Exercises: Prototype chain

Problems for exercises and homework for the "JavaScript Advanced" course @ SoftUni. Submit your solutions in the SoftUni judge system at https://judge.softuni.bg/Contests/341/.

1. Balloons

You have been tasked to create several classes for balloons.

Implement a class **Balloon**, which is initialized with a **color** (String) and **gasWeight** (Number). These two arguments should be **public members**.

Implement another class **PartyBalloon**, which inherits the **Balloon** class and is initialized with **2 additional parameters** – **ribbonColor** (String) and **ribbonLength** (Number).
The **PartyBalloon** class should have a **property ribbon**, which is an **object** with **color** and **length** – the ones given upon initialization. The ribbon property should have a **getter**.

Implement another class **BirthdayBalloon**, which inherits the **PartyBalloon** class and is initialized with **1 extra parameter** – **text** (String). The **text** should be a property, and should have a **getter**.

Screenshots

First, we need to create a function, which will hold our classes, since we will return more than one and the Judge needs to know how to work with them. We create a simple function and we add the first class, the base class for all Balloons to it.

```
function solve() {
    class Balloon {
        constructor(color, gasWeight) {
            this.color = color;
            this.gasWeight = gasWeight;
        }
    }
}
```

Now that we have our base class, we can create the first child class – the **PartyBalloon**, which extends the base Balloon class.

Upon inheriting the **Balloon** class, the constructor of the **PartyBalloon** class will require the use of the super() method, to initialize the **Balloon** base constructor.

We also need to add the **ribbon object property** in the constructor of the PartyBalloon class. This one is for you to do.

```
function solve() {
    class Balloon {
        constructor(color, gasWeight) {
            this.color = color;
            this.gasWeight = gasWeight;
        }
    }

    class PartyBalloon extends Balloon {
        constructor(color, gasWeight, ribbonColor, ribbonLength) {
            super(color, gasWeight);
            //TODO: Initialize ribbon object
        }

        get ribbon() {
            return this._ribbon;
        }
    }
}
```

Now that we know how to basically inherit classes… Create the **BirthdayBalloon** class on your own. The **BirthdayBalloon** class should extend the **PartyBalloon** class, and should add an **extra property**. It is the same as the previous class.

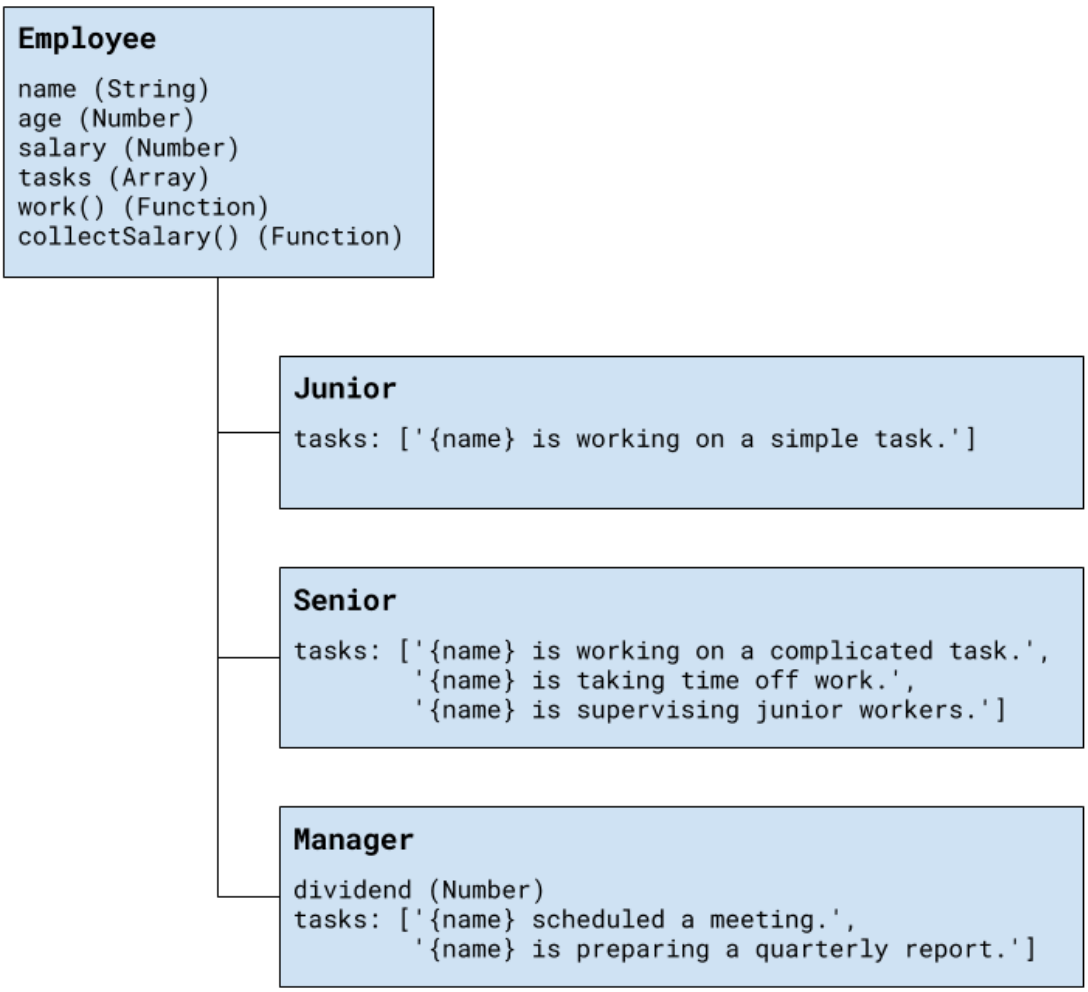
Lastly, we need to return an object, containing all of our classes, so that the Judge can work with them.

```
function solve() {

    class Balloon {...}

    class PartyBalloon extends Balloon {...}

    class BirthdayBalloon extends PartyBalloon {...}

    return {
        Balloon: Balloon,
        PartyBalloon: PartyBalloon,
        BirthdayBalloon: BirthdayBalloon
    }
}
```

