# Class 5: Building Add to Cart Feature & API Integration

## SESSION OVERVIEW:

By the end of this session, students will be able to:

- Understand the layout and structural requirements for developing a Cart Page, focusing on user-friendly design and smooth interaction.
- Implement JavaScript DOM Manipulation to build the functionality for adding food items to the cart, with real-time updates and efficient user interaction.
- Use Local Storage to store and manage cart items, ensuring data persists across page reloads.
- Apply basic asynchronous JavaScript techniques such as Promises and async/await to handle operations that require waiting for external actions (e.g., API calls) and managing asynchronous operations smoothly.
- Recognize the significance of a well-structured Cart Page in improving user experience, allowing users to easily add, remove, and view items in their cart before proceeding to checkout.

**SESSION TOPICS: Building Add to Cart Feature & API Integration**

1. **Understanding Cart Page Layout:**
    - **Cart Page Structure:**
        - Recognize the importance of structuring the cart page to ensure a smooth and efficient user experience.
        - Include essential elements like item names, prices, quantities, total cost, and buttons for updating or removing items.
    - **Adding Items to the Cart:**
        - **JavaScript DOM Manipulation:**
            - Learn how to dynamically add items to the cart using JavaScript and DOM methods.
            - Ensure the cart updates in real-time when items are added or removed.
2. **Storing Cart Data Locally:**
    - **Local Storage for Persistence:**
        - Implement Local Storage to save cart items, ensuring that the cart data persists even when the page is reloaded.
        - Learn how to retrieve, update, and manage cart data using Local Storage
3. **Handling Asynchronous Operations:**

- **Basic Asynchronous JavaScript Techniques:**
  - Apply Promises and `async/await` to handle API calls, ensuring data fetching and cart functionality are seamless.
  - Learn error handling to manage potential issues like network failures or missing data during API requests.

4. **Enhancing User Experience:**
   - **Interactive Features and Feedback:**
     - Add real-time feedback for cart updates, such as notifications or alerts when items are added or removed.
     - Ensure the cart page and layout reflect updates dynamically, creating an intuitive user experience.
5. **Ensuring Responsiveness and Accessibility:**
   - **Responsive Design Techniques:**
     - Use CSS Flexbox and Grid to ensure the cart page layout adapts to different screen sizes and devices (desktops, tablets, mobile).
     - Apply media queries to adjust the cart's layout and text size for optimal viewing across various devices.

## Layout of the Cart page:

Let's break down the implementation of a restaurant menu app cart page into the specified subtopics:  basic Layout of the cart page: Navbar, cart Section, and Footer.

# 1.HTML Basics:

First, let's create the basic HTML structure for our Menu page. HTML structure that defines the overall layout of the cart page.

**HTML Code**

```
    <section class="cart-section">
        <h2>Your Cart</h2>
        <div id="cart-container"></div>
        <div id="empty-message" style="display:none;">
            <p>Your cart is empty. Explore our <a href="ourmenu.html">menu</a> to
add items.</p>
        </div>
        <div id="cart-total">
            <p>Total: $<span id="total-price">0</span></p>
            <button onclick="openModal()" id="checkout-btn">Proceed to
Checkout</button>
```

```
        </div>
    </section>
```

**CSS style**:

```
/* Cart Section Styles */
.cart-section {
    max-width: 1200px;
    margin: 30px auto;
    padding: 20px;
    background-color: white;
    border-radius: 8px;
    box-shadow: 0 4px 8px rgba(0, 0, 0, 0.1);
}

.cart-section h2 {
    text-align: center;
    font-size: 2rem;
    margin-bottom: 20px;
}

#cart-container {
    margin-bottom: 20px;
}

#empty-message {
    text-align: center;
    font-size: 1.2rem;
    color: #888;
}

#cart-total {
    text-align: right;
    font-size: 1.5rem;
}

#cart-total button {
    background-color: #4CAF50;
    color: white;
```

```
    padding: 10px 20px;
    border: none;
    border-radius: 5px;
    cursor: pointer;
}

#cart-total button:hover {
    background-color: #45a049;
}
```

