JavaScript Syntax and Operators

JS Syntax and JS Operators

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#js-core

JavaScript Syntax

Values, Literals, Variables, Operators, Expressions

JavaScript Syntax

- JavaScript syntax refers to a set of **rules** that determine:
  - How the language will be **written** (by the programmer)
  - How the language will be **interpreted** (by the browser).

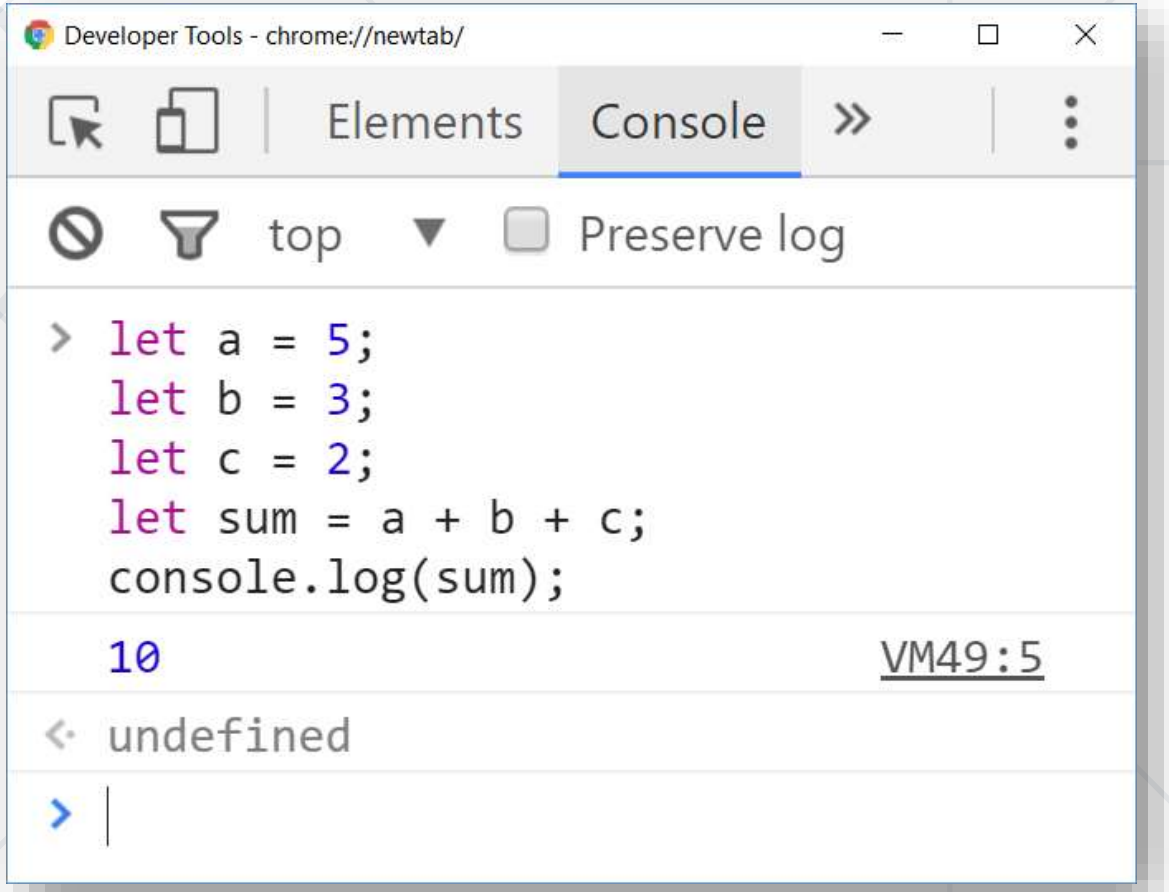
```
let x, y;                    // Declare variables
x=5; y=6;                    // Assign values
let z = x + y;               // Calculate values
console.log(z);              // Print values
```

JavaScript Code: Example

```
let a = 5;
let b = 3;
let c = 2;

let sum = a + b + c;

console.log(sum); // 10
```



JavaScript Fixed Values

- Fixed values – literals
  - **Array Literals**: list of zero or more **array element**, enclosed in square brackets ([ ])

