Object Composition

Closures, Revealing Module Pattern, Object Inheritance, Prototypes

SoftUni Team

Technical Trainers

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#JS-CORE

Object Composition

Objects Holding Other Objects

What is Object Composition?

Combining simple objects or data types into more **complex ones**

```
let student = {
  firstName: 'Maria',
  lastName: 'Green',
  age: 22,
  location: { lat: 42.698, lng: 23.322 }
}
console.log(student);
console.log(student.location.lat);
```

Composing Objects

```
let name = "Sofia";
let population = 1325744;
let country = "Bulgaria";
let town = { name, population, country };
console.log(town);
// Object {name: "Sofia", population: 1325744,
country: "Bulgaria"}
```

Combine variables into object

```
town.location = { lat: 42.698, lng: 23.322 };
console.log(town); // Object {…, location: Object}
```

Combining Data with Functions

```
let rect = {
  width: 10,
  height: 4,
  grow: function(w, h) {
    this.width += w; this.height += h;
  },
  print: function() {
    console.log(`[${this.width} x ${this.height}]`);
  }
};
rect.grow(2, 3);
rect.print(); // [12 x 7]
```

Printing Objects: toString() Function

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```
let rect = {
  width: 10,
  height: 4,
  toString: function() {
    return `rect[${this.width} x ${this.height}]`;
  }
};

console.log(rect); // Object {width: 10, height: 4}
// This will invoke toString() to convert the object to String
console.log('' + rect); // rect[12 x 7]
```

Problem: Order Rectangles

Create **objects** to represent the rectangles. Should additionally have two functions:

- **area()** - that returns the area of the rectangle
- **compareTo(**other**)** - compares the current rectangle with another

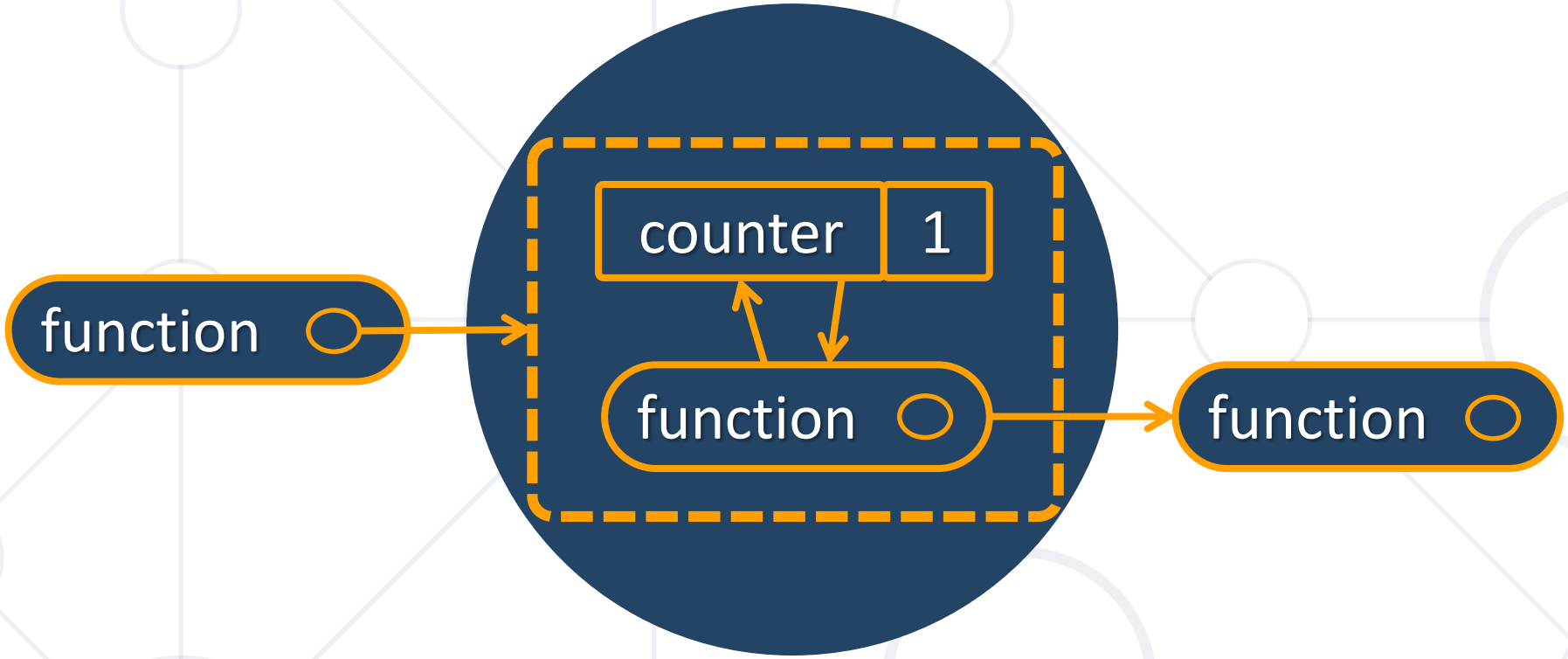
Input	Output
`[[10,5],[5,12]]`	`[{width:5, height:12, area:function(), compareTo:function(other)},` `{width:10, height:5, area:funciton(),compareTo:function(other)}]`

Solution: Order Rectangles

