

# React.JS CheatSheet



# REACT.JS CHEATSHEET

## Intro to React:

Component-Based • Declarative UI • Virtual DOM • JSX • SPA

## Basic Setup:

npx create-react-app • JSX Syntax • Functional Components • Props

## Hooks:

useState • useEffect • useRef • useContext • useReducer • useMemo • useCallback

## Component Communication:

Props Drilling • Context API • State Lifting • Event Handlers

## Rendering Techniques:

Conditional Rendering • Lists with .map() • Keys in Lists

## Forms:

Controlled Components • Input Handling • Form Submission • Basic Validation

## React Router (v6):

BrowserRouter • Routes & Route • Link & NavLink • Dynamic Routing • 404 Page

## Styling:

CSS Modules • Inline Styles • Styled-Components • Tailwind CSS • SCSS/SASS

## Advanced Features:

Fragments (<> </>) • StrictMode • Portals • Error Boundaries • Lazy Loading

## Testing:

Jest • React Testing Library • Snapshot Testing • Hook Testing

## APIs & Fetching Data:

fetch & axios • REST vs GraphQL • Loading States • Error Handling

## Optimization & Best Practices:

Code Splitting • Memoization • Avoid Re-renders • Folder Structure

## TypeScript with React:

Typed Props & State • Interfaces • useState<Type> • Optional Props

## UI Libraries:

Material UI • Chakra UI • Ant Design • Tailwind CSS • ShadCN/UI

## Lifecycle Methods (Class Components):

constructor() • render() • componentDidMount() • componentDidUpdate() • componentWillUnmount()

## Higher Order Components (HOCs):

withAuth(Component) • withLogger(Component) • Reusability • Code Wrapping

## Custom Hooks:

useLocalStorage() • useWindowSize() • useDarkMode() • useDebounce()

## Common Mistakes:

Incorrect Key Props • Improper State Updates • Infinite Loops in useEffect • Direct DOM Manipulation

## Mini Projects:

Todo App • Weather App • Calculator • Notes App • Movie Search • Login/Register Form

## More Project Ideas:

Counter with Hooks • Dark/Light Mode Toggle • Search Filter List • API Pagination • Responsive Navbar

# TABLE OF CONTENTS

## 1. Introduction to React

- What is React?
- History and Features
- Virtual DOM Explained
- React vs Vanilla JS vs Other Frameworks

## 2. Environment Setup

- Installing Node.js and npm
- Create React App (CRA)
- Project Structure
- Using Vite for Faster Setup

## 3. JSX Basics

- What is JSX?
- JSX Syntax Rules
- Embedding Expressions
- JSX Best Practices

## 4. Components

- Functional Components
- Class Components
- Component Naming and Structure
- Props in Components
- Props Destructuring
- Children Props

## 5. State Management

- useState Hook
- setState in Class Components
- Lifting State Up
- Passing State as Props

## 6. Event Handling

- Handling Events in React
- Event Binding
- Synthetic Events
- Prevent Default and Event Objects

# TABLE OF CONTENTS

## 7. Conditional Rendering

- if/else Statements
- Ternary Operators
- Logical && Operator
- Switch Statements

## 8. Lists and Keys

- Rendering Lists with .map()
- Using key Props
- Handling Empty Lists

## 9. Forms in React

- Controlled vs Uncontrolled Components
- Handling Inputs (text, checkbox, radio, select)
- Form Submission
- Form Validation Basics

## 10. useEffect Hook

- Basic Usage of useEffect
- Dependency Array
- Cleanup Function
- Fetching Data on Mount

## 11. Other React Hooks

- useRef
- useContext
- useReducer
- useMemo
- useCallback
- Custom Hooks

## 12. React Router (v6+)

- Setting up React Router
- BrowserRouter, Routes, Route
- Link, NavLink
- Route Parameters
- Nested Routes
- Redirects and Navigate
- 404 Page Setup

# TABLE OF CONTENTS

## 13. Context API

- Creating and Providing Context
- Consuming Context
- Updating Context Values
- When to Use Context vs Props

## 14. State Management Libraries

- Redux Basics
- Redux Toolkit
- useSelector, useDispatch
- Zustand (Alternative)
- Recoil (Alternative)
- Context vs Redux

## 15. Styling in React

- CSS Modules
- Inline Styling
- Styled-Components
- Tailwind CSS with React
- SCSS/SASS with React

## 16. React Lifecycle (Class Components)

- constructor()
- render()
- componentDidMount()
- componentDidUpdate()
- componentWillUnmount()

## 17. Error Handling

- Error Boundaries
- Try-Catch in Event Handlers
- Handling Async Errors

## 18. Code Splitting and Lazy Loading

- React.lazy() and Suspense
- Dynamic Imports
- Loading Spinners

# TABLE OF CONTENTS

## 19. Refs and DOM Manipulation

- useRef and Accessing DOM Elements
- Forwarding Refs
- DOM Interaction Best Practices

## 20. Portals

- Creating Portals
- Use Cases (Modals, Tooltips)

## 21. Fragments and StrictMode

- <React.Fragment> and <>
- Why and When to Use
- <React.StrictMode> Usage

## 22. Higher Order Components (HOC)

- What is an HOC?
- Common HOC Patterns
- Pros and Cons

## 23. Custom Hooks

- When to Create Custom Hooks
- Examples (useLocalStorage, useWindowSize)
- Best Practices