Square brackets

Array element

```
let cars = ["Ford", "BMW", "Peugeot"]
let arrayLength = cars.length;        // 3
let secondCar = cars[1];              // "BMW"
```

JavaScript Fixed Values (2)

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- **Boolean Literals**: two literal values – **true** and **false**

```
console.log("0" == true);                          // false
console.log("0" == false);                         // true
if ("0") { console.log(true) };                    // true
console.log([] == true);                           // false
console.log([] == false);                          // true
if ([]) { console.log(true) };                     // true
console.log(null == false || null == true);        // false
if (!null) { console.log(true) };                  // true
```

JavaScript Fixed Values (2)

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- Integers:

```
0, 16, -528                    // Decimal, base10
015, 0001, -0o77               // Octal, base8
0x1123, 0x00111, -0xF1A7       // Hexadecimal, "hex" or base16
0b11, 0b0011, -0b11            // Binary, base2
```

- Floating-points Literal can have the following parts:
  - Preceded by "+" or "-"
  - A decimal point (".")
  - A fraction (another decimal number)
  - An exponent

```
3.141854
-0.54875
-3.1E+12
.1e-23
```

JavaScript Fixed Values (3)

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- Object Literals:
  - List of zero or more **pairs** of property names
  - Associated values of an object, enclosed in curly braces **{ }**

```
let car = {type: "Infinity", model: "QX80", color: "blue"};
let carType = car.type;
let carType = car["type"];  // Access property
car.year = 2018;
car["year"] = 2018; // Add new property
car.color = "black";
car["color"] = "black"; // Correct existing property
```

JavaScript Fixed Values (4)

- RegExp Literals: **pattern** enclosed between slashes (/ /)

```
let pattern = /[A-Za-z]+/;
```

- String Literals: **immutable** sequences of **Unicode** characters

```
"hello", "apple", '123', 'I like my car'
let str = "Infinity QX80";
console.log(str.length); // 13
console.log(str[0]);  // I
str[0] = 's'; // Beware: no error, but str stays unchanged!
console.log(str); // "Infinity QX80"
console.log(str[20]); // undefined
```

JavaScript special characters: **\b**, **\n**, **\t**, **\v**, **\'**, **\"**, ****

Problem: String Length

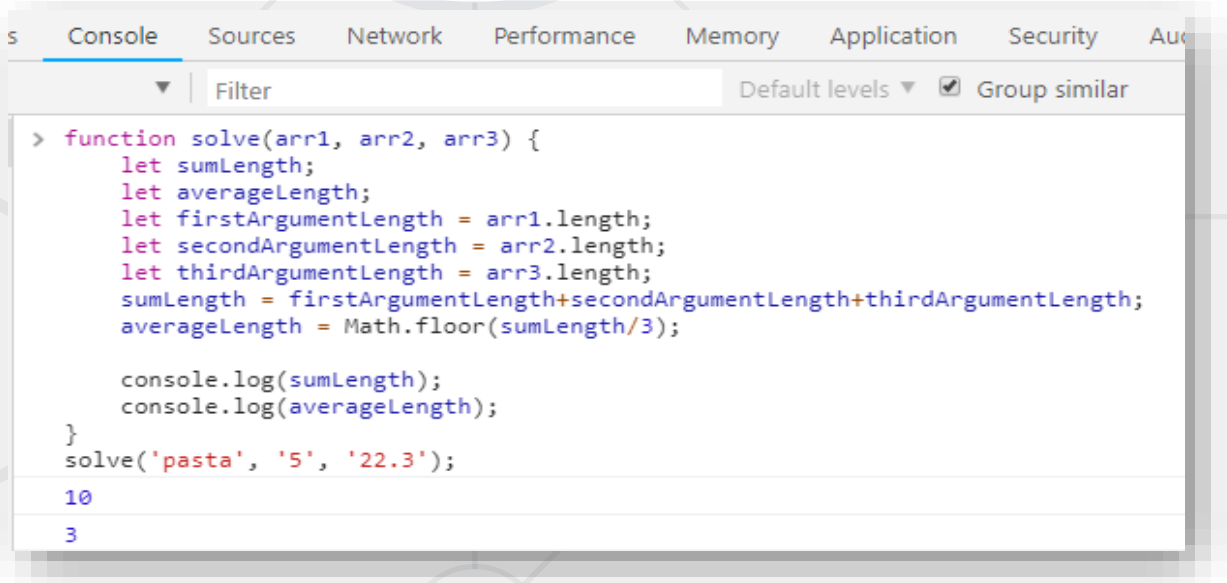
- You are given three strings argument
  - Print the sum of strings length and average length round down

```
function solve(arr1, arr2, arr3) {
   let sumLength;
   let averageLength;
   let firstArgLength = arr1.length;
   let secondArgLength = arr2.length;
   let thirdArgLength = arr3.length;
   sumLength = firstArgLength + secondArgLength + thirdArgLength;
   averageLength = Math.floor(sumLength/3);
   ...
}
```

