Exercise: Object Composition

1. Array Extension

Extend the build-in **`Array`** object with additional functionality. Implement the following functionality:

- **`last()`** - returns the last element of the array
- **`skip(n)`** - returns a new array which includes all original elements, except the first **n** elements; **n** is a **Number** parameter
- **`take(n)`** - returns a new array containing the first **n** elements from the original array; **n** is a **Number** parameter
- **`sum()`** - returns a sum of all array elements
- **`average()`** - returns the average of all array elements

Input / Output

Input for functions that expect it will be passed as valid parameters. Output from functions should be their **return** value.

Constraints

Structure your code as an **IIFE**.

Hints

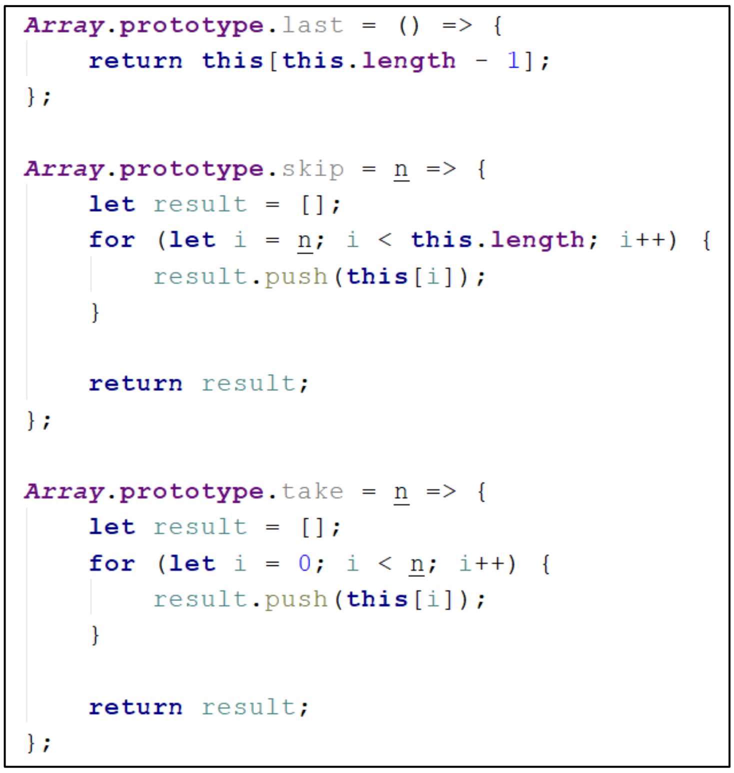
If we have an **instance** of and array, since we know it's an object, adding new properties to it is pretty straightforward:

```
let myArr = [1, 2, 3];

myArr.last = function () {
    // TODO
};
```

This however, only adds our new function to this instance. To add all functions just one time and have them work on **all arrays** is not much more complicated, we just have to attach them to Array's **prototype** instead:

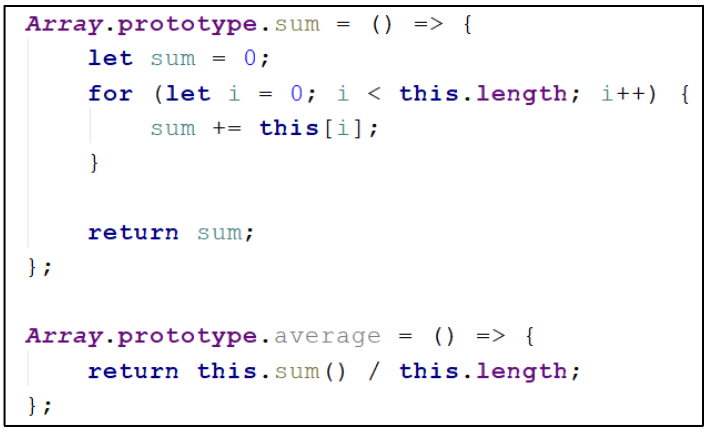
```
Array.prototype.last = function () {
    // TODO
};
```