## 24. Testing React Apps

- Unit Testing with Jest
- Component Testing with React Testing Library
- Writing Test Cases for Hooks and Components

## 25. Deployment

- Building for Production
- Hosting on Vercel, Netlify, Firebase
- GitHub Pages Deployment
- Environment Variables

## 26. React with APIs

- Fetching with fetch and axios
- REST vs GraphQL
- Error Handling in API Calls
- Displaying Loading States

## TABLE OF CONTENTS

### 27. **Best Practices & Optimization**

- Component Reusability
- Code Splitting
- Avoiding Unnecessary Renders
- Memoization
- Folder Structure Recommendations

### 28. **React with TypeScript (Bonus)**

- Why Use TypeScript?
- Typing Props and State
- Typing useState, useEffect, etc.
- Interfaces and Types

### 29. **Popular UI Libraries for React**

- Material UI (MUI)
- Ant Design
- Chakra UI
- Tailwind CSS
- ShadCN/UI

### 30. **Mini Projects (Bonus Section)**

- Common Beginner Mistakes in React
- Practice Tasks for Beginners

# 1. INTRODUCTION TO REACT

## 1.1 What is React?

- React is a JavaScript library used to build user interfaces (UIs). That means it helps you create the parts of a website that users can see and interact with.
- React is especially good for building single-page applications (SPAs) — websites that update the content without reloading the entire page. For example, when you scroll Instagram, the page doesn't reload, but new content appears — that's similar to how React works.

### In simple words:

- React helps you build websites that are fast, easy to manage, and don't reload every time something changes.

## 1.2 History and Features

- **Created by:** Jordan Walke, a software engineer at Facebook
- **Released in:** 2013 (open-sourced)
- **Used by:** Facebook, Instagram, Netflix, WhatsApp Web, etc.

### Key Features:

- **Component-based:** You build UI in small pieces called components.
- **Reusable:** One component can be used in many places.
- **Virtual DOM:** It updates only the changed part of the page instead of the whole page.
- **Fast and Efficient:** Because of virtual DOM and smart updates.

## 1.3 Virtual DOM Explained

- DOM stands for Document Object Model — it's like a tree structure of your HTML.
- React creates a copy of the real DOM in memory. This copy is called the Virtual DOM.
- When something changes, React compares the virtual DOM with the real DOM and only updates the parts that actually changed.
- This makes the website faster, because it doesn't reload everything.

# 1. INTRODUCTION TO REACT

## 1.4 React vs Vanilla JS vs Other Frameworks

Feature	React	Vanilla JS	Other Frameworks (e.g., Angular, Vue)
Structure	Component-based	No structure	Component-based
Speed	Very fast	Medium	Fast
Learning Curve	Easy to Medium	Easy	Medium to Hard
Reusability	High	Low	High
DOM Updates	Virtual DOM	Full page reload	Virtual DOM or optimized updates

- **Conclusion:** React offers a balanced approach — faster than plain JavaScript and easier to learn than some heavy frameworks like Angular.

## 2. ENVIRONMENT SETUP

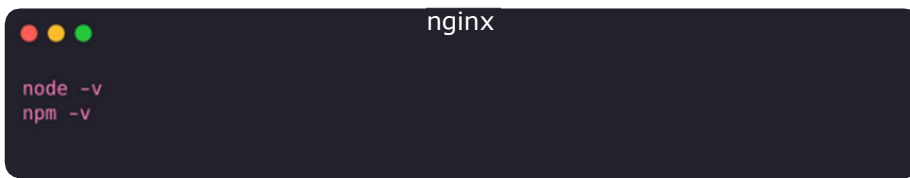
### 2.1 Installing Node.js and npm

- React apps need Node.js and npm (Node Package Manager) to work.

#### Steps:

1. Go to <https://nodejs.org>
2. Download the LTS version (Recommended for most users)
3. Install it

- After installing, open your terminal and check versions:



```
nginx
node -v
npm -v
```

- If you see the versions, Node.js and npm are installed correctly.

### 2.2 Create React App (CRA)

- React provides a tool called Create React App (CRA) to start building apps quickly.
- To create a project:

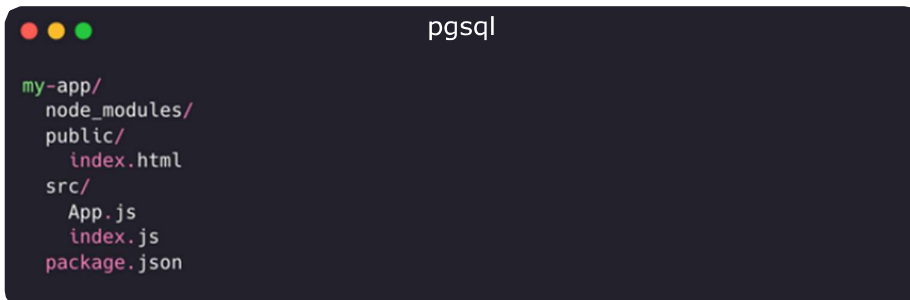


```
perl
npx create-react-app my-app
cd my-app
npm start
```

- "npx" runs a command without installing it globally.
- "create-react-app" sets up everything for you.
- "npm start" runs your app in the browser.

