Objects and Associative Arrays

Objects, JSON, Associative Arrays, Maps and Sets

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Table of Content

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#JSCORE

Objects in JS

Objects, Properties and JSON

Objects in JS

- Objects in JavaScript hold **key-value pairs**:

```
let obj = { name : "SoftUni", age : 3 };
console.log(obj); // Object {name: "SoftUni", age: 3}
obj['site'] = "https://softuni.bg";
console.log(obj); // Object {name: "SoftUni", age: 3,
site: " https://softuni.bg" }
delete obj.name; // Delete a property
obj.site = undefined; // Delete a property value
console.log(obj); // Object {age: 3, site: undefined}
```

Object Keys and Values

```
let course = { name: 'JS Core', hall: 'Open Source' };
let keys = Object.keys(course);
console.log(keys);  // [ 'name', 'hall' ]
if (course.hasOwnProperty('name'))
console.log(course.name);  // JS Core
```

```
let values = Object.values(course);
console.log(values); // [ 'JS Core', 'Open Source' ]
if (values.includes('JS Core'))
console.log("Found 'JS Core' value");
```

Object Freeze and Seal

```
let cat = { name: 'Tom', age: 5 };
Object.freeze(cat);
cat.age = 10;            // Error in strict mode
cat.gender = 'male';     // Error in strict mode
console.log(cat);        // { name: 'Tom', age: 5 }
```

```
cat = { name: 'Tom', age: 5 };
Object.seal(cat);
cat.age = 10;            // OK
delete cat.age;          // Error in strict mode
console.log(cat);        // { name: 'Tom', age: 10 }
```

Objects and JSON

- JavaScript **objects** can be stored as text in **JSON** format
  - JSON == JavaScript Object Notation == text object format

```
let obj = { name : "SoftUni", age : 3 };
let str = JSON.stringify(obj);
console.log(str); // {"name":"SoftUni","age":3}
```

```
let str = "{\"name\":\"Nakov\",\"age\":24}";
let obj = JSON.parse(str);
console.log(obj); // Object {name: "Nakov", age: 24}
```

Problem: Towns to JSON

- Read an **array of strings**, holding towns with GPS coordinates
  - Parse each string to **JS object** (see the below format)
  - Print the output array of objects as **JSON string**

```
| Town | Latitude | Longitude |
| Sofia | 42.696552 | 23.32601 |
| Beijing | 39.913818 | 116.363625 |
```

⇩

```
[{"Town":"Sofia","Latitude":42.696552,"Longitude":23.32601},
{"Town":"Beijing","Latitude":39.913818,"Longitude":116.363625}]
```

Solution: Towns to JSON

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```
function parseTownsToJSON(towns) {
    let townsArr = [];
    for (let town of towns.slice(1)) {
        let [empty, townName, lat, lng] =
            town.split(/\s*\|\s*/);
        let townObj = { Town: townName, Latitude:
            Number(lat), Longitude: Number(lng) };
        townsArr.push(townObj);
    }
    return JSON.stringify(townsArr);
}
```

```
parseTownsToJSON(['|Town|Lat|Lng|','|Sofia |42|23|'])
```

Check your solution here: https://judge.softuni.bg/Contests/315

Nested Objects in JS

```
let polygon = {
  about: { name: "triangle", color: "red" },
  corners: [{x:2, y:6}, {x:3, y:1}, {x:-2, y:2}]
};

console.log(JSON.stringify(polygon)); // {"about":
{"name":"triangle","color":"red"},"corners":[{"x":2,"y":6},
{"x":3,"y":1},{"x":-2,"y":2}]}

console.log(polygon.about.color); // red

polygon.about.location = {x:4, y:-7};
```

Problem: Score to HTML

- Read a **JSON string**, holding array of objects: **{name, score}**
- Print the objects as **HTML table** like shown below

```
[{"name":"Pesho & Kiro","score":479},{"name":"Gosho,
Maria & Viki","score":205}]
```

```
<table>
  <tr><th>name</th><th>score</th></tr>
  <tr><td>Pesho &amp; Kiro</td><td>479</td></tr>
  <tr><td>Gosho, Maria &amp; Viki</td><td>205</td></tr>
</table>
```

Solution: Score to HTML

