Modern Frontend Web Development

HTML5, CSS3, JavaScript, Tools, and Web APIs for new web developers

📚 **Course Repository:**

https://github.com/chrisminnick/modern-frontend-web-dev

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Course Overview

Modern Frontend Web Development

What You'll Learn:

- HTML5 semantic markup and modern standards
- CSS3 with Grid, Flexbox, and responsive design
- JavaScript ES6+ with modern programming patterns
- DOM manipulation and event handling
- API integration and asynchronous programming
- Modern development tools and workflows
- React fundamentals and component architecture
- Testing, debugging, and deployment strategies

Course Structure: 8 modules, 17 hands-on labs, 1 final project

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Building Your Portfolio

Career Development

Module 1: Introduction to Web Development Fundamentals

What Makes a Frontend Developer?

Core Responsibilities:

- **User Interface (UI):** Visual design and layout
- **User Experience (UX):** Interaction and usability
- **Performance:** Fast loading and responsive applications
- **Accessibility:** Inclusive design for all users
- **Cross-browser Compatibility:** Works everywhere

Skills You'll Develop:

- Technical proficiency in HTML, CSS, JavaScript
- Problem-solving and debugging
- Design principles and user-centered thinking
- Version control and collaboration
- Modern toolchain and workflow management

The Modern Web Platform

Evolution of Web Development:

Then (Early 2000s):

- Static HTML pages
- Table-based layouts
- Inline styles and scripts
- Browser compatibility nightmares

Now (2024):

- Component-based architectures
- Mobile-first responsive design
- Modern JavaScript with ES6+ features
- Build tools and development workflows
- Progressive Web Applications (PWAs)

Key Principles: Semantic HTML, Separation of concerns, Progressive enhancement

Web Standards and Browser Evolution

Modern Web Standards:

- **HTML5:** Semantic elements, multimedia, APIs
- **CSS3:** Flexbox, Grid, animations, responsive design
- **ES6+:** Modern JavaScript features and syntax
- **Web APIs:** Geolocation, Storage, Canvas, Service Workers

Browser Capabilities Today:

- Native support for modern JavaScript
- Advanced CSS layout systems
- Built-in developer tools
- Performance optimization features
- Security enhancements (HTTPS, CSP)

The Frontend Ecosystem

Development Tools:

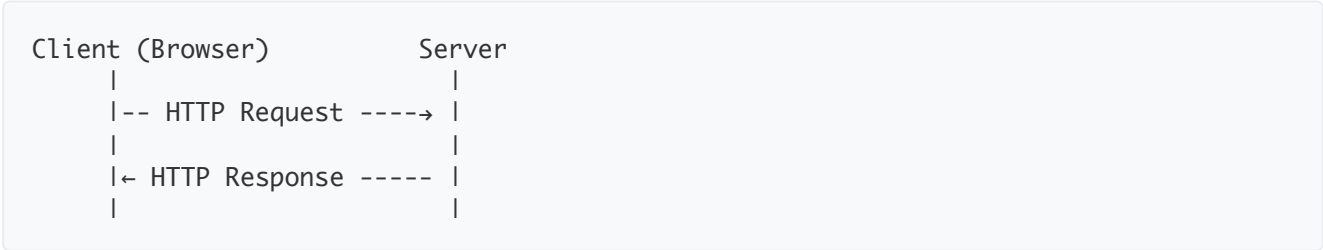
- **Code Editors:** VS Code, WebStorm, Sublime Text
- **Version Control:** Git, GitHub, GitLab
- **Package Managers:** npm, yarn, pnpm
- **Build Tools:** Vite, webpack, Parcel, Rollup

Frameworks and Libraries:

- **React:** Component-based UI library
- **Vue:** Progressive framework
- **Angular:** Full-featured framework
- **Svelte:** Compile-time optimized

Client-Server Architecture

How Web Applications Work:



Client-Side (Frontend):

- HTML structure and content
- CSS styling and layout
- JavaScript interactivity and logic
- User interface and experience

Server-Side (Backend):

- Data processing and storage
- Business logic and APIs
- Authentication and security
- Database management

Frontend vs Backend vs Full-Stack

Role	Focus Areas	Key Responsibilities	Technologies
Frontend Developer	User interface and experience	Client-side logic and interactivity Browser compatibility and performance Design implementation	HTML, CSS, JavaScript React, Vue, Angular Sass, Webpack
Backend Developer	Server-side logic and APIs	Database design and management Security and authentication Infrastructure and deployment	Node.js, Python, Java SQL, NoSQL databases APIs, Cloud services
Full-Stack Developer	End-to-end development	Both frontend and backend skills System architecture decisions DevOps and deployment workflows	All of the above Docker, CI/CD System design

Understanding Web Protocols

Internet Protocols enable web communication:

TCP/IP - Transmission Control Protocol/Internet Protocol

- The Internet is a packet-switched network
- TCP collects and reassembles packets
- IP ensures packets reach the right destination

DNS - Domain Name System

- Converts between IP addresses and Domain Names
- Example: google.com → 142.250.191.14

HTTP/HTTPS - Hypertext Transfer Protocol

- Application-level protocol for web communication
- HTTPS adds security with SSL/TLS encryption

HTTP Methods and Status Codes

Common HTTP Methods:

- **GET:** Retrieve data from server
- **POST:** Send data to server (create)
- **PUT:** Update existing data
- **DELETE:** Remove data
- **PATCH:** Partial update

Important Status Codes:

- **200:** OK - Request successful
- **404:** Not Found - Resource doesn't exist
- **500:** Internal Server Error
- **401:** Unauthorized access
- **403:** Forbidden access

Modern Development Environment

Essential Tools for Front-End Development:

Code Editor: Visual Studio Code

- Syntax highlighting, IntelliSense, extensions
- Integrated terminal and Git support

Runtime: Node.js and npm

- JavaScript runtime outside the browser
- Package manager for dependencies

Build Tool: Vite

- Fast development server with Hot Module Replacement
- Optimized production builds

Version Control: Git

- Track changes and collaborate effectively

Setting Up Your Development Environment

System Requirements:

- **Operating System:** Windows 10+, macOS 10.14+, or Linux
- **RAM:** 8GB minimum, 16GB recommended
- **Storage:** 10GB free space for tools and projects
- **Internet:** Broadband connection for downloads

Installation Order:

1. **VS Code** - Primary code editor
2. **Git** - Version control system
3. **Node.js** - JavaScript runtime and npm
4. **Chrome** - Development browser with DevTools

VS Code Extensions for Web Development

Essential Extensions:

- **Live Server:** Local development server
- **Prettier:** Code formatting
- **ESLint:** JavaScript linting
- **Auto Rename Tag:** HTML tag synchronization
- **Bracket Pair Colorizer:** Visual bracket matching

Helpful Extensions:

- **GitLens:** Enhanced Git integration
- **Thunder Client:** API testing
- **Material Icon Theme:** Better file icons
- **Error Lens:** Inline error display

Lab 01: Working with the Command Line in VSCode

Learning Objectives:

- Open and use integrated terminal in VSCode
- Practice basic command line navigation
- Build confidence with commands for Git, npm, and project setup

Key Commands:

- `pwd` - Show current directory
- `ls` - List files and folders
- `cd` - Change directory
- `mkdir` - Create directory
- `touch` - Create file

Module 2: Tools and Workflows

Version Control with Git

Why Version Control Matters:

- Track changes over time
- Collaborate with team members
- Revert to previous versions
- Branch and merge features

Git Workflow:

1. `git init` - Initialize repository
2. `git add` - Stage changes
3. `git commit` - Save changes
4. `git push` - Upload to remote repository

Git Branches and Collaboration

Why Use Branches?

- **Feature Development:** Isolate new features
- **Bug Fixes:** Separate fixes from main code
- **Experimentation:** Try new approaches safely
- **Team Collaboration:** Multiple developers working simultaneously

Branch Commands:

```
git branch feature-login     # Create new branch
git checkout feature-login   # Switch to branch
git merge feature-login      # Merge branch
git branch -d feature-login  # Delete branch
```

Git Best Practices

Commit Message Guidelines:

- **Clear and Concise:** Describe what was changed
- **Present Tense:** "Add feature" not "Added feature"
- **Limit Length:** 50 characters for summary line
- **Be Specific:** "Fix login button styling" vs "Fix bug"

Repository Structure:

- **README.md:** Project documentation
- **.gitignore:** Files to exclude from tracking
- **Consistent Naming:** Use clear file and folder names
- **Organize Code:** Logical folder structure

Package Management with npm

What is npm?

- Node Package Manager
- Manages dependencies for JavaScript projects
- Provides scripts for common tasks

Key npm Commands:

- `npm init` - Initialize project
- `npm install` - Install dependencies
- `npm run` - Execute scripts
- `npm update` - Update packages

package.json - Project configuration file

Understanding package.json

Essential Fields:

```
{
  "name": "my-project",
  "version": "1.0.0",
  "description": "A modern web project",
  "main": "index.js",
  "scripts": {
    "start": "vite",
    "build": "vite build",
    "test": "jest"
  },
  "dependencies": {},
  "devDependencies": {}
}
```

Dependencies vs DevDependencies

Type	Purpose	Examples	Installation Command
Dependencies	Needed in production	React, lodash, axios	`npm install package-name`
DevDependencies	Development tools only	Vite, Jest, ESLint, Prettier	`npm install -D package-name`

Key Differences:

- **Dependencies** - Libraries your app needs to run in production
- **DevDependencies** - Build tools, testing frameworks, linters (not shipped to users)

Examples:

```
npm install react          # Production dependency
npm install -D vite        # Development dependency
```

npm Scripts and Automation

Common Script Patterns:

```
{
  "scripts": {
    "dev": "vite",
    "build": "vite build",
    "preview": "vite preview",
    "test": "jest",
    "lint": "eslint src/",
    "format": "prettier --write src/"
  }
}
```

Running Scripts:

```
npm run dev      # Start development server
npm run build    # Build for production
npm test         # Run tests
```

Browser Developer Tools

Chrome DevTools Features:

Elements Panel:

- Inspect and modify HTML/CSS live
- Debug layout issues

Console Panel:

- View JavaScript errors and logs
- Test code interactively

Sources Panel:

- Set breakpoints and debug JavaScript
- Step through code execution

Network Panel:

- Monitor HTTP requests and responses

Lab 02: Using Visual Studio Code Basics

Learning Objectives:

- Master VSCode features and extensions
- Learn Markdown for documentation
- Use Emmet for faster HTML writing
- Customize development environment

Key VSCode Features:

- Command Palette (Cmd/Ctrl + Shift + P)
- Multi-cursor editing
- Live Server extension
- Markdown preview

Module 3: HTML Fundamentals

What is HTML?

