JavaScript Functions

Functions:

- Function is one the most important building block of JavaScript. It is a similar to procedure.
- It is a set of instructions that will calculate or perform any task.
- But this is written separately in a block which can be called again and again to perform that task.
- It can take in input or not. You can pass as many inputs. These inputs are known as ***parameters.***
- Also it can return a value or not. Function those who don’t return values are known as void function.
- To use a function, you must define it somewhere in the scope from which you wish to call it.

Function Declaration

- Making or defining a function is known as a function declaration.
- If consists of ***function*** keyword followed by the name of the function with parenthesis in which you can pass the parameters as inputs.
- Then {} brackets in which you can write appropriate instructions.

```
/keyword  name parameters
  function add  (a , b) {
  // block of code
  return a + b
}
```

Function Invocation:

- For this to work you need to call this function name.
- This is also known as invoking the function.
- If the function has no return statement then you can just call it.
- But if has the ***return*** value then you have to store the value in an variable

```
x = add(5,6)  // calling a function
```

JS Functions

- Block of code designed to perform a particular task.

```
function myFunction(p1, p2) {
  return p1 * p2;   // The function returns the product of p1 and p2
}
```

- A JavaScript function is defined with the `function` keyword, followed by a name, followed by parentheses ().

- Calling:

myFunction(5,2);

```
function foo(a) {
    console.log("msg1:",a);
}

function foo(a,b,c) {
    console.log("msg2:",a,b,c);
}


foo("hello");
```

Function Overloading

- *Unlike other programming languages, JavaScript* ***Does not support Function Overloading****.*

```
function foo(a) {
    console.log("msg1",a);
}

function foo(a,b,c) {
    console.log("msg2:",a,b,c);
}

foo1("hello");
```

```
/* The above function will be
   overwritten by the function
   below, and the below
function
   will be executed for any
number
   and any type of arguments */
```

JS Functions – ES6 Default Parameters

- With default parameters, a manual check in the function body is no longer necessary

```
function multiply(a = 0, b = 1) {
  return a * b;
}
multiply();
multiply(5);
multiply(5, 5);
```

Less Arguments

```
function foo(a) {
    console.log("msg1",a);
}
function foo(a,b,c) {
    console.log("msg2:",a,b,c);
}
function foo() {
    console.log("msg3:",a, b);
}

foo("hello");
```

```
function foo(a) {
   console.log("msg1",a);
}

function foo(a,b,c) {
   console.log("msg2:",a,b,c);
}

function foo() {
   console.log("msg3:");
}

foo("hello");
```

```
function foo(a) {
   console.log("msg1",a);
}

function foo(a,b,c) {
   console.log("msg2:",a,b,c);
}

function foo() {
   console.log("msg3:",arguments[0]);
}

 foo("hello");
```

```
function foo(a) {
    console.log("msg1",a);
}

function foo(a,b,c) {
    console.log("msg2:",a,b,c);
}

function foo() {
    console.log("msg3:",arguments[1]);
}

 foo("hello");
```

JS Functions – Arguments Object

- The arguments of a function are maintained in an array-like object
- All arguments can be retrieved using `arguments` object

```
function myConcat() {
    var result = '';
    // iterate through arguments
    for (let i = 0; i < arguments.length; i++)
        result += arguments[i] + " ";
    return result;
}
var result = myConcat( 'red', 'orange', 'blue');
console.log(result);
var result = myConcat('elephant', 'giraffe', 'lion', 'cheetah');
console.log(result);
var result = myConcat( 'sage', 'basil', 'oregano', 'pepper', 'parsley');
console.log(result);
```

Note: The `arguments` variable is "array-like", but not an array. It is array-like in that it has a numbered index and a `length` property. However, it does *not* possess all of the array-manipulation methods.