### 2.3 Project Structure

- When you create a React app, you'll see a folder like this:



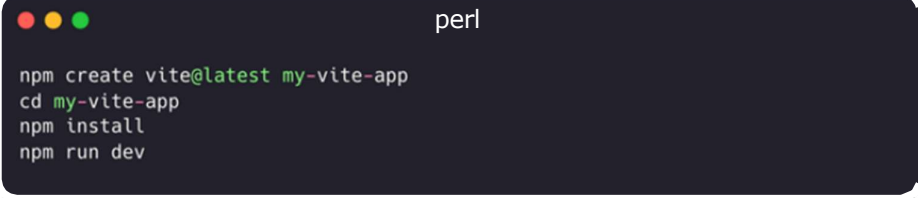
```
pgsql
my-app/
node_modules/
public/
  index.html
src/
  App.js
  index.js
package.json
```

- **public/index.html:** Main HTML file
- **src/index.js:** Starting point of your React app
- **src/App.js:** Main component

## 2. ENVIRONMENT SETUP

### 2.4 Using Vite for Faster Setup

- Vite is a modern build tool that's faster than CRA.
- To create a Vite project:

A terminal window with a dark background and light text. The window title is 'perl'. The terminal shows the following commands: 'npm create vite@latest my-vite-app', 'cd my-vite-app', 'npm install', and 'npm run dev'.

```
perl  
npm create vite@latest my-vite-app  
cd my-vite-app  
npm install  
npm run dev
```

- Vite starts faster and is better for modern projects.

## 3. JSX BASICS

### 3.1 What is JSX?

- JSX stands for JavaScript XML. It lets you write HTML-like code inside JavaScript.

Example:

```
jsx
const element = <h1>Hello, world!</h1>;
```

- This looks like HTML, but it's actually JavaScript code.

### 3.2 JSX Syntax Rules

- Return only one parent element.

```
jsx
return (
  <div>
    <h1>Title</h1>
    <p>Paragraph</p>
  </div>
);
```

- Use camelCase for attributes like className, onClick:

```
jsx
<button className="btn" onClick={handleClick}>Click Me</button>
```

### 3.3 Embedding Expressions

- You can write JavaScript inside JSX using { }.

Example:

```
jsx
const name = "Rudra";
return <h1>Hello, {name}</h1>;
```

### 3.4 JSX Best Practices

- Use meaningful names for variables and components.
- Keep JSX clean and readable.
- Avoid too much logic inside JSX.
- Use fragments (<> </>) if you don't want to wrap everything in a <div>.

## 4. COMPONENTS

### 4.1 Functional Components

- A simple way to create a component using a function.

```
function Welcome() {  
  return <h1>Hello from Functional Component</h1>;  
}
```

### 4.2 Class Components

- Another way using ES6 class (older way).

```
class Welcome extends React.Component {  
  render() {  
    return <h1>Hello from Class Component</h1>;  
  }  
}
```

### 4.3 Component Naming and Structure

- Always start component names with Capital letters.
- Each component should be in its own file.

```
// File: Header.js  
function Header() {  
  return <h1>This is a Header</h1>;  
}  
export default Header;
```

### 4.4 Props in Components

- Props (short for properties) are used to pass data from one component to another.

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

Used like:

```
<Welcome name="Rudra" />
```

### 4.5 Props Destructuring

- Instead of props.name, you can do:

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

## 4. COMPONENTS

### 4.6 Children Props

- Props can also include inner HTML using `props.children`.

```
jsx  
  
function Layout(props) {  
  return <div>{props.children}</div>;  
}  
  
<Layout>  
  <p>This is content inside the layout</p>  
</Layout>
```

## 5. STATE MANAGEMENT

### 5.1 useState Hook

- For functional components, we use the useState hook to manage data.

```
jsx

import { useState } from 'react';

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

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

### 5.2 setState in Class Components

- In class components, we use this.state and this.setState().

```
jsx

class Counter extends React.Component {
  constructor() {
    super();
    this.state = { count: 0 };
  }

  render() {
    return (
      <div>
        <p>Count: {this.state.count}</p>
        <button onClick={() => this.setState({ count: this.state.count + 1
      })}>
          Add
        </button>
      </div>
    );
  }
}
```

### 5.3 Lifting State Up

- When two components need to share the same state, move the state to their common parent.

```
jsx

function Parent() {
  const [value, setValue] = useState("");

  return (
    <>
      <Input value={value} setValue={setValue} />
      <Display value={value} />
    </>
  );
}
```

## 5. STATE MANAGEMENT

### 5.4 Passing State as Props

- You can pass the current state value to another component using props.

```
function Display({ value }) {  
  return <h1>{value}</h1>;  
}
```

## 6. EVENT HANDLING

### 6.1 Handling Events in React

- In React, we can handle user actions like clicks, typing, or hovering using event handlers.

Example: Button click

```
jsx

function ClickButton() {
  function handleClick() {
    alert("Button was clicked!");
  }

  return <button onClick={handleClick}>Click Me</button>;
}
```

**Note:** We use camelCase like onClick instead of onclick.

### 6.2 Event Binding

- In class components, we often need to bind the event handler to this.