### Explanation of the Cart Section Components

- **`.cart-section`**:
  A styled container for the cart, using a **white background**, **rounded corners**, and a **shadow** to give it a polished appearance.
- **`#cart-container`**:
  Acts as a dynamic holder for cart items. JavaScript populates this container with items added by the user, arranging them neatly.
- **`#empty-message`**:
  Displayed when the cart is empty, this message is styled centrally with subdued colors to inform users about their cart status.
- **`#cart-total`**:
  A section that summarizes the total cart price. Positioned to the right for better visibility, it includes a prominent button for the **checkout process**.
- **`#checkout-btn`**:
  A styled button encouraging users to proceed with their purchase. It features hover effects for interactivity, improving the user experience.

## Dynamic Rendering Menu item:

Let's create a Dynamic Menu item to be rendered by Fetch API:
Remove  all the static code of the menu item

**Updated HTML Structure  Menu page:**

```
 <section>
<div class="ourmenu-category" id="search-items">

                <div class="ourmenu-items">
```

codingninjas

```
            </div>
        </div>

<!-- best seller -->
        <div class="ourmenu-category" id="best-seller">
            <div class="ourmenu-category-header">
              <h3>Best Seller</h3>
            </div>
            <div class="ourmenu-items">
           </div>
        </div>
    <!-- Trending -->
    <div class="ourmenu-category" id="trending">
        <div class="ourmenu-category-header">
            <h3>Trending</h3>
        </div>
        <div class="ourmenu-items">
            </div>
    </div>

      <!-- starter -->
      <div class="ourmenu-category" id="starter">
          <div class="ourmenu-category-header">
              <h3>Starter</h3>
          </div>
          <div class="ourmenu-items">
              <div class="ourmenu-card">
               </div>
      </div>

      <!-- Beverages -->
      <div class="ourmenu-category" id="beverages">
          <div class="ourmenu-category-header">
              <h3>Beverages</h3>
          </div>
          <div class="ourmenu-items">
             </div>
      </div>
```

```
<!-- Main Course -->
<div class="ourmenu-category" id="main-course">
    <div class="ourmenu-category-header">
        <h3>Main Course</h3>
    </div>
    <div class="ourmenu-items">

    </div>
</div>

<!-- combo -->
<section class="combo-comparison" id = "combos">
    <div class="container">
        <h2>Combo </h2>
        <table class="comparison-table">
            <thead>
                <tr>
                    <th rowspan="2">Combo Size</th>
                    <th rowspan="2">Items</th>
                    <th colspan="2">Price</th>
                    <th rowspan="2">Add to Cart</th>
                </tr>
                <tr>
                    <th>Original</th>
                    <th>Discounted</th>
                </tr>
            </thead>
            <tbody>
                <!-- Small Combo -->

                <tr>
                    <td>Small</td>
                    <td>
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+1" alt="Item 1" /> -->
                            <p>Item Name 1</p>
                        </div>
```

```
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+2" alt="Item 2" /> -->
                            <p>Item Name 2</p>
                        </div>
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+3" alt="Item 3" /> -->
                            <p>Item Name 3</p>
                        </div>
                    </td>
                    <td><strike>$30</strike></td>
                    <td>$25</td>
                    <td><button class="cta-btn">Add to Cart</button></td>
                </tr>

                <!-- Medium Combo -->
                <tr>
                    <td>Medium</td>
                    <td>
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+1" alt="Item 1" /> -->
                            <p>Item Name 1</p>
                        </div>
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+2" alt="Item 2" /> -->
                            <p>Item Name 2</p>
                        </div>
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+3" alt="Item 3" /> -->
                            <p>Item Name 3</p>
                        </div>
                    </td>
                    <td><strike>$40</strike></td>
                    <td>$35</td>
                    <td><button class="cta-btn">Add to Cart</button></td>
```

```
                </tr>

                <!-- Large Combo -->
                <tr>
                    <td>Large</td>
                    <td>
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+1" alt="Item 1" /> -->
                            <p>Item Name 1</p>
                        </div>
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+2" alt="Item 2" /> -->
                            <p>Item Name 2</p>
                        </div>
                        <div class="item">
                            <!-- <img
src="https://placehold.co/200x100?text=item+3" alt="Item 3" /> -->
                            <p>Item Name 3</p>
                        </div>
                    </td>
                    <td><strike>$50</strike></td>
                    <td>$45</td>
                    <td><button class="cta-btn">Add to Cart</button></td>
                </tr>
            </tbody>
        </table>
    </div>
</section>

    </section>
```