```
let rects = [];
for (let [width, height] of data) {
  let rect = comparator(width, height);
  rects.push(rect);
}
rects.sort((a, b) => a.compareTo(b));
return rects;
// Continue on the next slide
```

Solution: Order Rectangles (2)

```
function comparator(w, h) {
  let rect = {
    width: w,
    height: h,
    area: () => rect.width * rect.height,
    compareTo: function (other) {
      let result = other.area() - rect.area();
      return result || (other.width - rect.width);
    }
  };
  return rect;
}
```



Closures

Enclosing Object State in a Function

What is Closure?

State maintained (closed) inside a function

- Hidden from the outside world
- Example: counter with closures

```
function counterClosure() {
  let counter = 0;
  function getNextCount() {
    console.log(++counter);
  };
  return getNextCount;
}
```

```
let count =
counterClosure();
count(); // 1
count(); // 2
count(); // 3
count(); // 4
count(); // 5
```

Closures - Shorter Syntax with IIFE

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```
let counter = (function() {
  let num = 0;
  return function() {
    console.log(++num);
  };
})();
counter(); // 1
counter(); // 2
counter(); // 3
```

```
let counter = (() => {
  let num = 0;
  return () =>
    console.log(++num);
})();
counter(); // 1
counter(); // 2
counter(); // 3
counter(); // 4
```

Problem: Fibonacci

Write a function that when called

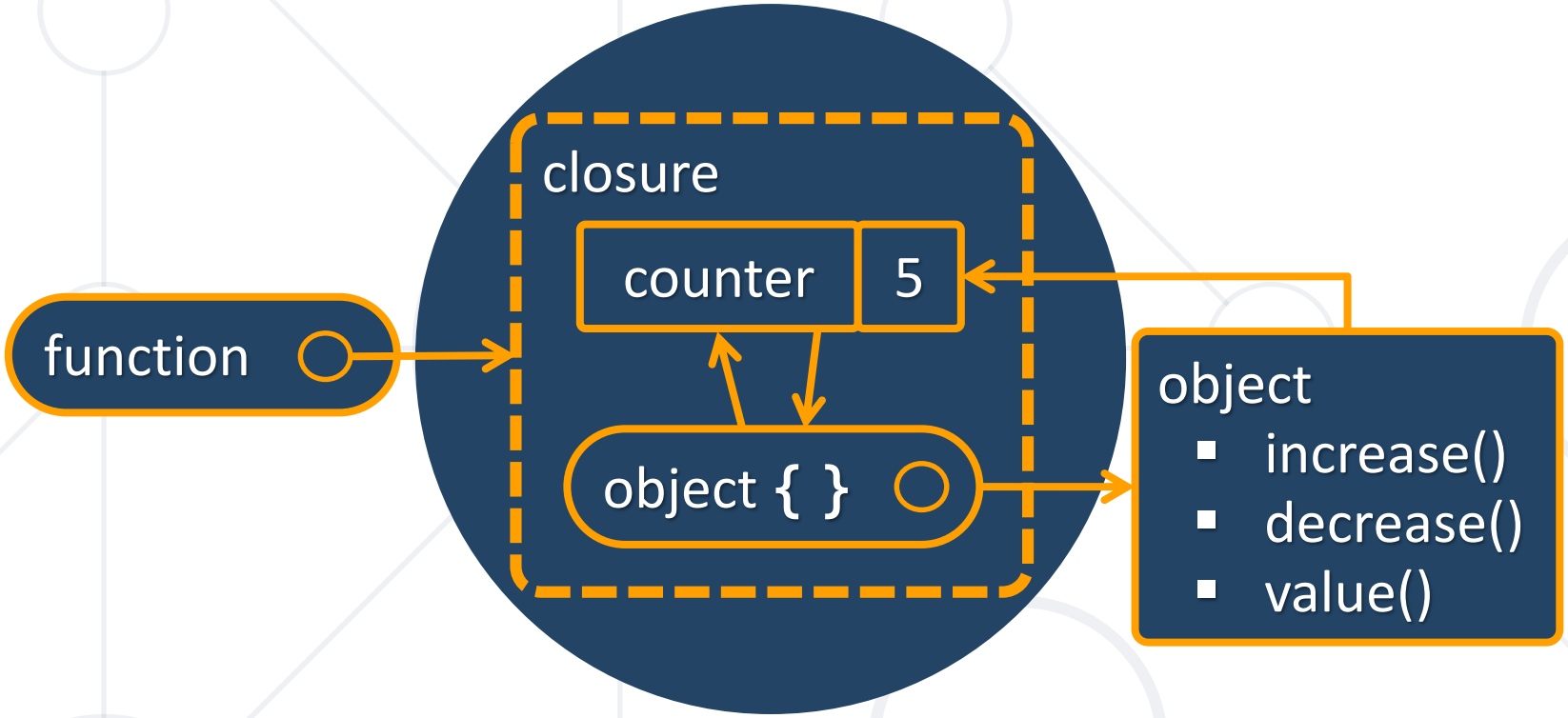
- **returns** the next **Fibonacci number**, starting at 0, 1
- use a **closure** to keep the current number

