

Functions

$$f(x)$$

SoftUni Team
Technical Trainers



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Software University

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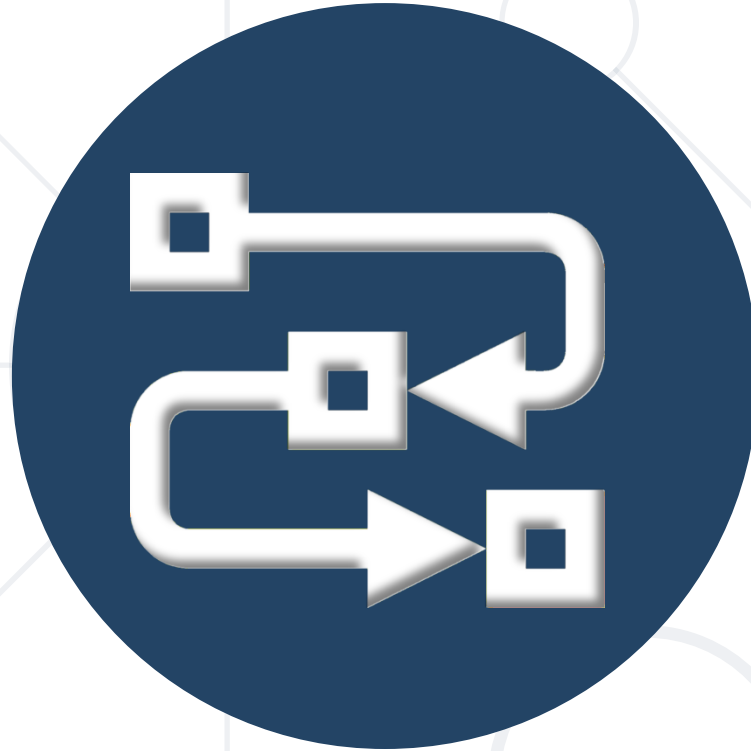
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sli.do

#fund-js



Functions Overview

Definition and Objectives

Functions in JS

- A **function** is a **subprogram** designed to perform a particular task
 - Functions are executed when they are called. This is known as **invoking** a function
 - Values can be **passed** into functions and used within the function

Use **camel-case**

Parameter

```
function printStars(count) {  
  console.log("*".repeat(count));  
}
```



Why Use Functions?

More **manageable programming**

- **Splits** large problems into small pieces
- Better **organization** of the program
- Improves code **readability** and **understandability**

Avoiding **repeating code**

- Improves code maintainability

Code **reusability**

- Using existing functions several times





Declaring and Invoking Functions

Declaring Function

- Functions can be declared in two ways:
 - **Function declaration** (recommended way)

```
function printText(text){  
  console.log(text);  
}
```

- **Function expression** (useful in functional programming)

```
let printText = function(text){  
  console.log(text);  
}
```



Declaring Function

- Functions can have **parameters**
- Functions **always** return a value (custom or default)



```
function printText(text){  
  console.log(text);  
}
```

Name

Parameters

Body

Invoking a Function

- Functions are first **declared**, then **invoked** (many times)

```
function hLine() {  
  console.log("-----");  
}
```

Function
Declaration

- Functions can be **invoked (called)** by their name

```
hLine();
```

Function
Invocation

Invoking a Function (2)

- Invocation from another function:

```
function printDocument() {  
    printLabel();  
    printContent();  
}
```

Function invoking
functions

- Self-invocation (**recursion**):

```
function countdown(x) {  
    console.log(x);  
    if (x > 0) { countdown(x - 1); }  
}
```

Function invoking
itself

Functions Without Parameters

- Does **not** receive arguments when invoked
- Result is **always the same** (unless it reads data from outside)

```
function printHeader() {  
    console.log('~~~-    {@}    -~~~');  
    console.log('~- Certificate -~');  
    console.log('~~~- ~---~ -~~~');  
}  
printHeader();    // Output is always the same
```

Functions With Parameters

- Can receive **any number** and **type** of arguments when invoked

```
function multiply(a, b) {  
  console.log(a*b);  
}  
multiply(5, 7); // 35
```