HTML = HyperText Markup Language

- **HyperText** - Text with links to other text
- **Markup** - Tags that describe content structure
- **Language** - Set of rules and syntax

HTML's Purpose:

- **Structure content** - Not appearance (that's CSS)
- **Describe meaning** - What content is, not how it looks
- **Create relationships** - Between different pieces of content
- **Enable accessibility** - Screen readers and other tools

HTML is the skeleton of every web page!

HTML Tags, Elements, and Attributes

Understanding the Building Blocks:

Tag: The markup syntax

```
<tagname></tagname>
```

Element: Complete structure (opening tag + content + closing tag)

```
<h1>This is a heading element</h1>
```

Attribute: Extra information about an element

```
<img src="photo.jpg" alt="A beautiful sunset" />
```

HTML Tag Syntax

Opening and Closing Tags:

```
<h1>This is a heading</h1>
<p>This is a paragraph</p>
<strong>This text is important</strong>
```

Self-Closing Tags (no content):

```
<img src="image.jpg" alt="Description" />
<br />
<hr />
<input type="text" name="username" />
```

Nested Elements:

```
<p>This paragraph has <strong>bold text</strong> inside it.</p>
<div>
  <h2>A heading inside a div</h2>
  <p>A paragraph inside the same div</p>
</div>
```

Common HTML Attributes

Universal Attributes (work on most elements):

```
<!-- ID - unique identifier -->
<div id="main-content">Content here</div>

<!-- Class - group elements for styling -->
<p class="highlight important">Special paragraph</p>

<!-- Title - tooltip text -->
<span title="This appears on hover">Hover over me</span>

<!-- Style - inline CSS (avoid when possible) -->
<p style="color: red;">Red text</p>
```

Element-Specific Attributes:

```
<!-- Links -->
<a href="https://example.com" target="_blank">Visit site</a>

<!-- Images -->
<img src="photo.jpg" alt="Photo description" width="300" />

<!-- Form inputs -->
<input type="email" name="email" required placeholder="Enter email" />
```

Basic HTML Document Structure

Every HTML document needs this structure:

```
<!DOCTYPE html>
<!-- Declares HTML5 -->
<html lang="en">
  <!-- Root element with language -->
  <head>
    <!-- Information ABOUT the page -->
    <meta charset="UTF-8" />
    <!-- Character encoding -->
    <title>Page Title</title>
    <!-- Shows in browser tab -->
  </head>
  <body>
    <!-- Visible content goes here -->
    <h1>Main Heading</h1>
    <p>Your content here</p>
  </body>
</html>
```

Key Parts:

- `<!DOCTYPE html>` - Tells browser this is HTML5
- `<html>` - Root container for entire page
- `<head>` - Metadata (not visible on page)
- `<body>` - All visible content

Essential HTML Elements

Text Content:

```
<h1>Main Heading</h1>
<!-- Most important heading -->
<h2>Subheading</h2>
<!-- Secondary heading -->
<h3>Sub-subheading</h3>
<!-- And so on... h1-h6 -->

<p>This is a paragraph of text.</p>

<strong>Important text</strong>
<!-- Bold, semantically important -->
<em>Emphasized text</em>
<!-- Italic, semantically emphasized -->

<br />
<!-- Line break -->
<hr />
<!-- Horizontal rule/divider -->
```

Lists:

```
<!-- Unordered list (bullets) -->
<ul>
  <li>First item</li>
  <li>Second item</li>
</ul>

<!-- Ordered list (numbers) -->
<ol>
  <li>Step one</li>
  <li>Step two</li>
</ol>
```

Links and Images

Creating Links:

```
<!-- Link to another website -->
<a href="https://www.google.com">Visit Google</a>

<!-- Link to another page on your site -->
<a href="about.html">About Us</a>

<!-- Link to section on same page -->
<a href="#contact">Go to Contact Section</a>

<!-- Email link -->
<a href="mailto:someone@example.com">Send Email</a>
```

Adding Images:

```
<!-- Basic image -->
<img src="photo.jpg" alt="Description of photo" />

<!-- Image with size and linking -->
<a href="large-photo.jpg">
  <img src="small-photo.jpg" alt="Click for larger view" width="200" />
</a>
```

Alt text is crucial for accessibility!

HTML5 Semantic Elements

Modern HTML5 provides meaningful structure:

Document Structure:

- `<header>` - Page or section header
- `<nav>` - Navigation links
- `<main>` - Primary content
- `<footer>` - Page or section footer

Content Organization:

- `<article>` - Self-contained content
- `<section>` - Logical document divisions
- `<aside>` - Sidebar or tangential content
- `<figure>` & `<figcaption>` - Images with captions

Benefits: Better SEO, accessibility, and maintainability

Complete HTML Document Structure

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0" />
    <title>My Website - Home</title>
    <meta name="description" content="A brief description of the page" />
    <link rel="stylesheet" href="styles.css" />
  </head>
  <body>
    <header>
      <nav><!-- Navigation menu --></nav>
    </header>

    <main>
      <article>
        <h1>Main Article Title</h1>
        <p>Article content goes here...</p>
      </article>

      <aside>
        <h2>Related Links</h2>
        <!-- Sidebar content -->
      </aside>
    </main>

    <footer>
      <p>&copy; 2025 My Website</p>
    </footer>

    <script src="script.js"></script>
  </body>
</html>
```

HTML Head Section Essentials

Critical Meta Tags:

```
<head>
  <!-- Character encoding (ALWAYS first) -->
  <meta charset="UTF-8" />

  <!-- Responsive design viewport -->
  <meta name="viewport" content="width=device-width, initial-scale=1.0" />

  <!-- Page title (shows in browser tab) -->
  <title>Specific Page Title - Site Name</title>

  <!-- SEO description -->
  <meta name="description" content="Brief description for search engines" />

  <!-- Favicon -->
  <link rel="icon" href="favicon.ico" type="image/x-icon" />

  <!-- CSS stylesheet -->
  <link rel="stylesheet" href="styles.css" />
</head>
```

HTML Tables

When to Use Tables:

- **Tabular data** (spreadsheet-like information)
- **NOT for layout** (use CSS Grid/Flexbox instead)

Basic Table Structure:

```
<table>
  <thead>
    <tr>
      <th>Name</th>
      <th>Age</th>
      <th>City</th>
    </tr>
  </thead>
  <tbody>
    <tr>
      <td>John Doe</td>
      <td>30</td>
      <td>New York</td>
    </tr>
    <tr>
      <td>Jane Smith</td>
      <td>25</td>
      <td>Los Angeles</td>
    </tr>
  </tbody>
</table>
```

HTML Forms Basics

Form Structure:

```
<form action="/submit" method="POST">
  <!-- Form fields go here -->

  <button type="submit">Submit Form</button>
</form>
```

Common Input Types:

```
<!-- Text input -->
<label for="name">Name:</label>
<input type="text" id="name" name="name" required />

<!-- Email input (with validation) -->
<label for="email">Email:</label>
<input type="email" id="email" name="email" required />

<!-- Password input -->
<label for="password">Password:</label>
<input type="password" id="password" name="password" required />

<!-- Number input -->
<label for="age">Age:</label>
<input type="number" id="age" name="age" min="1" max="120" />
```

Form Elements and Validation

More Input Types:

```
<!-- Textarea for longer text -->
<label for="message">Message:</label>
<textarea id="message" name="message" rows="4" cols="50"></textarea>

<!-- Select dropdown -->
<label for="country">Country:</label>
<select id="country" name="country">
  <option value="">Choose a country</option>
  <option value="us">United States</option>
  <option value="ca">Canada</option>
  <option value="uk">United Kingdom</option>
</select>

<!-- Radio buttons (choose one) -->
<fieldset>
  <legend>Preferred Contact Method:</legend>
  <input type="radio" id="contact-email" name="contact" value="email" />
  <label for="contact-email">Email</label>

  <input type="radio" id="contact-phone" name="contact" value="phone" />
  <label for="contact-phone">Phone</label>
</fieldset>
```

HTML Input Types Reference

Input Type	Purpose	Validation	Example
`text`	Single-line text	Length, pattern	`<input type="text" name="username">`
`email`	Email addresses	Email format	`<input type="email" name="email">`
`password`	Hidden text input	Length, pattern	`<input type="password" name="pass">`
`number`	Numeric input	Min, max, step	`<input type="number" min="1" max="100">`
`tel`	Phone numbers	Pattern matching	`<input type="tel" name="phone">`
`url`	Web addresses	URL format	`<input type="url" name="website">`
`date`	Date picker	Date range	`<input type="date" name="birthday">`
`time`	Time picker	Time format	`<input type="time" name="meeting">`
`file`	File uploads	File types	`<input type="file" accept=".pdf,.jpg">`
`checkbox`	On/off toggle	N/A	`<input type="checkbox" name="agree">`
`radio`	Single choice	N/A	`<input type="radio" name="size" value="M">`
`range`	Slider control	Min, max, step	`<input type="range" min="0" max="100">`
`search`	Search input	Text validation	`<input type="search" name="query">`
`hidden`	Hidden data	N/A	`<input type="hidden" name="token">`

HTML Validation Attributes

Built-in Form Validation:

```
<!-- Required field -->
<input type="text" name="username" required />

<!-- Minimum/Maximum length -->
<input type="password" name="password" minlength="8" maxlength="20" required />

<!-- Pattern matching (regex) -->
<input
  type="text"
  name="phone"
  pattern="[0-9]{3}-[0-9]{3}-[0-9]{4}"
  placeholder="123-456-7890"
/>

<!-- Email validation -->
<input type="email" name="email" required />

<!-- URL validation -->
<input type="url" name="website" placeholder="https://example.com" />