Submit in the judge a **function (NOT IIFE)**, which holds all classes, and returns them as an object.

2. People

Define several JS classes, that represent a company's employee records. Every employee has a **name** and **age**, a **salary** and a list of **tasks**, while every position has specific properties not present in the others. Place all common functionality in a **parent abstract** class. Follow the diagram bellow:



Every position has different tasks. In addition to all common properties, the manager position has a **dividend** he can collect along with his salary.

All employees have a **work** function that when called cycles trough the list responsibilities for that position and prints the current one. When all tasks have been printed, the list starts over from the beginning. Employees can also **collect salary**, which outputs the amount, plus any **bonuses**.

Your program needs to expose a module, containing the three classes **`Junior`**, **`Senior`** and **`Manager`**. The properties **`name`** and **`age`** are set trough the constructor, while the **`salary`** and a manager's **`dividend`** are initially set to zero and can be changed later. The list of **`tasks`** is filled by each position. The resulting objects also expose the functions **`work()`** and **`collectSalary()`**. When **`work()`** is called, one of the following lines is printed on the console, depending on the current task in the list:

`{employee name} is working on a simple task.`

`{employee name} is working on a complicated task.`

`{employee name} is taking time off work.`

`{employee name} is supervising junior workers.`

{employee name} scheduled a meeting.

{employee name} is preparing a quarterly report.

And when **collectSalary()** is called, print the following:

{employee name} received {salary + bonuses} this month.

Input / Output

Any input will be passed as valid arguments, where applicable. Print any output that is required to the console as a string.

Submit your code as a revealing module, containing the three classes. Any definitions need to be named exactly as described above.

3. Posts

Your need to create several classes for **Posts**.

Implement a class **Post**, which is initialized with a **title** (String) and **content** (String). The 2 arguments should be **public members**.
The **Post** class should also have **toString()** function which returns the following result:

```
"Post: {postTitle}"
"Content: {postContent}"
```

Implement another class which is called **SocialMediaPost**, which inherits the **Post** class.
The **SocialMediaPost** class should be initialized with **2 additional arguments** – **likes** (Number) and **dislikes** (Number).
The **SocialMediaPost** class should hold an **array of comments** (Strings), and a function **addComment(comment)**, which **adds comments** to **that array**.
The **SocialMediaPost** class should extend the **toString()** function of the **Post** class, and should return the following result:

```
"Post: {postTitle}"
"Content: {postContent}"
"Rating: {postLikes - postDislikes}"
"Comments:"
" * {comment1}"
" * {comment2}"
. . .
```

In case **there are no comments**, return information only about the **title**, **content** and **rating** of the **post**.

Implement another class which is called **BlogPost**, which inherits the **Post** class.
The **BlogPost** class should be initialized with **1 additional arguments** – **views** (Number).
The **BlogPost** class should hold a function **view()**, which **increments** the **views** of the object with **1**, every time it is called. The function should **return the object**, so that **chaining is supported**.
The **BlogPost** class should extend the **toString()** function of the Post class, and should return the following result:

```
"Post: {postTitle}"
"Content: {postContent}"
"Views: {postViews}"
```

Example

posts.js

```
let post = new Post("Post", "Content");

console.log(post.toString());

// Post: Post
// Content: Content

let scm = new SocialMediaPost("TestTitle", "TestContent", 25, 30);

scm.addComment("Good post");
scm.addComment("Very good post");
scm.addComment("Wow!");

console.log(scm.toString());

// Post: TestTitle
// Content: TestContent
// Rating: -5
// Comments:
//  * Good post
//  * Very good post
//  * Wow!
```

Submit in the judge a **function (NOT IIFE)**, which holds all classes, and returns them as an object.