```
function scoreToHTMLTable(scoreJSON) {
  let html = "<table>\n";
  html += "  <tr><th>name</th><th>score</th>\n";
  let arr = JSON.parse(scoreJSON);
  for (let obj of arr)
    html += `  <tr><td>${htmlEscape(obj['name'])}` +
      `</td><td>${obj['score']}</td></tr>\n`;
  return html + "</table>";
  function htmlEscape(text) { // TODO … }
}
```

```
scoreToHTMLTable([{"name":"Pesho","score":70}])
```

Check your solution here: https://judge.softuni.bg/Contests/315

Iterating Over Object Values

```
let laptop = { RAM: '8GB', CPU: 'i7 2.20 GHz' };
```

```
for (let key in laptop) {
  console.log(key);               // RAM, CPU
  console.log(laptop[key]);  // 8GB, i7 2.20 GHz
}
```

```
for (let value of laptop) {
  // TypeError: laptop is not iterable
}
```

Problem: From JSON to HTML Table

- Read a **JSON string**, holding array of JS objects (key / value pairs)
  - Print the objects as **HTML table** like shown below

```
[{"Name":"Tomatoes & Chips","Price":2.35},{"Name":"J&B
Chocolate","Price":0.96}]
```

```
<table>
  <tr><th>Name</th><th>Price</th></tr>
  <tr><td>Tomatoes &amp; Chips</td><td>2.35</td></tr>
  <tr><td>J&amp;B Chocolate</td><td>0.96</td></tr>
</table>
```

Solution: From JSON to HTML Table

```
function JSONToHTMLTable(json) {
  let html = "<table>\n";
  let arr = JSON.parse(json);
  html += "  <tr>";
  for (let key of Object.keys(arr[0]))
    html += `<th>${htmlEscape(key)}</th>`;
    html += "</tr>\n";
  for (let obj of arr) {
  // TODO: print obj values in <tr><td>…</td></tr>
  return html + "</table>";
  function htmlEscape(text) { // TODO … }
}
```

```
JSONToHTMLTable(['[{"X":5,"Y":7},{"X":2,"Y":4}]'])
```

Check your solution here: https://judge.softuni.bg/Contests/315

Associative Arrays

Objects as Associative Arrays in JS

Associative Arrays (Maps, Dictionaries)

- **Associative arrays** (**maps** / **dictionaries**) == arrays indexed by keys
  - Not by numbers 0, 1, 2, …
- Hold a set of pairs **{key -> value}**, just like JS object

Traditional array

key	0	1	2	3	4
value	8	-3	12	408	33

Associative array (dictionary)

key	value
John Smith	+1-555-8976
Lisa Smith	+1-555-1234
Sam Doe	+1-555-5030

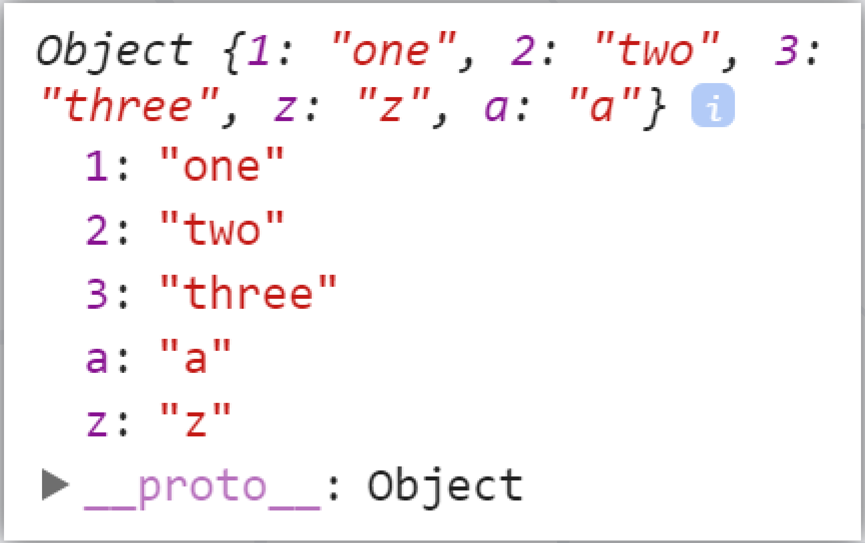
Phonebook - Associative array Example

```
let phonebook = { };
phonebook["John Smith"] = "+1-555-8976";   // Add
phonebook["Lisa Smith"] = "+1-555-1234";
phonebook["Sam Doe"] = "+1-555-5030";
phonebook["Nakov"] = "+359-899-555-592";
phonebook["Nakov"] = "+359-2-981-9819";   // Replace

delete phonebook["John Smith"];             // Delete

console.log(Object.keys(phonebook).length); // 3

for (let key in phonebook) {                // Print
  console.log(`${key} -> ${phonebook[key]}`);
}
```

The Order of Keys in JS Object

- The **order of keys** in JS objects in unspecified!

