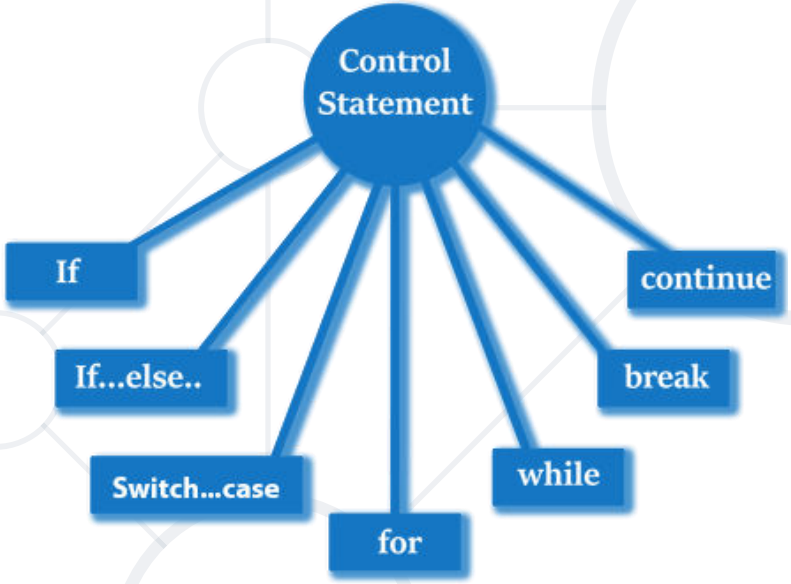
Control-Flow Logic in JS

Operators, Expressions, Statements, Conditional Statements, Loops



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Have a Question?

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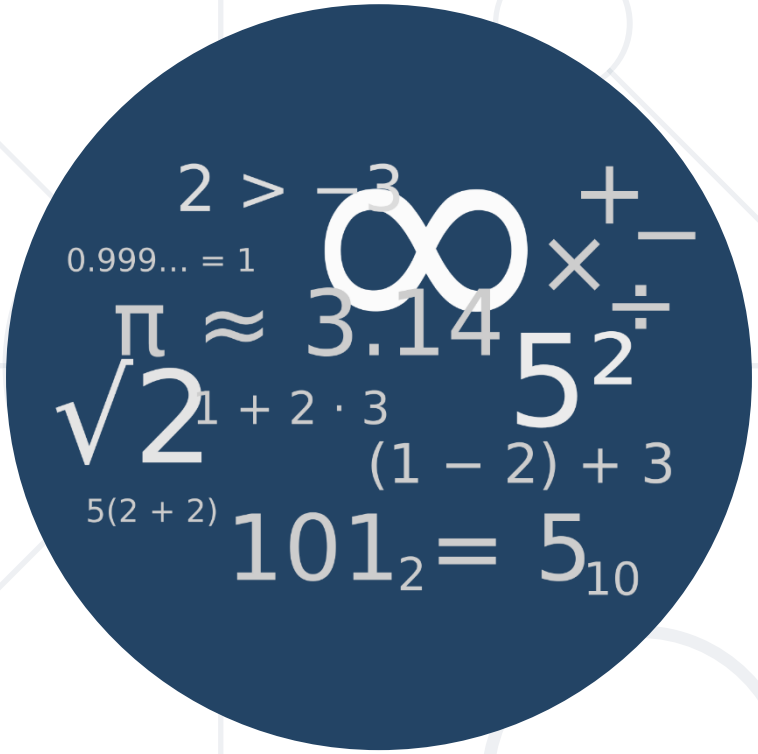
sli.do

#JSCORE



Operators and Expressions in JS

Arithmetic, Logical, Comparison, Assignment, Others

Arithmetic Operators in JS

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```
console.log(3 + 4 - 2); // 5 (add / subtract numbers)
console.log(3 * 2); // 6 (multiply numbers)
console.log(2 ** 10); // 1024 (exponential operator **)
console.log(5 / 2); // 2.5 (divide numbers)
console.log(5 / 0); // Infinity (divide by zero)
console.log(Infinity / Infinity); // NaN (wrong 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 ++)
```

Problem: Multiply Two Numbers

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- Write a JS function to multiply two numbers

```
function mult(num1, num2) {

  let result = num1 * num2
  return result
}
```

Test this function in the **judge system**

The judge sends the input as **parameters**, specified in the **problem description**