<!-- Number ranges -->
<input type="number" name="quantity" min="1" max="10" value="1" />

<!-- Date input -->
<input type="date" name="birthday" min="1900-01-01" max="2025-12-31" />
```

HTML Best Practices

Writing Clean HTML:

1. Use Semantic Elements:

```
<!-- ❌ Non-semantic -->
<div class="header">
  <div class="nav">Navigation</div>
</div>

<!-- ✅ Semantic -->
<header>
  <nav>Navigation</nav>
</header>
```

2. Always Use Alt Text:

```
<!-- ❌ Missing alt -->
<img src="photo.jpg" />

<!-- ✅ Descriptive alt -->
<img src="photo.jpg" alt="Students working together in library" />
```

3. Proper Nesting and Indentation:

```
<!-- ✅ Well-structured -->
<article>
  <h1>Article Title</h1>
  <p>First paragraph with <strong>important text</strong>.</p>
  <p>Second paragraph.</p>
</article>
```

HTML Accessibility Fundamentals

Making HTML Accessible:

Use Proper Headings Hierarchy:

```
<h1>Main Page Title</h1>
<h2>Section Title</h2>
<h3>Subsection Title</h3>
<h3>Another Subsection</h3>
<h2>Another Section</h2>
```

Label Form Elements:

```
<!-- ✅ Proper labeling -->
<label for="email">Email Address:</label>
<input type="email" id="email" name="email" required />

<!-- ✅ Alternative with aria-label -->
<input type="search" aria-label="Search products" placeholder="Search..." />
```

Use ARIA Attributes When Needed:

```
<button aria-expanded="false" aria-controls="menu">Menu</button>
<ul id="menu" aria-hidden="true">
  <li><a href="#home">Home</a></li>
  <li><a href="#about">About</a></li>
</ul>
```

Semantic HTML Benefits

For Search Engines (SEO):

- Better content understanding
- Improved search rankings
- Rich snippets in search results
- Structured data compatibility

For Accessibility:

- Screen reader navigation
- Keyboard navigation support
- Clear content hierarchy
- Assistive technology compatibility

For Developers:

- Self-documenting code
- Easier maintenance
- Better team collaboration
- Future-proof markup

HTML Attributes and Properties

Global Attributes (work on any element):

- `id` - Unique identifier
- `class` - CSS styling hook
- `data-*` - Custom data attributes
- `title` - Tooltip text
- `lang` - Language specification
- `hidden` - Hide element

Example:

```
<div
  id="main-content"
  class="container active"
  data-theme="dark"
  title="Main content area"
>
  Content here
</div>
```

HTML Forms and User Input

Essential Form Elements:

Input Types:

- `<input type="text">` - Text fields
- `<input type="email">` - Email validation
- `<input type="password">` - Hidden input
- `<input type="number">` - Numeric input
- `<input type="date">` - Date picker

Form Structure:

```
<form action="/submit" method="POST">
  <label for="name">Name:</label>
  <input type="text" id="name" name="name" required />
  <button type="submit">Submit</button>
</form>
```

Form Validation and Accessibility

HTML5 Validation Attributes:

```
<input
  type="email"
  required
  pattern="[a-z0-9._%+-]+@[a-z0-9.-]+\.[a-z]{2,}$"
  minlength="5"
  maxlength="100"
  placeholder="Enter your email"
/>
```

Accessibility Best Practices:

- Always use `<label>` elements
- Associate labels with inputs using `for` attribute
- Provide helpful error messages
- Use fieldsets for grouping related inputs
- Include instructions and requirements

Advanced Form Elements

Selection Elements:

```
<!-- Dropdown -->
<select name="country">
  <option value="us">United States</option>
  <option value="ca">Canada</option>
</select>

<!-- Radio buttons -->
<input type="radio" id="small" name="size" value="small" />
<label for="small">Small</label>

<!-- Checkboxes -->
<input type="checkbox" id="newsletter" name="newsletter" />
<label for="newsletter">Subscribe to newsletter</label>

<!-- Text area -->
<textarea name="message" rows="4" cols="50"></textarea>
```

Lab 03: Controlling Your Versions with Git

Learning Objectives:

- Initialize Git repositories
- Stage and commit changes
- Work with remote repositories
- Understand Git workflow and best practices

Key Git Commands:

- `git init` - Initialize repository
- `git add` - Stage changes
- `git commit` - Save changes with message
- `git push` - Upload to remote repository

Lab 04: Initializing npm

Learning Objectives:

- Initialize npm package.json
- Understand package.json structure
- Configure project metadata
- Set up npm scripts

Key Concepts:

- `npm init` command
- Package.json configuration
- Project dependencies vs devDependencies
- npm script basics

Module 4: CSS Fundamentals

Introduction to CSS

What is CSS?

- **Cascading Style Sheets** - Controls presentation and layout
- **Separation of Concerns** - HTML for structure, CSS for styling
- **Cascading** - Styles flow down and can override each other
- **Style Sheets** - Collections of style rules

Why Use CSS?

- **Consistent Styling** across multiple pages
- **Maintainability** - Change styles in one place
- **Responsive Design** - Adapt to different screen sizes
- **Enhanced User Experience** - Better visual design

Adding CSS to HTML

Three Ways to Include CSS:

1. External Stylesheet (Recommended):

```
<head>
  <link rel="stylesheet" href="styles.css" />
</head>
```

2. Internal Styles:

```
<head>
  <style>
    h1 {
      color: blue;
    }
  </style>
</head>
```

3. Inline Styles (Avoid):

```
<h1 style="color: blue;">Heading</h1>
```

CSS Syntax and Rules

CSS Rule Structure:

```
selector {
  property: value;
  another-property: another-value;
}
```

Example CSS Rules:

```
/* Element selector */
h1 {
  color: blue;
  font-size: 24px;
  margin-bottom: 10px;
}

/* Class selector */
.highlight {
  background-color: yellow;
  padding: 5px;
}

/* ID selector */
#main-title {
  text-align: center;
  font-weight: bold;
}
```

CSS Selectors Fundamentals

Basic Selector Types:

Element Selectors:

```
h1 {
  color: blue;
}
p {
  margin: 10px;
}
div {
  border: 1px solid black;
}
```

Class Selectors:

```
.warning {
  color: red;
}
.button {
  padding: 10px;
}
.container {
  max-width: 1200px;
}
```

ID Selectors:

```
#header {
  background: navy;
}
#main-content {
  padding: 20px;
}
```

Advanced CSS Selectors

Combinator Selectors:

```
/* Descendant selector */
.container p {
  margin: 15px;
}

/* Child selector */
.nav > li {
  display: inline-block;
}

/* Adjacent sibling */
h1 + p {
  font-weight: bold;
}

/* General sibling */
h1 ~ p {
  color: gray;
}
```

Attribute Selectors:

```
input[type='text'] {
  border: 1px solid blue;
}
a[href^='https'] {
  color: green;
}
img[alt] {
  border: 2px solid red;
}
```

CSS Selector Reference

Selector Type	Syntax	Description	Example
Element	`element`	Selects all elements of that type	`p { color: blue; }`
Class	`.class`	Selects elements with that class	`.highlight { background: yellow; }`
ID	`#id`	Selects element with that ID	`#header { font-size: 24px; }`
Descendant	`A B`	B inside A (any level)	`.nav a { color: white; }`
Child	`A > B`	B directly inside A	`.nav > li { display: inline; }`
Adjacent Sibling	`A + B`	B immediately after A	`h1 + p { font-weight: bold; }`
General Sibling	`A ~ B`	B after A (same parent)	`h1 ~ p { color: gray; }`
Attribute	`[attr]`	Has attribute	`img[alt] { border: 1px solid; }`
Attribute Value	`[attr="value"]`	Exact attribute value	`input[type="text"] { width: 200px; }`
Attribute Contains	`[attr*="value"]`	Contains substring	`a[href*="example"] { color: red; }`
Attribute Starts	`[attr^="value"]`	Starts with string	`a[href^="https"] { color: green; }`
Attribute Ends	`[attr$="value"]`	Ends with string	`a[href$=".pdf"] { color: blue; }`

CSS Specificity and Cascade

Specificity Hierarchy (highest to lowest):

1. **Inline styles** `style="..."` (1000 points)
2. **IDs** `#header` (100 points)
3. **Classes, attributes, pseudo-classes** `.nav, [type], :hover` (10 points)
4. **Elements** `h1, div, p` (1 point)

Specificity Examples:

```
/* Specificity: 1 */
p {
  color: black;
}

/* Specificity: 10 */
.text {
  color: blue;
}

/* Specificity: 11 */
p.text {
  color: red;
}

/* Specificity: 100 */
#main {
  color: green;
}
```

CSS Inheritance and Cascade

Property Inheritance Comparison:

Inherited Properties	Non-Inherited Properties	Why?
`font-family, font-size, color`	`margin, padding, border`	Text styling flows down to children
`text-align, line-height`	`background-color, background-image`	Layout properties are element-specific
`list-style`	`width, height`	Typography should be consistent
`cursor`	`position, top, left`	Positioning is unique per element

Example:

```
body {
  font-family: Arial, sans-serif; /* Inherited */
  color: #333; /* Inherited */
  margin: 0; /* NOT inherited */
}

p {
  /* Inherits font-family and color from body */
  margin: 1em 0; /* Must be set explicitly */
}
```

Selector Types (by specificity):

1. **Inline styles** `style="color: red"`

2. **IDs** `#header`

3. **Classes** `.nav-item`

4. **Elements** `h1`

Specificity Calculation:

```
/* Specificity: 0,0,1,1 */
h1.title {
  color: blue;
}

/* Specificity: 0,1,0,0 */
#main {
  color: red;
}

/* This wins due to higher specificity */
```

CSS Box Model Fundamentals

Understanding the Box Model:

Every HTML element is a rectangular box with four areas:

1. **Content** - The actual content (text, images)

2. **Padding** - Space between content and border

3. **Border** - Line around the padding

4. **Margin** - Space outside the border

Visual Representation:

```
|------------ margin ------------|
|  |-------- border ---------|   |
|  |  |---- padding -----|   |   |
|  |  |     CONTENT      |   |   |
|  |  |------------------|   |   |
|  |-------------------------|   |
|---------------------------------|
```

Box Model Properties

Setting Box Model Values:

```
.box {
  /* Content dimensions */
  width: 200px;
  height: 100px;

  /* Padding (inside spacing) */
  padding: 20px;
  /* OR specific sides */
  padding: 10px 15px 20px 25px; /* top right bottom left */

  /* Border */
  border: 2px solid blue;
  border-width: 2px;
  border-style: solid;
  border-color: blue;

  /* Margin (outside spacing) */
  margin: 10px;
  margin: 10px auto; /* top/bottom 10px, left/right auto-center */
}
```

Box-Sizing Property

The Problem with Default Box Model:

```
.box1 {
  width: 200px;
  padding: 20px;
  border: 2px solid black;
  /* Total width = 200 + 20 + 20 + 2 + 2 = 244px */
}
```

The Solution - Border-Box:

```
.box2 {
  box-sizing: border-box;
  width: 200px;
  padding: 20px;
  border: 2px solid black;
  /* Total width = 200px (includes padding and border) */
}

/* Apply to all elements (recommended) */
* {
  box-sizing: border-box;
}
```

Margin and Padding Best Practices

Margin Collapse:

```
.element1 {
  margin-bottom: 20px;
}
.element2 {
  margin-top: 30px;
}
/* Actual space between = 30px (not 50px) */
```

Centering with Margin:

```
.center-block {
  width: 500px;
  margin: 0 auto; /* Centers horizontally */
}
```

Padding for Internal Spacing:

```
.card {
  padding: 20px; /* Space inside the card */
  margin: 20px; /* Space outside the card */
  border: 1px solid #ccc;
}
```

CSS Colors

Color Value Types:

Named Colors:

```
color: red;
background-color: blue;
border-color: green;
```

Hexadecimal Colors:

```
color: #ff0000; /* Red */
background: #00ff00; /* Green */
border: 1px solid #0000ff; /* Blue */

/* Shorthand hex */
color: #f00; /* Same as #FF0000 */
```

RGB and RGBA:

```
color: rgb(255, 0, 0); /* Red */
background: rgba(0, 255, 0, 0.5); /* Semi-transparent green */
```

CSS Typography Basics

Font Properties:

```
.text-style {
  /* Font family (fallback fonts) */
  font-family: 'Arial', 'Helvetica', sans-serif;

  /* Font size */
  font-size: 18px;
  font-size: 1.2em; /* Relative to parent */
  font-size: 1.2rem; /* Relative to root */

  /* Font weight */
  font-weight: normal; /* 400 */
  font-weight: bold; /* 700 */
  font-weight: 300; /* Light */

  /* Font style */
  font-style: normal;
  font-style: italic;
}
```

Text Styling Properties

Text Properties:

```
.text-formatting {
  /* Text alignment */
  text-align: left;
  text-align: center;
  text-align: right;
  text-align: justify;

  /* Text decoration */
  text-decoration: none;
  text-decoration: underline;
  text-decoration: line-through;

  /* Text transform */
  text-transform: uppercase;
  text-transform: lowercase;
  text-transform: capitalize;

  /* Line height (spacing between lines) */
  line-height: 1.5;
  line-height: 24px;
}
```

Web Fonts

Google Fonts Integration:

1. Link in HTML:

```
<head>
  <link
    href="https://fonts.googleapis.com/css2?family=Open+Sans:wght@300;400;700&display=s
    rel="stylesheet"
  />
</head>
```

2. Use in CSS:

```
body {
  font-family: 'Open Sans', Arial, sans-serif;
}

.heading {
  font-family: 'Open Sans', sans-serif;
  font-weight: 700; /* Bold */
}

.light-text {
  font-weight: 300; /* Light */
}
```

CSS Positioning Reference

Position Value	Behavior	Positioned Relative To	Use Cases
static	Normal document flow	N/A (no positioning)	Default behavior, basic layouts
relative	Moved from normal position	Its original position	Small adjustments, context for absolute
absolute	Removed from flow	Nearest positioned ancestor	Overlays, tooltips, dropdowns
fixed	Removed from flow	Viewport (browser window)	Navigation bars, modals, sticky headers
sticky	Hybrid relative/fixed	Viewport + container	Section headers, table headers

Position Property Examples:

```
/* Static (default) */
.normal {
  position: static;
}

/* Relative positioning */
.shifted {
  position: relative;
  top: 10px; /* 10px down from normal position */
  left: 20px; /* 20px right from normal position */
}

/* Absolute positioning */
.overlay {
  position: absolute;
  top: 50px; /* 50px from top of positioned parent */
  right: 0; /* 0px from right edge */
}

/* Fixed positioning */
.navbar {
  position: fixed;
  top: 0; /* Stick to top of viewport */
  width: 100%; /* Full width */
}

/* Sticky positioning */
.header {
  position: sticky;
  top: 20px; /* Stick when 20px from viewport top */
}
```

Advanced Positioning

Fixed Positioning:

```
.header {
  position: fixed;
  top: 0;
  left: 0;
  width: 100%;
  background: white;
  z-index: 1000; /* Stay on top */
}
```

Sticky Positioning:

```
.sidebar {
  position: sticky;
  top: 20px; /* Stick when 20px from top */
}
```

Z-Index (Stacking Order):

```
.modal {
  position: fixed;
  z-index: 1000; /* Higher = on top */
}

.overlay {
  position: fixed;
  z-index: 999; /* Behind modal */
}
```

Modern CSS Units

Unit Type	Unit	Description	Best Use Case	Example
Absolute	`px`	Pixels (screen dots)	Borders, small fixed sizes	`border: 1px solid black`
Absolute	`pt`	Points (print measurement)	Print stylesheets	`font-size: 12pt`
Relative	`em`	Relative to parent font size	Component spacing	`margin: 1em`
Relative	`rem`	Relative to root font size	Font sizes, consistent spacing	`font-size: 1.2rem`
Relative	`%`	Percentage of parent	Responsive widths	`width: 50%`
Viewport	`vw`	Viewport width (1vw = 1%)	Full-width layouts	`width: 100vw`
Viewport	`vh`	Viewport height (1vh = 1%)	Full-height sections	`height: 100vh`
Viewport	`vmin`	Smallest viewport dimension	Square responsive elements	`width: 50vmin`
Viewport	`vmax`	Largest viewport dimension	Large responsive text	`font-size: 5vmax`

Best Practices:

- **rem** for typography and consistent spacing
- **em** for component-relative spacing
- **%** or **vw/vh** for responsive layouts

Responsive Design Principles

Mobile-First Approach:

```
/* Base styles for mobile */
.container {
  width: 100%;
}

/* Tablet styles */
@media (min-width: 768px) {
  .container {
    width: 750px;
  }
}

/* Desktop styles */
@media (min-width: 1024px) {
  .container {
    width: 1200px;
  }
}
```

Key Breakpoints:

- Mobile: < 768px
- Tablet: 768px - 1024px
- Desktop: > 1024px

CSS Flexbox Deep Dive

Flex Container Properties:

```
.container {
  display: flex;
  flex-direction: row | column;
  justify-content: flex-start | center | space-between;
  align-items: stretch | center | flex-start;
  flex-wrap: nowrap | wrap;
  gap: 1rem;
}
```

Flex Item Properties:

```
.item {
  flex-grow: 1; /* How much to grow */
  flex-shrink: 1; /* How much to shrink */
  flex-basis: auto; /* Initial size */
  align-self: auto; /* Override container alignment */
}
```

CSS Grid Layout System

Grid Container Setup:

```
.grid-container {
  display: grid;
  grid-template-columns: 1fr 2fr 1fr;
  grid-template-rows: auto 1fr auto;
  grid-gap: 1rem;
  grid-template-areas:
    'header header header'
    'sidebar main aside'
    'footer footer footer';
}
```

Grid Item Placement:

```
.header {
  grid-area: header;
}
.main {
  grid-area: main;
}
.sidebar {
  grid-area: sidebar;
}
```

CSS Animations and Transitions

Transitions for Smooth Changes:

```
.button {
  background-color: blue;
  transition: all 0.3s ease;
}

.button:hover {
  background-color: darkblue;
  transform: scale(1.05);
}
```

Keyframe Animations:

```
@keyframes slideIn {
  from {
    transform: translateX(-100%);
  }
  to {
    transform: translateX(0);
  }
}

.slide-element {
  animation: slideIn 0.5s ease-out;
}
```

Lab 05: Using npm

Learning Objectives:

- Install and manage packages with npm
- Understand node_modules and package-lock.json
- Use npm scripts for automation
- Work with package versions

Key npm Commands:

- `npm install` - Install dependencies
- `npm install --save-dev` - Install dev dependencies
- `npm run` - Execute scripts
- `npm update` - Update packages

Lab 06: Creating a New Project with Vite

Learning Objectives:

- Set up a new project using Vite
- Understand modern build tools
- Configure development environment
- Use hot module replacement (HMR)

Vite Benefits:

- Fast development server
- Instant hot module replacement
- Optimized production builds
- Modern JavaScript support

Module 5: JavaScript Fundamentals

What is JavaScript?

JavaScript = The Programming Language of the Web

- **Dynamic Language** - Code executes at runtime
- **Interpreted** - No compilation step needed
- **Multi-paradigm** - Functional, object-oriented, procedural
- **Event-driven** - Responds to user interactions

JavaScript Powers:

- **Interactivity** - Respond to clicks, form submissions
- **Dynamic Content** - Update page content without reload
- **Animations** - Smooth transitions and effects
- **API Communication** - Fetch data from servers
- **Modern Apps** - Single Page Applications (SPAs)

JavaScript runs everywhere: browsers, servers (Node.js), mobile apps!

Adding JavaScript to HTML

Three Ways to Include JavaScript:

1. External Script File (Recommended):

```
<head>
  <script src="script.js"></script>
</head>
<!-- OR before closing body tag -->
<body>
  <!-- HTML content -->
  <script src="script.js"></script>
</body>
```

2. Internal Script:

```
<head>
  <script>
    console.log('Hello from internal script!');
  </script>
</head>
```

3. Inline (Avoid):