```
let obj = {
  "1": 'one',
  "3": 'three',
  "2": 'two',
  "z": 'z',
  "a": 'a'
};
console.log(Object.keys(obj)); // ["1", "2", "3", "z", "a"]
console.log(obj); // Object {1: "one", 2: "two", 3: "three",
z: "z", a: "a"}
```



```
Object {1: "one", 2: "two", 3:
"three", z: "z", a: "a"}
  1: "one"
  2: "two"
  3: "three"
  a: "a"
  z: "z"
▶ __proto__: Object
```

Problem: Sum by Town

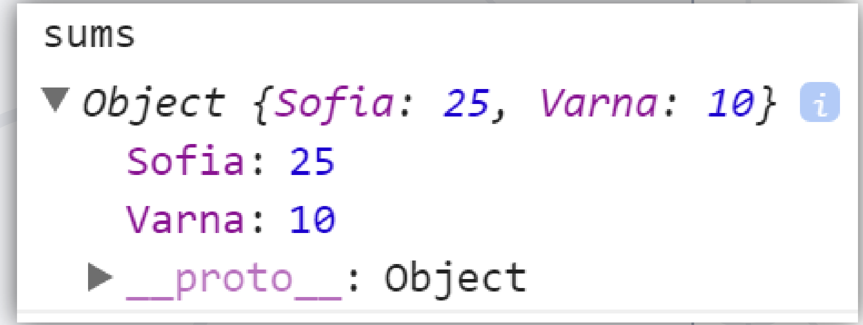
- Read **towns** and **incomes** (like shown below) and print a **JSON object** holding **the total** income for each **town** (see below)
  - Print the towns in their **natural order** as object properties

```
Sofia
20
Varna
3
Sofia
5
Varna
4
```

```
{"Sofia":"25","Varna":"7"}
```

Solution: Sum of Towns

```
function sumOfTowns(arr) {
  let sums = {};
  for (let i=0; i<arr.length; i+=2) {
    let [town, income] = [arr[i], Number(arr[i+1])];
    if (sums[town] == undefined){
      sums[town] = income;
    } else{
      sums[town] += income;
    }
  }
  return JSON.stringify(sums);
}
```



```
sums
▼ Object {Sofia: 25, Varna: 10}
    Sofia: 25
    Varna: 10
  ▶ __proto__: Object
```

```
sumOfTowns(['Sofia','20', 'Varna','10', 'Sofia','5'])
```

Check your solution here: https://judge.softuni.bg/Contests/315

Problem: Count Word in a Text

- Write a JS function to **count** the **words** in a text (case sensitive)
  - Words are sequence of **letters**, **digits** and **_**
  - The **input** text comes as **array of strings**
  - Return the **output** as **JSON string**

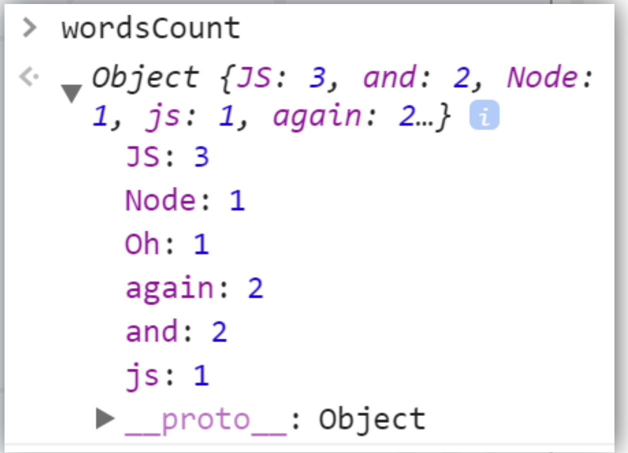
```
JS devs use Node.js for server-side JS.
-- JS for devs
```

```
{"JS":3,"devs":2,"use":1,"Node":1,"js":1,"for":2,
"server":1,"side":1}
```

Solution: Count Words in a Text