```
mult(4, 2.5) // returns 10
```

Invoke the above function to test it **locally**

Check your solution here: https://judge.softuni.bg/Contests/288

Problem: Boxes and Bottles

- Write a JS function to calculate how many boxes will be needed to fit **n** bottles if each box fits **k** bottles

20 5	➡	4	15 7	➡	3	5 10	➡	1

```
function boxesAndBottles(n, k) {
  console.log(Math.ceil(n / k));
}
```

Check your solution here: https://judge.softuni.bg/Contests/288

Logical Operators in JS

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- The || operators returns the leftmost "**true**" value:

```
let t = false || 0 || '' || 5 || 'hi' || true;
console.log(t); // 5
```

- The && operators returns the leftmost "**false**" value:

```
let val = true && 'yes' && 5 && null && false;
console.log(val); // null
```

Comparison Operators in JS

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- Comparison operators compare values
- ==, !=, <, >, >=, <=, ===, !==
- The == means "equal after type conversion"
- The === means "equal and of the same type"

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

Assignment and Other Operators in JS

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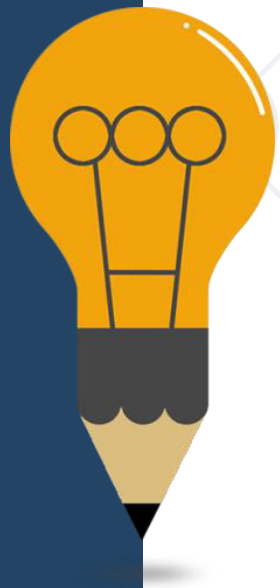
- Assign a value to variable: =, +=, -=, *=, /=, |=, …

```
let y = 4; console.log(y *= 2); // 8
let z = y = 3; // y=3 and z=3
console.log(z += 2); // 5
let unknown_value;
console.log(unknown_value); // undefined
```



- Conditional ternary operator ? :

```
console.log((new Date()).getDay() % 2 === 0 ?
  "even date" : "odd date")
```

Problem: Leap Year

- Write a JS function to check whether a year is leap
  - Can be divided to 4 and cannot be divided to 100
  - Or can be divided to 400

1980	➡	yes	1900	➡	no

```
function leapYear(year) {
  let leap = (year % 4 === 0 && year % 100 !== 0)
      || (year % 400 === 0);
  console.log(leap ? "yes" : "no");
}
```

Check your solution here: https://judge.softuni.bg/Contests/288

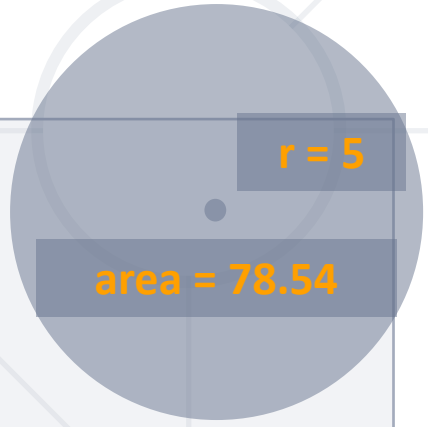
Expressions in JS: Circle Area

- Expressions combine variables, values, operators, function calls
  - Example: calculate circle area by given radius

```
function circleArea(r) {
  let area = Math.PI * r * r;
  console.log(area); // 78.53981633974483

  let areaRounded = Math.round(area * 100) / 100;
  console.log(areaRounded); // 78.54
}
```

Circle area expression




```
circleArea(5);
```

Check your solution here: https://judge.softuni.bg/Contests/288

Expressions in JS: Triangle Area

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- Calculate triangle area by its 3 sides

```
function triangleArea(a, b, c) {
  let sp = (a + b + c) / 2;
  let area = Math.sqrt(sp * (sp - a) * (sp - b) * (sp - c));
  return area;
}
```

Heron's formula