Sample execution

```
let fib = getFibonator();
console.log(fib()); // 1
console.log(fib()); // 1
console.log(fib()); // 2
console.log(fib()); // 3
console.log(fib()); // 5
console.log(fib()); // 8
console.log(fib()); // 13
```

Solution: Fibonacci

```
function getFibonator() {
  let sum = 0;
  let first = 0;
  let second = 1;
  return function () {
      sum = first + second;
      first = second;
      second = sum
      return first;
  }
}
```



Module and Revealing Module Patterns

"Module" Pattern (with Object Literal)

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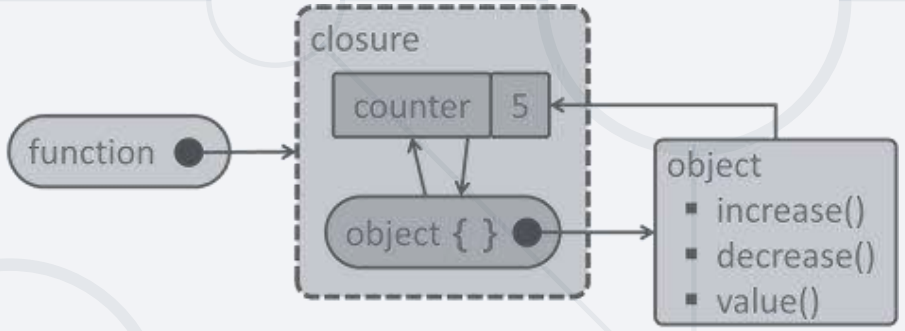
```
let moduleObj = {
  count: 0, // public
  increase: function(num) { return this.count += num },
  decrease: function(num) { return this.count -= num },
  value: function() { return this.count }
};
moduleObj.count = 2; // the counter is accessible
console.log(moduleObj.value()); // 2
console.log(moduleObj.increase(5)); // 7
console.log(moduleObj.decrease(1)); // 6
```

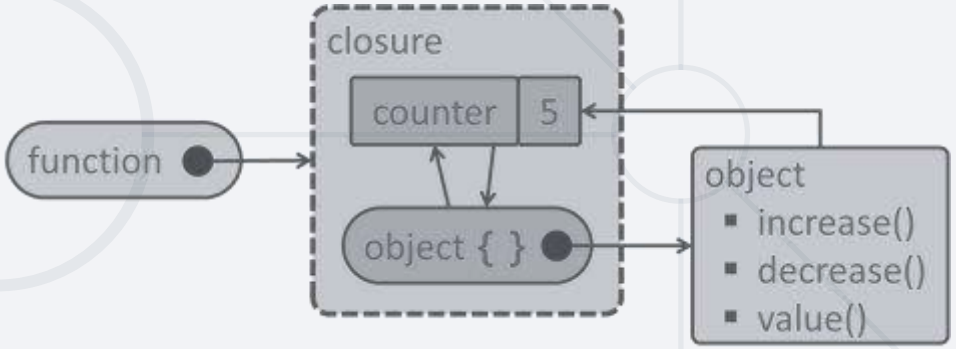
"Module" Pattern (with Closure)

```
let module = (function() {
  let count = 0; // private
  return {
    increase: (num) => count += num,
    decrease: (num) => count -= num,
    value: () => count,
  };
})();
console.log(module.value()); // 0
console.log(module.increase(5)); // 5
console.log(module.decrease(2)); // 3
console.log(module.count); // undefined (not accessible)
```



"Revealing Module" Pattern (with Closure)

```
let revModule = (function() {
  let count = 0; // private
  function change(amount) { return count += amount; }
  function increase(num) { return change(num); }
  function decrease(num) { return change(-num); }
  function value() { return count; }
  return { increase, decrease, value };
})();
console.log(revModule.value()); // 0
console.log(revModule.increase(5)); // 5
console.log(revModule.decrease(2)); // 3
console.log(revModule.count); // undefined (not accessible)
```



Problem: List processor

Using a closure, create an inner object to process list commands

- **add** - adds the following string in an inner collection
- **remove** - removes all occurrences
- **print** - prints all elements of the inner collection joined by **","**

Input	Output
`['add hello', 'add again', 'remove hello', 'add again', 'print']`	`again, again`