Pass two numbers

```
function printName(nameArr) {  
  console.log(nameArr[0] + ' ' + nameArr[1]);  
}  
printName(['John', 'Smith']); // John Smith
```

Pass array of strings

Problem : Grades

- Write a function that **receives a grade** between 2.00 and 6.00 and prints a formatted line with **grade and description**
 - Grade $< 3.00 \rightarrow$ **Fail**
 - Grade ≥ 3.00 and $< 3.50 \rightarrow$ **Poor**
 - Grade ≥ 3.50 and $< 4.50 \rightarrow$ **Good**
 - Grade ≥ 4.50 and $< 5.50 \rightarrow$ **Very good**
 - Grade $\geq 5.50 \rightarrow$ **Excellent**

Input	Output
3.33	Poor (3.33)
4.50	Very good (4.50)
2.99	Fail (2)

```
function formatGrade(grade) {  
  if (grade < 3.00) {  
    console.log('Fail (2)');  
  } else if (grade < 3.5) {  
    console.log(`Poor (${grade})`);  
  }  
  // TODO: Add other conditions  
}
```

Problem : Math Power

- Create a function that **calculates** the result of a number, raised to the given power
 - **Print** the result to the console

Input	Output	Comment
2, 8	256	$2^8 = 2 * 2 * 2 * 2 * 2 * 2 * 2 * 2 = 256$
3, 4	81	$3^4 = 3 * 3 * 3 * 3 = 81$


```
function pow(num, power){  
  let result = 1;  
  // Loop exponent times  
  for(let i = 0; i < power; i++){  
    //multiply the base value  
    result *= num;  
  }  
  console.log(result);  
}
```



Returning Values

The Return Statement

- The **return** keyword immediately **stops the function's execution**
- **Returns** the specified value to the caller

```
function readFullName(firstName, lastName) {  
    return firstName + " " + lastName;  
}
```

```
const fullName = readFullName("John", "Smith");  
console.log(fullName) //John Smith
```



Using the Return Values

- Return value can be:

- Assigned** to a variable

```
const max = getMax(5, 10);
```

- Used** in expression

```
const total = getPrice() * quantity * 1.20;
```

- Passed** to another function

```
multiply(getMax(5,10), 20)
```



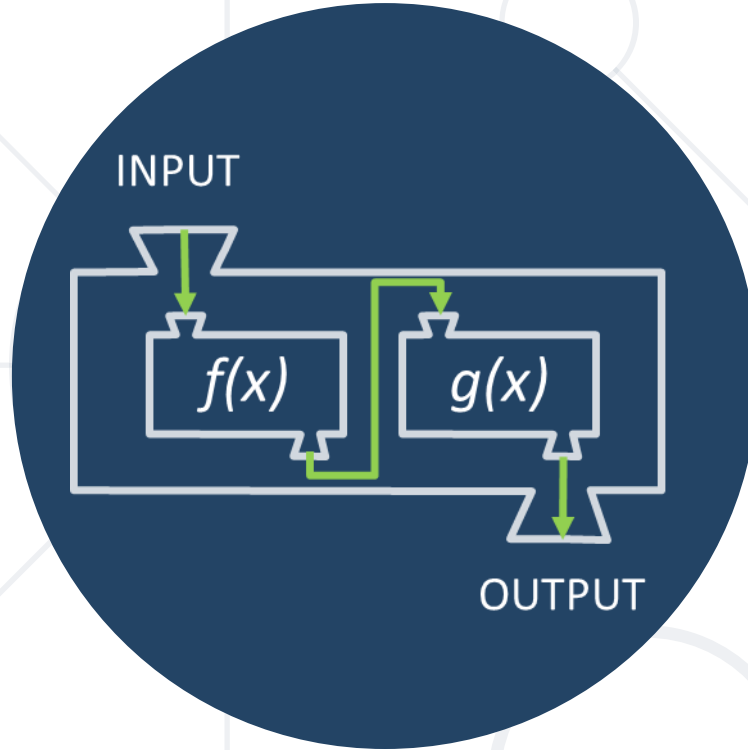
Returning Values: Examples

- Check if **array index** is valid:

```
function isValid(index, arr) {  
  if (index < 0 || index >= arr.length) {  
    return false;  
  } else {  
    return true;  
  }  
}
```