JS Functions – Rest Parameters

- The rest parameter syntax allows us to represent an indefinite number of arguments as an array.
- Rest Parameters are received as an Array and all Array operations can be applied

```
function sumNums(...nums) {
    let sum = 0;
console.log(nums.length);
    for (let i = 0; i < nums.length; i++)
        sum += nums[i];
    return sum;
}
console.log(sumNums(1, 1, 1));
```

JS Functions – Rest Parameters

- The rest parameter syntax allows us to represent an indefinite number of arguments as an array.
- Rest Parameters are received as an Array and all Array operations can be applied

```
function fun(arg1, ...args) {
    return args.length ;
}
console.log(fun(1, 2, 3, 4, 5, 6, 7, 8, 9) + " arguments passed");
// ? arguments passed
```

JS Functions – Rest Parameters

```
function fun( ...args, arg1) {
    return args.length ;
}
console.log(fun(1, 2, 3, 4, 5, 6, 7, 8, 9) + " arguments passed");
// ? arguments passed
```

JS Functions – Pass by Value

- JavaScript is Pass by Value for Primitive Data (Number, String, Boolean)

```
function sum(n1, n2) {
    n1 = n1 + n2;
    return n1;
}
var a = 10, b = 10
console.log(a, "+", b, "=", sum(a, b))
```

```
function strFun(p1) {
    p1 = "Eleven"
}
var a = "Ten"
strFun(a)
console.log(a)
```

JS Functions – Pass by Reference

- Objects are of Reference Type
  - Therefore, JavaScript is Pass by Reference for Objects

```
function strFun(p1) {
    p1.value = "Eleven"
}
var a = { value: "Ten" }
strFun(a)
console.log(a.value)
```

```
function strFun(p1) {
    p1.value = "Eleven"
    p1.index++
}
var a = { value: "Ten", index: 0 }
strFun(a)
console.log(a.index)
```

Visit this link for the detailed discussion:

https://stackoverflow.com/questions/13104494/does-javascript-pass-by-reference

JS Functions – Function Expression

- The Javascript Function Expression is used to define a function inside any expression.
- The Function Expression allows us to create an anonymous function that doesn’t have any function name which is the main difference between Function Expression and Function Declaration.
- A function expression has to be stored in a variable and can be accessed using *variableName.*

JS Functions – Function Expression

- **Syntax for Function Declaration:**

```
function functionName(x, y) { statements... return (z) };
```

- **Syntax for Function Expression (anonymous):**

```
let variableName = function(x, y) { statements... return (z) };
```

- **Syntax for Function Expression (named):**

```
let variableName = function functionName (x, y) {

statements... return (z) };
```

JS Functions – Function Expression

- However, a name can be provided with a function expression. Providing a name allows the function to refer to itself

```
const factorial = function fac(n) { return n < 2 ? 1 : n * fac(n - 1) }
console.log(factorial(3))
```

JS Arrow Functions

- Arrow functions were introduced in ES6
- An arrow function expression has a shorter syntax compared to function expressions

```
let variableName = (x, y) => { statements... return (z) };
```

Code for Function Declaration

```
function callAdd(x, y) {
  let z = x + y;
  return z;
}
console.log("Addition : " + callAdd(7, 4));
```

Code for Function Expression (anonymous)

```
let calSub = function (x, y) {
  let z = x - y;
  return z;
}

console.log("Subtraction : " + calSub(7, 4));
```

Code for Function Expression (named)

```
let calMul = function Mul(x, y) {
  let z = x * y;
  return z;
}

console.log("Multiplication : " + calMul(7, 4));
```

Code for Arrow Function

```
let calDiv = (x, y) => {
  let z = x / y;
  return z;
}

console.log("Division : " + calDiv(24, 4));
```

Self Exercises: What is Expected Output?

```
const mult = (a, b) => a = a !== undefined ? a : 0; b = b !== undefined ? b : 1; a * b;
console.log(mult(2, 3))
```

```
const mult = () => {
    a = a !== undefined ? a : 0;
    b = b !== undefined ? b : 1;
    return a * b;
}
console.log(mult(2, 3))
```

```
const mult = () => {
 var a = a !== undefined ? a : 0;
 var b = b !== undefined ? b : 1;
       a * b;
}
console.log(mult(2, 3))
```

```
const mult = () => {
    var a = a !== undefined ? a : 0;
    var b = b !== undefined ? b : 1;
    return a * b;
}
console.log(mult(2, 3))
```

```
const mult = (a, b) => {
    a = a !== undefined ? a : 0;
    b = b !== undefined ? b : 1;
    return a * b;
}
console.log(mult(2, 3))
```