```
triangleArea(2, 3.5, 4);
// 3.4994419197923547
```

Check your solution here: https://judge.softuni.bg/Contests/288

Problem: Cone Volume and Surface Area

- Write a JS function to calculate cone volume and surface
  - The cone height **h** and radius of the base **r** are given

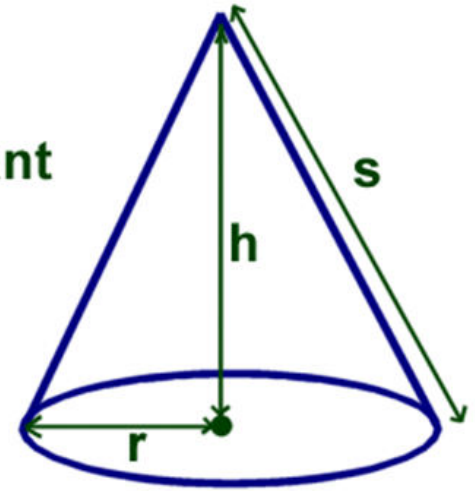
```
3
5
```

```
volume = 47.1239
area = 83.2298
```

```
3.3
7.8
```

```
volume = 88.9511
area = 122.0159
```

r = radius
h = height
s = length of slant



Formulas + online calculator:
http://www.calculatorsoup.com/calculators/geometry-solids/cone.php

Solution: Cone Volume and Surface Area

- Slant height
  - $s = \sqrt{(r^2 + h^2)}$
- Volume
  - $V = \pi * r^2 * h / 3$
- Base surface area
  - $B = \pi * r^2$
- Lateral surface area
  - $L = \pi * r * s$

```
function cone(r, h) {
  let s = Math.sqrt(r * r + h * h);
  let volume = Math.PI * r * r * h / 3;
  console.log("volume = " + volume);
  let area = Math.PI * r * (r + s);
  console.log("area = " + area);
}
```

- Total surface area: $A = B + L = \pi * r * (r + s)$

Check your solution here: https://judge.softuni.bg/Contests/288

Statements in JS

- **Statements** are "**commands**" to be executed

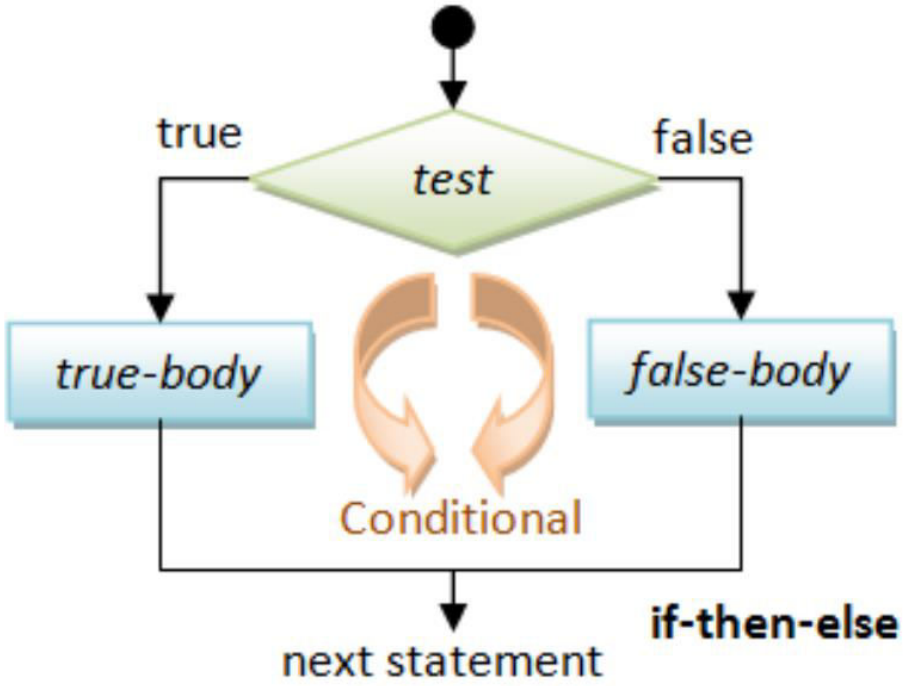
```
let number = 5;
console.log(number)

if (number === 5) {
  number = number + 1
  console.log(number)
}
;
```

Semicolon ; at the end of line is not mandatory in JS

Block { } statements hold a sequence of commands

Empty statement



Conditional Statements

If-else, switch-case

Conditional Statements: if-else

- JS supports the classical **if** / **if-else** statements:

```
let number = 5;

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

Problem: Odd / Even

- Write a JS function to check if a number is **odd** or **even** or **invalid**

```
function oddEven(num) {
  if (!Number.isInteger(num))
    console.log("invalid")
  else if (num % 2 === 0)
    console.log("even")
  else
    console.log("odd")
}
```