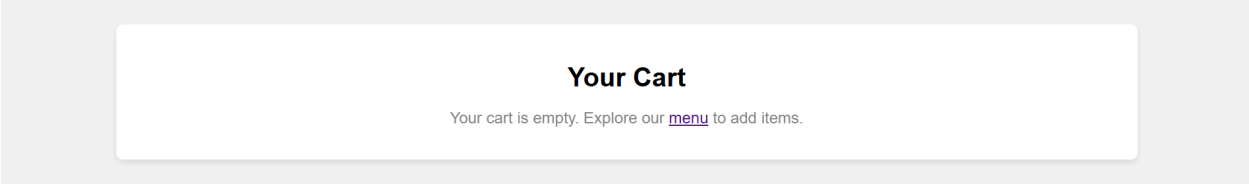
Javascript Code:

```
      let foodItems =[]
async function fetchFoodItems() {
    try {
        // Fetch the data from 'fooditem.json' (make sure this file exists)
```

```
        const response = await
fetch('https://mocki.io/v1/3073be3b-e808-47c0-9165-ec51182104d7');

        // If the fetch fails, show an error
        if (!response.ok) {
            throw new Error('Network response was not ok');
        }

        // Parse the JSON data and pass it to the next function
         foodItems = await response.json();
        populateMenu(foodItems); // This function will display the food items
    } catch (error) {
        // If there's an error with the fetch, log it to the console
        console.error('There has been a problem with your fetch operation:',
error);
    }
}
function createMenuItem(item) {
        return `
            <div class="ourmenu-card" >
                <img src="${item.imageurl}" alt="${item.title}"
onclick="redirecttoproductdetails(${item.id})">
                <div class="menu-card-content" >
                    <h4>${item.title}</h4>
                    <p>${item.description}</p>
                    <span>Price: <strike
class="strike-price">$${item.actual_price.toFixed(2)}</strike>
$${item.selling_price.toFixed(2)}</span>
                </div>
                <div class="add-to-cart-btn">
                    <button class="cta-button" onclick="addToCart(${item.id},
'${item.title}', ${item.selling_price} , '${item.imageurl}')">Add to
Cart</button>
                </div>
            </div>
        `;
    }

// This function will organize and display the food items
```

```
function populateMenu(foodItems) {
    // An object to store categories of food items
    const categories = {
        'best-seller': [],
        'trending': [],
        'starter': [],
        'beverages': [],
        'main-course': []
    };

    // Go through each food item
    foodItems.forEach(item => {
        // Add the item to 'best-seller' or 'trending' if applicable
        if (item.best_seller === "yes") {
            categories['best-seller'].push(item);
        }
        if (item.trending === "yes") {
            categories['trending'].push(item);
        }

        // Add the item to its category (starter, beverages, etc.)
        categories[item.category.toLowerCase().replace(" ", "-")].push(item);
    });


    // Now populate each category on the webpage
    // For each category (best-seller, trending, etc.), create HTML for its items
    for (const category in categories) {
        const categoryContainer = document.getElementById(category);
        if (categoryContainer) {
            const itemsHTML = categories[category].map(createMenuItem).join('');
            categoryContainer.querySelector('.ourmenu-items').innerHTML =
itemsHTML;
        }
    }
}
```

**Output:**




**Explanation:**

**Global Variable**

- `foodItems = []`: Holds the fetched food item data.

