Classes and Class Members

Classes, Constructors, Properties

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#JSCORE

Objects and Classes

Defining and Using Classes in JS

Objects

- In programming **objects** holds a set of named values
  - E.g. a **rectangle** object holds **width**, **height**

```
rect

width = 5
height = 4
color = 'red'
```

Object name

Object properties

```
▼ Object
    color: "red"
    height: 4
    width: 5
```

- Creating a "**rect**" object in JS:

```
let rect = { width: 5, height: 4, color: 'red' };
```

Classes

- In programming **classes** provide the **structure** for objects
  - Act as **template** for objects of the same type
- Classes define:
  - **Data** (properties, attributes), e.g. `width`, `height`, `color`
  - **Actions** (behavior), e.g. `calcArea()`, `resize(ratio)`
- One class may have many instances (objects)
- Example class: `Rectangle`
- Example objects: `redRect`, `blueRect`

Defining Classes in JS

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```
class Rectangle {
  constructor(width, height, color) {
    this.width = width;
    this.height = height;
    this.color = color;
  }
}
let redRect = new Rectangle(4, 5, 'red');
let blueRect = new Rectangle(8, 3, 'blue');
console.log(redRect, blueRect);
```

The constructor defines class data

```
▶ Rectangle {width: 4, height: 5, color: "red"}
▶ Rectangle {width: 8, height: 3, color: "blue"}
```

```
▼ Rectangle i
    color: "red"
    height: 5
    width: 4
  ▶ __proto__: Object
```

```
▼ Rectangle i
    color: "blue"
    height: 3
    width: 8
  ▶ __proto__: Object
```

Create a new object

Classes Holding Data + Methods

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

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

Methods perform operations over the class data

Check your solution here: https://judge.softuni.bg/Contests/336

Classes vs. Objects

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Classes

```
class
Rectangle
```

Class name

```
width
height
color
```

Class data (properties)

```
calcArea()
resize(…)
```

Class actions (methods)

Objects

```
object
rect1
```

Object name

```
width = 4
height = 5
```

Object data

```
object
rect2
```

Object name

```
width = 8
height = 3
```

Object data

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Problem: Persons

- Create a class **Person** to hold **firstName** + **lastName** + **age** + **email**
  - Define **`toString()`** method to print the person in this format:

```
{firstName} {lastName} (age: {age}, email: {email})
```

- Write a function **`getPersons()`** to return an array of the followin g persons:

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

Problem: Persons – Output

- The **getPersons()** function should work like this:

```
console.log(getPersons().join(", "));
```

```
Maria Petrova (age: 22, email: mp@yahoo.com),
SoftUni undefined (age: undefined, email: undefined),
Stephan Nikolov (age: 25, email: undefined),
Peter Kolev (age: 24, email: ptr@gmail.com)
```

Solution: Person Class

```
class Person {
  constructor(firstName, lastName, age, email) {
    [this.firstName, this.lastName, this.age, this.email] = [fi
rstName, lastName, age, email];
  }
  toString() {
    return `${this.firstName} ${this.lastName} (age: ${this.age
}, email: ${this.email})`;
  }
}
```

Check your solution here: https://judge.softuni.bg/Contests/336

Solution: getPersons() Function

```
function getPersons() {
  class Person { … }
  return [
    new Person('Maria', 'Petrova', 22, 'mp@yahoo.com'),
    new Person('SoftUni'),
    new Person('Stephan', 'Nikolov', 25),
    new Person('Peter', 'Kolev', 24, 'ptr@gmail.com'),
  ];
}
```

Check your solution here: https://judge.softuni.bg/Contests/336

```
▼ Circle {radius: 2}
    diameter: 4
    radius: 2
```

Accessor Properties

Defining Getters and Setters

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"

Class Circle will hold property "radius" + accessor properties "diameter" and "area"

Accessor Properties in Action

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

```
▼ Circle {radius: 2}
    area: 12.566370614359172
    diameter: 4
    radius: 2
  ▶ __proto__: Object
```