```
<button onclick="alert('Hello!')">Click me</button>
```

JavaScript Basics: Variables and Values

What are Variables?

- **Containers** for storing data values
- **Labels** that reference memory locations
- **Dynamic** - can change during program execution

Creating Variables:

```
// Modern JavaScript (ES6+)
let userName = 'Alice'; // Can be changed
const maxUsers = 100; // Cannot be changed
var oldWay = 'avoid this'; // Old way (function-scoped)

// Changing values
userName = 'Bob'; // ✅ Allowed with let
// maxUsers = 200;              // ❌ Error! const cannot change
```

Variable Naming Rules:

- Must start with letter, underscore, or $
- Case sensitive (`userName` ≠ `username`)
- Use camelCase for multiple words

JavaScript Data Types Fundamentals

Primitive Data Types:

1. Numbers:

```
let age = 25; // Integer
let price = 19.99; // Decimal
let negative = -10; // Negative
let infinity = Infinity; // Special number value
```

2. Strings (Text):

```
let firstName = 'John'; // Single quotes
let lastName = 'Doe'; // Double quotes
let fullName = `${firstName} ${lastName}`; // Template literal
let multiLine = `Line 1
Line 2`; // Multi-line string
```

3. Booleans (True/False):

```
let isLoggedIn = true;
let isComplete = false;
let isValid = age >= 18; // Expression result
```

JavaScript Data Types Reference

Data Type	Description	Example	Common Use
Number	Integers and decimals	`42`, `3.14`, `Infinity`	Calculations, counters, prices
String	Text data	`"Hello"`, `'World'`, `` \`Template\` ``	User input, messages, content
Boolean	True/false values	`true`, `false`	Conditions, flags, states
Array	Ordered list of values	`[1, 2, 3]`, `['a', 'b']`	Collections, lists, sequences
Object	Key-value pairs	`{name: 'John', age: 30}`	Complex data, entities, configs
null	Intentionally empty	`null`	Reset values, empty states
undefined	Not yet assigned	`undefined`	Uninitialized variables

Examples:

```
// Numbers
let age = 25;
let price = 99.99;

// Strings
let name = 'Alice';
let message = `Hello ${name}!`;

// Booleans
let isActive = true;
let isComplete = false;

// Arrays
let colors = ['red', 'green', 'blue'];
let numbers = [1, 2, 3, 4, 5];

// Objects
let person = {
  name: 'Alice',
  age: 30,
  address: { city: 'New York', state: 'NY' },
};

// Special values
let emptyValue = null;
let notAssigned; // undefined
```

Basic JavaScript Operators

Arithmetic Operators:

```
let a = 10;
let b = 3;

console.log(a + b); // 13 (addition)
console.log(a - b); // 7  (subtraction)
console.log(a * b); // 30 (multiplication)
console.log(a / b); // 3.333... (division)
console.log(a % b); // 1  (remainder/modulo)
console.log(a ** b); // 1000 (exponentiation)
```

Assignment Operators:

```
let x = 5; // Basic assignment
x += 3; // x = x + 3; (8)
x -= 2; // x = x - 2; (6)
x *= 2; // x = x * 2; (12)
x /= 3; // x = x / 3; (4)
```

Comparison Operators:

```
console.log(5 == '5'); // true  (loose equality)
console.log(5 === '5'); // false (strict equality)
console.log(5 != '5'); // false (loose inequality)
console.log(5 !== '5'); // true  (strict inequality)
console.log(10 > 5); // true
console.log(10 <= 10); // true
```

JavaScript Control Flow: Conditionals

If Statements:

```
let age = 20;

if (age >= 18) {
  console.log('You are an adult');
} else {
  console.log('You are a minor');
}

// Multiple conditions
if (age < 13) {
  console.log('Child');
} else if (age < 18) {
  console.log('Teen');
} else if (age < 65) {
  console.log('Adult');
} else {
  console.log('Senior');
}
```

Logical Operators:

```
let isLoggedIn = true;
let isPremium = false;

// AND (&&) - both must be true
if (isLoggedIn && isPremium) {
  console.log('Access premium content');
}

// OR (||) - at least one must be true
if (isLoggedIn || isPremium) {
  console.log('Show some content');
}

// NOT (!) - opposite
if (!isLoggedIn) {
  console.log('Please log in');
}
```

JavaScript Loops

For Loops:

```
// Traditional for loop
for (let i = 0; i < 5; i++) {
  console.log(`Count: ${i}`);
}

// For...of loop (arrays)
let fruits = ['apple', 'banana', 'orange'];
for (let fruit of fruits) {
  console.log(fruit);
}

// For...in loop (objects)
let person = { name: 'John', age: 30 };
for (let key in person) {
  console.log(`${key}: ${person[key]}`);
}
```

While Loops:

```
let count = 0;
while (count < 3) {
  console.log(`While count: ${count}`);
  count++;
}

// Do-while (runs at least once)
let input;
do {
  input = prompt('Enter "quit" to stop:');
} while (input !== 'quit');
```

JavaScript Functions Basics

What are Functions?

- **Reusable blocks of code**
- **Take inputs** (parameters)
- **Return outputs** (return values)
- **Organize code** into logical chunks

Function Declaration:

```
function greetUser(name) {
  return `Hello, ${name}!`;
}

// Calling the function
let message = greetUser('Alice');
console.log(message); // "Hello, Alice!"
```

Function Parameters and Arguments:

```
function calculateArea(width, height) {
  return width * height;
}

// Arguments are the actual values passed
let area = calculateArea(10, 5); // 50

// Default parameters
function greet(name = 'Guest') {
  return `Welcome, ${name}!`;
}
```

Modern JavaScript (ES6+)

Essential Modern Features:

Variable Declarations:

```
const name = 'John'; // Immutable
let age = 25; // Block-scoped
// Avoid var           // Function-scoped (legacy)
```

Arrow Functions:

```
const add = (a, b) => a + b;
const greet = (name) => `Hello, ${name}!`;

// Multiple lines
const processUser = (user) => {
  console.log(`Processing ${user.name}`);
  return user.id;
};
```

Template Literals:

```
const message = `Welcome, ${name}! You are ${age} years old.`;
const html = `
  <div>
    <h1>${title}</h1>
    <p>${content}</p>
  </div>
`;
```

JavaScript Data Types

Primitive Types:

```
// Numbers
const age = 25;
const price = 99.99;
const infinity = Infinity;

// Strings
const name = 'John';
const template = `Hello ${name}`;

// Booleans
const isActive = true;
const isComplete = false;

// Special values
const empty = null;
const notDefined = undefined;
```

Functions in Modern JavaScript

Function Declaration:

```
function greet(name) {
  return `Hello, ${name}!`;
}
```

Function Expression:

```
const greet = function (name) {
  return `Hello, ${name}!`;
};
```

Arrow Function:

```
const greet = (name) => `Hello, ${name}!`;

// Multiple parameters
const add = (a, b) => a + b;

// Block body for complex logic
const processUser = (user) => {
  const formatted = user.name.toUpperCase();
  return `Welcome, ${formatted}!`;
};
```

Scope and Hoisting

Block Scope with let and const:

```
function example() {
  if (true) {
    let blockScoped = "I'm only available in this block";
    const alsoBlockScoped = 'Me too!';
    var functionScoped = "I'm available in the whole function";
  }

  // console.log(blockScoped); // Error!
  console.log(functionScoped); // "I'm available..."
}
```

Hoisting Behavior:

```
console.log(x); // undefined (not an error)
var x = 5;

// console.log(y); // ReferenceError
let y = 10;
```

Destructuring and Spread Operator

Array Destructuring:

```
const [first, second, ...rest] = [1, 2, 3, 4, 5];
// first = 1, second = 2, rest = [3, 4, 5]
```

Object Destructuring:

```
const { name, age, city = 'Unknown' } = person;
```

Spread Operator:

```
const newArray = [...oldArray, newItem];
const newObject = { ...oldObject, newProperty: value };
```

Conditional Statements and Loops

Modern Conditional Syntax:

```
// Ternary operator
const status = age >= 18 ? 'adult' : 'minor';

// Nullish coalescing
const username = user.name ?? 'Anonymous';

// Optional chaining
const city = user.address?.city ?? 'Unknown';

// Switch with modern syntax
switch (day) {
  case 'monday':
  case 'tuesday':
    return 'weekday';
  case 'saturday':
  case 'sunday':
    return 'weekend';
  default:
    return 'unknown';
}
```

Modern Loop Patterns

Array Iteration:

```
const numbers = [1, 2, 3, 4, 5];

// for...of loop
for (const num of numbers) {
  console.log(num);
}

// forEach method
numbers.forEach((num) => console.log(num));

// for...in for objects
const person = { name: 'John', age: 30 };
for (const key in person) {
  console.log(`${key}: ${person[key]}`);
}
```

Error Handling

Try-Catch Blocks:

```
try {
  const data = JSON.parse(jsonString);
  processData(data);
} catch (error) {
  console.error('Parsing failed:', error.message);
} finally {
  console.log('Cleanup code runs regardless');
}
```

Custom Errors:

```
function validateAge(age) {
  if (age < 0) {
    throw new Error('Age cannot be negative');
  }
  if (age > 150) {
    throw new Error('Age seems unrealistic');
  }
  return true;
}
```

Lab 07: Using Chrome Developer Tools – Elements Panel

Learning Objectives:

- Navigate the Elements panel in Chrome DevTools
- Inspect and modify HTML elements
- Edit CSS styles in real-time
- Debug layout and styling issues

Elements Panel Features:

- DOM tree inspection
- Style editing and computed styles
- Box model visualization
- Event listener debugging

Lab 08: Using Chrome Developer Tools – Sources Panel (JavaScript Debugging)

Learning Objectives:

- Debug JavaScript using the Sources panel
- Set breakpoints and step through code
- Inspect variable values and call stack
- Use console for debugging

Debugging Features:

- Breakpoint management
- Step over, step into, step out
- Variable inspection and watches
- Call stack analysis

Module 6: Advanced JavaScript

Working with Arrays - Fundamentals

Creating and Accessing Arrays:

```
// Creating arrays
let fruits = ['apple', 'banana', 'orange'];
let numbers = new Array(1, 2, 3, 4, 5);
let mixed = ['text', 42, true, { name: 'John' }];

// Accessing elements (zero-indexed)
console.log(fruits[0]); // 'apple'
console.log(fruits[fruits.length - 1]); // 'orange' (last item)

// Checking if it's an array
console.log(Array.isArray(fruits)); // true
```

Basic Array Properties and Methods:

```
let colors = ['red', 'green', 'blue'];

// Length property
console.log(colors.length); // 3

// Adding elements
colors.push('yellow'); // Add to end
colors.unshift('purple'); // Add to beginning

// Removing elements
let lastColor = colors.pop(); // Remove from end
let firstColor = colors.shift(); // Remove from beginning

// Finding elements
let index = colors.indexOf('green'); // Returns index or -1
let exists = colors.includes('blue'); // true/false
```

Array Manipulation Methods

Modifying Arrays:

```
let animals = ['cat', 'dog', 'bird', 'fish'];

// Splice - add/remove elements at specific position
animals.splice(2, 1, 'hamster', 'rabbit'); // Remove 1 at index 2, add 2 new
// Result: ['cat', 'dog', 'hamster', 'rabbit', 'fish']

// Slice - create new array from portion
let pets = animals.slice(0, 3); // First 3 elements (doesn't modify original)

// Join - convert to string
let animalString = animals.join(', '); // 'cat, dog, hamster'

// Reverse and sort
animals.reverse(); // Modifies original
animals.sort(); // Alphabetical sort (modifies original)
```

Array Searching and Testing:

```
let scores = [85, 92, 78, 96, 88];

// Find methods
let highScore = scores.find((score) => score > 90); // 92 (first match)
let highIndex = scores.findIndex((score) => score > 90); // 1 (index of first match)

// Testing methods
let allPassing = scores.every((score) => score >= 70); // true (all pass test)
let someFailing = scores.some((score) => score < 80); // true (at least one passes test
```

Working with Objects - Fundamentals

Creating and Accessing Objects:

```
// Object literal syntax (most common)
let person = {
  firstName: 'John',
  lastName: 'Doe',
  age: 30,
  isEmployed: true,
  address: {
    street: '123 Main St',
    city: 'Anytown',
    state: 'CA',
  },
};

// Accessing properties
console.log(person.firstName); // Dot notation
console.log(person['last-name']); // Bracket notation (for special chars)
console.log(person.address.city); // Nested properties
```

Adding, Modifying, and Deleting Properties:

```
// Adding new properties
person.email = 'john@example.com';
person['phone'] = '555-1234';

// Modifying existing properties
person.age = 31;
person.isEmployed = false;

// Deleting properties
delete person.phone;

// Checking if property exists
console.log('email' in person); // true
console.log(person.hasOwnProperty('age')); // true
```

Object Methods and this Keyword

Objects with Methods:

```
let calculator = {
  result: 0,

  add: function (number) {
    this.result += number;
    return this; // Enable method chaining
  },

  subtract: function (number) {
    this.result -= number;
    return this;
  },

  getValue: function () {
    return this.result;
  },

  reset: function () {
    this.result = 0;
    return this;
  },
};

// Using the object methods
calculator.add(10).subtract(3).add(5); // Method chaining
console.log(calculator.getValue()); // 12
```

Modern Object Methods (ES6+):

```
// Shorthand method syntax
let user = {
  name: 'Alice',

  // Instead of: greet: function() { ... }
  greet() {
    return `Hello, I'm ${this.name}`;
  },

  // Arrow functions don't have their own 'this'
  sayBye: () => {
    // 'this' refers to global object, not 'user'
    return 'Goodbye';
  },
};
```

Arrays and Objects

Modern Array Methods:

```
const numbers = [1, 2, 3, 4, 5];

// Transformation
const doubled = numbers.map((n) => n * 2);

// Filtering
const evens = numbers.filter((n) => n % 2 === 0);

// Reduction
const sum = numbers.reduce((acc, n) => acc + n, 0);

// Finding
const found = numbers.find((n) => n > 3);
```

Object Methods:

```
const keys = Object.keys(obj);
const values = Object.values(obj);
const entries = Object.entries(obj);
```

Essential Array Methods Reference

Method	Purpose	Returns	Example
`map()`	Transform each element	New array	`[1,2,3].map(x => x*2)` → `[2,4,6]`
`filter()`	Keep elements that pass test	New array	`[1,2,3,4].filter(x => x > 2)` → `[3,4]`
`reduce()`	Reduce to single value	Single value	`[1,2,3].reduce((a,b) => a+b, 0)` → `6`
`find()`	Find first matching element	Element or undefined	`[1,2,3].find(x => x > 2)` → `3`
`findIndex()`	Find index of first match	Index or -1	`[1,2,3].findIndex(x => x > 2)` → `2`
`some()`	Test if any element passes	Boolean	`[1,2,3].some(x => x > 2)` → `true`
`every()`	Test if all elements pass	Boolean	`[1,2,3].every(x => x > 0)` → `true`
`includes()`	Check if value exists	Boolean	`[1,2,3].includes(2)` → `true`
`forEach()`	Execute function on each	undefined	`[1,2,3].forEach(x => console.log(x))`

Advanced Array Methods

Functional Programming Approaches:

```
const users = [
  { name: 'John', age: 30, active: true },
  { name: 'Jane', age: 25, active: false },
  { name: 'Bob', age: 35, active: true },
];

// Method chaining
const result = users
  .filter((user) => user.active)
  .map((user) => ({ ...user, name: user.name.toUpperCase() }))
  .sort((a, b) => a.age - b.age);

// Some and every
const hasActiveUsers = users.some((user) => user.active);
const allAdults = users.every((user) => user.age >= 18);
```

Object-Oriented JavaScript

Class Syntax:

```
class Person {
  constructor(name, age) {
    this.name = name;
    this.age = age;
  }

  greet() {
    return `Hello, I'm ${this.name}`;
  }

  get isAdult() {
    return this.age >= 18;
  }

  static fromString(str) {
    const [name, age] = str.split(',');
    return new Person(name, parseInt(age));
  }
}

const john = new Person('John', 30);
const jane = Person.fromString('Jane,25');
```

JavaScript Modules

Exporting from modules:

```
// math.js
export const PI = 3.14159;

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

export default function multiply(a, b) {
  return a * b;
}
```

Importing modules:

```
// main.js
import multiply, { PI, add } from './math.js';
import * as MathUtils from './math.js';

console.log(add(2, 3)); // 5
console.log(multiply(4, 5)); // 20
console.log(MathUtils.PI); // 3.14159
```

Introduction to the DOM

What is the DOM?

- **Document Object Model** - Programming interface for HTML documents
- **Tree Structure** - Hierarchical representation of HTML elements
- **Live Representation** - Changes update the page in real-time
- **JavaScript Interface** - How JavaScript interacts with HTML/CSS

DOM Tree Example:

```
document
  └── html
      ├── head
      |   ├── title
      |   └── meta
      └── body
          ├── header
          ├── main
          |   ├── h1
          |   └── p
          └── footer
```

Selecting DOM Elements

Basic Selection Methods:

```
// By ID (returns single element or null)
const header = document.getElementById('main-header');

// By class name (returns HTMLCollection)
const buttons = document.getElementsByClassName('btn');

// By tag name (returns HTMLCollection)
const paragraphs = document.getElementsByTagName('p');

// Modern query selectors (recommended)
const firstButton = document.querySelector('.btn'); // First match
const allButtons = document.querySelectorAll('.btn'); // All matches

// Advanced CSS selectors
const navLinks = document.querySelectorAll('nav a'); // All links in nav
const activeItems = document.querySelectorAll('.item.active'); // Multiple classes
```

Element Relationships:

```
const element = document.querySelector('.content');

// Parent/child relationships
const parent = element.parentElement;
const children = element.children; // HTMLCollection
const childNodes = element.childNodes; // NodeList (includes text nodes)

// Sibling relationships
const nextSibling = element.nextElementSibling;
const prevSibling = element.previousElementSibling;
```

Reading and Modifying Content

Text Content:

```
const heading = document.querySelector('h1');

// Get text content (no HTML tags)
console.log(heading.textContent); // "Welcome to My Site"

// Set text content (escapes HTML)
heading.textContent = 'New Heading Text';

// Get/set inner HTML (includes HTML tags)
console.log(heading.innerHTML); // "Welcome <em>to</em> My Site"
heading.innerHTML = 'New <strong>Bold</strong> Heading';
```

Attributes:

```
const image = document.querySelector('img');

// Get attribute values
const src = image.getAttribute('src');
const alt = image.getAttribute('alt');

// Set attribute values
image.setAttribute('src', 'new-image.jpg');
image.setAttribute('alt', 'New image description');

// Remove attributes
image.removeAttribute('title');

// Common attributes have direct properties
image.src = 'another-image.jpg'; // Same as setAttribute('src', ...)
image.alt = 'Another description';
```

Modifying Styles and Classes

CSS Classes:

```
const element = document.querySelector('.box');

// Check if class exists
if (element.classList.contains('active')) {
  console.log('Element is active');
}

// Add classes
element.classList.add('highlighted');
element.classList.add('large', 'rounded'); // Multiple classes

// Remove classes
element.classList.remove('old-style');

// Toggle classes (add if not present, remove if present)
element.classList.toggle('visible');

// Replace classes
element.classList.replace('old-class', 'new-class');
```

Inline Styles:

```
const box = document.querySelector('.box');

// Set individual style properties
box.style.backgroundColor = 'blue';
box.style.width = '200px';
box.style.display = 'none';

// Set multiple styles at once
box.style.cssText = 'background-color: red; width: 300px; height: 200px;';

// Get computed styles (actual applied styles)
const computedStyle = window.getComputedStyle(box);
console.log(computedStyle.backgroundColor); // Actual background color
```

Creating and Modifying Elements

Creating New Elements:

```
// Create new elements
const newDiv = document.createElement('div');
const newParagraph = document.createElement('p');
const newImage = document.createElement('img');

// Set properties and content
newDiv.textContent = 'This is a new div';
newDiv.className = 'dynamic-content';
newDiv.id = 'generated-div';

newImage.src = 'photo.jpg';
newImage.alt = 'A dynamically created image';