5	→	odd
8	→	even
-3	→	odd
1.5	→	invalid
0	→	even

Check your solution here: https://judge.softuni.bg/Contests/288

Truthy and Falsy Expressions in JavaScript

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- JavaScript is rich of unexpected behaviour

```
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
```

The switch-case Statement

- Selects for execution a statement from a list depending on the value of the **switch** expression

```
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: Fruit or Vegetable

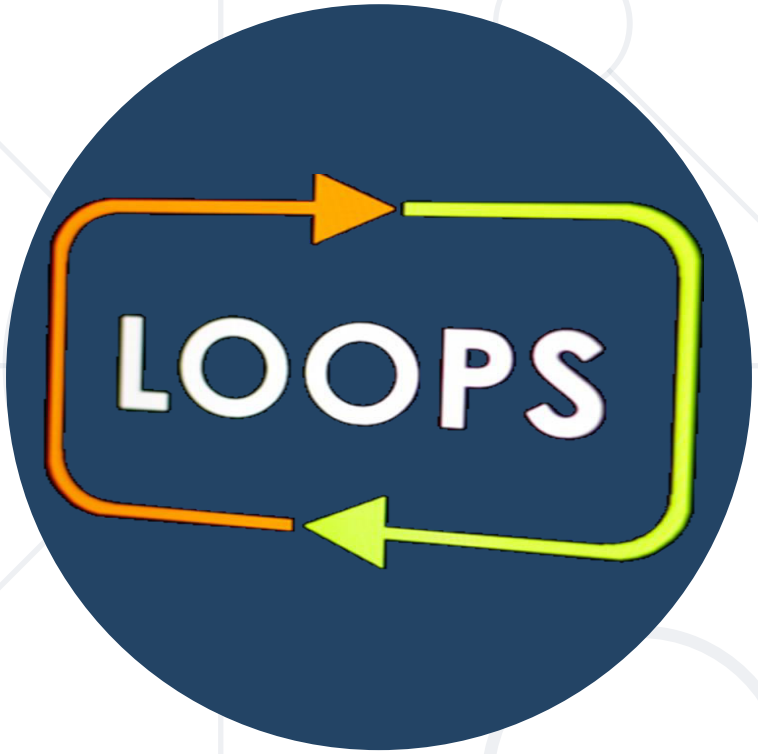
- Write a JS function to print "**fruit**", "**vegetable**" or "**unknown**" depending on the input string
  - Fruits are: banana, apple, kiwi, cherry, lemon, grapes, peach
  - Vegetable are: tomato, cucumber, pepper, onion, garlic, parsley
  - All others are unknown

`lemon` →	`fruit`	→ `peach` →	`fruit`
`onion` →	`vegetable`	→ `pizza` →	`unknown`

Solution: Fruit or Vegetable

```
function food(word) {
  switch (word) {
    case 'banana':
    case 'apple':
    case 'kiwi':
    case 'cherry':
    case 'lemon':
    case 'grapes':
    case 'peach':
      console.log('fruit');
      break;
    case 'tomato':
    case 'cucumber':
    case 'pepper':
    case 'onion':
    case 'parsley':
    case 'garlic':
      console.log('vegetable');
      break;
    default:
      console.log('unknown');
  }
}
```

Check your solution here: https://judge.softuni.bg/Contests/288



Loops in JS

For, while, do-while

Loops: for

- The **for** / **while** / **do-while** loops work as in C++, C# and Java
- Classical **for**-loop

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

```
for (let i = 50; i >= 10; i -= 10)
  console.log(i)
// 50 40 30 20 10
```

Loops: while, do-while, …

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

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

Problem: Colorful Numbers 1 … n

- Write a JS function to print the numbers from 1 to n
  - Return a string holding HTML list **
…
**
  - Display the odd lines in **green**, even lines in **blue**

```
<ul>
  <li><span style='color:green'>1</span></li>
  <li><span style='color:blue'>2</span></li>
  <li><span style='color:green'>3</span></li>
  …
</ul>
```

Solution: Colorful Numbers 1 … n

```
function nums(n) {
  let html = '<ul>\n';
  for (let i = 1; i <= n; i++) {
    let color = 'blue';
    if (i % 2 !== 0) color = 'green';
    html += `<li><span style='color:${color}'>${i}</span></li>\n`;
  }
  html += '</ul>';
  return html;
}
```