```
function countWords(inputLines) {
  let text = inputLines.join('\n');
  let words = text.split(/[^A-Za-z0-9_]+/)
    .filter(w => w != '');
  let wordsCount = {};
  for (let w of words){
    wordsCount[w] ? wordsCount[w]++ :
    wordsCount[w] = 1;
  }
  return JSON.stringify(wordsCount);
}
```

```
countWords(['JS and Node.js', 'JS again and again', 'Oh, JS?'])
```



```
> wordsCount
<· ▼Object {JS: 3, and: 2, Node: 1, js: 1, again: 2…}
      JS: 3
      Node: 1
      Oh: 1
      again: 2
      and: 2
      js: 1
    ▶ __proto__: Object
```

Check your solution here: https://judge.softuni.bg/Contests/315

Live Exercises

Practice: JS Objects & JSON

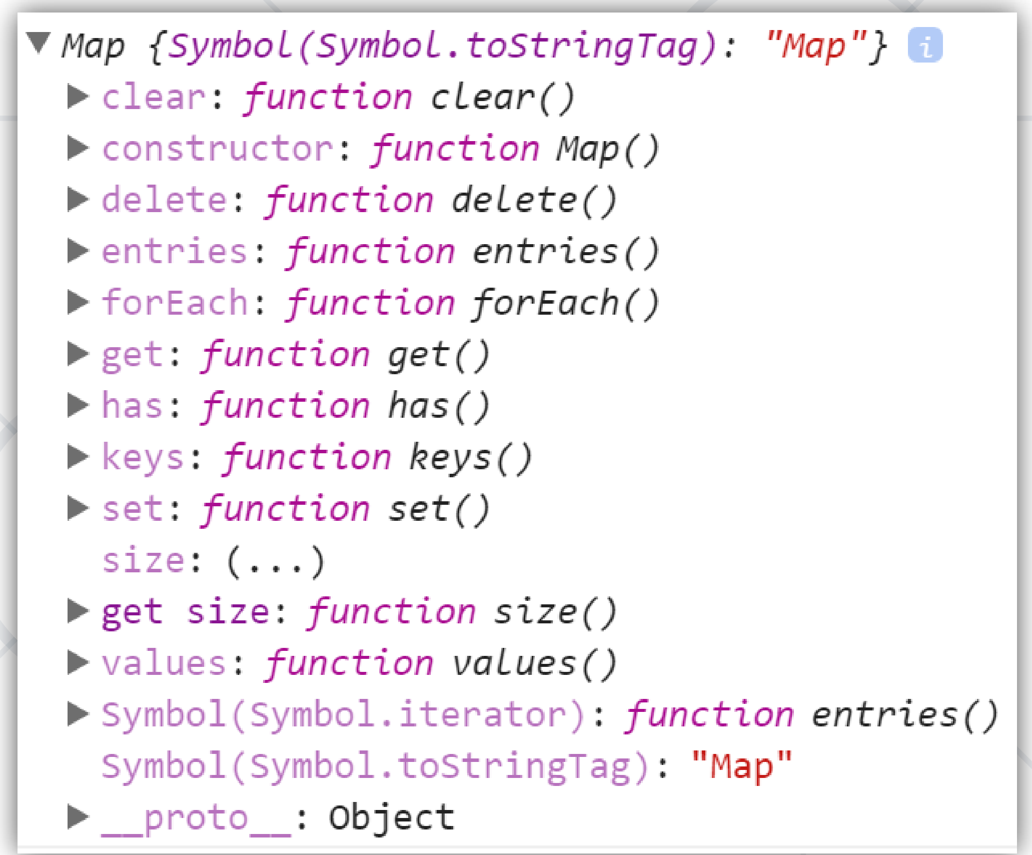
The Map Class in JS

Key / Value Map

The Map Class in JS

- The **Map** class holds **{ key -> value }** map
- Better functionality than plain JS object