```
jsx

class Welcome extends React.Component {
  constructor() {
    super();
    this.state = { name: "Rudra" };
    this.handleClick = this.handleClick.bind(this);
  }

  handleClick() {
    alert("Hello " + this.state.name);
  }

  render() {
    return <button onClick={this.handleClick}>Greet</button>;
  }
}
```

- In functional components, you don't need binding.

### 6.3 Synthetic Events

- React uses a system called Synthetic Events. It wraps browser events to work the same way across all browsers.
- It behaves like regular JavaScript events but works consistently everywhere.

Example:

```
jsx

function handleInput(event) {
  console.log(event.target.value);
}
```

## 6. EVENT HANDLING

### 6.4 Prevent Default and Event Objects

- If you want to stop the default action (like refreshing the page on form submit), use `event.preventDefault()`.

Example:

```
jsx
function MyForm() {
  function handleSubmit(e) {
    e.preventDefault(); // stops page from refreshing
    alert("Form submitted");
  }

  return <form onSubmit={handleSubmit}><button>Submit</button></form>;
}
```

## 7. CONDITIONAL RENDERING

### 7.1 if/else Statements

- You can use normal if/else logic before the return.

```
jsx
function Greeting(props) {
  if (props.isLoggedIn) {
    return <h1>Welcome back!</h1>;
  } else {
    return <h1>Please log in.</h1>;
  }
}
```

### 7.2 Ternary Operators

- Short way to write if/else inside JSX:

```
jsx
return (
  <div>
    {isLoggedIn ? <h1>Hi User</h1> : <h1>Please Sign In</h1>}
  </div>
);
```

### 7.3 Logical && Operator

- Use && when you want to render something only if a condition is true.

```
jsx
{cart.length > 0 && <p>You have {cart.length} items in cart</p>}
```

- If cart.length is 0, it won't show anything.

### 7.4 Switch Statements

- For multiple conditions, you can use switch.

```
jsx
function StatusMessage({ status }) {
  switch (status) {
    case "loading":
      return <p>Loading...</p>;
    case "success":
      return <p>Data loaded!</p>;
    case "error":
      return <p>Error occurred.</p>;
    default:
      return <p>Unknown status</p>;
  }
}
```

## 8. LISTS AND KEYS

### 8.1 Rendering Lists with .map()

- When you want to show many items, use .map() to loop through them.

```
jsx
const fruits = ["Apple", "Banana", "Mango"];

function FruitList() {
  return (
    <ul>
      {fruits.map((fruit) => <li>{fruit}</li>)}
    </ul>
  );
}
```

### 8.2 Using key Props

- Each item in a list needs a unique key so React can track changes.

```
jsx
{fruits.map((fruit, index) => (
  <li key={index}>{fruit}</li>
))}
```

- Use a unique ID if available (don't always rely on index).

### 8.3 Handling Empty Lists

- You can check if the list is empty before showing it.

```
jsx
{fruits.length === 0 ? (
  <p>No fruits available</p>
) : (
  <ul>{fruits.map(fruit => <li>{fruit}</li>)}</ul>
)}
```

## 9. FORMS IN REACT

### 9.1 Controlled vs Uncontrolled Components

- Controlled Component: React controls the input value using useState.
- Uncontrolled Component: DOM handles the input using a ref.

Controlled example:

```
jsx
const [name, setName] = useState("");
<input value={name} onChange={(e) => setName(e.target.value)} />
```

### 9.2 Handling Inputs (text, checkbox, radio, select)

#### • Text:

```
jsx
<input type="text" value={name} onChange={(e) => setName(e.target.value)} />
```

#### • Checkbox:

```
jsx
<input type="checkbox" checked={isChecked} onChange={(e) =>
setIsChecked(e.target.checked)} />
```

#### • Radio:

```
jsx
<input type="radio" value="Male" checked={gender === "Male"} onChange={(e) =>
setGender(e.target.value)} />
```

#### • Select dropdown:

```
jsx
<select value={city} onChange={(e) => setCity(e.target.value)}>
  <option value="Delhi">Delhi</option>
  <option value="Mumbai">Mumbai</option>
</select>
```

### 9.3 Form Submission

## 9. FORMS IN REACT

```
jsx

function MyForm() {
  const [name, setName] = useState("");

  function handleSubmit(e) {
    e.preventDefault();
    alert("Submitted name: " + name);
  }

  return (
    <form onSubmit={handleSubmit}>
      <input value={name} onChange={(e) => setName(e.target.value)} />
      <button>Submit</button>
    </form>
  );
}
```

## 9. FORMS IN REACT

### 9.4 Form Validation Basics

- Before submitting, check if the inputs are correct.

```
jsx  
  
function handleSubmit(e) {  
  e.preventDefault();  
  if (name === "") {  
    alert("Name is required");  
    return;  
  }  
  // Continue with form submission  
}
```

## 10. USEEFFECT HOOK

### 10.1 Basic Usage of useEffect

- "useEffect" lets you run code after your component renders.

Example:

```
jsx
useEffect(() => {
  console.log("Component mounted!");
});
```

### 10.2 Dependency Array

- You can control when useEffect runs using dependencies.