With such a declaration, we gain access to the context of the calling instance via **`this`**. We can then easily access indexes and other existing properties. Don't forget we don't want to modify the exiting array, but to create a new one:



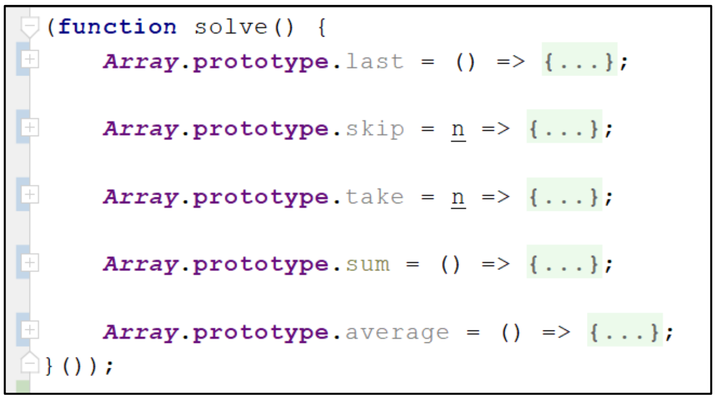
```
Array.prototype.last = () => {
    return this[this.length - 1];
};

Array.prototype.skip = n => {
    let result = [];
    for (let i = n; i < this.length; i++) {
        result.push(this[i]);
    }

    return result;
};

Array.prototype.take = n => {
    let result = [];
    for (let i = 0; i < n; i++) {
        result.push(this[i]);
    }

    return result;
};
```

Note these functions do not have any error checking - if **n** is **negative** or **outside the bounds** of the array, and exception will be thrown, so take care when using them, or add your own validation. The last two functions require a little bit of arithmetic to be performed:



```
Array.prototype.sum = () => {
    let sum = 0;
    for (let i = 0; i < this.length; i++) {
        sum += this[i];
    }

    return sum;
};

Array.prototype.average = () => {
    return this.sum() / this.length;
};
```

To test our program in the Judge, we need to wrap it in an IIFE, like it's shown on the right. There is **no return value**, since the code execution results in functionality being added to and existing object, so they take effect instantly. We are ready to submit our solution.



```
(function solve() {
    Array.prototype.last = () => {...};

    Array.prototype.skip = n => {...};

    Array.prototype.take = n => {...};

    Array.prototype.sum = () => {...};

    Array.prototype.average = () => {...};
}());
```

2. Construction Crew

Write a program that receives a **`worker`** object as a parameter and modifies its properties. Workers have the following structure:

```
{ weight: Number,
  experience: Number,
  levelOfHydrated: Number,
  dizziness: Boolean }
```

Weight is expressed in **kilograms**, **experience** in **years** and **`levelOfHydrated`** is in **milliliters**. If you receive a worker who's **`dizziness`** property is set to **`true`** it means he needs to intake some **water** in order to be able to work correctly. The required amount is 0.1ml per **kilogram** per year of **`experience`**. The required amount must be **added** to the **existing amount**. Once the water is administered, change the **`dizziness`** property to **`false`**.

Workers who **do not have dizziness** should **not** be modified in any way. Return them as they were.

Input

Your function will receive a valid **object** as **parameter**.

Output

Return the **same object** that was passed in, **modified** as necessary.

Examples

Input	Output

`{ weight: 80,`
`experience: 1,`
`levelOfHydrated: 0,`
`dizziness: true }`
	`{ weight: 80,`
	`experience: 1,`
	`levelOfHydrated: 8,`
	`dizziness: false }`

`{ weight: 120,`
`experience: 20,`
`levelOfHydrated: 200,`
`dizziness: true }`
	`{ weight: 120,`
	`experience: 20,`
	`levelOfHydrated: 440,`
	`dizziness: false }`

`{ weight: 95,`
`experience: 3,`
`levelOfHydrated: 0,`
`dizziness: false }`
	`{ weight: 95,`
	`experience: 3,`
	`levelOfHydrated: 0,`
	`dizziness: false }`