```
document.body.innerHTML = nums(10)
```

Check your solution here: https://judge.softuni.bg/Contests/288

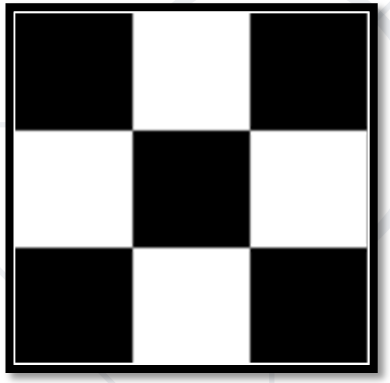
Live Exercises

Problem: Chessboard

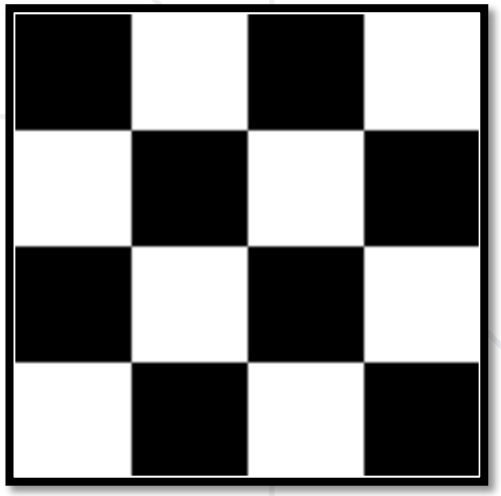
- Write a JS function to print a chessboard of size **n**. Examples:

```
<div class="chessboard">
  <div>
    <span class="black"></span>
    <span class="white"></span>
  </div>
  <div>
    <span class="white"></span>
    <span class="black"></span>
  </div>
  <div>…</div>
</div>
```

n = 3



n = 4



Solution: Chessboard

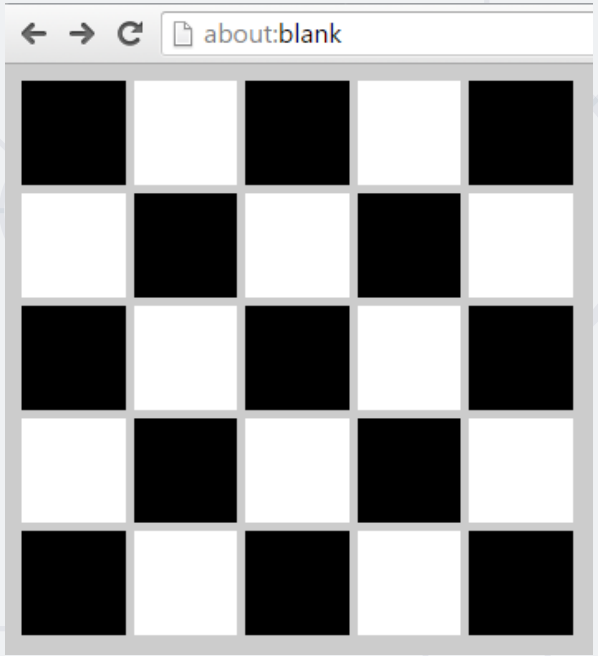
```
function chessboard(size) {
  let html = '<div class="chessboard">\n';
  for (let row = 0; row < size; row++) {
    html += '  <div>\n';
    let color = (row % 2 === 0) ? 'black' : 'white';
    for (let col = 0; col < size; col++) {
      html += `    <span class="${color}"></span>\n`;
      color = (color === 'white') ? 'black' : 'white';
    }
    html += '  </div>\n';
  }
  return html + '</div>';
}
```

Check your solution here: https://judge.softuni.bg/Contests/288

Chessboard: Visualization in the Browser

```
let css = document.createElement("style");
css.innerHTML = `
  body { background: #CCC; }
  .chessboard { display: inline-block; }
  .black, .white {
     width:50px; height:50px;
     display: inline-block; }
  .black { background: black; }
  .white { background: white; }
`;
document.getElementsByTagName("head")[0].appendChild(css);

document.body.innerHTML = chessboard(5);
```



For Each Loop

- 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
```

Problem: Binary Logarithm

- Write a JS function to enter **n** numbers and print for each number **x** its binary logarithm ($\log_2 x$)

```
function binaryLogarithm(nums) {
  for (let x of nums) {
    console.log(Math.log2(x));
  }
}
```

```
1024
1048576
256
1
2
```

```
10
20
8
0
1
```

