue',
        ];
```

```javascript
function foo(
            param1,
            param2,
) {}

foo(
      'abc',
      'def',
);
```

```javascript
nsole.log(arr.length); // 3
```

Decorators

```
function readonly(target, key, descriptor) {
  descriptor.writable = false;
  return descriptor;
}



class Cat {
  @readonly
  meow() { return `${this.name} says Meow!`; }
}
```

Decorators

```javascript
let descriptor = {
  value: specifiedFunction,
  enumerable: false,
  configurable: true,
  writable: true
};

// The decorator has the same signature as `Object.defineProperty`,
// and has an opportunity to intercede before the relevant
// `defineProperty` actually occurs
descriptor = readonly(Cat.prototype, 'meow', descriptor) || descriptor;
Object.defineProperty(Cat.prototype, 'meow', descriptor);


var garfield = new Cat();
garfield.meow = function() {
  console.log('I want lasagne!');
}

// Exception: Attempted to assign to readonly property
```

Decorators

```
import { readonly } from 'core-decorators';

class Meal {
  @readonly
  entree = 'steak';
}

var dinner = new Meal();
dinner.entree = 'salmon';
// Cannot assign to read only property 'entree' of [object Object]
```

Decorating a class

```javascript
function superhero(target) {
 target.isSuperhero = true;
 target.power = 'flight';
}

@superhero
class MySuperHero() {}

console.log(MySuperHero.isSuperhero); // true
```

Decorator with the parameter

```javascript
function superhero(isSuperhero) {
  return function(target) {
    target.isSuperhero = isSuperhero
  }
}

@superhero(true)
class MySuperheroClass() { }
console.log(MySuperheroClass.isSuperhero) // true

@superhero(false)
class MySuperheroClass() { }
console.log(MySuperheroClass.isSuperhero) // false
```