JavaScript Introduction

Introduction to JavaScript

JavaScript is a **versatile, high-level programming language** that powers the interactive behavior of websites. It works alongside HTML (structure) and CSS (style) to create dynamic, responsive web pages.

- **Client-side**: Runs in the browser to handle user interactions.
- **Server-side**: Runs on servers using Node.js.
- **Dynamically typed**: Variable types are determined at runtime.
- **Interpreted**: Executes code line by line.
- **Single-threaded**: Handles one task at a time, but supports asynchronous operations.

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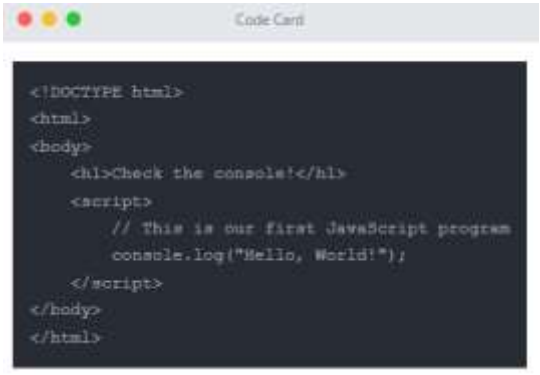
2. Writing Your First JavaScript Program

A. In the Browser



- <script>: Embeds JavaScript in HTML.
- console.log(): Prints messages to the browser's developer console.

B. In Node.js (Server Console)

Create a file named hello.js:

// This is a comment

console.log("Hello, World!");

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Run it in the terminal:

node hello.js

Output:

Hello, World!

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3. Comments in JavaScript

Comments are notes in your code that are ignored by the interpreter.

- **Single-line**: // This is a comment
- **Multi-line**:

  /* This is a

  multi-line comment */

Use comments to explain logic, organize code, or temporarily disable lines.

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4. Key Features of JavaScript

- **Client-side scripting**: Fast response without server communication.
- **Event-driven**: Reacts to user actions like clicks and typing.
- **Asynchronous**: Handles tasks like data fetching without freezing the page.
- **Versatile**: Used for simple scripts and complex applications.
- **Rich ecosystem**: Includes frameworks like React, Angular, and Vue.js.

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5. Client-Side vs Server-Side JavaScript

Feature	Client-Side	Server-Side
Runs in	Browser	Server (Node.js)
Tasks	DOM manipulation, form validation	Database access, file handling, APIs

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Feature	Client-Side	Server-Side
Examples	React, Vue, Angular	Node.js, Express.js

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6. Programming Paradigms

JavaScript supports multiple styles:

- **Imperative**: Step-by-step instructions.

```
for (let i = 0; i < 3; i++) {
    console.log(i);
}
```

- **Declarative**: Describes what to do.

```
[1, 2, 3].forEach(num => console.log(num));
```

- **Object-Oriented**:

```
class Person {
    constructor(name) {
        this.name = name;
    }
    greet() {
        console.log("Hello, " + this.name);
    }
}
```

- **Functional**:

```
const doubled = [1, 2, 3].map(n => n * 2);
```

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7. Limitations of JavaScript

- **Security risks**: Vulnerable to XSS if not handled properly.
- **Performance**: Slower than compiled languages for heavy tasks.
- **Complexity**: Advanced features require deeper understanding.
- **Weak typing**: No strict type enforcement, which can lead to bugs.

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8. ECMAScript Versions

JavaScript evolves through ECMAScript standards.

Version	Year	Key Features
ES5	2009	Strict mode, JSON support
ES6	2015	let/const, classes, arrow functions
ES7–ES13	2016–2022	async/await, BigInt, optional chaining
ES14	2023	toSorted, findLast, static blocks

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9. Real-World Applications

- **Form validation**
- **Interactive games**
- **Animations and effects**
- **APIs and data fetching**
- **Full-stack web apps**

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10. Example: Interactive Button

```
<button id="myBtn">Click Me</button>
<p id="message"></p>

<script>
    document.getElementById("myBtn").addEventListener("click", function() {
        document.getElementById("message").innerText = "Button was clicked!";
    });
</script>
```

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11. Best Practices

- Use let and const instead of var.
- Write clear, descriptive variable names.
- Keep functions focused and reusable.
- Comment only when necessary.
- Use ES6+ features for cleaner code.

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12. Introduction to Node.js

What Is Node.js?

Node.js is a **JavaScript runtime environment** that allows you to run JavaScript outside the browser, on your computer or server.

- Built on Chrome's **V8 engine**
- Enables **server-side development** using JavaScript
- Comes with **npm** (Node Package Manager) for installing libraries

Why Node.js?

Benefit	Description
Full-stack development	Use JavaScript for both frontend and backend
Fast and efficient	Handles many tasks without blocking
Rich ecosystem	Thousands of packages via npm
Real-time apps	Ideal for chat, games, and live updates

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Node.js vs Browser JavaScript

Feature	Browser	Node.js
Environment	Web browser	Server/computer
Access	DOM, window, alert	Files, network, database
Use case	UI and interactivity	Backend logic and APIs

Simple Node.js Server

```
const http = require('http');
const server = http.createServer((req, res) => {
    res.writeHead(200, { 'Content-Type': 'text/plain' });
    res.end('Hello, CodeFrill!');
});
server.listen(3000, () => {
    console.log('Server running at http://localhost:3000');
});
```

Run it with:

node server.js

Visit http://localhost:3000 in your browser to see the result.

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13. Summary

JavaScript is:

- A **powerful, flexible language** for web development
- Used on both the **client-side** and **server-side** (via Node.js)
- Capable of supporting **multiple programming styles**
- Constantly evolving through **ECMAScript updates**
- The foundation of **modern web applications**