📝 Lesson 02: Strings & String Methods

Quick Reference Guide

🔑 Key Concept: Strings are IMMUTABLE

Strings cannot be changed in place. All string methods return a **NEW string** — the original stays the same!

```
let name = "alex";
name.toUpperCase();      // Returns "ALEX" but doesn't save it!
console.log(name);       // Still "alex"

name = name.toUpperCase();  // NOW it's saved!
console.log(name);          // "ALEX"
```

> ⚠️ **Always save the result** if you want to keep the change!

📏 String Length

The `.length` property returns the number of characters in a string.

```
let word = "GameHub";
console.log(word.length);   // 7
```

- Spaces count! `"Hi there".length` → 8
- It's a **property**, not a method — no parentheses!

🔢 String Indexing

Each character has a position number (index). **Indexes start at 0!**

```
String:   G  a  m  e  H  u  b
Index:    0  1  2  3  4  5  6
```

Accessing Characters

```
let word = "GameHub";

word[0]              // "G" (first character)
word[4]              // "H" (fifth character)
word[word.length - 1] // "b" (last character)
word[100]            // undefined (doesn't exist)
```

> 💡 **Pro tip:** Use `string[string.length - 1]` to always get the last character!

🔧 String Methods

Case Conversion

Method	Description	Example
`.toUpperCase()`	Converts to ALL CAPS	`"hello".toUpperCase()` → `"HELLO"`
`.toLowerCase()`	Converts to all lowercase	`"HELLO".toLowerCase()` → `"hello"`

```
let text = "Hello World";
console.log(text.toUpperCase());  // "HELLO WORLD"
console.log(text.toLowerCase());  // "hello world"
console.log(text);                // "Hello World" (unchanged!)
```

Trimming Whitespace

Method	Description
`.trim()`	Removes whitespace from both ends
`.trimStart()`	Removes whitespace from beginning only
`.trimEnd()`	Removes whitespace from end only

```
let messy = "   hello world   ";
console.log(messy.trim());       // "hello world"
console.log(messy.trimStart());  // "hello world   "
console.log(messy.trimEnd());    // "   hello world"
```

> 💡 Great for cleaning up user input!

Searching Strings

Method	Returns	Description
`.includes(text)`	`true` / `false`	Checks if string contains text
`.indexOf(text)`	number / `-1`	Returns position of text (or -1 if not found)
`.lastIndexOf(text)`	number / `-1`	Returns last position of text

```
let sentence = "I love playing games";

// includes() - Does it contain this?
sentence.includes("love");    // true
sentence.includes("hate");    // false

// indexOf() - Where is it?
sentence.indexOf("love");     // 2
sentence.indexOf("playing");  // 7
sentence.indexOf("xyz");      // -1 (not found)
```

> ⚠️ **Case-sensitive!** `"Hello".includes("hello")` → `false`

Fix Case-Sensitivity

```
let text = "I Love GAMES";
text.toLowerCase().includes("games");  // true
```

Extracting Substrings

Method	Description
`.slice(start, end)`	Extracts from start to end (end not included)
`.slice(start)`	Extracts from start to end of string
`.slice(-n)`	Extracts last n characters

```
let word = "JavaScript";
//          0123456789

word.slice(0, 4);   // "Java" (indexes 0, 1, 2, 3)
word.slice(4, 7);   // "Scr" (indexes 4, 5, 6)
word.slice(4);      // "Script" (index 4 to end)
word.slice(-3);     // "ipt" (last 3 characters)
word.slice(-6, -3); // "Scr" (negative indexes work too!)
```

> 💡 **Remember:** End index is NOT included!

Replacing Text

Method	Description
`.replace(old, new)`	Replaces **first** occurrence
`.replaceAll(old, new)`	Replaces **all** occurrences

```
let text = "I like cats. Cats are great!";

text.replace("cats", "dogs");
// "I like dogs. Cats are great!" (only first one!)

text.replaceAll("cats", "dogs");
// "I like dogs. Cats are great!" (still case-sensitive!)
```

> ⚠️ **Case-sensitive!** "Cats" ≠ "cats"

⛓️ Method Chaining

Since each method returns a string, you can call multiple methods in a row:

```
let input = "   HELLO WORLD   ";

// Chain multiple methods
let result = input.trim().toLowerCase().replace("world", "gamers");
console.log(result);  // "hello gamers"
```

How it works:

1. `"   HELLO WORLD   ".trim()` → `"HELLO WORLD"`
2. `"HELLO WORLD".toLowerCase()` → `"hello world"`
3. `"hello world".replace("world", "gamers")` → `"hello gamers"`

📋 Methods Cheat Sheet

Method	What It Does	Returns
`.length`	Character count	Number
`[index]`	Get character at position	String (1 char)
`.toUpperCase()`	ALL CAPS	String

Method	What It Does	Returns
`.toLowerCase()`	all lowercase	String
`.trim()`	Remove edge whitespace	String
`.includes(x)`	Contains x?	Boolean
`.indexOf(x)`	Position of x	Number (-1 if not found)
`.slice(a, b)`	Extract portion	String
`.replace(a, b)`	Swap first a→b	String
`.replaceAll(a, b)`	Swap all a→b	String

⚠️ Common Mistakes

1. Forgetting Parentheses

```
// ❌ Wrong
str.toUpperCase

// ✅ Correct
str.toUpperCase()
```

2. Not Saving the Result

```
// ❌ Wrong - doesn't save!
let name = "alex";
name.toUpperCase();

// ✅ Correct - saves the result
let name = "alex";
name = name.toUpperCase();
```

3. Off-By-One Errors

```
let word = "Hello";
// ❌ Wrong - there is no index 5!
word[5]  // undefined

// ✅ Correct - last character
word[word.length - 1]  // "o" (index 4)
```

4. Case Sensitivity

```
// ❌ Returns false!
"Hello World".includes("hello")

// ✅ Convert to same case first
"Hello World".toLowerCase().includes("hello")
```

5. slice() End Index Not Included

```
"Hello".slice(0, 2)  // "He" (not "Hel"!)
// Indexes 0 and 1, NOT 2
```

🎮 Real World Examples

Clean User Input

```
let userInput = "   PLAYER_ONE   ";
let clean = userInput.trim().toLowerCase();
// "player_one"
```

Extract Email Domain

```
let email = "player@gamehub.com";
let atIndex = email.indexOf("@");
let domain = email.slice(atIndex + 1);
// "gamehub.com"
```

Get First Name

```
let fullName = "John Smith";
let spaceIndex = fullName.indexOf(" ");
let firstName = fullName.slice(0, spaceIndex);
// "John"
```

Get File Extension

```
let filename = "screenshot.png";
let dotIndex = filename.indexOf(".");
let extension = filename.slice(dotIndex + 1);
// "png"
```

Create Initials

```
let name = "Alex Johnson";
let firstInitial = name[0];
let lastInitial = name[name.indexOf(" ") + 1];
let initials = firstInitial + lastInitial;
// "AJ"
```

🧠 Key Takeaways

1. **Strings are immutable** — methods return NEW strings
2. **Indexes start at 0** — first character is `[0]`
3. **Use `length - 1`** — to get the last character
4. **Methods are case-sensitive** — convert case when needed

5. **Chain methods** — for cleaner, more readable code
6. **Always save results** — `str = str.toUpperCase()`