3. Car Factory

Write a program that assembles a car by **given requirements** out of **existing components**. The client will place an order in the form of an **object describing** the car. You need to **determine** which parts to use to fulfil the client's order. You have the following parts in storage:

An **`engine`** has **`power`** (given in horsepower) and **`volume`** (given in cubic centimeters). Both of these values are **numbers**. When selecting an engine, pick the **smallest possible** that still meets the requirements.

```
Small engine: { power: 90, volume: 1800 }
```

```
Normal engine: { power: 120, volume: 2400 }
```

```
Monster engine: { power: 200, volume: 3500 }
```

A **`carriage`** has a **`type`** and **`color`**. Both of these values are **strings**. You have two types of carriages in storage and can paint it **any color**.

```
Hatchback: { type: 'hatchback', color: <as required> }
```

```
Coupe: { type: 'coupe', color: <as required> }
```

The **`wheels`** will be represented by an **array** of 4 **numbers**, each number represents the **diameter** of the wheel in inches. The size can only be an **odd number**. Round **down** any requirements you receive to the nearest odd number.

Input

You will receive an **object** as an **argument** to your function. The format will be as follows:

```
{ model: <model name>,
  power: <minimum power>,
  color: <color>,
  carriage: <carriage type>,
  wheelsize: <size> }
```

Output

Return the resulting car **object** as a result of your function. See the examples for details.

Examples

Sample input	Output

`{ model: 'VW Golf II',`
`  power: 90,`
`  color: 'blue',`
`  carriage: 'hatchback',`
`  wheelsize: 14 }`
	`{ model: 'VW Golf II',`
	`  engine: { power: 90,`
	`            volume: 1800 },`
	`  carriage: { type: 'hatchback',`
	`              color: 'blue' },`
	`  wheels: [13, 13, 13, 13] }`

`{ model: 'Opel Vectra',`
`  power: 110,`
`  color: 'grey',`
	`{ model: 'Opel Vectra',`
	`  engine: { power: 120,`
	`            volume: 2400 },`

`carriage: 'coupe',`
`wheelsize: 17 }`
	`carriage: { type: 'coupe',`
	`           color: 'grey' },`
	`wheels: [17, 17, 17, 17] }`

4. Extensible Object

Create an object that can clone the functionality of another object into itself. Implement an **`extend(template)`** function that would copy all of the properties of template to the parent object and if the property is a function, add it to the object's prototype instead.

Input / Output

Your code should **return** the extensible **object instance**. The **`extend()`** function of your object will receive a valid object as **input parameter**, and has **no** output.

Examples

Extensible object	Resulting object

`myObj: {`
`  __proto__: {}`
`  extend: function () {…}`
`}`
	`myObj: {`
	`  __proto__: {`
	`    extensionMethod: function () {…}`
	`  },`
	`  extend: function () {…},`
	`  extensionProperty: 'someString'`
	`}`

Template object	

`template: {`
`  extensionMethod: function () {…},`
`  extensionProperty: 'someString'`
`}`	

Note that **`__proto__`** is a hidden property, representing the object's **`prototype`** - depending on your test environment, you may not have access to it directly, but you can use other functions to do that.

Hints

To gain access to the prototype of an instance, use the **`Object.getPrototypeOf()`** function. To make a function shared between all instances, it'll have to be attached to the prototype instead of the instance.

5. String Extension

Extend the build-in String object with additional functionality. Implement the following functions:

- **`ensureStart(str)`** - append **str** to the beginning of a string, **only** if it's **not** already present
- **`ensureEnd(str)`** - append **str** to the end of a string, **only** if it's **not** already present
- **`isEmpty()`** - return **true** if the string is **empty**, **false** otherwise

- `truncate(n)` - truncates the string to **n** characters by **removing words** and appends an ellipsis (three periods) to the end. If a string is less than **n** characters long, return the **same string**. If it is longer, split the string where a **space** occurs and append an ellipsis to it so that the **total length** is less than or equal to **n**. If **no space** occurs anywhere in the string, return **n - 3** characters and an ellipsis. If **n** is less than 4, return **n** amount of periods.
- `format(string, …params)` - static method to replace placeholders with parameters. A placeholder is a number surrounded by curly braces. If parameter index cannot be found for a certain placeholder, do not modify it. Note static methods are attached to the **String object** instead of it's prototype. See the examples for more info.