```
let score = new Map();
score.set("Peter", 130);
score.set("Maria", 85);
for (let [k, v] of score){
  console.log(k + ' -> ' + v);
}
```



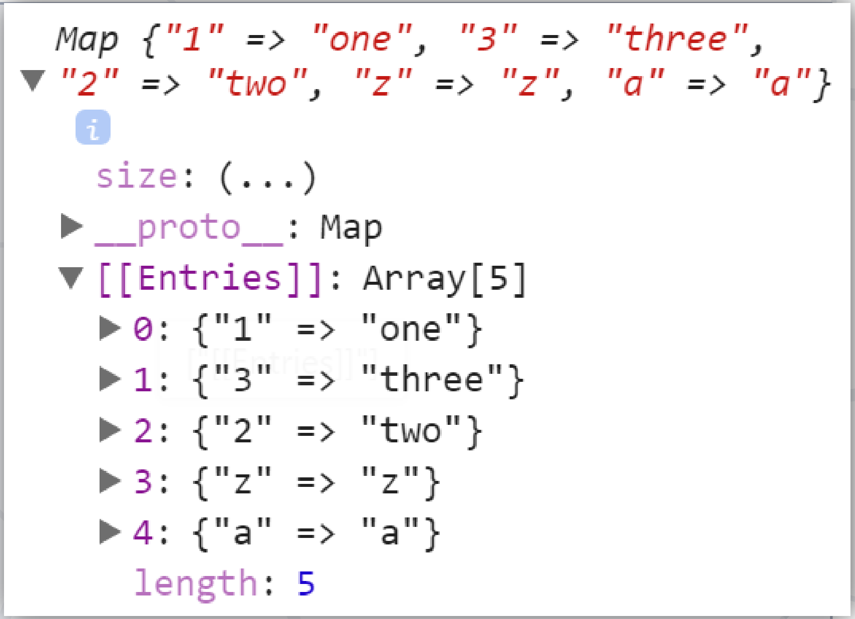
```
▼ Map {Symbol(Symbol.toStringTag): "Map"}
  ▶ clear: function clear()
  ▶ constructor: function Map()
  ▶ delete: function delete()
  ▶ entries: function entries()
  ▶ forEach: function forEach()
  ▶ get: function get()
  ▶ has: function has()
  ▶ keys: function keys()
  ▶ set: function set()
    size: (...)
  ▶ get size: function size()
  ▶ values: function values()
  ▶ Symbol(Symbol.iterator): function entries()
    Symbol(Symbol.toStringTag): "Map"
  ▶ __proto__: Object
```

Phonebook - Map Example

```
let phonebook = new Map();
phonebook.set("John Smith", "+1-555-8976"); // Add
phonebook.set("Lisa Smith","+1-555-1234");
phonebook.set("Sam Doe", "+1-555-5030");
phonebook.set("Nakov", "+359-899-555-592");
phonebook.set("Nakov", "+359-2-981-9819"); // Replace

phonebook.delete("John Smith"); // Delete
console.log(phonebook.size); // 3

for (let [key, value] of phonebook){ // Print
  console.log(`${key} -> ${value}`);
}
```

Maps Preserve the Insertion Order of Keys

```
let map = new Map([
["1", 'one'],
["3", 'three'],
["2", 'two'],
["z", 'z'],
["a", 'a']
]);

console.log(map);
// Map {"1" => "one", "3" => "three", "2" => "two",
"z" => "z", "a" => "a"}
console.log(Array.from(map.keys()));
// ["1", "3", "2", "z", "a"]
```



```
  Map {"1" => "one", "3" => "three",
▼ "2" => "two", "z" => "z", "a" => "a"}
    size: (...)
  ▶ __proto__: Map
  ▼ [[Entries]]: Array[5]
    ▶ 0: {"1" => "one"}
    ▶ 1: {"3" => "three"}
    ▶ 2: {"2" => "two"}
    ▶ 3: {"z" => "z"}
    ▶ 4: {"a" => "a"}
      length: 5
```

Problem: Count Words in a Text (with Map)

- Write a JS function to **count** the **words** in a text (case sensitive)
  - Words are sequence of **letters**, **digits** and **_**
  - The **input** comes as **array of strings**
  - Order alphabetically the **output** words

```
JS devs use Node.js for
server-side JS.
JS devs use JS.
-- JS for devs --
```

```
'devs' -> 3 times
'for' -> 2 times
'js' -> 6 times
'node' -> 1 times
'server' -> 1 times
'side' -> 1 times
'use' -> 2 times
```

Solution: Count Words in a Text (with Map)

```
function countWords(inputLines) {
  let words = inputLines.join('\n').toLowerCase()
    .split(/[^A-Za-z0-9_]+/).filter(w => w != '');
  let wordsCount = new Map();
  for (let w of words)
    wordsCount.has(w) ? wordsCount.set(w,
      wordsCount.get(w)+1) : wordsCount.set(w, 1);
  let allWords = Array.from(wordsCount.keys()).sort();
  allWords.forEach(w =>
    console.log(`'${w}' -> ${wordsCount.get(w)} times`));
}
```