4. The Elemelons

If Watermelons exist, Firemelons, Earthmelons and Airmelons should also exist. Create **classes** for **The 4 Elemelons**.

Create an **abstract class** for the Elemelons. Name it **`Melon`**.
The **`Melon`** class should be initialized with **`weight`** (Number), and **`melonSort`** (String). The 2 arguments should be **public members**.

Create classes **`Watermelon`**, **`Firemelon`**, **`Earthmelon`**, **`Airmelon`**. Each of them should **inherit** the **abstract class `Melon`** and its functionality. Aside from the abstract functionality, **each** of the **Elemelons** should have property **`elementIndex`** (Number), which is **equal** to its **`weight * `** the **string length** of its **`melonSort`**. The property should have only a **getter**.

All of the classes should hold a **`toString()`** function, which returns the following result for them:

`"Element: {Water/Fire/Earth/Air}"`
`"Sort: {elemelonSort}"`
`"Element Index: {elemelonElementIndex}"`

Create one more class which is called **`Melolemonmelon`**, which inherits **one** of the **4 elemelons**, **regardless of which**.
The Melolemonmelon **has no element**, but it can **morph** into any of the others. Implement a function **morph()**, which **changes the current element** of the Melolemonmelon, **each time** it is called.
Upon initialization, the **initial element** is **Water**. From then it should go in the following order: **Fire, Earth, Air, Water, Fire…** and so on.
The **`toString()`** function should remain the same as its parent class.

To create an abstract class you must make sure that that class cannot be instantiated directly. Put the following code in the constructor of the Melon class, before all else.

melon.js

```
class Melon {
    constructor(weight, melonSort) {
        if (new.target === Melon) {
            throw new TypeError("Abstract class cannot be instantiated directly");
        }

        //TODO: initialize weight and melonSort properties
    }
}
```

Example

scripts.js

```
let test = new Melon(100, "Test");
//Throws error

let watermelon = new Watermelon(12.5, "Kingsize");
console.log(watermelon.toString());

// Element: Water
// Sort: Kingsize
// Element Index: 100
```

Submit in the judge a **function (NOT IIFE)**, which holds all classes, and returns them as an object.

5. *C# Console

Write **Mocha unit tests** to verify the functionality of a JavaScript implementation of the C# Console **class**. If you've written some code in C#, you would know that you can format text using placeholders, an example would look like this:

```
Console.WriteLine("The sum of {0} and {1} is {2}", 3, 4, 7);
```

Here the first placeholder **{0}** is exchanged for the first parameter passed after the text template - **3**. The second placeholder **{1}** for the second parameter - **4** and so on.

You will be provied with a class **Console** which has similar functionality to the C# one. The **Console** should have a static method writeLine which supports the following:

- **writeLine(string)** - if only a single argument is passed and it is a string, the function should simply return it.
- **writeLine(object)** - if only a single parameter is passed and it is an object - return the **JSON** representation of the object.
- **writeLine(templateString, parameters)** - It should support the following:
  - If multiple arguments are passed, but the first is not a string - throw a **TypeError**.
  - If the number of **parameters** does not correspond to the number of placeholders in the template string - throw a **RangeError**.
  - If the placeholders have indexes not withing the **parameters** range(for instance we have a placeholder **{13}** and only 5 params) throw a **RangeError**.
  - if multiple arguments are passed and the first is a string, find all placeholders from the string and **exchange** them with the supplied **parameters**.

Any cases not mentioned above, do not need to be checked.

Constraints

- All arguments in the **writeLine(templateString, parameters)** will be **strings**.
- There will never be two placeholders with the same number.