Note strings are **immutable**, so your functions will return new strings as a result.

Input / Output

Your main code should be structured as an IIFE **without** input or output - it should modify the existing **String prototype** instead.

Input and output of the **extension functions** should be as described above.

Examples

Sample input	Value of *str*
`let str = 'my string';`	
`str = str.ensureStart('my');`	`'my string'       // 'my' already present`
`str = str.ensureStart('hello ');`	`'hello my string'`
`str = str.truncate(16);`	`'hello my string' // length is 15`
`str = str.truncate(14);`	`'hello my...'     // length is 11`
`str = str.truncate(8);`	`'hello...'`
`str = str.truncate(4);`	`'h...'`
`str = str.truncate(2);`	`'..'`
`str = String.format('The {0} {1} fox', 'quick', 'brown');`	`'The quick brown fox'`
`str = String.format('jumps {0} {1}', 'dog');`	`'jumps dog {1}'   // no parameter at 1`

6. *Sorted List

Implement a collection, which keeps a list of numbers, sorted in **ascending order**. It must support the following functionality:

- `add(elemenent)` - adds a new element to the collection
- `remove(index)` - removes the element at position **index**
- `get(index)` - returns the value of the element at position **index**
- `size` - number of elements stored in the collection

The **correct order** of the element must be kept **at all times**, regardless of which operation is called. **Removing** and **retrieving** elements **shouldn't** work if the provided index points **outside the length** of the collection (either throw an error or do nothing). Note the **size** of the collection is **NOT** a function. Write your code such that the first function in your solution **returns an instance** of your Sorted List.

Input / Output

All function that expect **input** as **parameters** will receive valid data. Any result expected from a function should be **returned** as it's result. Your **main function** should **return** an **object instance** with the required functionality as it's result.

7. * Bug Tracker

Create a program for managing bug reports. It must perform as a self-contained module with exposed functionality. Whenever a new element is added, deleted or changed with a command, the HTML should be updated automatically. A bug report has the following structure:

```
{ ID: Number,
  author: String,
  description: String,
  reproducible: Boolean,
  severity: Number,
  status: String }
```

The **ID** of each report has to be a **unique** number, starting from **zero** and increasing **sequentially**. The module needs to implement the following **functions**:

- **`report(author, description, reproducible, severity)`** - **create** a new bug report and store it. The **ID** is assigned automatically to the next available number and the **status** defaults to **`'Open'`**
- **`setStatus(id, newStatus)`** - change the status of a bug registered in the system to **`newStatus`** by given **ID**
- **`remove(id)`** - delete a bug report by given **ID**
- **`sort(method)`** - change the order in which bug reports are displayed on the webpage. The **`method`** argument is a string and can be either **`'author'`**, **`'severity'`** or **`'ID'`**. Always sort in ascending order (default behavior for alphabetical sort). The default sorting method is by **`'ID'`**.
- **`output(selector)`** - set the HTML element inside which the result is to be displayed to **`selector`**

Use the following structure for each HTML report:

index.html

`<div id="report_${ID}" class="report">`
`  <div class="body">`
`    <p>${description}</p>`
`  </div>`
`  <div class="title">`

```
    <span class="author">Submitted by: ${author}</span>
    <span class="status">${status} | ${severity}</span>
  </div>
</div>
```

Input

Input will be passed to each applicable function as **parameters** in the correct format.

Output

Your solution must **expose** a **module** with all required functions bundled in it (**return** it as a result of your main function). The HTML should be **modified** as specified.