

Functional Programming

- Functional programming is a programming paradigm
- A programming paradigm is a style of building the structure and elements of computer programs
- Functional programming is a declarative programming paradigm, which means programming is done with expressions or declarations instead of statements

Key Concepts

- Pure functions / Avoid side effects
- Function composition
 - Higher-order functions
 - Currying
 - Recursion
- Immutability
- Referential transparency
- Lazy evaluation

Pure Functions

- A pure function is a function that:
 - Given the same input, will always return the same output
 - Produces no side effects

```
function add(a, b) {  
  return a + b;  
}
```

Immutability

```
const arr = [1, 2, 3];  
arr.push(4);  
console.log(arr); // [1, 2, 3, 4]
```

```
const arr = [1, 2, 3];  
const newArr = arr.concat(4);  
console.log(arr); // [1, 2, 3]  
console.log(newArr); // [1, 2, 3, 4]
```

Higher-Order Functions

- A higher-order function is a function that:
 - Takes one or more functions as arguments
 - Returns a function as its result

```
function add(a, b) {  
  return a + b;  
}  
  
function operate(a, b, func) {  
  return func(a, b);  
}  
  
console.log(operate(1, 2, add)); // 3
```

Currying

- Currying is the process of taking a function with multiple arguments and returning a series of functions that take one argument and eventually resolve to a value

ES6+ Features

- Arrow functions
- Spread/rest operators
- Destructuring
- Default parameters
- Template literals
- Class
- `let` & `const`
- Promises (will cover later)

Arrow Functions

- no `arguments` object
- no `this` binding
- no `prototype` property

```
const add = (a, b) => {  
  return a + b;  
};
```

```
const sum = (a, b) => a + b;
```

```
const square = x => x * x;
```

```
const foo = () => ({ bar: 1 });
```


this in Arrow Functions

- Arrow functions do not have their own `this`
- The value of `this` inside an arrow function remains the same throughout the lifecycle of the function and is always bound to the value of `this` in the closest non-arrow parent function

```
const obj = {  
  name: 'John',  
  sayHi: function () {  
    console.log(`Hi, I'm ${this.name}`);  
  }  
};
```

```
obj.sayHi(); // Hi, I'm John
```

```
const obj = {  
  name: 'John',  
  sayHi: () => {  
    console.log(`Hi, I'm ${this.name}`);  
  }  
};
```

```
obj.sayHi(); // Hi, I'm undefined
```

Spread/Rest Operators

```
const arr = [1, 2, 3];  
const newArr = [...arr, 4, 5, 6];  
console.log(newArr); // [1, 2, 3, 4, 5, 6]
```

```
const obj = { a: 1, b: 2 };  
const newObj = { ...obj, c: 3 };  
console.log(newObj); // { a: 1, b: 2, c: 3 }
```

```
function foo(...args) {  
  for (let i = 0; i < args.length; i++) {  
    console.log(args[i]);  
  }  
}
```

Destructuring

```
const arr = [1, 2, 3];  
const [a, b, c] = arr;  
console.log(a, b, c); // 1 2 3
```

```
const obj = { a: 1, b: 2, c: 3 };  
const { a, b, c } = obj;  
console.log(a, b, c); // 1 2 3
```

Template Literals

```
const name = 'John';  
const age = 30;  
console.log(`Hi, I'm ${name} and I'm ${age} years old`);
```

map, **filter**, **and** **reduce**

map-filter-reduce.js

Map and Set

- `Map` is a collection of keyed data items, just like an `Object`
- `Set` is a collection of unique values
 - based on strict equality
 - `has()` method faster than `indexOf()` / `includes()`

Map vs. Object

- `Map` is iterable - `for...of`
- `Map` keys can be any type
 - `Object` keys are always strings and symbols
- `Map` keys are ordered
- `Map` size is easily retrieved
- `Map` is faster than `Object` for frequent key/value manipulation in some cases

Date and Time

- `Date` object represents a single moment in time in a platform-independent format

```
const now = new Date();  
console.log(now); // 2018-01-01T00:00:00.000Z
```

```
const date = new Date(2018, 0, 1);  
console.log(date); // 2018-01-01T00:00:00.000Z
```

```
const date = new Date('2018-01-01');  
console.log(date); // 2018-01-01T00:00:00.000Z
```


Regular Expressions

- A regular expression is a sequence of characters that forms a search pattern
- Regular expressions can be used to perform all types of text search and text replace operations
- <https://deerchao.cn/tutorials/regex/regex.htm>
- <https://www.regexpal.com/>

```
const str = 'Hello World';  
const regex = /hello/i;  
console.log(regex.test(str)); // true
```

Regular Expressions (cont'd)

character	matches
<code>.</code>	any character except newline
<code>\w</code>	word character
<code>\W</code>	non-word character
<code>\d</code>	digit
<code>\D</code>	non-digit
<code>\s</code>	whitespace
<code>\S</code>	non-whitespace

flag	description
<code>g</code>	global match
<code>i</code>	case-insensitive
<code>m</code>	multiline
<code>s</code>	dotall
<code>u</code>	unicode

Regular Expressions (cont'd)

character	matches
<code>{n}</code>	exactly n times
<code>{n, }</code>	at least n times
<code>{n, m}</code>	at least n times but no more than m times
<code>?</code>	0 or 1 time
<code>*</code>	0 or more times
<code>+</code>	1 or more times

character	matches
<code>*?</code>	0 or more times, ungreedy
<code>+?</code>	1 or more times, ungreedy
<code>??</code>	0 or 1 time, ungreedy
<code>{n, m}?</code>	at least n times but no more than m times, ungreedy
<code>{n, }?</code>	at least n times, ungreedy

Shallow vs. Deep Copy

```
const obj = { a: 1, b: 2 };  
const newObj = obj;  
newObj.a = 3;  
console.log(obj.a); // 3
```

```
const obj = { a: 1, b: 2 };  
const newObj = { ...obj };  
// const newObj = JSON.parse(JSON.stringify(obj));  
newObj.a = 3;  
console.log(obj.a); // 1
```