**`fetchFoodItems` Function**

- **Purpose:** Fetches data from a JSON file or API and triggers menu rendering.
- **Steps:**
  1. Fetches data using `fetch`.
  2. Checks response status; throws an error if unsuccessful.
  3. Parses JSON and assigns it to `foodItems`.
  4. Calls `populateMenu(foodItems)` to render items.
- **Error Handling:** Logs errors if fetching fails.

**`createMenuItem` Function**

- **Purpose:** Generates HTML for individual food items.
- **Components:**
  - **Image:** Triggers `redirecttoproductdetails(item.id)` on click.
  - **Details:** Displays title, description, and prices.
  - **Button:** Calls `addToCart` with item details on click.

**`populateMenu` Function**

- **Purpose:** Groups food items by category and renders them.
- **Steps:**
  1. Categorizes items (`best-seller`, `trending`, etc.).
  2. Finds HTML containers for each category.
  3. Generates and inserts item HTML using `createMenuItem`.

**Categories Object**

- Groups items as:
  - **Best Seller:** For `best_seller: "yes"`.
  - **Trending:** For `trending: "yes"`.
  - **Other Categories:** Based on the `category` field (e.g., `starter`, `beverages`).

Cart Functionality:

Let's implement the basic JavaScript functionality for our **Add to Cart feature**. This involves writing code to handle adding items to the cart, dynamically updating the cart's contents, calculating the total price, and managing user interactions like removing items or adjusting quantities.

Add to cart Button functionality:
Html code:

```
 <div class="add-to-cart-btn">
                    <button class="cta-button" onclick="addToCart(${item.id},
'${item.title}', ${item.selling_price} , '${item.imageurl}')">Add to
Cart</button>
  </div>
```

Javascript Code:

```
function addToCart(itemId, title, price,imageurl) {
    let cart = JSON.parse(localStorage.getItem('cart')) || [];

    // Check if the item already exists in the cart
    const itemIndex = cart.findIndex(item => item.id === itemId);

    if (itemIndex > -1) {
        // If item exists, update the quantity
        cart[itemIndex].quantity += 1;
    } else {
        // If item doesn't exist, add new item to the cart
        cart.push({ id: itemId, title: title, price: price, quantity: 1
,imageurl:imageurl });
    }

    // Save the updated cart back to localStorage
    localStorage.setItem('cart', JSON.stringify(cart));

    // Display success message
    showSuccessMessage(`${title} has been added to your cart!`);
```

```
}

// Function to display success message
function showSuccessMessage(message) {
    const messageDiv = document.createElement('div');
    messageDiv.classList.add('success-message');
    messageDiv.textContent = message;
    document.body.appendChild(messageDiv);

    // Remove the message after 3 seconds
    setTimeout(() => {
        messageDiv.remove();
    }, 3000);
}
```

Explanation:

**`addToCart` Function**:

- Adds items to the cart stored in `localStorage`.
- Updates quantity if the item exists; adds it as new if not.
- Saves the updated cart and shows a success message.

**`showSuccessMessage` Function**:

- Creates and displays a success message.
- Removes it after 3 seconds.