JavaScript Classes

ES6 Classes

- JavaScript classes, introduced in ECMAScript 2015, are primarily syntactical sugar over JavaScript's existing prototype-based inheritance
- The class syntax *does not* introduce a new object-oriented inheritance model to JavaScript
- Classes are in fact "special functions", and just as you can define function expressions and function declarations
- Class syntax has two components:
  - class expressions
  - class declarations

Class Declarations

- One way to define a class is using a class declaration. To declare a class, you use the **class** keyword

```
class Rectangle {
    constructor(height, width) {
        this.height = height;
        this.width = width;
    }
}


const rect1 = new Rectangle(10, 10);
const rect2 = new Rectangle();
rect1.height = 20;
rect2 = rect1; // can do?
```

Class Expression

- A **class expression** is another way to define a class. Class expressions can be named or unnamed

```
// named
let Rectangle = class Rectangle2 {
    constructor(height, width) {
        this.height = height;
        this.width = width;
    }
};
const rect1 = new Rectangle(10, 10);
console.log(Rectangle.name);
// output: "Rectangle2“
console.log(rect1.height);
```

```
// unnamed
let Rectangle = class {
    constructor(height, width) {
        this.height = height;
        this.width = width;
    }
};
const rect1 = new Rectangle(10, 10);
console.log(Rectangle.name);
// output: "Rectangle"
console.log(rect1.height);
```

Constructor

- The constructor method is a special method for creating and initializing an object created with a class
- There can only be one special method with the name "**`constructor`**" in a class
- A SyntaxError will be thrown if the class contains more than one occurrence of a constructor method.
- A constructor can use the **`super`** keyword to call the constructor of the super class.

Getters, Methods

- Get keyword is used for creating Getter
  - Getter is called as a property or field name instead of function
  - E.g. **`square.area`** and not ~~**`square.area()`**~~

```
class Rectangle {
    constructor(height, width) {
        this.height = height;
        this.width = width;
    }
    // Getter
    get area() {
        return this.calcArea();
    }
    // Method
    calcArea() {
        return this.height * this.width;
    }
}

const square = new Rectangle(10, 10);

console.log(square.area); // 100
console.log(square.calcArea());
```

Getters, Methods – Another Example

- Height is a getter and used as rect.Height

Set Heightt is a setter and used as `rect.Heightt = 20;`

```
class Rectangle {
    constructor(height, width) {
        this.height = height;
        this.width = width;
    }
    get Height() {
        return this.height;
    }
    set Heightt(height) {
        this.height = height;
    }

}

var rect = new Rectangle(10, 15);
console.log(rect.Height); // 10

rect.Heightt = 20;

console.log(rect.Height); // 20
```

Static Method

- The static keyword defines a static method for a class
- Static methods are called without instantiating their class and cannot be called through a class instance
- Static methods are often used to create **utility functions** for an application.

```
class Point {
    constructor(x, y) {
        this.x = x;
        this.y = y;
    }

    static distance(a, b) {
        const dx = a.x - b.x;
        const dy = a.y - b.y;

        return Math.hypot(dx, dy);
    }
}

const p1 = new Point(5, 5);
const p2 = new Point(10, 10);

console.log(Point.distance(p1, p2));
```

Private Field Declarations

```
class Rectangle {
    #height = 0;
    #width;
    constructor(height, width) {
        this.#height = height;
        this.#width = width;
    }
    get Height() {
        return this.#height;
    }
    setHeight(height) {
        this.#height = height;
    }
}

var rect = new Rectangle(10, 15);
console.log(`Height of Rectangle is ${rect.height} cm`)
console.log(rect.Height);
rect.setHeight(20);
//rect.Height=20;

console.log(rect.Height);
```

Inheritance

- The **extends** keyword is used in class declarations or class expressions to create a class as a child of another class.

```
class Animal {
    constructor(name) {
        this.name = name;
    }
    speak() {
        console.log(`${this.name} makes a noise.`);
    }
}

class Dog extends Animal {
    constructor(name) {
        super(name);  // call the super class constru
ctor and pass in the name parameter
    }
    speak() {
        console.log(`${this.name} barks.`);
    }
}

let d = new Dog('Random dog');
d.speak(); // Random dog barks.
```

Hoisting (1/4)

