JavaScript Classes

Classes, Constructors, Properties, Unit Tests

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Have a Question?

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Classes in JS

Definition, Declaration, Expression, Hoisting

Class Definition

Structure for objects

- Classes define:
  - **Data** (properties, attributes)
  - **Actions** (behavior)
- One class may have **many instances** (objects)
- The class syntax has two components:
  - **Class Expressions** and **Class Declarations**

Class Declaration

- Use the **class keyword** with the name of the class
- The **constructor** defines class data

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

Class Expression

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Another way to **define a class**

- Class expressions can be **named** or **unnamed**

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

```
// named
let Rectangle = class Rectangle2 {
  constructor(height, width) {
    this.height = height;
    this.width = width;
  }
};
```

Hoisting

- **Function declarations are hoisted and class declarations are not**
- You first need to declare your class and then access it, otherwise a **ReferenceError** will be thrown

```
const p = new Rectangle(); // ReferenceError
class Rectangle {}
```

- **Class expressions** are subject to the same **hoisting restrictions**

Problem: Rectangle

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Write a JS **class** for a rectangle object

- It needs to have **width**, **height**, **color** and **calcArea()** method

```
let rect = new Rectangle(4, 5, 'red');
console.log(rect.width);       // 4
console.log(rect.height);      // 5
console.log(rect.color);       // Red
console.log(rect.calcArea()); // 20
```

Solution: Rectangle

```
class Rectangle {
    constructor(width, height, color) {
        this.width = width;
        this.height = height;
        this.color = color;
    }
    calcArea(){
        return this.width * this.height;
    }
}
```

Class Body and Methods

Definition, Constructor, Prototype, Fields

Class Body

- The **constructor** is a special method for **creating** and **initializing** an object created with a class
- A **SyntaxError** will be thrown if a class contains **more than one** occurrence of a **constructor method**

```
class Rectangle {
    // Class Body
}
```

```
constructor() {
    // Class Body
}
```

```
class Rectangle() {
    // Syntax Error
}
```

Prototype

- JS objects **inherit properties** and **methods** from a **prototype**
- The **Prototype Property** allows you to add **new properties** to object **constructors**

```
function Person(first, last, age) {
    this.firstName = first;
    this.lastName = last;
    this.age = age;
}
Person.prototype.nationality = "Bulgarian";
```

Prototype Methods

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Before ES2015 (ES6), **classes** were composed **manually**

```
function Rectangle(width, height) {
  this.width = width;
  this.height = height;
}
Rectangle.prototype.area = function () {
  return this.width * this.height;
}
let rect = new Rectangle(3, 5);
```

Comparison with the New Syntax

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

  area() {
    return this.width * this.height;
  }
}
```

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

```
Rectangle.prototype.area = function() {
  return this.width * this.height;
},
```

Static Methods

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- The **static** keyword defines a **static method** for a class

```
static staticMethod() {
    return 'Static method has been called';
}
```

- Called **without instantiating** their class and **cannot be called** through a class instance
- To call a static method of the same class, you can use the **this** keyword

```
static anotherStaticMethod() {
    return this.staticMethod() + ' from another method';
}
```

Accessor Properties

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```
class Circle {
  constructor(radius) { this.radius = radius; }
  get diameter() { return 2 * this.radius; }
  set diameter(diameter) {
    this.radius = diameter / 2;
  }
  get area() {
    return Math.PI * this.radius * this.radius;
  }
}
```

Property getter

Property setter

Read-only property "area"

Accessor Properties in Action

```
let c = new Circle(2);
console.log(`Radius: ${c.radius}`); // 2
console.log(`Diameter: ${c.diameter}`); // 4
console.log(`Area: ${c.area}`); // 12.566370614359172
```

```
c.diameter = 1.6;
console.log(`Radius: ${c.radius}`); // 0.8
console.log(`Diameter: ${c.diameter}`); // 1.6
console.log(`Area: ${c.area}`); // 2.0106192982974678
```

Private Properties

- Prefix each private property name with an **underscore**

```
function Point(x, y) {
    this._x = x;
    this._y = y;
}
```

- To make a private property **readable**/**writable** from any function, it's common to define **getters**/**setters**

Accessing Private Properties

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```
Point.prototype.getX = function () {
    return this._x;
};
```

```
Point.prototype.setX = function (x) {
    this._x = x;
};
```

```
Point.prototype.getY = function () {
    return this._y;
};
```

```
Point.prototype.setY = function (y) {
    this._y = y;
};
```

Problem: Person

Write a JS class that represent a personal record

- It needs to have the following properties:
  - **firstName**, **lastName**, **age** and **email**
- And a **toString()** method

```
let person = new Person('Maria', 'Petrova', 22, 'mp@yahoo.com');
console.log(person.toString());
// Maria Petrova (age: 22, email: mp@yahoo.com)
```

Solution: Person

```
class Person {
    constructor(fName, lName, age, email) {
        this.firstName = fName;
        this.lastName = lName;
        this.age = age;
        this.email = email;
    }
    toString() {
        return `${this.firstName} ${this.lastName}
                (age: ${this.age}, email: ${this.email})`
    }
}
```

Problem: Get Persons

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Write a JS **function** that returns an array of **Person objects**

- Use the class from the previous task
- There will be **no input**, the data is **static** and matches on this data

First Name	Last Name	Age	Email
Maria	Petrova	22	mp@yahoo.com
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Stephan	Nikolov	25	
Peter	Kolev	24	ptr.@gmail.com

Solution: Get Persons

```
class Person {

    constructor(firstName, lastName, age, email){
        this.firstName = firstName;
        this.lastName = lastName;
        this.age = age;
        this.email = email;
    }

    toString (){
        return `${this.firstName} ${this.lastName}
                (age: ${this.age}, email: ${this.email})`