dynamically updating the cart's contents:

```
function updateTotalPrice() {
            const cart = JSON.parse(localStorage.getItem('cart')) || [];
            const totalPriceElement = document.getElementById('total-price');
            const total = cart.reduce((acc, item) => acc + (item.price *
item.quantity), 0);
            totalPriceElement.textContent = total.toFixed(2);
        }

        function addItemToCart(itemId, title, price) {
```

```
            let cart = JSON.parse(localStorage.getItem('cart')) || [];
            const itemIndex = cart.findIndex(item => item.id === itemId);

            if (itemIndex > -1) {
                cart[itemIndex].quantity += 1;
            } else {
                cart.push({ id: itemId, title: title, price: price, quantity: 1
});
            }

            localStorage.setItem('cart', JSON.stringify(cart));
            updateTotalPrice();
            renderCart();
        }

        function incrementQuantity(itemId) {
            let cart = JSON.parse(localStorage.getItem('cart')) || [];
            const itemIndex = cart.findIndex(item => item.id === itemId);

            if (itemIndex > -1) {
                cart[itemIndex].quantity += 1;
                localStorage.setItem('cart', JSON.stringify(cart));
                updateTotalPrice();
                renderCart();
            }
        }

        function decrementQuantity(itemId) {
            let cart = JSON.parse(localStorage.getItem('cart')) || [];
            const itemIndex = cart.findIndex(item => item.id === itemId);

            if (itemIndex > -1) {
                if (cart[itemIndex].quantity > 1) {
                    cart[itemIndex].quantity -= 1;
                } else {
                    cart.splice(itemIndex, 1);
                }
                localStorage.setItem('cart', JSON.stringify(cart));
                updateTotalPrice();
```

```
                renderCart();
            }
        }

        function removeFromCart(itemId) {
    let cart = JSON.parse(localStorage.getItem('cart')) || [];
    cart = cart.filter(item => item.id !== itemId);
    localStorage.setItem('cart', JSON.stringify(cart));

    updateTotalPrice(); // Update total after modifying the cart
    renderCart(); // Re-render to update the UI properly
}

        function renderCart() {
    const cart = JSON.parse(localStorage.getItem('cart')) || [];
    const cartContainer = document.getElementById('cart-container');
    const emptyMessage = document.getElementById('empty-message');
    const cartTotal = document.getElementById('cart-total');

    // Clear existing content in the cart container
    cartContainer.innerHTML = '';

    if (cart.length === 0) {
        emptyMessage.style.display = 'block';
        cartTotal.style.display = 'none';
    } else {
        emptyMessage.style.display = 'none';
        cartTotal.style.display = 'block';

        cartContainer.innerHTML = cart.map(item => `
            <div class="cart-item">
                <div class="cart-item-details-left">
                    <img src="${item.imageurl}" alt="${item.title}" />
                    <div class="cart-item-details">
                        <h4>${item.title}</h4>
                        <p>Price: $${item.price.toFixed(2)}</p>
                        <p>Total: $${(item.price * item.quantity).toFixed(2)}</p>
                    </div>
                </div>
```

```
                <div class="controls-container">
                    <div class="quantity-controls">
                        Quantity:
                        <button
onclick="decrementQuantity(${item.id})">-</button>
                        <span>${item.quantity}</span>
                        <button
onclick="incrementQuantity(${item.id})">+</button>
                    </div>
                    <button class="remove-button"
onclick="removeFromCart(${item.id})">Remove</button>
                </div>
            </div>
        `).join('');
    }
}
 document.addEventListener('DOMContentLoaded', function() {
            updateTotalPrice();
            renderCart();
        });
```