```
jsx
useEffect(() => {
  console.log("Name changed!");
}, [name]);
```

- Empty array []: run only once (like on mount)
- With [name]: run when name changes

### 10.3 Cleanup Function

- If you want to clean up something (like removing a timer), return a function inside useEffect.

```
jsx
useEffect(() => {
  const timer = setInterval(() => {
    console.log("Tick");
  }, 1000);

  return () => {
    clearInterval(timer); // cleanup
  };
}, []);
```

### 10.4 Fetching Data on Mount

```
jsx
useEffect(() => {
  fetch("https://api.example.com/data")
    .then(res => res.json())
    .then(data => setData(data));
}, []);
```

- It runs once after the component loads and gets the data.

## 11. OTHER REACT HOOKS

### 11.1 useRef

- useRef is used to store a value that doesn't need to re-render the component.
- It's also used to directly access a DOM element (like an input box).

```
jsx

import { useRef } from 'react';

function MyComponent() {
  const inputRef = useRef();

  function focusInput() {
    inputRef.current.focus(); // Focus the input box
  }

  return (
    <>
      <input ref={inputRef} />
      <button onClick={focusInput}>Focus Input</button>
    </>
  );
}
```

### 11.2 useContext

- It helps to share values like user info or theme between components without props.

```
jsx

import { useContext, createContext } from 'react';

const ThemeContext = createContext();

function App() {
  return (
    <ThemeContext.Provider value="dark">
      <Child />
    </ThemeContext.Provider>
  );
}

function Child() {
  const theme = useContext(ThemeContext);
  return <div>The theme is {theme}</div>;
}
```

## 11. OTHER REACT HOOKS

### 11.3 useReducer

- Like useState, but better when state is complex (like a counter with actions).

```
jsx

import { useReducer } from 'react';

function reducer(state, action) {
  if (action.type === 'increment') return { count: state.count + 1 };
  return state;
}

function Counter() {
  const [state, dispatch] = useReducer(reducer, { count: 0 });

  return (
    <>
      <p>{state.count}</p>
      <button onClick={() => dispatch({ type: 'increment' })}>+1</button>
    </>
  );
}
```

### 11.4 useMemo

- Stops a function from running again if the inputs (dependencies) didn't change.

```
jsx

const expensiveValue = useMemo(() => {
  return slowCalculation(num);
}, [num]);
```

### 11.5 useCallback

- Stops a function from re-creating again and again.

```
jsx

const handleClick = useCallback(() => {
  console.log('clicked');
}, []);
```

### 11.6 Custom Hooks

- Your own reusable hook logic using other hooks.

```
jsx

function useCounter() {
  const [count, setCount] = useState(0);
  const increment = () => setCount(count + 1);
  return { count, increment };
}
```

## 12. REACT ROUTER (V6+)

### 12.1 Installation

```
jsx  
npm install react-router-dom
```

### 12.2 BrowserRouter, Routes, Route

```
jsx  
  
import { BrowserRouter, Routes, Route } from 'react-router-dom';  
  
<BrowserRouter>  
  <Routes>  
    <Route path="/" element={<Home />} />  
    <Route path="/about" element={<About />} />  
  </Routes>  
</BrowserRouter>
```

### 12.3 Link and NavLink

```
jsx  
  
<Link to="/about">Go to About</Link>  
  
<NavLink to="/about">About</NavLink>
```

### 12.4 Route Parameters

```
jsx  
  
<Route path="/user/:id" element={<User />} />
```

- Use useParams() in User component to get the id.

### 12.5 Nested Routes

```
jsx  
  
<Route path="/dashboard" element={<Dashboard />}>  
  <Route path="stats" element={<Stats />} />  
</Route>
```

### 12.6 Redirects and Navigate

```
jsx  
  
<Navigate to="/login" />
```

### 12.7 404 Page

```
jsx  
  
<Route path="*" element={<NotFound />} />
```

## 13. CONTEXT API

### 13.1 Creating and Providing Context

```
jsx
const UserContext = createContext();
<UserContext.Provider value={user}>
  <App />
</UserContext.Provider>
```

### 13.2 Consuming Context

```
jsx
const user = useContext(UserContext);
```

### 13.3 Updating Context

- Use `useState` and pass both value and function via `value`.

### 13.4 Context vs Props

- Use props if data is used only by child.
- Use context when many components need the data.

## 14. STATE MANAGEMENT LIBRARIES

### 14.1 Redux (Basics)

- A central store to keep all app data.
- Use actions to update data.

### 14.2 Redux Toolkit

- Easier way to write Redux

```
jsx
const counterSlice = createSlice({
  name: 'counter',
  initialState: 0,
  reducers: {
    increment: state => state + 1
  }
});
```

### 14.3 useSelector and useDispatch

```
jsx
const count = useSelector(state => state.counter);
const dispatch = useDispatch();
```

### 14.4 Zustand

- Lightweight library, less setup.

```
jsx
const useStore = create(set => ({
  count: 0,
  increase: () => set(state => ({ count: state.count + 1 }))
}));
```

### 14.5 Recoil

- Works with atoms (like small pieces of state).