Problem: String length (2)

```
function solve(arr1, arr2, arr3) {
  ...
  console.log(sumLength);
  console.log(averageLength);
}
```

```
solve('pasta', '5', '22.3')
```



Check your solution here: https://judge.softuni.bg/Contests/Practice/Index/1421#0

JavaScript Variable Values

- **Variable values** – variables are used to **store** data values
- JS uses **let**, **const** and **var** keywords to declare variables
  - **let** – for **reassign** a variable:

```
let name = "George";
name = "Maria";
```

  - **const** - once assigned, constants **cannot** be modified

```
const name = "George";
name = "Maria";
console.log(name) // TypeError: Assignment to constant variable.
```

  - **var** - a keyword which defines a variable globally
    - Regardless of block scope
    - **Do not use var in your code**

JavaScript Operators

- **Arithmetic operators**:
  - Take numerical values (either literals or variables) as their operands
  - Returns a single numerical value
    - Addition (+)
    - Subtraction (-)
    - Multiplication (*)
    - Division (/)
    - Remainder (%)
    - Exponentiation (**)

```
let a = 15;
let b = 5;
let c;
c = a + b; // 20
c = a - b; // 10
c = a * b; // 75
c = a / b; // 3
c = a % b; // 0
c = a ** b; // 759375
```

Arithmetic Operators

```
console.log(3 + 4 - 2);                    // 5 (add / subtract numbers)
console.log(5 / 0);                        // Infinity (divide by zero)
console.log(Infinity / Infinity);          // NaN (wrong division)
console.log(Math.round(7 / 3));            // 2 (integral division)
console.log(Math.ceil(7 / 3));             // 3 (integral division)
console.log(Math.floor(7 / 3));            // 2 (integral division)
console.log(7 % 3);                        // 1 (remainder of division)
console.log(5.3 % 3);                      // 2.3 (remainder of division)
let a = 5; console.log(++a);               // 6 (prefixed ++)
console.log(a++);                          // 6 (postfix ++)
```

JavaScript Operators

- **Assignment operators**: they **assign** a value to its left operand based in the value of its right operand.

```
let a = 15;
let b = 5;
a = b;                    // Assign the value of b to a
console.log(a);           // 5
console.log(b);           // 5
```

```
let a = 15;
let b = 5;
b = a;                    // Assign the value of a to b
console.log(a);           // 15
console.log(b);           // 15
```

Compound assignment operators

Name	Shorthand operator	Meaning
Assignment	x = y	x = y
Addition assignment	x += y	x = x + y
Subtraction assignment	x -= y	x = x - y
Multiplication assignment	x *= y	x = x * y
Division assignment	x /= y	x = x / y
Remainder assignment	x %= y	x = x % y
Exponentiation assignment	x **= y	x = x ** y

JavaScript Syntactic Categories

- In JavaScript there are two major syntactic categories:
- Statements are "**commands**" to be executed
  - if

```
let number = 5;

if (number % 2 === 0) {
  console.log("Even number");
}
```

  - else if

```
let number = 5;

if (number % 2 === 0) {
  console.log("Even number");
} else {
  console.log("Odd number");
}
```

Statements

- for

```
for (let i = 0; i <= 5; i++){
  console.log(i);          // 0 1 2 3 4 5
};
```

- switch

```
let day = 3;
switch (day) {
  case 1: console.log('Monday'); break;
  case 2: console.log('Tuesday'); break;
  case 3: console.log('Wednesday'); break;
   …
  case 7: console.log('Sunday'); break;
  default: console.log('Error!'); break;
};
```