// Create text nodes
const textNode = document.createTextNode('Plain text content');
```

Adding Elements to the DOM:

```
const container = document.querySelector('.container');
const newElement = document.createElement('p');
newElement.textContent = 'New paragraph';

// Append to end
container.appendChild(newElement);

// Insert at specific position
const firstChild = container.firstElementChild;
container.insertBefore(newElement, firstChild);

// Modern insertion methods (IE not supported)
container.prepend(newElement); // Add to beginning
container.append(newElement); // Add to end
element.before(newElement); // Insert before element
element.after(newElement); // Insert after element
```

Removing and Replacing Elements

Removing Elements:

```
const elementToRemove = document.querySelector('.remove-me');

// Modern way (remove itself)
elementToRemove.remove();

// Traditional way (remove from parent)
elementToRemove.parentElement.removeChild(elementToRemove);

// Remove all children
const container = document.querySelector('.container');
container.innerHTML = ''; // Quick but loses event listeners

// Better way to remove all children
while (container.firstChild) {
  container.removeChild(container.firstChild);
}
```

Replacing Elements:

```
const oldElement = document.querySelector('.old');
const newElement = document.createElement('div');
newElement.textContent = 'Replacement content';

// Replace element
oldElement.parentElement.replaceChild(newElement, oldElement);

// Modern way
oldElement.replaceWith(newElement);
```

DOM Manipulation

Modern DOM API:

```
// Selection
const element = document.querySelector('.my-class');
const elements = document.querySelectorAll('.item');

// Modification
element.textContent = 'New text';
element.innerHTML = '<strong>Bold text</strong>';
element.classList.add('active');

// Creation
const newElement = document.createElement('div');
newElement.setAttribute('data-id', '123');
parent.appendChild(newElement);
```

Advanced DOM Techniques

Working with Multiple Elements:

```
// Select all buttons and add event listeners
const buttons = document.querySelectorAll('.btn');
buttons.forEach((button) => {
  button.addEventListener('click', handleClick);
});

// Create elements with attributes
function createCard(title, content) {
  const card = document.createElement('div');
  card.className = 'card';
  card.innerHTML = `
    <h3>${title}</h3>
    <p>${content}</p>
  `;
  return card;
}

// Insert elements at specific positions
const container = document.querySelector('#container');
const newCard = createCard('Title', 'Content');
container.insertBefore(newCard, container.firstChild);
```

DOM Events Deep Dive

Event Object Properties:

```
function handleEvent(event) {
  console.log('Event type:', event.type);
  console.log('Target element:', event.target);
  console.log('Current target:', event.currentTarget);
  console.log('Mouse position:', event.clientX, event.clientY);
  console.log('Key pressed:', event.key);

  // Prevent default behavior
  event.preventDefault();

  // Stop event propagation
  event.stopPropagation();
}
```

Event Handling

Modern Event Handling:

```
// Event listeners
button.addEventListener('click', handleClick);

// Event object
function handleClick(event) {
  event.preventDefault();
  console.log(event.target);
}

// Event delegation
container.addEventListener('click', (event) => {
  if (event.target.matches('.button')) {
    // Handle button click
  }
});
```

Lab 09: Creating an HTML Form

Learning Objectives:

- Create interactive forms with proper validation
- Use semantic form elements and attributes
- Implement accessibility best practices
- Handle form data with JavaScript

Key Concepts:

- Form validation attributes (`required`, `pattern`)
- Label-input relationships
- Form accessibility
- Modern input types

Lab 10: Using CSS Selectors

Learning Objectives:

- Master different types of CSS selectors
- Understand selector specificity
- Apply styles effectively
- Practice advanced selector techniques

Selector Types:

- Element, class, and ID selectors
- Attribute selectors
- Pseudo-classes and pseudo-elements
- Combinator selectors

Lab 11: Positioning with CSS (and Flexbox)

Learning Objectives:

- Master CSS positioning properties
- Use Flexbox for flexible layouts
- Create responsive design patterns
- Build common UI components

Key Concepts:

- Static, relative, absolute, fixed positioning
- Flexbox container and item properties
- Alignment and distribution
- Responsive layout techniques

Module 7: APIs and Asynchronous JavaScript

Working with APIs

Fetch API for HTTP Requests:

```
// GET request
const response = await fetch('/api/users');
const users = await response.json();

// POST request
const response = await fetch('/api/users', {
  method: 'POST',
  headers: {
    'Content-Type': 'application/json',
  },
  body: JSON.stringify(userData),
});
```

Error Handling:

```
try {
  const data = await fetchUserData();
  console.log(data);
} catch (error) {
  console.error('Failed to fetch data:', error);
}
```

Asynchronous JavaScript

Promises and Async/Await:

```
// Promise-based
function fetchData() {
  return fetch('/api/data')
    .then((response) => response.json())
    .then((data) => console.log(data))
    .catch((error) => console.error(error));
}

// Async/await
async function fetchData() {
  try {
    const response = await fetch('/api/data');
    const data = await response.json();
    console.log(data);
  } catch (error) {
    console.error(error);
}
```

Understanding Promises

Promise States:

- **Pending:** Initial state, neither fulfilled nor rejected
- **Fulfilled:** Operation completed successfully
- **Rejected:** Operation failed

```
// Creating a Promise
const fetchData = new Promise((resolve, reject) => {
  setTimeout(() => {
    const success = Math.random() > 0.5;
    if (success) {
      resolve({ data: 'Success!' });
    } else {
      reject(new Error('Failed to fetch'));
    }
  }, 1000);
});

// Using the Promise
fetchData
  .then((result) => console.log(result))
  .catch((error) => console.error(error));
```

Async/Await Best Practices

Error Handling with Async/Await:

```
async function fetchUserData(userId) {
  try {
    const userResponse = await fetch(`/api/users/${userId}`);
    if (!userResponse.ok) {
      throw new Error(`HTTP error! status: ${userResponse.status}`);
    }

    const user = await userResponse.json();

    const postsResponse = await fetch(`/api/users/${userId}/posts`);
    const posts = await postsResponse.json();

    return { user, posts };
  } catch (error) {
    console.error('Failed to fetch user data:', error.message);
    throw error; // Re-throw if needed
  }
}
```

Working with Multiple Promises

Promise.all for Parallel Execution:

```
async function fetchAllData() {
  try {
    const [users, posts, comments] = await Promise.all([
      fetch('/api/users').then((r) => r.json()),
      fetch('/api/posts').then((r) => r.json()),
      fetch('/api/comments').then((r) => r.json()),
    ]);

    return { users, posts, comments };
  } catch (error) {
    console.error('One or more requests failed:', error);
  }
}
```

Promise.allSettled for Handling Mixed Results:

```
const results = await Promise.allSettled([
  fetch('/api/users'),
  fetch('/api/posts'),
  fetch('/api/comments'),
]);

results.forEach((result, index) => {
  if (result.status === 'fulfilled') {
    console.log(`Request ${index} succeeded:`, result.value);
  } else {
    console.log(`Request ${index} failed:`, result.reason);
  }
});
```

REST API Conventions

HTTP Methods and Usage:

Method	Purpose	Example
GET	Retrieve data	`GET /api/users`
POST	Create new resource	`POST /api/users`
PUT	Update entire resource	`PUT /api/users/123`
PATCH	Partial update	`PATCH /api/users/123`
DELETE	Remove resource	`DELETE /api/users/123`

Request/Response Structure:

```
// POST request with JSON data
const response = await fetch('/api/users', {
  method: 'POST',
  headers: {
    'Content-Type': 'application/json',
    Authorization: 'Bearer token123',
  },
  body: JSON.stringify({
    name: 'John Doe',
    email: 'john@example.com',
  }),
});
```

Lab 12: Variables, Arrays, and Constants in JavaScript

Learning Objectives:

- Use modern variable declarations (`const` , `let`)
- Work with arrays and array methods
- Understand scope and hoisting
- Practice data manipulation techniques

Key Concepts:

- Variable declarations and scope
- Array creation and manipulation
- Const vs let vs var
- Modern JavaScript syntax

Lab 13: Using Chrome DevTools – JavaScript Console

Learning Objectives:

- Master the JavaScript Console in Chrome DevTools
- Debug JavaScript code effectively
- Test JavaScript expressions interactively
- Analyze runtime errors and warnings

Console Methods Reference

Method	Purpose	Output	Example
`console.log()`	General output	Normal text	`console.log('Hello World')`
`console.error()`	Error messages	Red text with stack trace	`console.error('Something went wrong')`
`console.warn()`	Warning messages	Yellow text with icon	`console.warn('Deprecated feature')`
`console.info()`	Information	Blue text with icon	`console.info('Server connected')`
`console.table()`	Tabular data	Formatted table	`console.table([{name: 'John', age: 30}])`
`console.dir()`	Object structure	Expandable object tree	`console.dir(document.body)`
`console.group()`	Group messages	Collapsible group	`console.group('User Data')`
`console.groupEnd()`	End group	Closes group	`console.groupEnd()`
`console.time()`	Start timer	Performance timing	`console.time('API Call')`
`console.timeEnd()`	End timer	Shows elapsed time	`console.timeEnd('API Call')`
`console.trace()`	Stack trace	Function call stack	`console.trace('Debug point')`
`console.clear()`	Clear console	Clears all output	`console.clear()`

Console Examples:

```
// Basic logging
console.log('Application started');
console.error('Network connection failed');
console.warn('Feature will be deprecated');

// Data visualization
const userData = [
  { name: 'John', age: 30, role: 'Developer' },
  { name: 'Jane', age: 25, role: 'Designer' },
];
console.table(userData);

// Performance timing
console.time('Data Processing');
// ... some code ...
console.timeEnd('Data Processing');