- Hoisting is JavaScript's default behavior of moving declarations to the top.
- In JavaScript, a variable can be declared after it has been used.
- In other words; a variable can be used before it has been declared.

```
x = 5;
var x;
console.log(x); // 5
```

```
var x;
x = 5;
console.log(x); // 5
```

```
fName = "Ali"
lName = "Zafar"
var fName, lName
console.log(fName, lName); // Ali Zafar
```

```
var fName, lName
fName = "Ali"
lName = "Zafar"
console.log(fName, lName); // Ali Zafar
```

Hoisting (2/4)

- Variables and constants declared with **`let`** or **`const`** are not hoisted!

```
x = 5
let x
console.log(x)
// ReferenceError: Cannot access 'x' before initialization
```

```
x = 5
const x
console.log(x)
// SyntaxError: Missing initializer in const declaration
```

Hoisting (3/4)

- JavaScript only hoists declarations, not initializations.
- only the declaration (var y), not the initialization (=7) is hoisted to the top.

```
var x = 5; // Initialize x
var y = 7; // Initialize y
console.log(x + y) // 12
```

```
var x = 5; // Initialize x
console.log(x + y) // NaN
var y = 7; // Initialize y
```

```
var x = 5;  // Initialize x
var y;      // Declare y
console.log(x + y); // NaN
y = 7;      // Initialize y
```

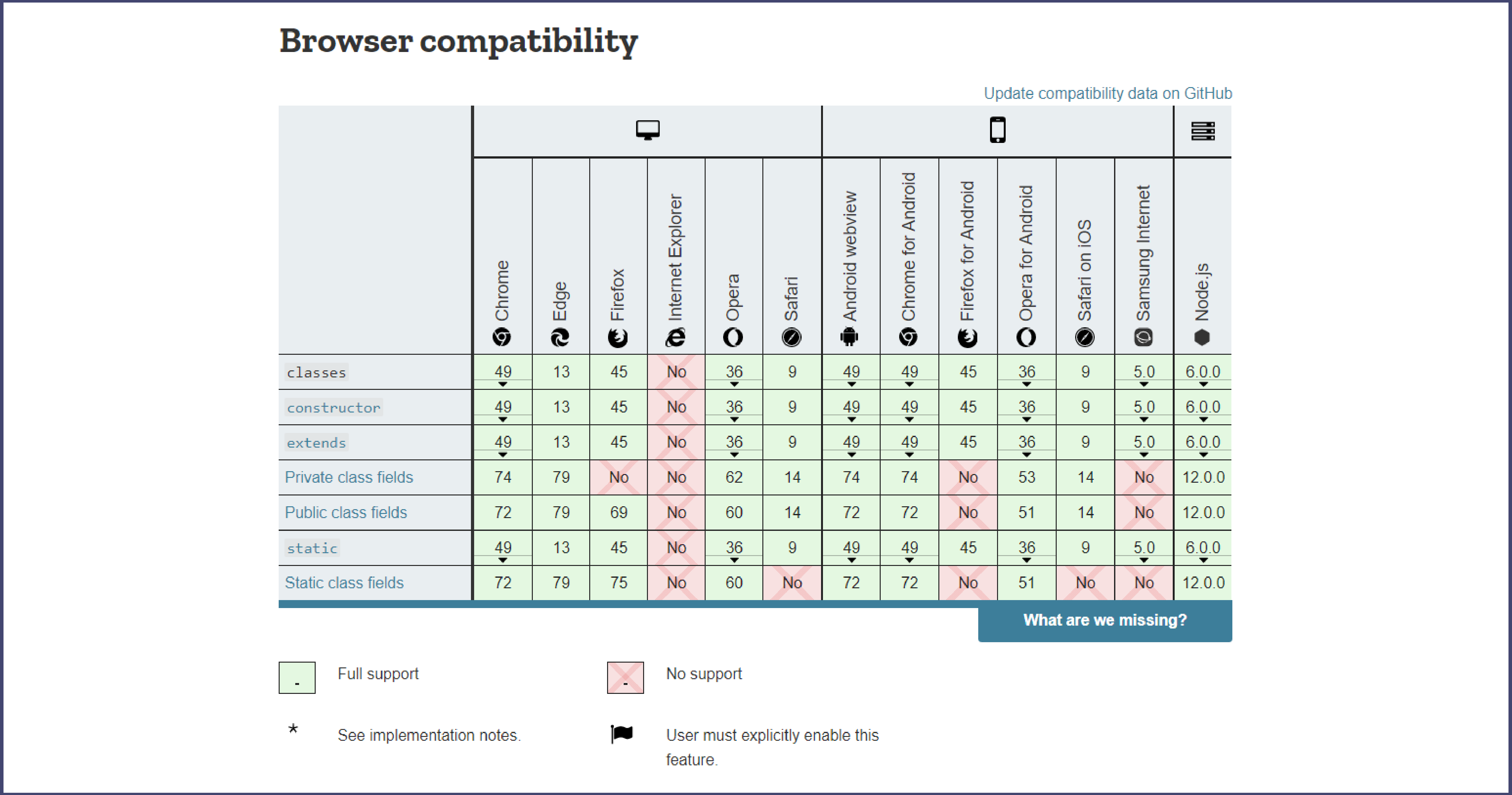
```
var x = 5;  // Initialize x
y = 7;      // Initialize y
console.log(x + y); // 12
var y;      // Declare y
```