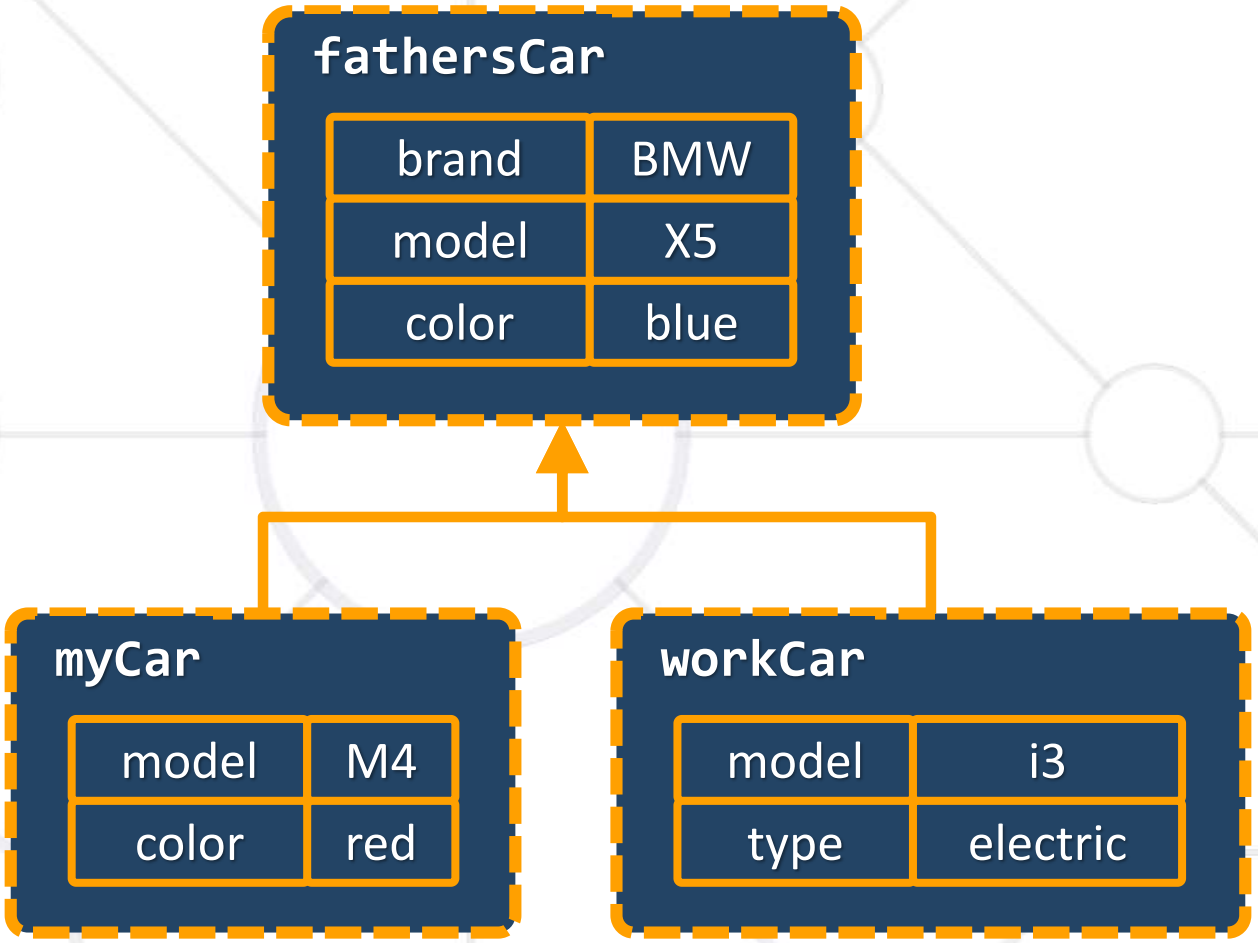
Solution: List processor

```
let arr = []
let command = {
  add: function (arr, str) {
    arr.push(str)
    return arr;
  },
  remove: function (arr, str) {
    arr = arr.filter(e => e !== str);
    return arr
  },
  print: function (str) {
    console.log(arr.join(','));
    return arr;
  }
};        // Continue on the next slide
```

Solution: List processor (2)

```
return function (input) {

  for (let e of input) {
    e = e.split(' ');
    arr = command[e[0]](arr, e[1])
  }
}
```