```
countWords(['JS and Node.js', 'JS again and again', 'Oh, JS?'])
```

Check your solution here: https://judge.softuni.bg/Contests/315

Problem: Population in Towns

- Read **towns** and **populations** (like shown below) and print a **the towns** ant their **total population** for each town (see below)
  - Print the towns in the order of their first appearance

```
Varna <-> 40000
Sofia <-> 1200000
Plovdiv <-> 20000
Sofia <-> 100000
Varna <-> 420000
Plovdiv <-> 400000
Plovdiv <-> 50000
```

→

```
Varna : 460000
Sofia : 1300000
Plovdiv : 470000
```

Solution: Population in Towns

```
function populationInTowns(dataRows) {
  let total = new Map();
  for (let dataRow of dataRows) {
    let [town, population] = dataRow.split(/\s*<->\s*/)
    population = Number(population);
    if (total.has(town))
      total.set(town, total.get(town) + population);
    else total.set(town, population);
    }
  for (let [town, sum] of total)
    console.log(town + " : " + sum);
}
```

populationInTowns(['B<->20', 'A<->30', 'B<->5'])

Check your solution here: https://judge.softuni.bg/Contests/315

Problem: City Markets

- Read **sales data** in the following format

```
{town} -> {product} -> {amountOfSales}:{priceForOneUnit}
```

- Print for each **town** the **sum** of **incomes** for each **product**
  - **Order** the towns and products as they **first appear**

```
Sofia -> Laptops HP -> 200 : 2000
Sofia -> Raspberry -> 200000 : 1500
Montana -> Oranges -> 200000 : 1
Montana -> Cherries -> 1000 : 0.3
Sofia -> Audi Q7 -> 200 : 100000
```

```
Town - Sofia
$$$Laptops HP : 400000
$$$Raspberry : 300000000
$$$Audi Q7 : 20000000
Town - Montana
$$$Oranges : 200000
$$$Cherries : 4000
```

Solution: City Markets (Nested Maps)

```
function cityMarkets(sales) {
  let townsWithProducts = new Map();
  for (let sale of sales) {
    let [town, product, quantityPrice] = sale.split(/\s*->\s*/);
    let [quantity, price] = quantityPrice.split(/\s*:\s*/);
    if (!townsWithProducts.has(town))
      townsWithProducts.set(town, new Map());
    let income = quantity * price;
    let oldIncome = townsWithProducts.get(town).get(product);
    if (oldIncome) income += oldIncome;
    townsWithProducts.get(town).set(product, income);
  }
  // TODO: print the incomes by towns and products
}
```

Check your solution here: https://judge.softuni.bg/Contests/315

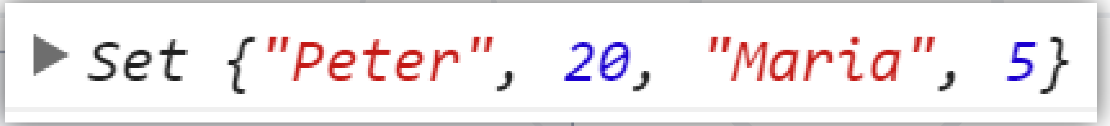
The Set Class in JS

Set of Unique Values of Any Type

The Set Class in JS

- **Sets** in JS are collections of **unique objects**
  - The **insertion order** is **preserved**, with **no duplicates**

```
let names = new Set();
names.add("Peter"); names.add(20);
names.add("Maria"); names.add(5);

console.log(names.has('Peter')); // true

names.add("Maria"); // Duplicates are skipped

names.delete(20); // Delete element if exists

for (let name of names) console.log(name);
```



```
▶ Set {"Peter", 20, "Maria", 5}
```

Problem: Extract Unique Words

- Write a JS function to extract all **unique words** from a text (case insensitive)
  - Words are sequences of **letters**, **digits** and **_**
  - The **input** comes as **array of strings**
  - The **output** should hold the words in their **order of appearance**

```
JS devs use Node.js for
server-side JS.
JS devs use JS.
-- JS for devs --
```