Hoisting (4/4)

- An important difference between function declarations and class declarations is that **function declarations are hoisted** and class declarations are not

```
var rect = new Rectangle();
class Rectangle { }
// ReferenceError
```

```
var sqr = Square();
function Square() { }
```



Browser compatibility

Update compatibility data on GitHub

	🖥						📱						🗄
	Chrome	Edge	Firefox	Internet Explorer	Opera	Safari	Android webview	Chrome for Android	Firefox for Android	Opera for Android	Safari on iOS	Samsung Internet	Node.js
`classes`	49	13	45	No	36	9	49	49	45	36	9	5.0	6.0.0
`constructor`	49	13	45	No	36	9	49	49	45	36	9	5.0	6.0.0
`extends`	49	13	45	No	36	9	49	49	45	36	9	5.0	6.0.0
Private class fields	74	79	No	No	62	14	74	74	No	53	14	No	12.0.0
Public class fields	72	79	69	No	60	14	72	72	No	51	14	No	12.0.0
`static`	49	13	45	No	36	9	49	49	45	36	9	5.0	6.0.0
Static class fields	72	79	75	No	60	No	72	72	No	51	No	No	12.0.0

What are we missing?

🟩 Full support

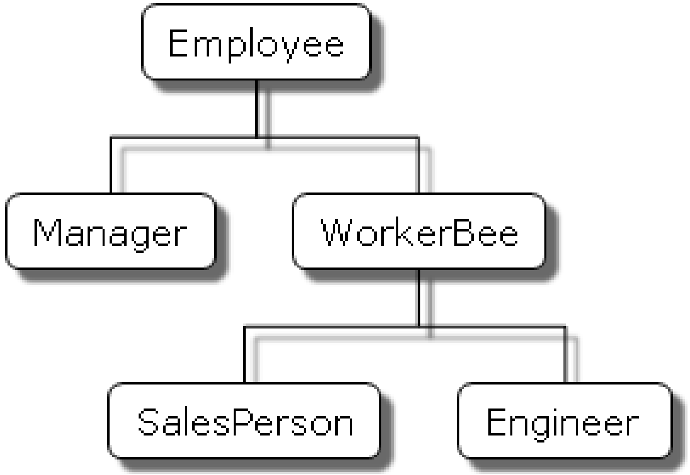
🟥 No support

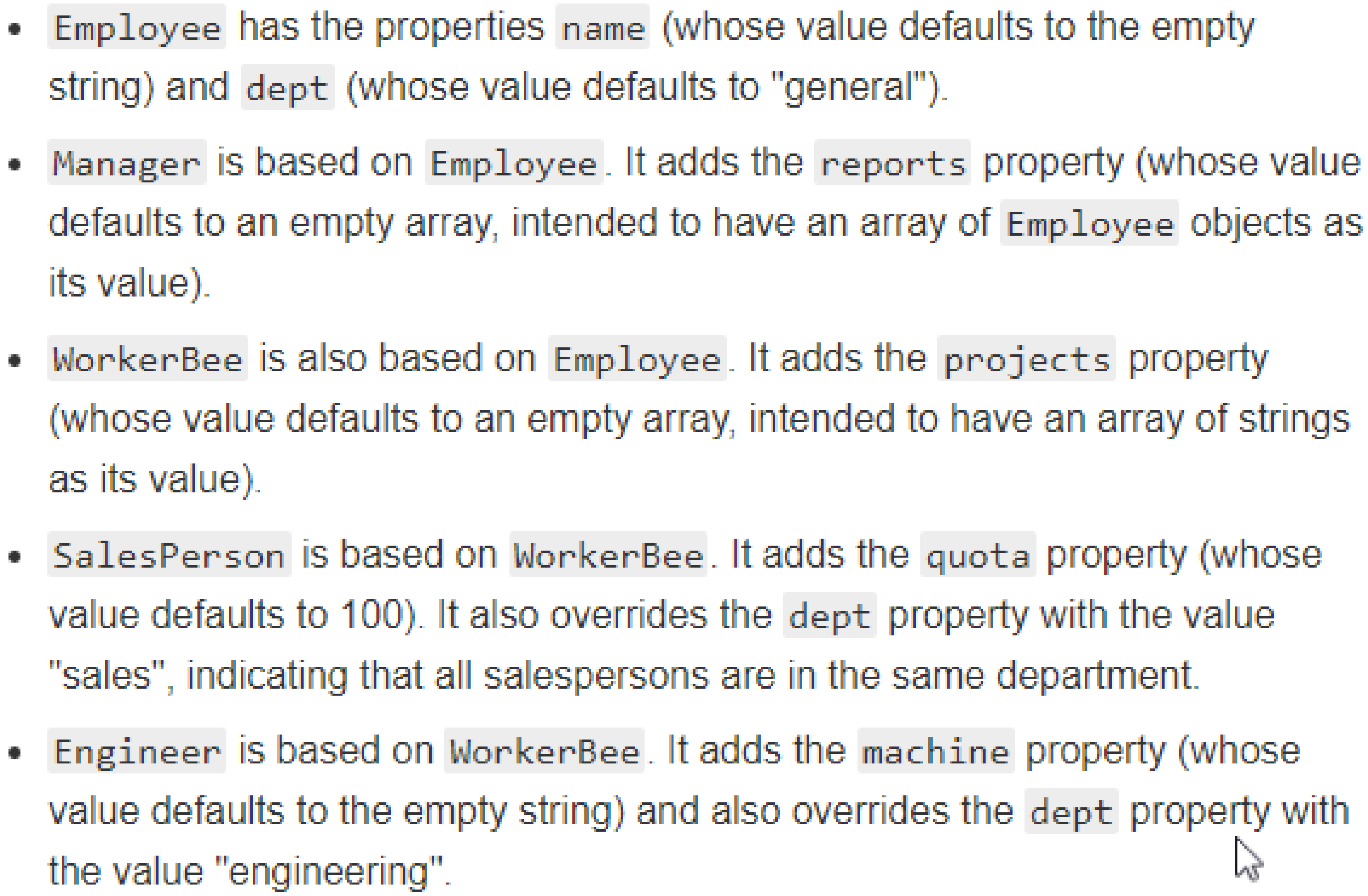
* See implementation notes.

⚑ User must explicitly enable this feature.

Exercise: Implement following scenario in ES6 Classes

A simple object hierarchy with the following objects:





- `Employee` has the properties `name` (whose value defaults to the empty string) and `dept` (whose value defaults to "general").
- `Manager` is based on `Employee`. It adds the `reports` property (whose value defaults to an empty array, intended to have an array of `Employee` objects as its value).
- `WorkerBee` is also based on `Employee`. It adds the `projects` property (whose value defaults to an empty array, intended to have an array of strings as its value).
- `SalesPerson` is based on `WorkerBee`. It adds the `quota` property (whose value defaults to 100). It also overrides the `dept` property with the value "sales", indicating that all salespersons are in the same department.
- `Engineer` is based on `WorkerBee`. It adds the `machine` property (whose value defaults to the empty string) and also overrides the `dept` property with the value "engineering".

References

- MDN Web Docs: Details of the object model (https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide/Details_of_the_Object_Model)
- W3Schools React ES6 (https://www.w3schools.com/react/react_es6.asp)

References

- MDN Web Docs: Details of the object model (https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide/Details_of_the_Object_Model)
- MDN Web Docs: Classes (https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Classes)
- W3Schools React ES6 (https://www.w3schools.com/react/react_es6.asp)