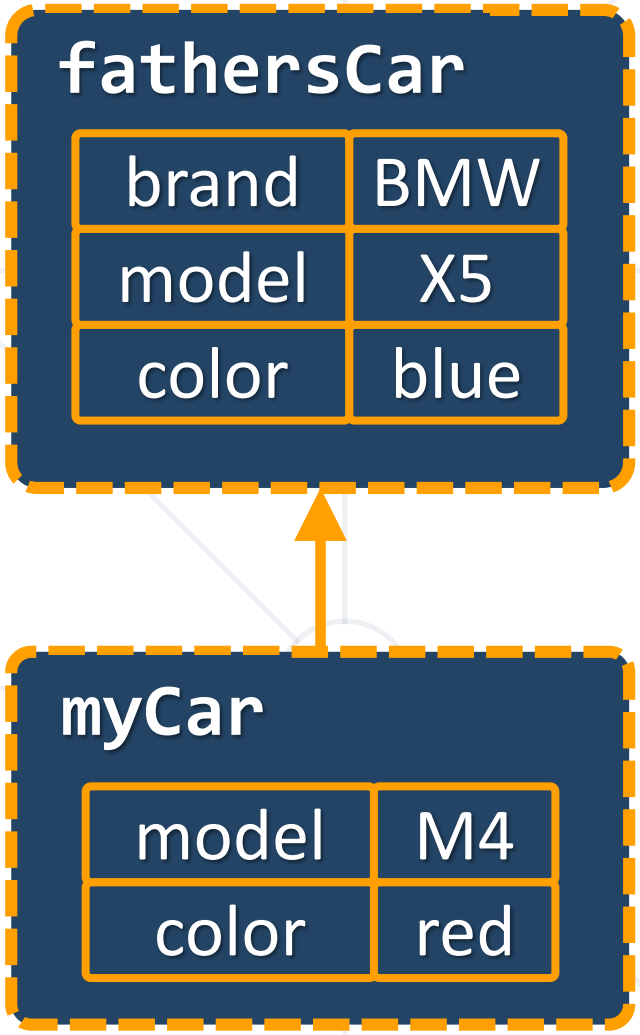
Object Inheritance

Object Inheritance

```
let fatherCar = { brand: 'BMW',
  model: 'X5', color: 'blue',
  toString: function() { return `[brand:
    ${this.brand}, model: ${this.model},
    color: ${this.color}]`; }
};
console.log('' + fatherCar);
```

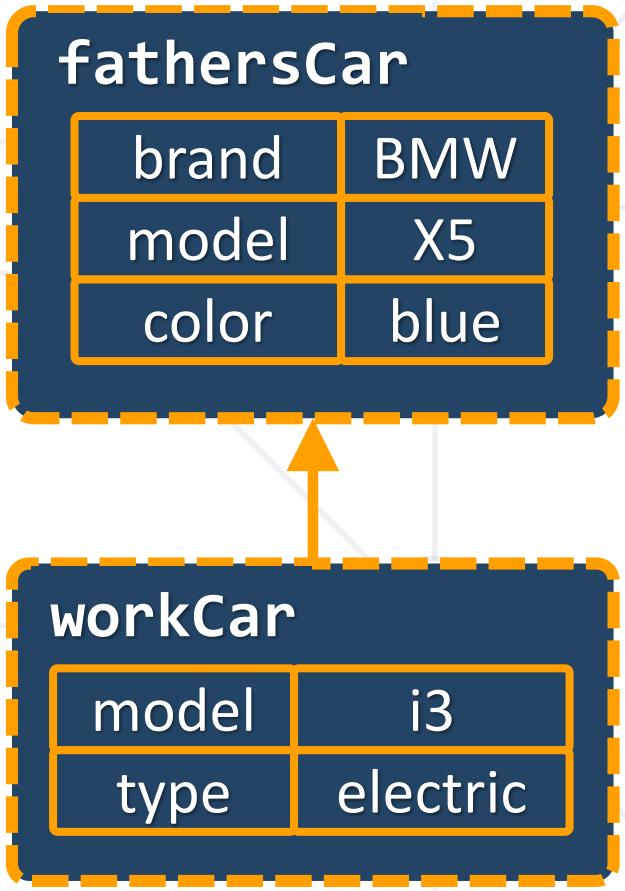
```
let myCar = Object.create(fatherCar);
myCar.model = 'M4';
myCar.color = 'red';
console.log('' + myCar);
```