```
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
```

```
▼ Circle {radius: 0.8}
    area: 2.0106192982974678
    diameter: 1.6
    radius: 0.8
```

static function (){}

Static Methods

Static Methods

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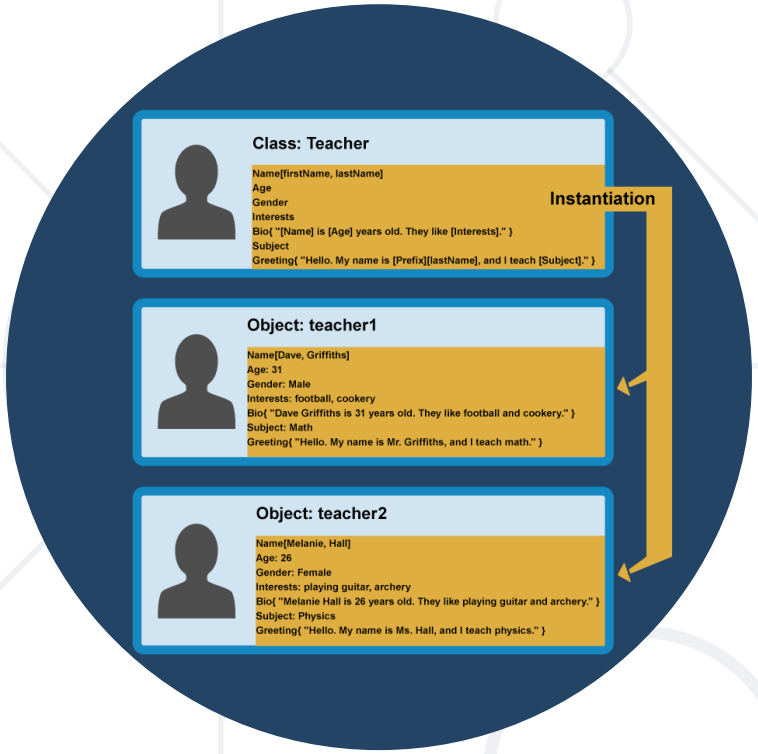
```
class Point {
  constructor(x, y) {
    this.x = x;
    this.y = y;
  }
  static distance(a, b) {
    const dx = a.x - b.x;
    const dy = a.y - b.y;
    return Math.sqrt(dx*dx + dy*dy);
  }
}
```

```
let p1 = new Point(5, 5);
let p2 = new Point(10, 10);
console.log(
  Point.distance(p1, p2));
```

Check your solution here: https://judge.softuni.bg/Contests/336



Legacy Classes in JS

Legacy Classes

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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);
```

Constructor function defines class data

Behavior (methods) is later attached to the prototype

Instantiation works the same way

Check your solution here: https://judge.softuni.bg/Contests/336

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;}
```

Protecting Class Data

Keeping the Class State Correct

Read Only Class Data

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```
class Cat {
  constructor(name, age) {
    this.name = name;
    this.age = age;
    Object.freeze(this);
  }
}
```


```
let c = new Cat('Garfield',  5);
c.name = 'Tom'; // not working (Error in strict mode)
c.sex = 'M';    // not working (Error in strict mode)
console.log(c); // Cat { name: 'Garfield', age: 5 }
```

Inextensible Class Data

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```
class Cat {
  constructor(name, age) {
    this.name = name;
    this.age = age;
    Object.seal(this);
  }
}
```

```
let c = new Cat('Garfield',  5);
c.name = 'Tom'; // OK
c.sex = 'M';     // not working (Error in strict mode)
console.log(c); // Cat { name: 'Tom', age: 5 }
```

Problem: Cards

- Write a function that returns a class **`Card`** and a enum **`Suits`**:
  - **`Suits`** is an object with keys [**`SPADES`**, **`HEARTS`**, **`DIAMONDS`**, **`CLUBS`**] and corresponding values [**♠, ♥, ♦, ♣**]
  - The **`Card`** class should hold a **Face** + **Suit**:
    - **Face** must be in [**2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K, A**]
    - **Suit** must be a value from **Suites**
  - **`Card.toString()`** should return the card as text, e.g. **K♦**
  - Creating an invalid Card (e.g. **-1♥**) should throw an Error

Problem: Cards – Sample Output

```
let defineCards = (function() { … } () )
let Suits = defineCards.Suites;
let Card = defineCards.Card;
```

```
let card = new Card("Q",Suits.DIAMONDS));
console.log('' + card); // Q♦
```

→ OK

```
let card = new Card("1",Suits.DIAMONDS);
```

→ Error

```
let card = new Card("A",Suits.Pesho);
```

→ Error

```
let card = new Card("A",'hearts');
```

→ Error

Solution: Create Cards Function

```
(function() {
  let Suits = {
    CLUBS: "\u2663",     // ♣
    DIAMONDS: "\u2666", // ♦
    HEARTS: "\u2665",    // ♥
    SPADES: "\u2660"     // ♠
  };
  let Faces = ['2', '3', '4', '5', '6', '7', '8', '9', '10',
'J', 'Q', 'K', 'A'];
  class Card { … }
  return { Suits, Card }
}())
```

Solution: Class Card

