**Lab: Prototypes and Inheritance**

Problems for exercises and homework for the ["JavaScript Applications" course @ SoftUni](https://softuni.bg/courses/js-applications). Submit your solutions in the SoftUni Judge system at [https://judge.softuni.bg/Contests/2770 HYPERLINK "https://judge.softuni.bg/Contests/2770/Prototypes-and-Inheritance-Lab"/ HYPERLINK "https://judge.softuni.bg/Contests/2770/Prototypes-and-Inheritance-Lab"Prototypes-and-Inheritance-Lab](https://judge.softuni.bg/Contests/2770/Prototypes-and-Inheritance-Lab)

* **Person**

Write a JS program which takes **first** & **last** names as **parameters** and returns an object with **firstName**, **lastName** and **fullName** ( **"{firstName} {lastName}"** ) properties which should be all **accessible**, we discovered that "accessible" also means "mutable". This means that:

* If **firstName** or **lastName** have changed, then **fullName** should also be changed.
* If **fullName** is changed, then **firstName** and **lastName** should also be changed.
* If **fullName** is **invalid**, you should not change the other properties. A **valid** **full name** is in the format

**"{firstName} {lastName}"**

**Examples**

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| **Sample Input** |
| **let person = new Person("Peter", "Ivanov");**  **console.log(person.fullName); *//Peter Ivanov***  **person.firstName = "George";**  **console.log(person.fullName); //George Ivanov**  **person.lastName = "Peterson";**  **console.log(person.fullName); //George Peterson**  **person.fullName = "Nikola Tesla";**  **console.log(person.firstName); //Nikola**  **console.log(person.lastName); //Tesla** |
| **let person = new Person("Albert", "Simpson");**  **console.log(person.fullName); //Albert Simpson**  **person.firstName = "Simon";**  **console.log(person.fullName); //Simon Simpson**  **person.fullName = "Peter";**  **console.log(person.firstName); // Simon**  **console.log(person.lastName); // Simpson** |

* **Person and Teacher**

Write a class **Person** and a class **Teacher** which extends **Person**.

* The **Person** class should have a **name** and an **email**
* The **Teacher** class should have a **name**, an **email**, and a **subject**

**Input \ Output**

There will be **NO** input. Your function should return an object containing the classes **Person** and **Teacher**.

**Hints:**

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| **template.js** |
| **function** *personAndTeacher*() {  *//* ***TODO:* return** {  ***Person***,  ***Teacher*** } } |

* **Inheriting and Replacing ToString**

Extend the **Person** and **Teacher** from the previous task and add a class **Student** inheriting from **Person** with additional property **course**. Add **toString()** functions to all classes, the formats should be as follows:

* **Person** - returns "**Person (name: {name}, email: {email})**"
* **Student** - returns "**Student (name: {name}, email: {email}, course: {course})**"
* **Teacher** - returns "**Teacher (name: {name}, email:{email}, subject:{subject})**"

Try to reuse code by using the **toString()** function of the base class.

**Input / Output**

There will be **NO** input. Your function should return an object containing the classes **Person**, **Teacher** and **Student**.

**Hints:**

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| **template.js** |
| **function** *toStringExtension***() {  *// TODO:* return {  *Person*,  *Teacher,***  ***Student* } }** |

* **Extend Prototype**

Write a function which receives a **class** and attaches to it a property **species** with value "**Human**" and a function **toSpeciesString()**. When called, the function returns a string with format:

**"I am a <species>. <toString()>"**

The function **toString()** is called from the current instance (call using **this**).

**Input / Output**

Your function will receive a **class** whose prototype it should extend. There is **NO** output, your function should only attach the properties to the given class’ prototype.

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| **template.js** |
| **function** *extendProrotype*(classToExtend) **{  *// TODO:* }** |

* **Class Hierarchy**

Write a function that returns **3** classes - **Figure**, **Circle** and **Rectangle**.

**Figure**:

* Should have property units ("**m**", "**cm**", "**mm**") with default value "**cm**"
* Should have a **getter area**
* Has method **changeUnits** that sets different units for that figure
* **Has method toString**, which returns `Figures units: {units}`

**Circle**:

* Extends **Figure**
* Has a property **radius**
* Overrides **area** getter to return the area of the Circle (PI \* r \* r)
* **toString()** - should return a string representation of the figure in the format

**"Figures units: {type} Area: {area} - radius: {radius}**"

**Rectangle:**

* Extends **Figure**
* Has properties **width**, **height** and **units** (extended from the class Figure)
* Overrides **area** getter to return the area of the **Rectangle** (width \* height)
* **toString()** - should return a string representation of the figure in the format

**"Figures units: {type} Area: {area} - width: {width}, height: {height}"**

**Note: All Parameters Passed in the Constructors Are in Centimeters ("cm")**

**Input / Output**

There will be **no** input. Your function should return an object containing the **Figure**, **Circle** and **Rectangle** classes.

**Examples**

This code demonstrates how your classes should behave:

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| **Sample Code** |
| **let c = new Circle(5);**  **console.log(c.area); // 78.53981633974483**  **console.log(c.toString()); // Figures units: cm Area: 78.53981633974483 - radius: 5**  **let r = new Rectangle(3, 4, 'mm');**  **console.log(r.area); // 1200**  **console.log(r.toString()); //Figures units: mm Area: 1200 - width: 30, height: 40**  **r.changeUnits('cm');**  **console.log(r.area); // 12**  **console.log(r.toString()); // Figures units: cm Area: 12 - width: 3, height: 4**  **c.changeUnits('mm');**  **console.log(c.area); // 7853.981633974483**  **console.log(c.toString()) // Figures units: mm Area: 7853.981633974483 - radius: 50** |