University of Maryland College Park
Department of Computer Science
CMSC335 Spring 2023
Exam #2 Key

FIRSTNAME, LASTNAME (PRINT IN UPPERCASE):

STUDENT ID (e.g., 123456789):

Instructions

- This exam is a closed-book, closed-notes exam with a duration of 75 minutes and 200 total points.
- You may lose credit if you do not follow the instructions below.
- **At this point, you must write your name and id at the top of this page and add your directory id (e.g., terps) at the end of odd-numbered pages.**
- Please use a pencil to answer the exam.
- **Do not remove the exam's staple or bend any of the pages, as doing so will interfere with the scanning process.**
- Provide answers in the rectangular areas. If you continue a problem on another page(s), make a note. **For multiple-choice questions, please fill in the bubble (do not circle).**
- For multiple-choice questions, you can assume only one answer unless stated otherwise.
- **Your code must be efficient and as short as possible.**
- **Provide your answer within the provided box.**
- You don't need to use meaningful variable names; however, we expect good indentation.
- You must stop writing once the time is up.

Grader Use Only

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Problem #1 (Miscellaneous)

1. (4 pts) Complete the second let declaration below using array destructuring to produce the average of the first and last array elements.

```
Average: 90
```

```
let scores = [80, 35, 45, 100];
let                                                                        = scores;
```

Answer: let [first, s, t, last] = scores;

```
document.writeln("Average: " + (first + last) / 2);
```

2. (4 pts) Complete the second let declaration below using object destructuring to produce the following output:

```
Model: turbo, Revolutions: 10000
```

```
let engine = {model: "turbo", year: 4000, revolutions: 10000};
let                                                                        = engine;
document.writeln(`Model: ${model}, Revolutions: ${revolutions}`);
```

Answer: let {model,revolutions} = engine;

3. (4 pts) Using the spread operator, complete the assignment below so we can generate the following output:

```
John,Kelly,40,50
```

```
let names = ["John", "Kelly"];
let ages = [40, 50];
let merged =
document.writeln(merged);
```

Answer: let merged = [...names, ...ages];

4. (6 pts) Write the **JSON** (not a JavaScript object) representation of an object that has the following properties:
   a. **gate** property with a value of "21A"
   b. **nonstop** property with a value of true
   c. **duration** property with a value of 1.5

   Answer: { gate: "21A", nonstop: true, duration: 1.5}

5. (5 pts) Using the => operator, initialize the **perimeter** variable with a function that computes a rectangle's perimeter. The perimeter is the sum of the length and width. The default values for length and width are four and five, respectively.

```
let perimeter =
```

Answer: (len = 4, width = 5) => len + width OR (len = 4, width = 5) => 2 * len + 2 * width;

6. (7 pts) Complete the definition of the following **Error** type using the JavaScript class approach. **Using any other approach will receive no credit.**

class DataRangeError

Answer:

```
class DataRangeError extends Error {
   constructor(message) {
      super(message);
   }
}
```

Problem #2 (Array Methods)

A **files** array keeps track of files. The following is an example of some entries the array could have:

```
const files = [
                  {name: "BobsResume", type: "docx", size: 100},
                  {name: "RachelsResume", type: "docx", size: 300},
                  {name: "Assignment1", type: "txt", size: 40},
                  {name: "Project2", type: "txt", size: 100},
                  {name: "Compiler", type: "docx", size: 700},
                  {name: "Quiz1", type: "md", size: 40},
                  {name: "Final", type: "md", size: 500}
              ];
```

To answer the following questions, you may only use the following functions: **filter, forEach, some, find, join, findIndex, reduce, and arrow (=>) functions.** You may **NOT** use iteration statements or conditionals (unless specified otherwise). Your code should work with different data (not just the entries above).

1. (6 pts) Complete the following statement so each file's **name** and **type** are printed on separate lines, using document.writeln().

files.

Answer: files.forEach(f => document.writeln(`${f.name} ${f.type}<br>`));

2. (8 pts) Complete the following statement so the **name** of files with a size of 100 is printed on separate lines using document.writeln().

files.

Answer: files.filter(f => f.size == 100).forEach(i => document.writeln(i.name + "<br>"))

3. (8 pts) Complete the following statement so **hasAtLeastATxtFileWith40** is initialized to true if there is at least one file with a "txt" type and a size of 40.

const hasAtLeastATxtFileWith40 = files.

Answer: files.some(f => f.type === "txt" && f.size == 40)

4. (8 pts) Complete the following statement so **findMDFile** is initialized with the name of a file with an "md" type and a size of 500. If no such file exists, **findMDFile** will undefined.

const findMDFile = files.

Answer: (files.find(f => f.type == "md" && f.size == 500))?.name;

5. (8 pts) Complete the following assignment so the file with the largest size is assigned to the **largestFile** variable. For example, for the above array, printing largestFile.name will display `"Compiler"`. **Using conditionals (e.g., if) is OK.**

const largestFile = files.