Object.create()
inherits an object

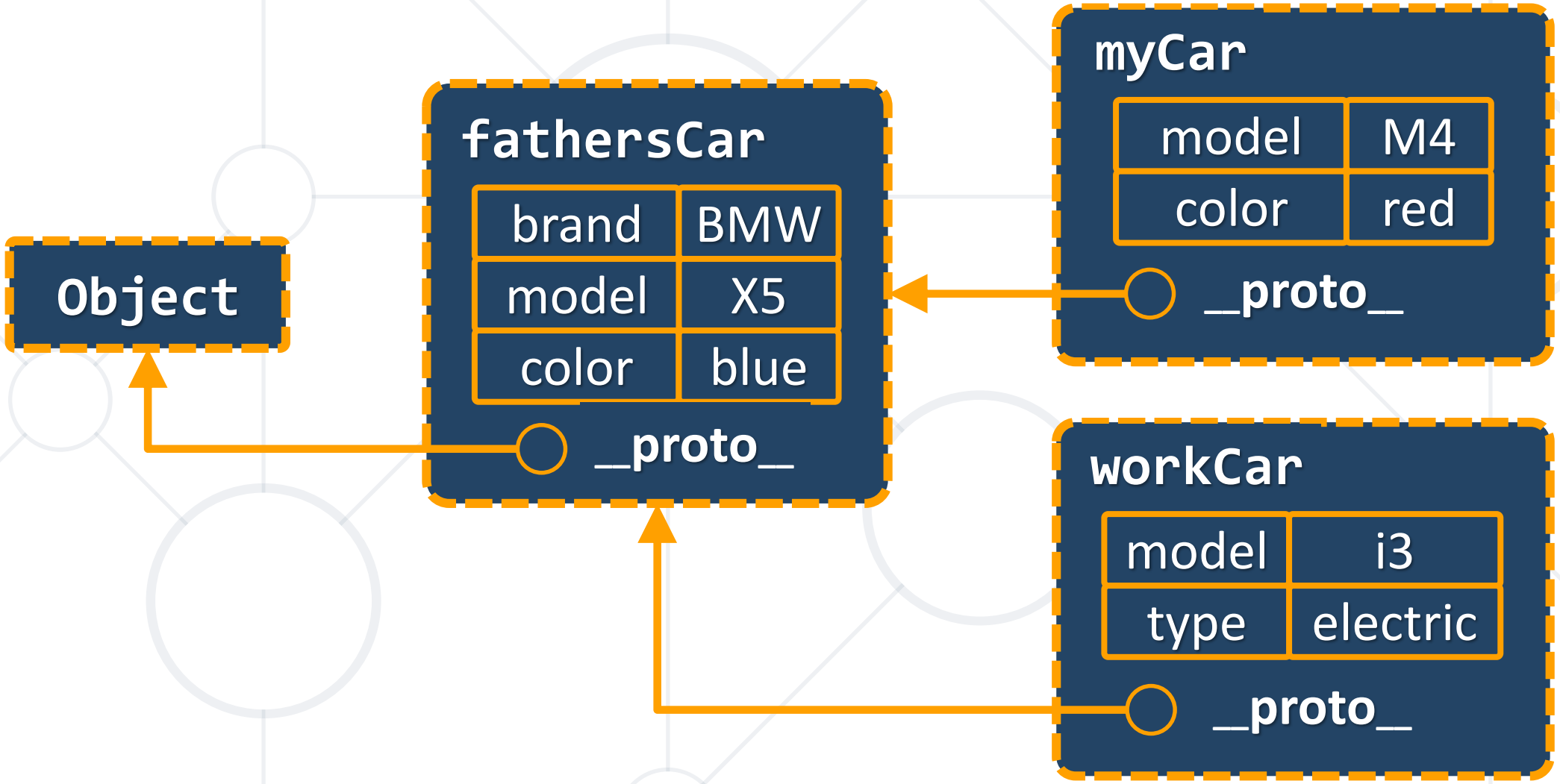


Object Inheritance (2)

```
let workCar =
  Object.create(fatherCar);
workCar.model = 'i3';
workCar.type = 'electric';
workCar.toString = function() {
  return `[brand: ${this.brand}, model:
    ${this.model}, color: ${this.color},
    type: ${this.type}]`;
}
console.log('' + workCar);
```