- Does the student pass the exam:

```
function pass(grade) {  
  return grade >= 3;  
}
```



Nested Functions

Nested Functions: Example

- Functions can be **nested**, i.e. hold other functions

```
function swapElements(arr) {  
  for (let i = 0; i < arr.length/2; i++) {  
    swap(arr, i, arr.length - 1 - i);  
  }  
  console.log(arr.join(' '));  
  function swap(elements, i, j) {  
    let temp = elements[i];  
    elements[i] = elements[j];  
    elements[j] = temp;  
  }  
}
```

Nested function

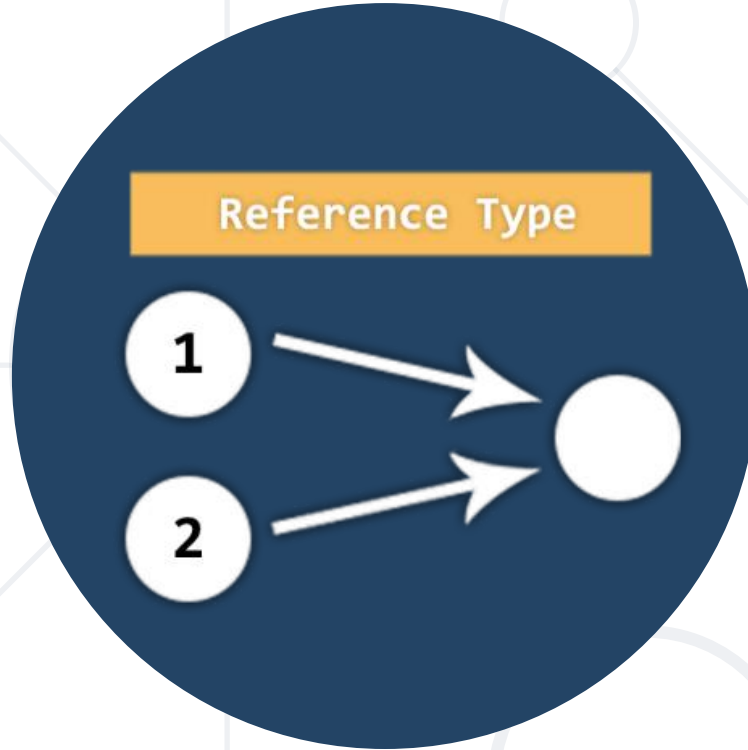
Problem: Print Certificate

- Write a function that receives a **grade** and an **array**, containing two strings and **prints** a formatted certificate
 - If the student failed, **print** '*<name> does not qualify*'

```
printCertificate(5.25, ['Peter', 'Carter']);  
// ~~- {@} ~~~  
// ~- Certificate ~  
// ~~- ~---~ ~~~  
// Peter Carter  
// Very good (5.25)
```


- Use the functions we declared in **earlier examples**:

```
function printCertificate(grade, nameArr) {  
  if (pass(grade)) {  
    printHeader();  
    printName(nameArr);  
    formatGrade(grade);  
  } else {  
    let msg = `${nameArr[0]} ${nameArr[1]} does not qualify`;  
    console.log(msg);  
  }  
}
```



Value vs. Reference Types

Memory Stack and Heap

Value Types

- **Value type** variables hold directly their value
 - number, boolean, string, ...
- Each variable has its own **copy** of the **value**

```
i = 42;  
ch = 'A';  
result = true;
```




Reference Types

- **Reference type** variables hold a reference (pointer / memory address) of the value itself
 - **object, Array**
- Two reference type variables can **reference** the **same object**
 - Operations on both variables access/modify **the same data**