// Grouped output
console.group('User Authentication');
console.log('Checking credentials...');
console.log('User authenticated successfully');
console.groupEnd();
```

Module 8: Modern Frameworks and Deployment

Introduction to Modern Frameworks

Why Use Frameworks?

- Component-based architecture
- State management
- Virtual DOM for performance
- Rich ecosystem and tooling

Popular Options:

- **React** - Component-based library
- **Vue** - Progressive framework
- **Angular** - Full-featured framework
- **Svelte** - Compile-time optimization

Key Concepts:

- Components and props
- State and lifecycle
- Event handling
- Routing and navigation

Introduction to React

What is React?

- **Library, not framework:** Focused on UI rendering
- **Component-based:** Build encapsulated components
- **Declarative:** Describe what UI should look like
- **Virtual DOM:** Efficient updates and rendering

React Component Example:

```
function Welcome({ name }) {
  return <h1>Hello, {name}!</h1>;
}

function App() {
  return (
    <div>
      <Welcome name="John" />
      <Welcome name="Jane" />
    </div>
  );
}
```

JSX and Component Composition

JSX Syntax Rules:

```
function UserCard({ user }) {
  const isOnline = user.status === 'online';

  return (
    <div className="user-card">
      <img src={user.avatar} alt={`${user.name}'s avatar`} />
      <h3>{user.name}</h3>
      <span className={isOnline ? 'online' : 'offline'}>
        {isOnline ? 'Online' : 'Offline'}
      </span>
      {user.isAdmin && <span className="admin-badge">Admin</span>}
    </div>
  );
}
```

Key JSX Rules:

- Use `className` instead of `class`
- Self-closing tags must end with `/>`
- JavaScript expressions in curly braces `{}`
- Must return single root element (or Fragment)

React Hooks

useState for State Management:

```
import { useState } from 'react';

function Counter() {
  const [count, setCount] = useState(0);

  return (
    <div>
      <p>Count: {count}</p>
      <button onClick={() => setCount(count + 1)}>Increment</button>
      <button onClick={() => setCount(count - 1)}>Decrement</button>
    </div>
  );
}
```

useEffect for Side Effects:

```
import { useState, useEffect } from 'react';

function UserProfile({ userId }) {
  const [user, setUser] = useState(null);

  useEffect(() => {
    fetch(`/api/users/${userId}`)
      .then((response) => response.json())
      .then(setUser);
  }, [userId]); // Dependency array

  if (!user) return <div>Loading...</div>;

  return <div>Welcome, {user.name}!</div>;
}
```

Component Communication

Props Flow (Parent to Child):

```
function Parent() {
  const handleChildClick = (message) => {
    alert(`Child says: ${message}`);
  };

  return <Child name="John" onButtonClick={handleChildClick} />;
}

function Child({ name, onButtonClick }) {
  return (
    <div>
      <h3>Hello, {name}!</h3>
      <button onClick={() => onButtonClick('Hello from child!')}>
        Click me
      </button>
    </div>
  );
}
```

Build Tools and Development Workflow

Modern Build Pipeline:

Vite - Next-generation build tool

- Lightning-fast development server
- Hot Module Replacement (HMR)
- Optimized production builds

Package Management:

- npm/yarn for dependency management
- package.json for project configuration
- Semantic versioning

Code Quality:

- ESLint for code linting
- Prettier for code formatting
- Git hooks for automated checks

Modern Development Workflow

Development Process:

1. **Planning:** Requirements and design
2. **Setup:** Initialize project with build tools
3. **Development:** Write code with hot reloading
4. **Testing:** Automated tests and manual QA
5. **Building:** Optimize for production
6. **Deployment:** Deploy to hosting platform
7. **Monitoring:** Track performance and errors

Continuous Integration/Deployment:

- Automated testing on code changes
- Automated builds and deployments
- Code quality checks and reviews
- Performance monitoring and alerts

Performance Optimization

Code Splitting:

```
// Dynamic imports for code splitting
const LazyComponent = lazy(() => import('./LazyComponent'));

function App() {
  return (
    <Suspense fallback={<div>Loading...</div>}>
      <LazyComponent />
    </Suspense>
  );
}
```

Bundle Analysis:

- Use tools like webpack-bundle-analyzer
- Identify large dependencies
- Remove unused code (tree shaking)
- Optimize images and assets

Performance Metrics:

- First Contentful Paint (FCP)
- Largest Contentful Paint (LCP)
- Cumulative Layout Shift (CLS)
- First Input Delay (FID)

Lab 14: Using JavaScript Methods

Learning Objectives:

- Work with JavaScript functions and methods
- Understand method syntax and this binding
- Practice built-in methods for strings and arrays
- Create custom methods for objects

Method Types:

- String methods (slice, substring, indexOf)
- Array methods (push, pop, shift, unshift)
- Object methods and this context
- Function expressions and arrow functions

Lab 15: Using JavaScript Objects

Learning Objectives:

- Create and manipulate JavaScript objects
- Understand object properties and methods
- Work with object constructors and prototypes
- Practice object-oriented programming concepts

Object Concepts:

- Object literal syntax
- Property access and modification
- Object methods and this binding
- Constructor functions and prototypes

Testing and Debugging

Testing Strategies:

- Unit testing with Jest
- Component testing with React Testing Library
- End-to-end testing with Cypress
- Manual testing and debugging

Debugging Tools:

- Browser DevTools
- React Developer Tools
- VS Code debugging
- Console logging strategies

Best Practices:

- Test-driven development
- Continuous integration
- Code coverage metrics

Lab 16: Performing DOM Manipulation

Learning Objectives:

- Select and modify DOM elements
- Create dynamic content with JavaScript
- Handle user interactions and events
- Build interactive web pages

DOM Techniques:

- Query selectors and element selection
- Content and attribute manipulation
- Dynamic element creation
- Event handling and delegation

Deployment and Performance

Deployment Options:

- **Static Hosting:** Netlify, Vercel, GitHub Pages
- **Cloud Platforms:** AWS, Google Cloud, Azure
- **CDN Integration:** Fast global delivery

Performance Optimization:

- Code splitting and lazy loading
- Image optimization
- Caching strategies
- Bundle size optimization

Monitoring:

- Performance metrics
- Error tracking
- User analytics

Lab 17: Building a Movie Review Webpage with jQuery

Learning Objectives:

- Introduction to jQuery library
- Build interactive web interfaces
- Practice DOM manipulation with jQuery
- Create a complete movie review application

jQuery Features:

- Simplified DOM selection and manipulation
- Event handling with jQuery
- AJAX requests for dynamic content
- Building interactive user interfaces

Course Summary and Next Steps

What You've Accomplished:

✅ Modern HTML5 and semantic markup

✅ Advanced CSS with Grid and Flexbox

✅ JavaScript ES6+ and modern patterns

✅ DOM manipulation and event handling

✅ API integration and async programming

✅ React fundamentals and component architecture

✅ Testing, debugging, and deployment

Next Steps:

- Build personal projects
- Contribute to open source
- Explore advanced frameworks
- Learn backend development
- Stay updated with web standards

Resources for Continued Learning:

- MDN Web Docs, JavaScript.info
- React Documentation
- Frontend Masters, freeCodeCamp
- GitHub projects and communities

Final Project Overview

Capstone Project: Personal Portfolio Website

Requirements:

- Responsive design with modern CSS
- Interactive features with JavaScript
- API integration for dynamic content
- React components for complex UI
- Professional deployment

Features to Implement:

- About section with personal information
- Portfolio showcase with project details
- Contact form with validation
- Blog or news section (API-driven)
- Dark/light theme toggle
- Mobile-responsive navigation

Assessment Criteria:

- Code quality and organization
- User experience and design
- Technical implementation
- Performance and accessibility

Web Accessibility (a11y)

Core Principles:

- **Perceivable:** Information presented in ways users can perceive
- **Operable:** Interface components must be operable
- **Understandable:** Information and UI operation must be understandable
- **Robust:** Content must be robust enough for various assistive technologies

Implementation:

```
<!-- Semantic HTML -->
<button aria-label="Close dialog" onclick="closeDialog()">x</button>

<!-- Alt text for images -->
<img src="chart.png" alt="Sales increased 25% from Q1 to Q2" />

<!-- Form labels -->
<label for="email">Email Address</label>
<input type="email" id="email" required />

<!-- Skip navigation -->
<a href="#main-content" class="skip-link">Skip to main content</a>
```

Security Best Practices

Frontend Security Concerns:

- **XSS (Cross-Site Scripting):** Sanitize user input
- **CSRF (Cross-Site Request Forgery):** Use CSRF tokens
- **Content Security Policy:** Restrict resource loading
- **HTTPS:** Always use secure connections
- **Input Validation:** Validate on both client and server

Example CSP Header:

```
<meta
  http-equiv="Content-Security-Policy"
  content="default-src 'self';
               script-src 'self' 'unsafe-inline';
               style-src 'self' 'unsafe-inline';"
/>
```

Industry Trends and Future

Current Trends:

- **Progressive Web Apps (PWAs):** App-like web experiences
- **JAMstack:** JavaScript, APIs, and Markup
- **Micro-frontends:** Composable frontend architectures
- **WebAssembly:** Near-native performance in browsers
- **AI/ML Integration:** AI-powered user experiences

Emerging Technologies:

- **Web Components:** Reusable custom elements
- **Server Components:** Server-side rendering with React
- **Edge Computing:** Faster response times globally
- **Web3/Blockchain:** Decentralized applications
- **AR/VR on the Web:** Immersive experiences

Building Your Portfolio

Essential Portfolio Elements:

- **About Section:** Your story and skills
- **Projects Showcase:** 3-5 quality projects
- **Code Examples:** GitHub repositories
- **Contact Information:** Easy ways to reach you
- **Responsive Design:** Works on all devices

Project Ideas:

- **Personal Website:** Showcase your skills
- **Todo App:** Demonstrate CRUD operations
- **Weather App:** API integration practice
- **E-commerce Site:** Complex state management
- **Blog Platform:** Full-stack application

Career Development

Building Your Skills:

- **Practice Regularly:** Code every day
- **Build Projects:** Create real applications
- **Contribute to Open Source:** GitHub contributions
- **Network:** Attend meetups and conferences
- **Stay Updated:** Follow industry blogs and podcasts

Job Search Tips:

- **Tailor Your Resume:** Match job requirements
- **Prepare for Interviews:** Practice coding challenges
- **Build Your Network:** LinkedIn and community involvement
- **Show Your Work:** Live demos and deployed projects
- **Continuous Learning:** Keep skills current