Prototype Chain



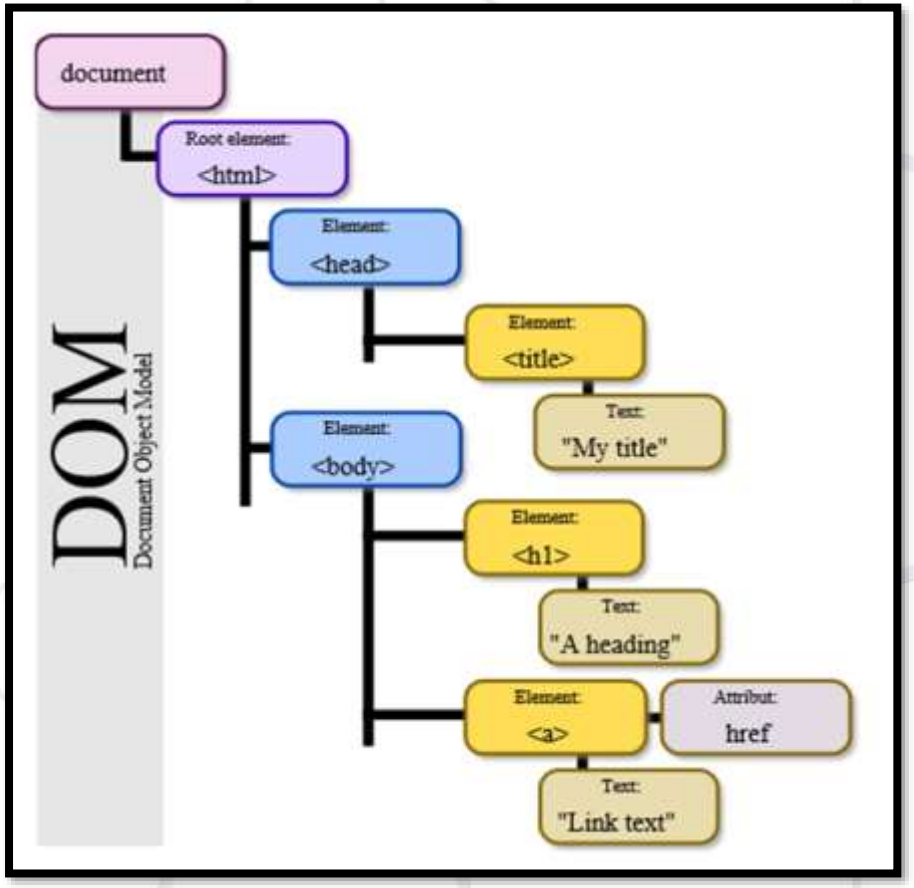
Prototype Chain

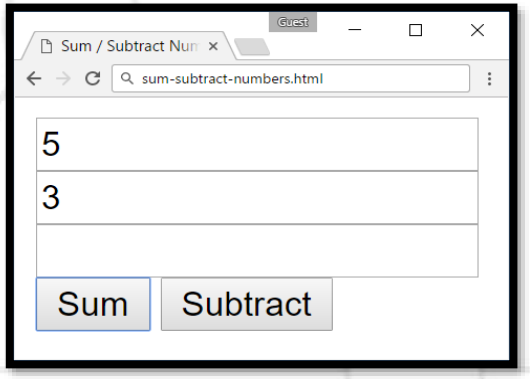
Objects have **prototype** (a parent object)

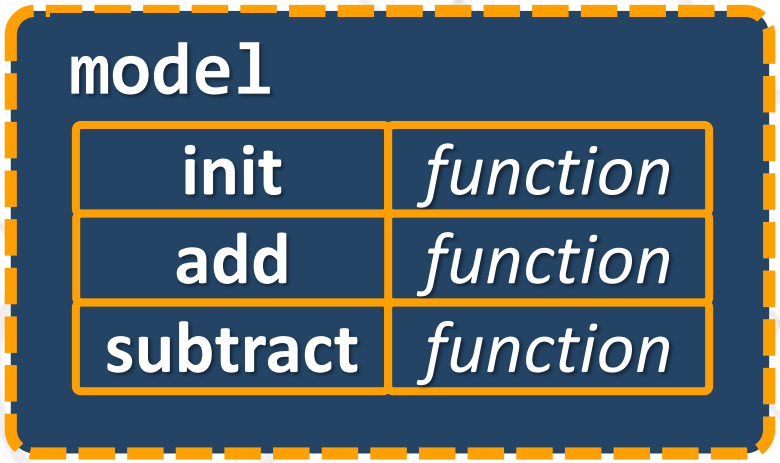
- Prototypes form a **prototype chain**

```
Object.getPrototypeOf(fatherCar);
// Object {}
Object.getPrototypeOf(myCar);
// Object {brand: "BMW", model: "X5", color: "blue"}
```

- If a property **is not found** in the object itself, it is searched in the **parent objects** (in the prototype chain)





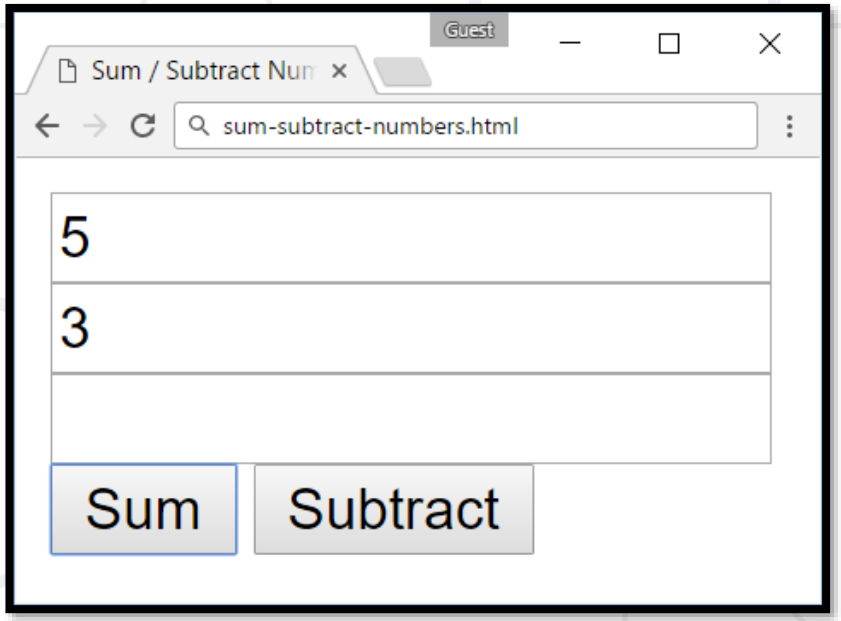


Objects Interacting with DOM

Example: Calculator

You are given the following HTML form

```
<input type="text" id="num1" />
<input type="text" id="num2" />
<input type="text" id="result"
readonly />
<br>
<button id="sumButton">
Sum</button>
<button id="subtractButton">
Subtract</button>
```