Value vs. Reference Types

pass by reference

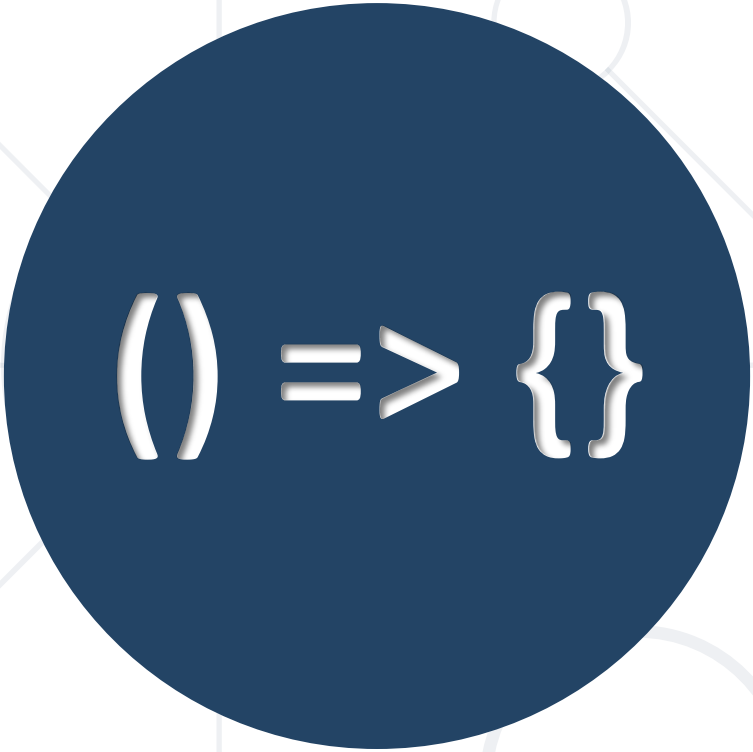
cup = 

fillCup()

pass by value

cup = 

fillCup()



`() => {}`

Arrow Functions

Arrow Functions

- These are functions with their own special syntax
- They accept a fixed number of arguments
- They operate in the **context** of their **enclosing scope**

```
let increment = x => x + 1;  
console.log(increment(5)); // 6
```

```
let increment = function(x) {  
  return x + 1;  
}
```

```
let sum = (a, b) => a + b;  
console.log(sum(5, 6)); // 11
```

"=>" (arrow)

This is the same as
the function **above**





Naming and Best Practices

Naming Functions

- Use **meaningful** names
- Should be in **camelCase**
- Names should answer the question:
 - **What does this function do?**

`findStudent, loadReport, add`

`Method1, DoSomething, handleStuff, DirtyHack`

Self explaining

Puzzling

- If you cannot find a good name for a function, think about whether it has a **clear intent**



Function parameters names

- Preferred form: [**Noun**] or [**Adjective**] + [**Noun**]
- Should be in **camelCase**
- Should be **meaningful**

`firstName, report, speedKmH,
usersList, fontSizeInPixels, font`

- Unit of measure should be obvious

`p, p1, p2, populate, LastName, last_name, convertImage`


- Each **function** should perform a **single**, well-defined task
 - A name should **describe that task** in a clear and non-ambiguous way
- **Avoid** functions **longer than one screen**
 - **Split them** to several shorter functions

```
function printReceipt(){  
    printHeader();  
    printBody();  
    printFooter();  
}
```


**Self documenting
and easy to test**

- Make sure to use correct **indentation**

```
function sum() {  
    ➡ // some code...  
    ➡ // some more code...  
}
```



```
function sum()  
    ➡ {  
        ➡ // some code...  
    ➡ // some more code...}
```



- Leave a **blank line** between **functions** and after **blocks**
- Always use **curly brackets** for **conditional** and **loop bodies**
- Avoid long lines** and **complex expressions**

Problem: Simple Calculator

- Write a function that **receives three parameters** and calculates the result, depending on a given operator
- The operator can be '**multiply**', '**divide**', '**add**', '**subtract**'
- The input comes as three parameters - two **numbers** and an operator as a **string**