```
js, devs, use, node,
for, server, side
```

Solution: Extract Unique Words

```
function extractWords(inputSentences) {
  let wordPattern = /\b[a-zA-Z0-9_]+\b/g;
  let words = new Set();
  for (let sentence of inputSentences) {
   let matches = sentence.match(wordPattern);
   matches.forEach(x=>words.add(x.toLowerCase()));
  }
  console.log([...words.values()].join(", "));
}
```

```
extractWords(['JS and Node.js', 'JS again and again', 'Oh, JS?'])
```

Check your solution here: https://judge.softuni.bg/Contests/315

Live Exercises

Practice: Using Maps and Sets

Summary

- **Objects** in JS hold key-value pairs

```
let obj = { name : "SoftUni", age : 3 };
obj.age++;
obj[town] = 'Sofia';
delete obj.name;
```

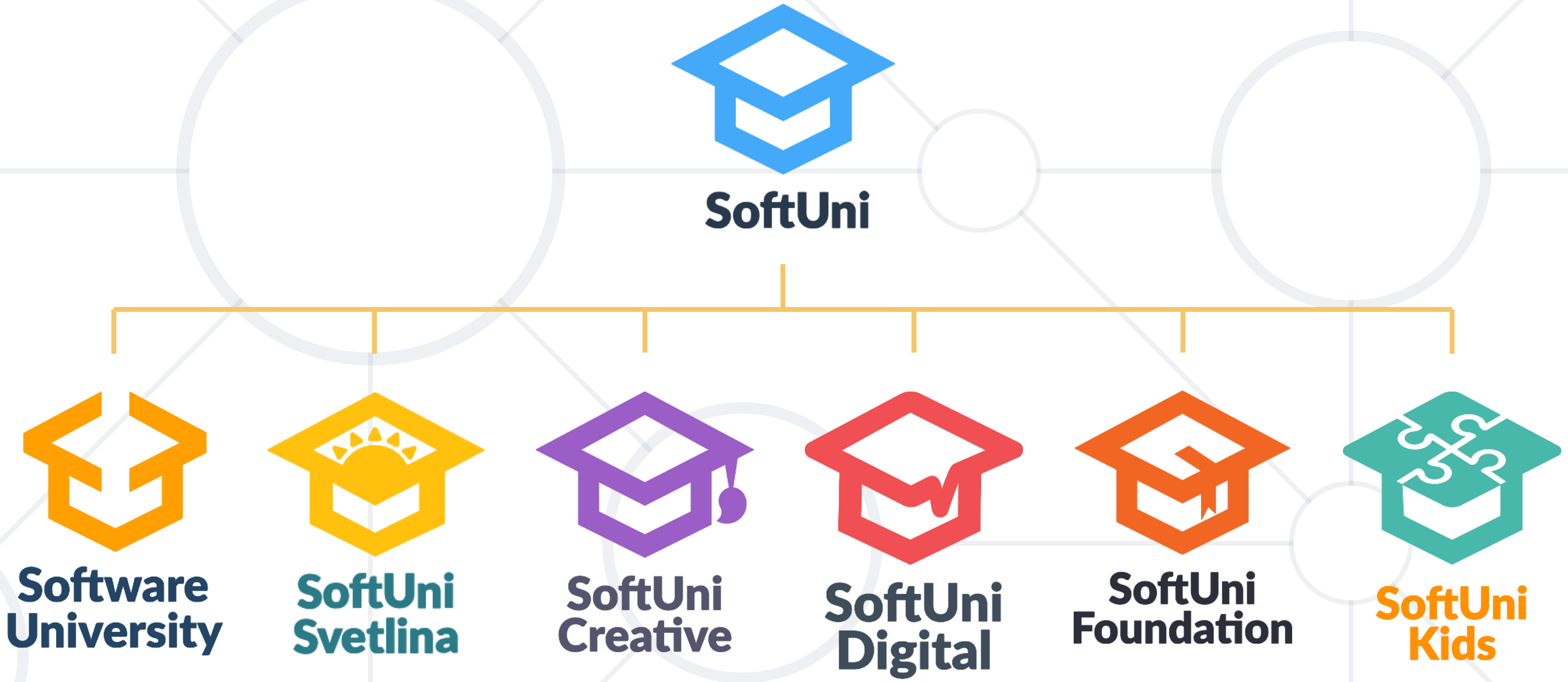
- **Maps** map key to values, preserve key order

```
let map = new Map();
map.set('score', 20);
```

- **Sets** hold unique collection of values

```
let map = new Set(); set.add(5);
```

Questions?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