Example: Calculator (2)

Write a JS function **getModel**() to return a JS object holding:

- function **init**() - initializes selectors for finding the fields **num1**, **num2** and **result** in the **DOM**
- function **add**() - calculates **result** = **num1** + **num2**
- function **subtract**() - calculates **result** = **num1** - **num2**

```
▼ Object {}
  ▶ add: function ()
  ▶ init: function (num1Sel, num2Sel, resultSel)
  ▶ subtract: function ()
```

Live Exercises

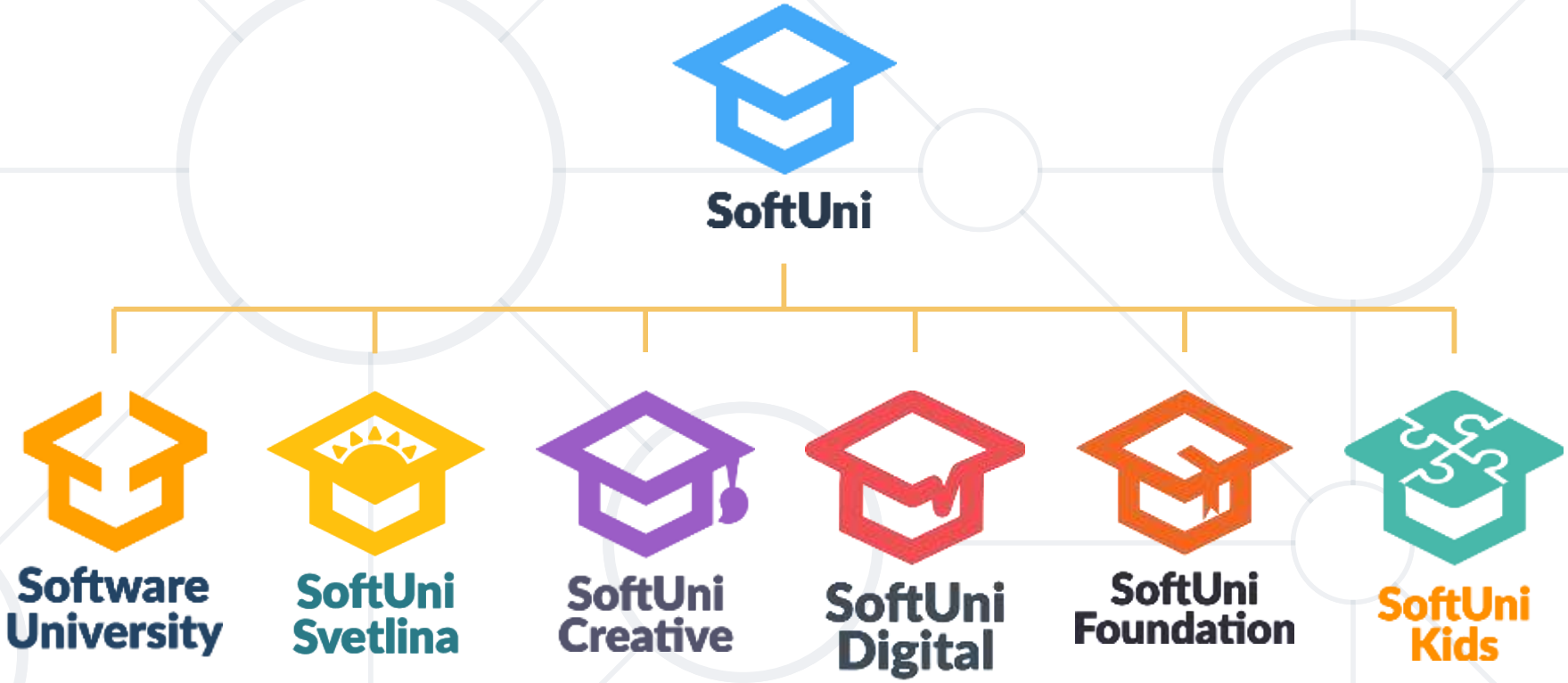
Summary

- Object composition combines **data** and **functions** into JS objects

```
let r = {w:5, h:3, grow:function() { … }}
```

- **The "Module" pattern** hides data into a function and reveals a JS object
- **The "Revealing Module" pattern** hides data and functions are reveals them as JS object
- Objects can **inherit** parent object by **Object.create(parent)**

Questions?



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