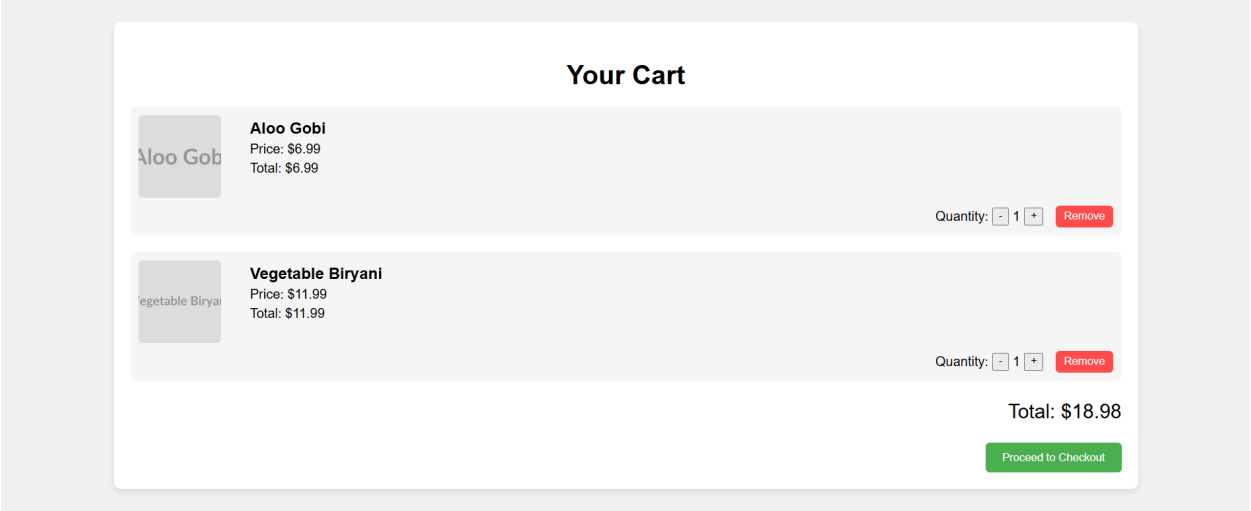
Css style:

```
/* Cart Item Styles */
.cart-item {
    display: flex;
    justify-content: space-between;
    /* align-items: center; */
    margin-bottom: 20px;
    padding: 10px;

    flex-direction: column;
    background-color: #f9f9f9;
    border-radius: 8px;
}

.cart-item img {
    width: 100px;
    height: 100px;
```

```
    object-fit: cover;
    border-radius: 5px;
    margin-right: 15px;
}

.cart-item-details {
    flex-grow: 1;
}
.cart-item-details-left{

    display: flex;
    gap: 20px;
}

.cart-item-details h4 {
    font-size: 1.2rem;
    margin: 5px 0;
}

.cart-item-details p {
    margin: 5px 0;
}
.controls-container {
    display: flex; /* Use flexbox layout */
    justify-content: flex-end; /* Align items to the end */
    align-items: center; /* Center items vertically */
    margin-top: 10px; /* Add some space above */
}

.quantity-controls {
    display: flex; /* Use flexbox for quantity controls */
    align-items: center; /* Center items vertically */
}

.quantity-controls button {
    margin: 0 5px; /* Add space between buttons */
}

.remove-button {
```

```
    margin-left: 10px; /* Add space between quantity controls and remove button
*/
    background-color: #ff4d4d; /* Red color for remove button */
    color: white;
    border: none;
    padding: 5px 10px;
    cursor: pointer;
    border-radius: 5px;
}

.remove-button:hover {
    background-color: #ff1a1a; /* Darker red on hover */
}
```

Output:




Explanation:

1. **`updateTotalPrice()`**
    - Calculates and updates the total cart price by summing up `(price × quantity)` of all items in the cart.
2. **`addItemToCart()`**
    - Adds an item to the cart or increments its quantity if it already exists.
    - Saves the cart to `localStorage` and updates the UI.
3. **`incrementQuantity()`**
    - Increases the quantity of a specific item in the cart.
    - Updates the cart in `localStorage` and refreshes the total price and UI.
4. **`decrementQuantity()`**

    - Decreases the quantity of a specific item. Removes the item if its quantity becomes zero.
    - Updates the cart in `localStorage` and refreshes the total price and UI.
5. **`removeFromCart()`**
    - Removes an item from the cart by filtering it out.
    - Updates the cart in `localStorage` and refreshes the total price and UI.
6. **`renderCart()`**
    - Dynamically generates HTML to display cart items.
    - Handles empty cart scenarios by showing or hiding appropriate messages/UI elements.

- **On Page Load (`DOMContentLoaded`):**
  Calls `updateTotalPrice()` and `renderCart()` to display the cart and total price correctly.

**Final output**:
Ourmenu.html
Cart.html
cartstyle.css

---

## Concept Indepths:

# Asynchronous Javascript

**Asynchronous JavaScript** is a crucial concept in modern web development, allowing developers to write code that does not block the execution of other code, ensuring a smooth and efficient user experience. In synchronous programming, one task must finish before another starts, but asynchronous programming allows tasks to run independently, so one task can start before the previous one finishes.