Input	Output
5, 10, 'multiply'	25

- **Bonus task:** use **arrow functions** for the solution

Solution: Simple Calculator

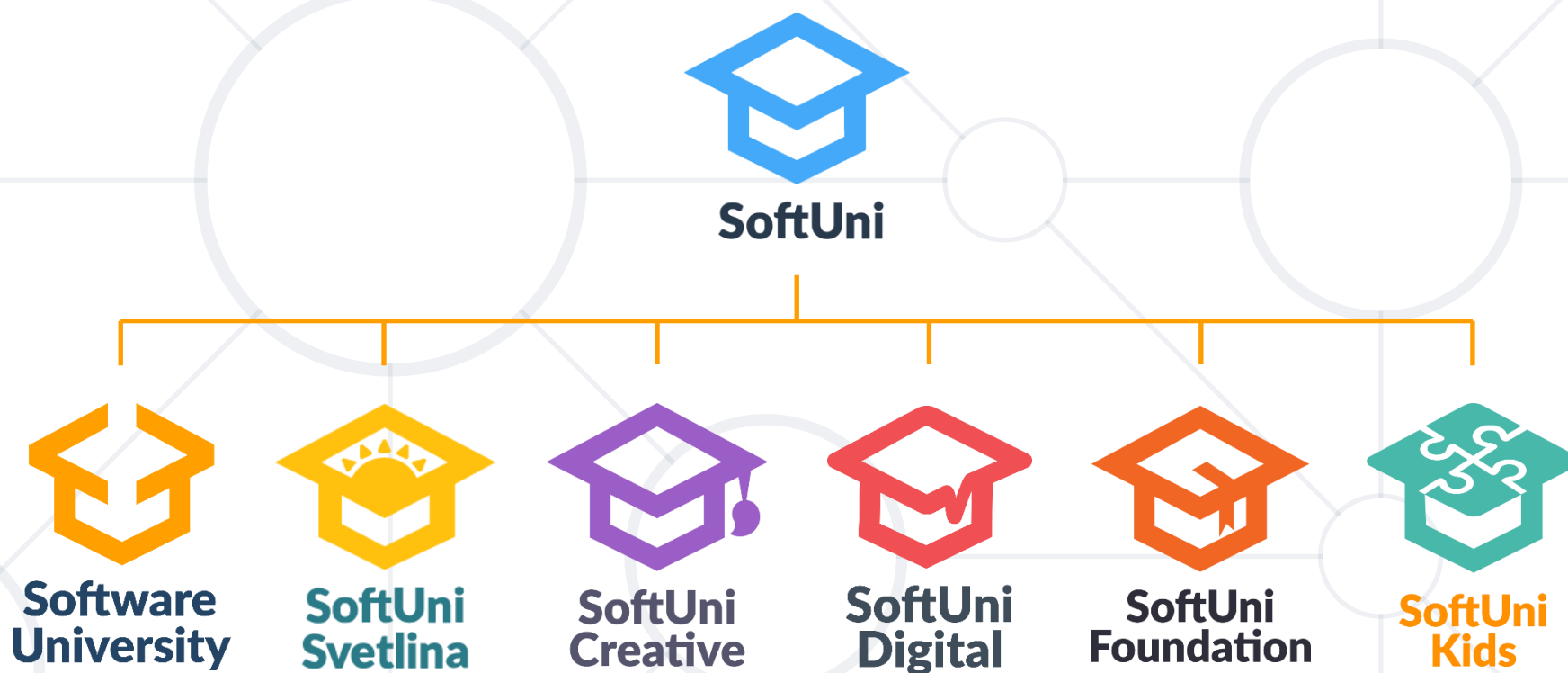
```
function solve(a, b, operator) {  
  switch (operator) {  
    case 'multiply':  
      multiply(a, b);  
      break;  
    //TODO: other cases  
  }  
  function multiply(a, b) { // ...body }  
  //TODO: other operations  
}
```

Functions:

- Break large programs into simple functions that solve small sub-problems
- Consist of **declaration** and **body**
- Are invoked by their **name**
- Can accept **parameters**



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