Check your solution here: https://judge.softuni.bg/Contests/288

Problem: Prime Number Checker

```
function isPrime(num) {
  let prime = true;
  for (let d = 2; d < Math.sqrt(num); d++) {
    if (num % d === 0) {
      prime = false;
      break;
    }
  }
  return prime && (num > 1);
}
```

- **break** exits the innermost loop

Check your solution here: https://judge.softuni.bg/Contests/288

Continue

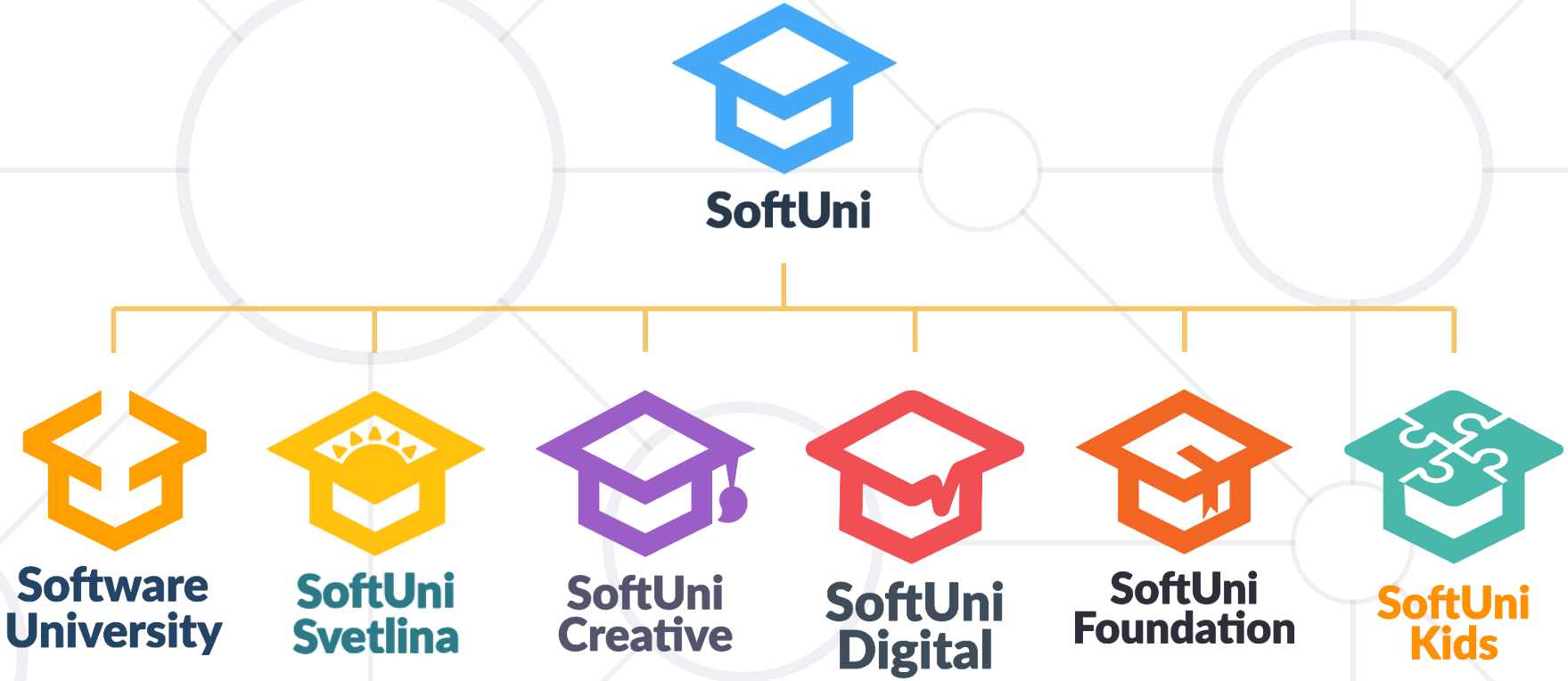
- **continue** goes to the next loop iteration
  - Skips the lines to the end of loop body

```
for (let x = 0; x < 10; x++) {
  if (x % 2 === 0)
    continue;
  console.log(x++);
}
// Prints 1 3 5 7 9
```

Summary

- Operators and expressions in JS are similar to C# / Java / PHP / C++, but not identical
  - **||** returns the leftmost "**true**" expression
- 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**

Questions?



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