**1. What is Asynchronous JavaScript?**

In simple terms, **asynchronous JavaScript** means that certain operations (such as API requests or timers) can run in the background, allowing other parts of your code to continue executing while waiting for these tasks to complete. This is particularly important for handling things like network requests, reading files, or processing data that takes time.

- **Synchronous JavaScript**: Each line of code is executed one after the other, blocking the subsequent operations until the current one is finished.

- **Asynchronous JavaScript**: Code is executed independently of other code, allowing for non-blocking behavior.

**Example:**

- **Synchronous**: If you request data from a server, the whole application stops until the response is received.
- **Asynchronous**: The request is sent in the background, and the application can still run and respond to the user while waiting for the server's response.

---

### 2. Why is Asynchronous JavaScript Important?

Asynchronous operations are essential for tasks like:

- **API Calls**: Fetching data from external sources without freezing the UI.
- **Event Handling**: User input, clicks, etc., are processed without blocking the execution of other code.
- **Timers**: Running tasks after a certain period (e.g., `setTimeout`, `setInterval`) without blocking the main program.

---

### 3. Core Concepts and Tools in Asynchronous JavaScript

#### a. Callback Functions

A **callback function** is a function passed into another function as an argument to be executed later once a task is completed. This was the primary way of handling asynchronous behavior in JavaScript before the introduction of Promises and async/await.

**Example:**

```
function fetchData(callback) {
    setTimeout(() => {
        const data = { name: "John", age: 30 };
        callback(data);  // callback is executed after 2 seconds
    }, 2000);
}

fetchData(function(data) {
    console.log(data);  // { name: "John", age: 30 }
});
```

- **Downsides of Callbacks**: Callback Hell – When callbacks are nested inside each other, it can lead to complex and hard-to-maintain code.

---

**b. Promises**

A **Promise** represents a value that may be available now, or in the future, or never. It is an object that allows you to attach **callbacks** for handling success (`.then()`) or failure (`.catch()`).

A Promise has three states:

- **Pending**: The operation is not yet completed.
- **Resolved (Fulfilled)**: The operation completed successfully.
- **Rejected**: The operation failed.

**Example:**

```
let myPromise = new Promise((resolve, reject) => {
    let success = true;
    if(success) {
        resolve("Data fetched successfully!");
    } else {
        reject("Error in fetching data");
    }
});

myPromise
    .then(result => console.log(result))  // "Data fetched successfully!"
    .catch(error => console.log(error));  // "Error in fetching data"
```

- **Advantages**: Better error handling and code readability compared to callbacks.

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**c. Async/Await**

**async/await** is a more modern and cleaner way to handle asynchronous operations. It allows you to write asynchronous code that looks and behaves like synchronous code, making it more readable and easier to maintain.

- **`async`**: Declares a function that returns a Promise. Inside an async function, you can use the `await` keyword.
- **`await`**: Pauses the execution of the async function until the Promise resolves.

**Example:**

```
async function fetchData() {
    try {
        let response = await fetch('https://jsonplaceholder.typicode.com/posts');
        let data = await response.json();
        console.log(data);  // Handle the fetched data
    } catch (error) {
        console.log("Error:", error);
    }
}
```

- **Advantages**: Makes asynchronous code easier to read and write by eliminating `.then()` and `.catch()` chaining.

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**4. Handling Asynchronous Operations**

- **Error Handling in Async/Await**: With async/await, you can handle errors using `try...catch` blocks, which are similar to synchronous code.
- **Chaining Promises**: Promises can be chained using `.then()` to handle multiple asynchronous tasks in sequence.

```
fetchData()
    .then(response => processData(response))
    .then(processedData => displayData(processedData))
    .catch(error => console.log("Error:", error));
```

```
Promise.all(): Executes multiple promises concurrently, waiting for all of them
to resolve or any one to reject.
javascript
Copy code
Promise.all([fetchData(), fetchData()])
    .then(results => console.log(results))
    .catch(error => console.log(error));
```