Problem: Math Operators

- Make the required arithmetic operation between two numbers and an arithmetic operator you take from the input

```
function solve(num1, num2, operator) {
  let result;
  switch (operator) {
    case '+': result = num1 + num2; break;
    case '-': result = num1 - num2; break;
    case '*': result = num1 * num2; break;
    case '/': result = num1 / num2; break;
    case '%': result = num1 % num2; break;
    case '**': result = num1 ** num2; break;
   }
  console.log(result);
}
```

```
solve(5, 6, '+');
```

Check your solution here: https://judge.softuni.bg/Contests/Practice/Index/1421#1

Problem: Sum of Numbers N...M

- Calculate the sum of all numbers from **n** to **m**

```
function solve(n, m) {
  let result = 0;
  let num1 = Number(n);
  let num2 = Number(m);
  for (let i = num1; i <= num2; i++) {
    result+=i;
   }
  return result;
}
```

```
solve(1, 5);
```

```
> function solve(n, m) {
      let num1 = Number(n);
      let num2 = Number(m);
      let result = 0;
      for (let i = num1; i <= num2; i++) {
          result+=i;
      }
      return result;
  }
  console.log(solve('1', '5'));
  15
```

Check your solution here: https://judge.softuni.bg/Contests/Practice/Index/1421#2

Statements (1)

- **while**

```
let count = 1;
while (count < 1024) {
  console.log(count *= 2); // 2 4 8 16 32 64 128 256 512 1024
};
```

- **do-while**

```
let s = "ho";
do {
  console.log(s);    // ho hoho hohohoho hohohohohohohoho
  s = s + s;
} while (s.length < 20);
```

Statements (2)

- for … in loop

```
let nums = [5, 10, 15, 20, 'maria', true];
for (let index in nums) {
  console.log(index);
}
// 0 1 2 3 4 5 → loops through the indices (keys), not values
```

- for … of loop

```
let nums = [5, 10, 15, 20, 'maria', true];
for (let value of nums) {
  console.log(value);
}
// 5 10 15 20 maria true → loops through the values
```

Statements (3)

- **debugger**

```
let x = 15 * 5;          // With the debugger turned on,
debugger;                this code should stop executing
console.log(x);          before it executes the third line
```

- **variable declaration**

```
let x = 5;        // x stores the value 5
let y = 14.5;     // y stored the value 14.5
```

Expressions

- Expression is any valid unit of code that resolves to a value:
  - with **side** effects:

```
let assignedVariable = 2;          // This is a statement
assignedVariable = 5;              // expression
console.log(assignedVariable)      // 5
```

  - with **resolve** effects:

```
let assignedVariable = 2;          // This is a statement
assignedVariable + 4;              // expression
assignedVariable * 10;             // expression
assignedVariable - 10;             // expression
console.log(assignedVariable);     // 2
```

JavaScript Operators

Comparison, Logical Operators

Comparison Operators

- **Comparison operators** - compare values
  - The `==` means "equal after type conversion"
  - The `===` means "equal and of the same type"
  - The `!=` means "not equal after type conversion"
  - The `!==` means "not equal and of the same type"
  - The `>` means "greater than"
  - The `<` means "less than"
  - The `>=` means "greater than or equal to"
  - The `<=` means "less than or equal to"

Comparison Operators (2)

- The ? is ternary operator

```
let a = 5, b = 4;
console.log(a == b);          // false
console.log(0 === "");        // false
console.log(a != b);          // true
console.log(3 !== "3");       // true
console.log(a < "5.5");       // true
console.log(a >= b);          // true
console.log(0 == []);         // true
console.log(a ? b : 10);      // 4
```

Logical Operators

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- **Logical operators** are used to determine the **logic** between **variables** or **values**
  - && (**logical and**) - returns the leftmost "**false**" value:

```
let val = true && 'yes' && 5 && null && false;
console.log(val); // null
let val = true && 'no' && 5 && 25 && 'yes';
console.log(val); // 'yes'
```

If all values are **true**, return the **last** value

  - || (**logical or**) - operators returns the leftmost "**true**" value:

```
let val = false || 0 || '' || 5 || 'hi' || true;
console.log(val); // 5
let val = false || '' || null || NaN || undefined;
console.log(val); // undefined
```