Answer:

```
files.reduce((result, elem) => {
        return result.size > elem.size ? result : elem;
    });
```

Problem #3 (Custom Type Definition)

Write **JavaScript** that defines two classes (**Bed** and **WaterBed**) using the "Default Pattern for Custom Type Definition" presented in lecture. **If you use E6 class definitions (similar to what you have in Java, where we use class and extends), you will not receive any credit for this problem.**

1. **Bed**
   a. Define a custom type with two instance variables named **model** and **weight** (not private).
   b. Define a constructor that has two parameters: **model** and **weight,** and initializes the appropriate instance variables.
   c. Define a method named **setModel** that will update the **model** instance variable with the specified parameter. The parameter has a default value of "BASIC".
   d. Define a method called **info** that **returns** a string with the **model** and **weight** (see the example below for format information).
   e. **Your implementation must be efficient (i.e., do not create unnecessary objects).**

Answer:

```
function Bed(model, weight) {
   this.model = model;
   this.weight = weight;
}

Bed.prototype = {
   constructor: Bed,

   setModel: function(model = "BASIC") {
       this.model = model;
   },

   info: function() {
      return `Model: ${this.model}, Weight: ${this.weight}`;
   }
};
```

2. **WaterBed**
   a. Define an **WaterBed** custom type that "extends" the **Bed** custom type. The type has an instance variable named **gallons**; this instance variable is not private.
   b. Define a constructor that has **model**, **weight**, and **gallons** as parameters. The constructor will initialize the corresponding instance variables.
   c. Define a method named **getGallons** that returns the gallons.
   d. **Your implementation must be efficient (i.e., do not create unnecessary objects).**

If you use E6 class definitions (similar to what you have in Java, where we use class and extends), you will not receive any credit for this problem.

Answer:

```
function WaterBed(model, weight, gallons) {
   Bed.call(this, model, weight);
   this.gallons = gallons;
}
WaterBed.prototype = new Bed();
WaterBed.prototype.constructor = WaterBed;
WaterBed.prototype.getGallons = function() {
   return this.gallons;
}
```

<u>Problem #4 (Class Declaration using "class")</u>

Write **JavaScript** that defines two classes (**Door** and **ElectricDoor**) using E6 class definitions (using **class**, **extends**, and **super**, etc. as in Java). **You will not get any credit if you use the "Default Pattern for Custom Type Definition" presented in class.**

1. **<u>Door</u>**

   Define a **Door** class with the specifications below. A door is associated with a **make** and an **area**.

   a. A **private** static field named **totalDoors** initialized to 0.
   b. Two **private instance** variables called **make**, and **area**. You must use the approach described in the lecture to make them private.
   c. Define a constructor that has two parameters: **make** and **area.** The constructor will initialize the corresponding instance variables, and increase the **totalDoors** static variable.
   d. Define a **non-static** method called **info()** that **prints** (using document.writeln) the **make**, and **area**. See the sample driver for format information.
   e. Define the equivalent of the toString() Java method. The method will return a string with the **make** and **area** values separated by a comma. The driver we provided has an example of using this method (look for **toString() output**).
   f. Define a setter method (using **set**) that has as parameter a make value and will update the **make** instance variable only if the parameter value is NOT null (otherwise, no change will occur). See the driver for an example of how we can use this method.
   g. Define a getter method (using **get**) that returns the **make** value (see driver for an example of how we can use it).
   h. Define a static method called **getTotalDoors()** that returns the total number of door objects created.

   Answer:

```
class Door {
    static #totalDoors = 0; /* Static variable */

    #make; /* private */
    #area;

    constructor(make, area) {
        this.#make = make;
        this.#area = area;
        Door.#totalDoors++;
    }

    info() {
        let output = `Make: ${this.#make}`;
        output += `, Area: ${this.#area}`;
        document.writeln(`${output}`);
    }

    [Symbol.toPrimitive]() {
        return this.#make + ", " + this.#area;
    }

    set make(newMake) {
        if (newMake != null) {
            this.#make = newMake;
        }
    }

    get make() {
        return this.#make;
    }

    static getTotalDoors() { /* Static method */
        return Door.#totalDoors;
    }
}
```

ElectricDoor

The **ElectricDoor** class extends the **Door** class, and it is associated with a voltage value. Define the **ElectricDoor** class with the specifications below.

a. A **private** instance variable named **voltage**. You must use the approach described in the lecture to make it private.
b. Define a constructor with three parameters: **make**, **area**, and **voltage**. The constructor will call the base class constructor and initialize the **voltage** instance variable with the corresponding parameter.
c. Define a **non-static** method called **info()** that calls the base class **info()** method and then prints the **voltage** value using document.writeln. See the sample driver for format information.