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**5. Industry Standards and Trends in Asynchronous JavaScript**

- **Error Handling**: With the rise of async/await, error handling has become more intuitive. In the industry, developers now use `try...catch` blocks extensively for managing errors in asynchronous code.
- **Concurrent Operations**: In modern applications, **Promise.all()** and **async/await** are widely used to handle multiple asynchronous operations concurrently, such as API requests for different data sets.
- **Service Workers**: In progressive web apps (PWAs), **Service Workers** are used for background tasks (e.g., caching, push notifications) without interrupting the user experience. These also rely heavily on asynchronous operations.
- **Web APIs and Fetch**: The **Fetch API** (introduced as a replacement for XMLHttpRequest) is asynchronous by default, making it easier to manage network requests in modern web applications.
- **Server-Side JavaScript (Node.js)**: In Node.js, asynchronous programming is essential because it handles numerous concurrent requests without blocking. Node.js uses **Event Loop** to manage asynchronous tasks efficiently.
- **Single-Threaded Nature of JavaScript**: JavaScript is single-threaded, meaning it can execute one operation at a time. Asynchronous programming allows JavaScript to handle multiple tasks concurrently (without blocking), which is especially useful in web browsers.

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**6. Advanced Asynchronous Concepts**

- **Event Loop**: JavaScript's event loop manages asynchronous operations. It is responsible for handling queued tasks (like API requests or timers) and executing them in a non-blocking way.
- **Microtasks and Macrotasks**: Microtasks (e.g., Promises) are executed before macrotasks (e.g., setTimeout). Understanding this ordering can be important when working with asynchronous code.

- **Observables**: Observables, used primarily in frameworks like **RxJS** (Reactive Extensions for JavaScript), provide a way to handle asynchronous data streams. They can be thought of as an advanced alternative to Promises, especially for handling streams of data.

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**7. Industry Trends and Use Cases**

- **Real-Time Applications**: Asynchronous JavaScript is critical in real-time applications like chat apps, live score updates, or collaborative platforms, where multiple users interact with data concurrently.
- **React/Redux**: In modern frameworks like React, asynchronous operations are handled using **Redux-Saga** or **Redux-Thunk**, which manage side effects and asynchronous data flow.
- **API-Driven Development**: Web and mobile applications today heavily rely on **REST APIs** or **GraphQL APIs**, both of which require asynchronous operations for fetching and processing data.

# Asynchronous JavaScript Interview Questions

## Basic Understanding of Asynchronous JavaScript

1. What do you understand by asynchronous JavaScript, and how is it different from synchronous JavaScript?
2. Can you give an example of a situation where asynchronous code is preferable to synchronous code?

## Callback Functions

3. Can you explain what a callback function is in JavaScript? How does it work in asynchronous operations?
4. What problems might arise when using callback functions? Can you explain the concept of 'callback hell' and how it can be avoided?

## Promises

5. What is a Promise in JavaScript, and what are the three possible states of a Promise?
6. How would you handle errors in a promise chain? Can you show an example of using `.catch()` to handle errors?
7. What is the difference between `.then()` and `.catch()` in a Promise? Could you explain how you would use both in error handling?

## Async/Await

8. What does the `async` keyword do in JavaScript, and how does it differ from regular functions?
9. When you use the `async` keyword, what does the function automatically return? Can you explain how this helps in asynchronous code execution?
10. What about `await`? How does it work inside an `async` function, and how does it make asynchronous code look more like synchronous code?
11. Can you provide an example where `await` is useful, especially for fetching data from an API?

## Promise Methods

12. Can you explain the difference between `Promise.all()` and `Promise.race()`? When would you use each of them?
13. Could you demonstrate an example where you might need to use `Promise.all()` to fetch multiple resources simultaneously?

## JavaScript Event Loop

14. Can you explain how the JavaScript event loop works and how it handles asynchronous operations?
15. What are microtasks and macrotasks, and how are they handled by the event loop? Could you give an example?

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