        }

    }

    return [new Person('Maria', 'Petrova', 22, 'mp@yahoo.com'),
            ... //TODO for the rest of the persons
```

Class Inheritance

Inheriting Data and Methods

Class Inheritance

Classes can **inherit** (extend) other classes

- Child class inherits data + methods from its parent
- The **extends** keyword is used to create a class which is a **child of another class**
- **Child class** can:
  - Add **properties** (data)
  - Add / replace **methods**
  - Add / replace **accessor** properties

Class Inheritance - Example

```
class Person {
  constructor(name, email) {
    this.name = name;
    this.email = email;
  }
}
```

```
class Teacher extends Person {
  constructor(name, email, subject) {
    super(name, email);
    this.subject = subject;
  }
}
```

Class Inheritance - Example

```
let p = new Person("Maria", "maria@gmail.com");
console.log(`Person: ${p.name} (${p.email})`);
// Person: Maria (maria@gmail.com)
```

```
let t = new Teacher("Ivan", "iv@yahoo.com", "PHP");
console.log(
    `Teacher: ${t.name} (${t.email}), teaches ${t.subject}`
);
// Teacher: Ivan (iv@yahoo.com), teaches PHP
```

Unit Tests on Classes

Unit Tests on Classes - Example

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```
class SortedList {
    constructor() { this.list = []; }
    add(element) { this.list.push(element); }
    remove(index) { this.list.splice(index, 1); }
    get size() { return this.list.length; } }
```

```
describe("Sorted List", function () {
    let sortedList;
    beforeEach(function () {
        sortedList = new SortedList();
    });
```

Unit Tests on Classes - Example

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```
it('must initialize data to an empty array', function () {
   expect(sortedList.list instanceof Array).to.equal(true, 'Data must be
of type array');
   expect(sortedList.list.size).to.equal(0, 'Data array must be
initialized empty');
});
```

```
it('should remove correctly', function () {
   sortedList.add(123);
   sortedList.add(1234);
   sortedList.remove(1);
   expect(sortedList.size).to.equal(1);
});
```

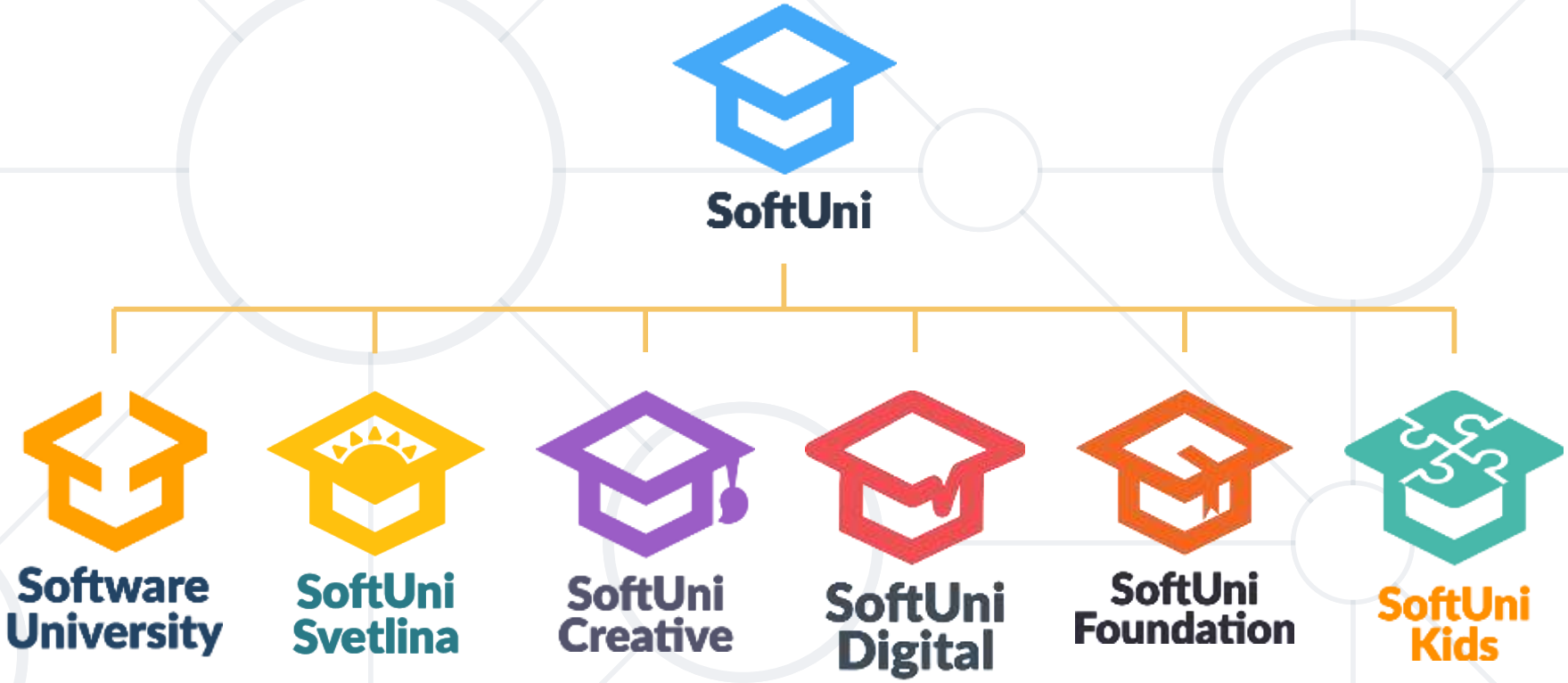
Live Exercises

Summary

Classes:

- Provide **structure** for objects.
- May define **methods**.
- May define **accessor properties**.
- Can **inherit** other classes.

Questions?



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