Answer:

```
class ElectricDoor extends Door {   // Using extends
    #voltage; /* private */

    constructor(make, area, voltage) {
       super(make, area);
       this.#voltage = voltage;
    }

    info() {
       super.info();
       document.writeln(`,Voltage: ${this.#voltage}`);
    }
  }
```

Problem #5 (Diagram)

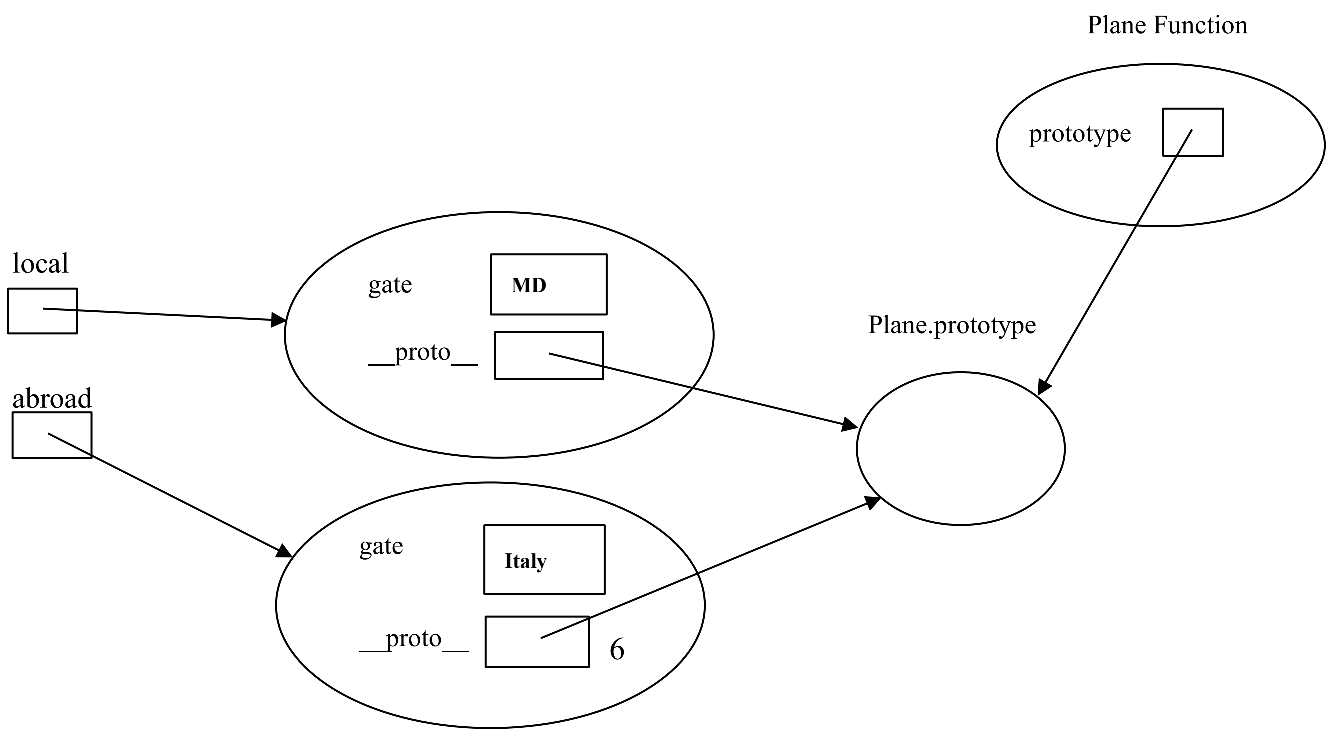
The **Plane** function is defined as follows:

```
function Plane(gate) {
   this.gate = gate;
}
```

Draw a diagram illustrating the objects and the relationships among the objects present after the following two **Plane** objects are created. Please make sure you label prototype objects as such (e.g., Plane.prototype). In your diagram, we expect to see the **prototype** and **__proto__** properties (and the objects they refer to). Add the **gate** property to the appropriate objects.

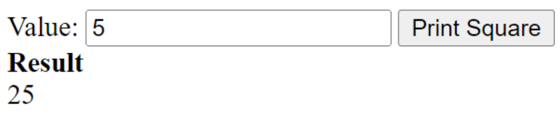
```
let local = new Plane("MD");
let abroad = new Plane("Italy");
```

Answer:



Problem #6 (Forms/JS)

Under the comments "You must implement/complete" provide code that will complete the functionality of a form that computes the square of the value provided in the text field. The function **computeSquare()** is called when a button labeled "Print Square" is clicked on. This function will display the square result inside the <div></div> provided. The text field has a default value of 5. You can add additional functions if you think it is necessary. The following is an example where the user entered 5 and clicked the "Print Square" button.


Value: 5

Result
25

```
 <!--You must implement/complete ->
Value: <input type="text"
<input type="button" value="Print Square"

<br><strong>Result</strong><br>
<div id="display"></div>

<script>
    function computeSquare() {
        // You must implement/complete
```

Answer:

```
Value: <input type="text" id="value" value="5">
<input type="button" value="Print Square" onclick="computeSquare()">

<br><strong>Result</strong><br>
<div id="display"></div>

<script>
  function computeSquare() {
    let value = document.querySelector("#value").value;
    document.querySelector("#display").innerHTML = value * value;
  }

</script>
```