```
jsx
const countState = atom({
  key: 'count',
  default: 0
});
```

### 14.6 Context vs Redux


## 15. STYLING IN REACT

### 15.1 CSS Modules

```
jsx  
import styles from './App.module.css';  
<div className={styles.box}>Text</div>
```

### 15.2 Inline Styling

```
jsx  
<div style={{ color: 'blue', fontSize: '20px' }}>Hello</div>
```

### 15.3 Styled Components

```
jsx  
const Button = styled.button`  
  background: red;  
  color: white;  
`;
```

### 15.4 Tailwind CSS

```
jsx  
npm install -D tailwindcss
```

```
jsx  
<div className="bg-blue-500 text-white p-4">Text</div>
```

### 15.5 SASS / SCSS

```
jsx  
npm install sass
```

```
jsx  
$color: blue;  
.title { color: $color; }
```

## 16. REACT LIFECYCLE (CLASS COMPONENTS)

- In class components, lifecycle methods let you run code at specific times in a component's life (mount, update, unmount).

### 16.1 constructor()

- Runs first, when the component is created.
- Used to initialize state and bind methods.

```
jsx
class MyComponent extends React.Component {
  constructor() {
    super();
    this.state = { count: 0 };
  }
}
```

### 16.2 render()

- Required method.
- Returns JSX to display on the screen.

```
jsx
render() {
  return <h1>Hello</h1>;
}
```

### 16.3 componentDidMount()

- Called after component is added to the DOM.
- Good for API calls or timers.

```
jsx
componentDidMount() {
  console.log('Component mounted');
}
```

### 16.4 componentDidUpdate()

- Runs when props or state change.
- Good for updating based on changes.

```
jsx
componentDidUpdate(prevProps, prevState) {
  if (this.state.count !== prevState.count) {
    console.log('Count changed');
  }
}
```

## 16. REACT LIFECYCLE (CLASS COMPONENTS)

### 16.5 `componentWillUnmount()`

- Called before component is removed.
- Use it to clear timers or remove listeners

```
jsx  
  
componentWillUnmount() {  
  console.log('Component will be removed');  
}
```

## 17. ERROR HANDLING

### 17.1 Error Boundaries

- A special class component that catches JavaScript errors in children.

```
jsx

class ErrorBoundary extends React.Component {
  constructor() {
    super();
    this.state = { hasError: false };
  }

  static getDerivedStateFromError(error) {
    return { hasError: true };
  }

  componentDidCatch(error, info) {
    console.log(error, info);
  }

  render() {
    if (this.state.hasError) {
      return <h1>Something went wrong.</h1>;
    }
    return this.props.children;
  }
}
```

### 17.2 Try-Catch in Event Handlers

```
jsx

function handleClick() {
  try {
    // risky code
  } catch (error) {
    console.log('Error:', error);
  }
}
```

### 17.3 Handling Async Errors

```
jsx

async function fetchData() {
  try {
    const res = await fetch('api/data');
    const data = await res.json();
  } catch (err) {
    console.log('Failed to fetch:', err);
  }
}
```

## 18. CODE SPLITTING AND LAZY LOADING

### 18.1 React.lazy() and Suspense

- React.lazy() loads components only when needed.

```
jsx
const LazyComponent = React.lazy(() => import('./LazyComponent'));
<Suspense fallback={<div>Loading...</div>}>
  <LazyComponent />
</Suspense>
```

### 18.2 Dynamic Imports

- Load parts of the code only when needed (saves load time).

```
jsx
import('./HeavyComponent').then(module => {
  const Comp = module.default;
});
```

### 18.3 Loading Spinners

- Use during lazy loading or data fetching.

```
jsx
<Suspense fallback={<Spinner />}>
  <LazyComponent />
</Suspense>
```

## 19. REFS AND DOM MANIPULATION

### 19.1 useRef and Accessing DOM Elements

- useRef() returns a reference to a DOM node.

```
jsx
const inputRef = useRef();

<input ref={inputRef} />
<button onClick={() => inputRef.current.focus()}>Focus</button>
```

### 19.2 Forwarding Refs

- Pass a ref to child from parent.

```
jsx
const MyInput = React.forwardRef((props, ref) => (
  <input ref={ref} {...props} />
));
```

### 19.3 DOM Interaction Best Practices

- Prefer React state.
- Use refs only when you must access DOM (e.g., focus, scroll).
- Avoid modifying DOM directly (don't use document.querySelector).

## 20. PORTALS IN REACT

### 20.1 What is a Portal?

- Normally, in React, all components render inside a single root element — like this:

```
jsx
<div id="root"></div>
```

- But what if you want to show something outside this root?
- For example, a popup, a modal, or a tooltip that appears on top of everything.
- That's where Portals help.
- A Portal lets you render a React component into a different part of the HTML, outside the main app root.

### 20.2 How to Create a Portal

**Step 1:** Add a new HTML element in index.html

- Open your public/index.html file and add a new <div> for the portal:

```
jsx
<body>
  <div id="root"></div>
  <div id="portal-root"></div> <!-- This is where portal content will go -->
</body>
```

**Step 2:** Use createPortal() in your component

```
jsx
import React from "react";
import ReactDOM from "react-dom/client";