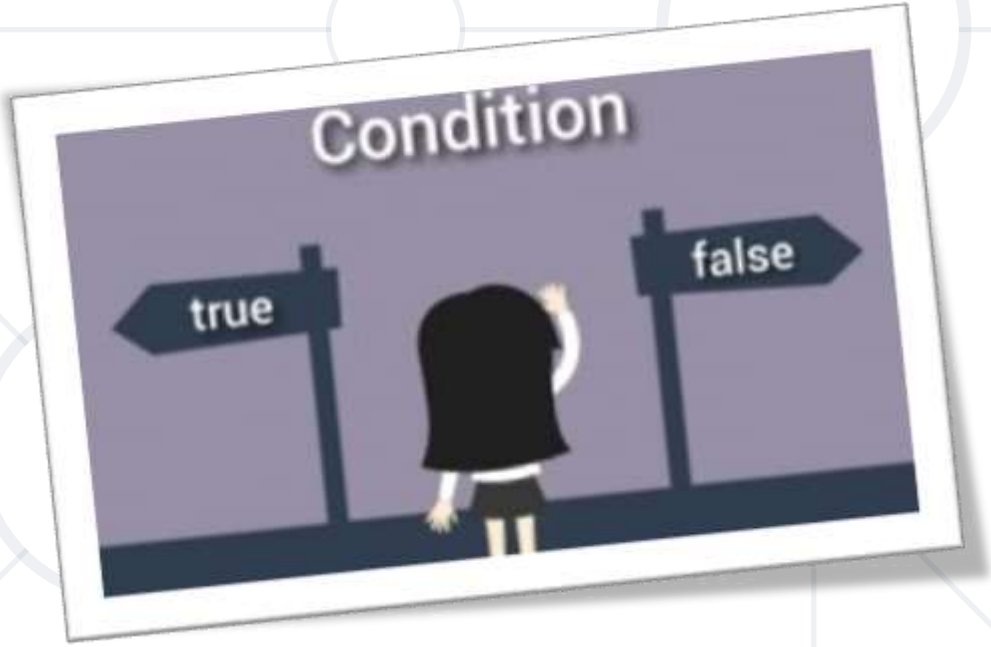
If all values are **false**, return the **last** value

Logical Operators (2)

- ! (**logical not**) – convert the operand to Boolean type: **true/false**

```
let val = !true
console.log(val); // false
let val = !false;
console.log(val); // true
```

A	B	A AND B	A OR B	NOT A
False	False	False	False	True
False	True	False	True	True
True	False	False	True	False
True	True	True	True	False



Problem: Larger Number

- Write a JS function that takes three number arguments as input and find the largest of them.

```
function solve(num1, num2, num3) {
  let result;
  if(num1>num2 && num1>num3) {
    result = num1;
  } else if (num2>num1 && num2>num3) {
    result = num2;
   } else if(num3>num1 && num3>num2) {
    result = num3;
   }
   console.log(`The largest number is ${result}.`)
}
```

```
solve(5, -3, 16)
```

Check your solution here: https://judge.softuni.bg/Contests/Practice/Index/1421#3

Typeof Operator

- The **typeof** operator returns a string indicating the type of operand

```
let val = 5; console.log(typeof(val));              // number
let str = 'hello'; console.log(typeof(str));        // string
let obj = {name: 'Maria', age:18};
console.log(typeof(obj));                           // object
let arr = [1, 2, 3]; console.log(typeof(arr));      // object
let bool = true; console.log(typeof(bool));         // Boolean
let func = function(){};
console.log(typeof(func));                          // function
let date = new Date();
console.log(typeof(date));                          // object
console.log(typeof(notDeclaredVariable));           //undefined
```

Problem: Circle Area

- Calculate the circle area if the input is a number.
  You need to check the type of the input

```
function solve(input) {
  let result = 0;
  let inputType = typeof(input);
  if (inputType === 'number') {
    result = Math.pow(input, 2) * Math.PI;
    console.log(result.toFixed(2));
  } else {
    console.log(`We can not calculate the circle area,
    because we receive a ${inputType}.`)
   }
}
```

```
solve(5);
```

Check your solution here: https://judge.softuni.bg/Contests/Practice/Index/1421#4