JS Code

To ease you in the process, you are provided with an implementation which meets all of the specification requirements for the **Console** object:

specialConsole.js

```
class Console {

  static get placeholder() {
    return /{\d+}/g;
  }

  static writeLine() {
    let message = arguments[0];
    if (arguments.length === 1) {
      if (typeof (message) === 'object') {
        message = JSON.stringify(message);
        return message;
      }
      else if (typeof(message) === 'string') {
        return message;
```

```
      }
    }
    else {
      if (typeof (message) !== 'string') {
        throw new TypeError("No string format given!");
      }
      else {
        let tokens = message.match(this.placeholder).sort(function (a, b) {
          a = Number(a.substring(1, a.length - 1));
          b = Number(b.substring(1, b.length - 1));
          return a - b;
        });
        if (tokens.length !== (arguments.length - 1)) {
          throw new RangeError("Incorrect amount of parameters given!");
        }
        else {
          for (let i = 0; i < tokens.length; i++) {
            let number = Number(tokens[i].substring(1, tokens[i].length - 1));
            if (number !== i) {
              throw new RangeError("Incorrect placeholders given!");
            }
            else {
              message = message.replace(tokens[i], arguments[i + 1])
            }
          }
          return message;
        }
      }
    }
  }
};
```

Your tests will be supplied a class named **"Console"** which contains the above-mentioned logic, all test cases you write should reference this variable. Submit in the judge your code containing Mocha tests testing the above functionality.

6. *Computer

You need to implement the class hierarchy for a computer business, here are the classes you should create and support:

- **Keyboard** - concrete class that contains:
  - **manufacturer** - string property for the name of the manufacturer.
  - **responseTime** - number property for the response time of the Keyboard.
- **Monitor** - concrete class that contains:
  - **manufacturer** - string property for the name of the manufacturer.
  - **width** - number property for the width of the screen.
  - **height** - number property for the height of the screen.
- **Battery** - concrete class that contains:
  - **manufacturer** - string property for the name of the manufacturer.
  - **expectedLife** - number property for the expected years of life of the Battery.
- **Computer** - **abstract** class that contains:
  - **manufacturer** - string property for the name of the manufacturer.
  - **processorSpeed** - a number property containing the speed of the processor in GHz.

    - **ram** - a number property containing the RAM of the computer in Gigabytes.
    - **hardDiskSpace** - a number property containing the hard disk space in Terabytes.
- **Laptop** - concrete class **extending** the **Computer** class that contains:
    - **weight** - a number property containing the weight of the Laptop in Kilograms.
    - **color** - a string property containing the color of the Laptop.
    - **battery** - an instance of the **Battery** class containing the Laptop's battery. There should be a **getter** and a **setter** for the property and validation that the passed in argument is actually an instance of the Battery class.
- **Desktop** - concrete class **extending** the **Computer** class that contains:
    - **keyboard** - an instance of the **Keyboard** class containing the Desktop PC's Keyboard. There should be a **getter** and a **setter** for the property and validation that the passed in argument is actually an instance of the Keyboard class.
    - **monitor** - an instance of the **Monitor** class containing the Desktop PC's Monitor. There should be a **getter** and a **setter** for the property and validation that the passed in argument is actually an instance of the Monitor class.

Attempting to instantiate an abstract class should throw an **Error**, attempting to pass an object that is not of the expected instance (ex. an object that is not an instance of Battery to the laptop as a battery) should throw a **TypeError**.

Example

template.js

```
function createComputerHierarchy() {
    //TODO

    return {
        Battery,
        Keyboard,
        Monitor,
        Computer,
        Laptop,
        Desktop
    }
}
```

You are asked to submit **ONLY the function** that returns an object containing the above mentioned classes.

Bonus:

In order to achieve a better code reuse, it's a good idea to have a base abstract class containing common information - check the classes, what common characteristics do they share that can be grouped in a common base class.

7. **Mixins

Using the classes from the last task, write two mixins (functions which attach some functionality to passed in classes' prototypes) to extend their functionality. You need to support the following mixins:

- **computerQualityMixin(classToExtend)** - a function that attaches the following functions to the prototype of the passed in class.

- **`getQuality()`** - returns a number equal to the computer's **`(processorSpeed + RAM + hardDiskSpace) / 3`**.
- **`isFast()`** - if **`processorSpeed > (ram / 4)`** returns **`true`**, otherwise **`false`**.
- **`isRoomy() -`** if **`hardDiskSpace > Math.floor(ram * processorSpeed)`** returns **`true`**, otherwise **`false`**.

- **`styleMixin(classToExtend)`** - a function that attaches the following functions to the prototype of the passed in class:
  - **`isFullSet()`** - if the computer's **`manufacturer`**, **`keyboard's manufacturer`** and **`monitor's manufacturer`** all have the same name returns **`true`**, otherwise **`false`**.
  - **`isClassy()`** - if the computer **`battery's expectedLife`** is **3 years or more** and the **`computer's color`** is either **"Silver"** or **"Black"** and the **`computer's weight`** is **less than 3 kilograms** returns **`true`**, otherwise returns **`false`**.

Example

template.js

```
function createMixins() {
    //TODO
    return {
        computerQualityMixin,
        styleMixin
    }
}
```

You are asked to submit **ONLY the function** that returns an object containing the above mentioned mixins.