// PortalComponent.jsx
function PortalComponent() {
  return ReactDOM.createPortal(
    <div style={{ backgroundColor: "white", padding: "20px", border: "2px solid black" }}>
      <h2>This is inside a portal!</h2>
    </div>,
    document.getElementById("portal-root") // Render this inside #portal-root
  );
}

export default PortalComponent;
```

- You can now use this PortalComponent in your app.

## 20. PORTALS IN REACT

### 20.3 Full Example: Modal with Portal

- Let's create a simple modal that opens and closes using a portal.

#### Modal.jsx

```
jsx
import React from "react";
import ReactDOM from "react-dom";

function Modal({ onClose, children }) {
  return ReactDOM.createPortal(
    <div style={styles.overlay}>
      <div style={styles.modal}>
        {children}
        <button onClick={onClose}>Close</button>
      </div>
    </div>,
    document.getElementById("portal-root")
  );
}

const styles = {
  overlay: {
    position: "fixed",
    top: 0, left: 0,
    width: "100%", height: "100%",
    backgroundColor: "rgba(0,0,0,0.5)",
    display: "flex",
    justifyContent: "center",
    alignItems: "center",
    zIndex: 1000,
  },
  modal: {
    background: "white",
    padding: "20px",
    borderRadius: "10px",
    boxShadow: "0 0 10px black"
  }
};

export default Modal;
```

#### App.jsx

## 20. PORTALS IN REACT

```
jsx

import React, { useState } from "react";
import Modal from "./Modal";

function App() {
  const [showModal, setShowModal] = useState(false);

  return (
    <div>
      <h1>Welcome to My App</h1>
      <button onClick={() => setShowModal(true)}>Open Modal</button>

      {showModal && (
        <Modal onClose={() => setShowModal(false)}>
          <h2>This is a Modal</h2>
          <p>You can put anything here!</p>
        </Modal>
      )}
    </div>
  );
}

export default App;
```

## 20. PORTALS IN REACT

### 20.4 Use Cases of Portals

#### **Modals/Popups**

- When you want a window to appear on top of everything else.

#### **Tooltips**

- Small hint boxes that appear on hover.

#### **Dropdown Menus**

- If a dropdown needs to overflow a parent with `overflow: hidden`.

#### **Sidebars or Toast Messages**

- For alerts or temporary notifications.

### 20.5 Why Use Portals?

- It solves CSS issues when the parent component has `overflow: hidden`, `z-index`, or `position: relative`.
- Keeps UI elements like modals and tooltips outside the normal hierarchy.
- Cleaner and more flexible design.

## 21. FRAGMENTS AND STRICTMODE

### 21.1 <React.Fragment> and <>...</>

- In React, a component must return a single parent element.
- But what if you need to return multiple elements without wrapping them in a <div>?
- Use Fragments!

Example:

```
jsx

// Using <div> (adds extra HTML)
return (
  <div>
    <h1>Hello</h1>
    <p>World</p>
  </div>
);

// Using <React.Fragment> (no extra HTML)
return (
  <React.Fragment>
    <h1>Hello</h1>
    <p>World</p>
  </React.Fragment>
);

// Shorter syntax: <>
return (
  <>
    <h1>Hello</h1>
    <p>World</p>
  </>
);
```

#### Why Use It?

- No extra <div> tags in the DOM.
- Keeps code clean.

### 21.2 <React.StrictMode>

- React provides a special wrapper that helps you find bugs early.

```
jsx

import React from 'react';
import ReactDOM from 'react-dom';
import App from './App';

ReactDOM.createRoot(document.getElementById("root")).render(
  <React.StrictMode>
    <App />
  </React.StrictMode>
);
```

#### What it does:

- Warns about unsafe code.
- Helps with future-proofing your app.
- Does not show anything to the user.
- Works only in development (not in production).

## 22. HIGHER ORDER COMPONENTS (HOC)

### 22.1 What is an HOC?

- An HOC is a function that takes a component and returns a new component.

```
jsx
const EnhancedComponent = withFeature(OriginalComponent);
```

- Think of it like adding extra powers to a component.

### 22.2 Example: withLogger HOC

```
jsx
function withLogger(WrappedComponent) {
  return function Enhanced(props) {
    console.log("Props:", props);
    return <WrappedComponent {...props} />;
  };
}
```

- Now use it:

```
jsx
const MyComponentWithLogger = withLogger(MyComponent);
```

### 22.3 Common HOC Use Cases

- Logging props
- Adding loading spinners
- Access control (admin vs normal user)
- Reusing logic across components

### 22.4 Pros and Cons

#### Pros

- Reuse logic easily
- Cleaner components

#### Cons

- Can become complex to debug
- Not as popular now (Hooks are preferred)

## 23. CUSTOM HOOKS

### 23.1 When to Create Custom Hooks

- When you find yourself copying the same `useEffect`, `useState`, or logic in multiple places — create a custom hook.

### 23.2 Example: `useLocalStorage`

```
jsx
import { useState, useEffect } from "react";

function useLocalStorage(key, initialValue) {
  const [value, setValue] = useState(() => {
    const stored = localStorage.getItem(key);
    return stored ? JSON.parse(stored) : initialValue;
  });

  useEffect(() => {
    localStorage.setItem(key, JSON.stringify(value));
  }, [key, value]);

  return [value, setValue];
}
```

Usage:

```
jsx
const [name, setName] = useLocalStorage("username", "Guest");
```

### 23.3 Another Example: `useWindowSize`