Instanceof Operator

- The **instanceof** operator returns **true** if the specified object in an instance of the specified object:

```
let cars = ["Saab", "Volvo", "BMW"];
console.log(cars instanceof Array);          // Returns true
console.log(cars instanceof Object);         // Returns true
console.log(cars instanceof String);         // Returns false
console.log(cars instanceof Number);         // Returns false
```

Live Exercises in Class (Lab)

Practice: JavaScript Syntax and Operators

Summary

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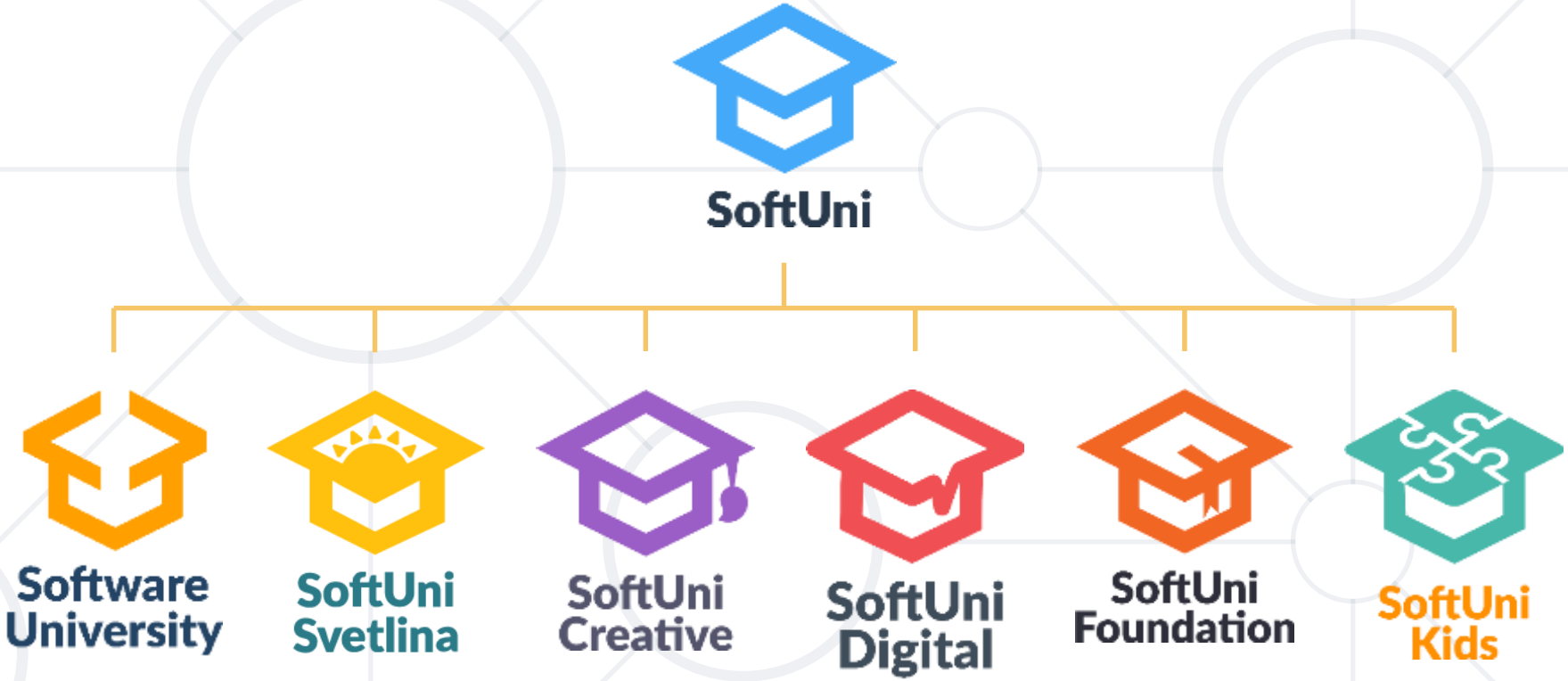
- Basic JavaScript syntax
- Conditional statements in JS are like in all modern programming languages:
  - Classical conditionals: if-else, switch-case
- Loops in JavaScript
  - Classical loops: while, do-while, for loops
  - Iterate over collection: for … in and for … of
- Comparison operators - ==, ===, >, <, >=, <=, !=, !==, ?
- Logical operators - &&, ||, !
- Typeof, instanceof

Questions?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