```
class Card {
  constructor(face, suit) {
    this.suit = suit;
    this.face = face;
  }

  get face() { return this._face; }
  set face(face) {
    if (!Faces.includes(face))
      throw new Error("Invalid card face: " + face);
    this._face = face;
  }
  …
```

Use different identifier **this._face** to avoid infinite recursion: **set suit()** invoking itself

Solution: Class Card (2)

```
class Card {

  …
  get suit() { return this._suit; }
  set suit(suit) {
    if (!Object.keys(Suits).map(
        k => Suits[k]).includes(suit))
      throw new Error("Invalid card suite: " + suit);
    this._suit = suit;
  }

  toString() { return `${this.face}${this.suit}`; }

}
```

Check your solution here: https://judge.softuni.bg/Contests/336

Live Exercises

Summary

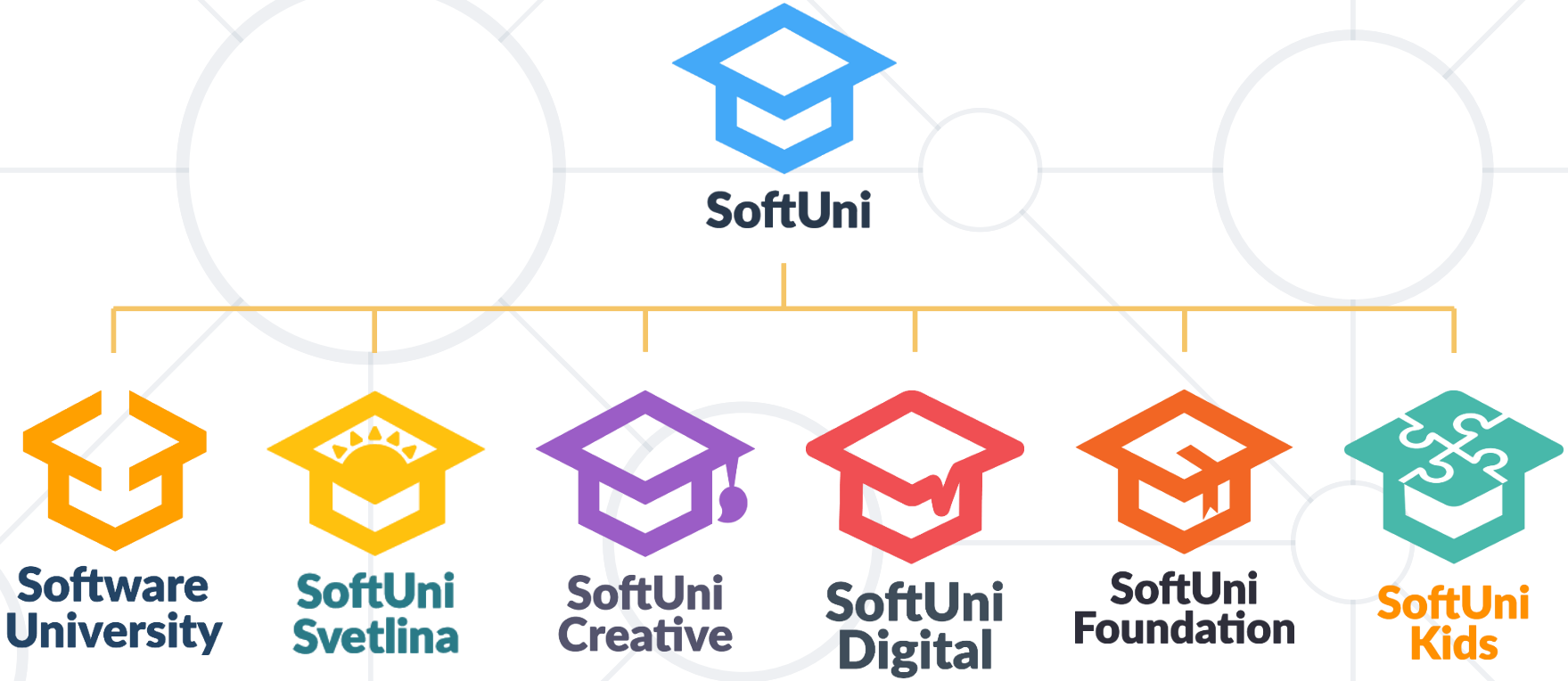
- Classes provide structure for objects
- Classes may define methods:

```
toString() { … }
```

- Classes may define accessor properties
  - Getters and setters:

```
get area() { return … }
```

Questions?



https://softuni.bg/trainings/2081/js-advanced-october-2018

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