```
jsx
function useWindowSize() {
  const [size, setSize] = useState([window.innerWidth, window.innerHeight]);

  useEffect(() => {
    const handleResize = () => setSize([window.innerWidth,
    window.innerHeight]);
    window.addEventListener("resize", handleResize);
    return () => window.removeEventListener("resize", handleResize);
  }, []);

  return size;
}
```

Usage:

```
jsx
const [width, height] = useWindowSize();
```

### 23.4 Best Practices

- Always start with `use`
- Return only what's needed
- Keep it simple

## 24. TESTING REACT APPS

### 24.1 Unit Testing with Jest

- Jest is a testing framework for JavaScript.

✓ Example test:

```
jsx

// sum.js
export function sum(a, b) {
  return a + b;
}

// sum.test.js
import { sum } from "./sum";

test("adds 2 + 3 to equal 5", () => {
  expect(sum(2, 3)).toBe(5);
});
```

### 24.2 Component Testing with React Testing Library

React Testing Library helps you test how a user would interact.

```
jsx

// Greeting.js
function Greeting() {
  return <h1>Hello User!</h1>;
}

// Greeting.test.js
import { render, screen } from "@testing-library/react";
import Greeting from "./Greeting";

test("shows greeting text", () => {
  render(<Greeting />);
  expect(screen.getByText("Hello User!")).toBeInTheDocument();
});
```

### 24.3 Testing Hooks

- For hooks, use @testing-library/react-hooks or test them inside a component.

```
jsx

function Counter() {
  const [count, setCount] = useState(0);
  return <button onClick={() => setCount(count + 1)}>Count: {count}</button>;
}
```

- Test using fireEvent from the testing library.

## 25. DEPLOYMENT

### 25.1 Build for Production

- Run this in the terminal:

```
bash
npm run build
```

- It creates a build/ folder with all optimized files.

### 25.2 Hosting on Vercel

1. Go to <https://vercel.com>
2. Connect your GitHub repo
3. Click "Deploy"

Done

### 25.3 Hosting on Netlify

1. Go to <https://netlify.com>
2. Drag your build folder
3. Or connect GitHub and deploy automatically

### 25.4 Hosting on Firebase

```
bash
npm install -g firebase-tools
firebase login
firebase init
firebase deploy
```

- Choose "Hosting" and follow the steps.

### 25.5 GitHub Pages

- Install the package:

```
bash
npm install gh-pages --save-dev
```

- Add to package.json:

```
json
"homepage": "https://your-username.github.io/your-repo"
```

- Then run:

```
bash
npm run build
npm run deploy
```

## 25. DEPLOYMENT

### 25.6 Environment Variables

- You can use environment variables for API keys or settings.
- Create a .env file:

```
env
REACT_APP_API_URL=https://example.com/api
```

- Use in code:

```
jsx
const url = process.env.REACT_APP_API_URL;
```

## 26. REACT WITH APIS

### 26.1 Fetching with fetch and axios

> Using fetch:

```
jsx
useEffect(() => {
  fetch("https://api.example.com/data")
    .then(res => res.json())
    .then(data => setData(data))
    .catch(err => console.error(err));
}, []);
```

> Using axios:

```
jsx
import axios from "axios";

useEffect(() => {
  axios.get("https://api.example.com/data")
    .then(res => setData(res.data))
    .catch(err => console.error(err));
}, []);
```

### 26.2 REST vs GraphQL

Feature	REST	GraphQL
Structure	Multiple endpoints	Single endpoint
Data Fetching	Fixed response	Flexible (you choose fields)
Overfetching	Yes (extra data)	No

### 26.3 Error Handling in API Calls

```
jsx
try {
  const res = await axios.get("api/url");
  setData(res.data);
} catch (error) {
  console.error("Something went wrong", error);
}
```

## 26. REACT WITH APIS

### 26.4 Displaying Loading States

```
jsx

const [loading, setLoading] = useState(true);

useEffect(() => {
  fetch("api")
    .then(res => res.json())
    .then(data => {
      setData(data);
      setLoading(false);
    });
}, []);

return loading ? <p>Loading...</p> : <p>Data Loaded</p>;
```

## 27. BEST PRACTICES & OPTIMIZATION

### 27.1 Component Reusability

- Create reusable components like Button, Input, Card instead of repeating code.

### 27.2 Code Splitting

- Use `React.lazy()` to load components only when needed.

```
jsx

const LazyComponent = React.lazy(() => import('./LazyComponent'));

<Suspense fallback={<p>Loading...</p>}>
  <LazyComponent />
</Suspense>
```

### 27.3 Avoiding Unnecessary Renders

- Use `React.memo` to prevent re-render when props haven't changed.

```
jsx

const MyComponent = React.memo(({ name }) => {
  return <p>{name}</p>;
});
```

### 27.4 Memoization

- Use `useMemo` or `useCallback` for expensive calculations or stable function references.

```
jsx

const memoizedValue = useMemo(() => expensiveFunction(value), [value]);
```

### 27.5 Folder Structure Recommendation

```
CSS

src/
├── components/
│   └── Button.jsx
├── pages/
│   └── Home.jsx
├── hooks/
│   └── useAuth.js
├── utils/
│   └── helpers.js
├── assets/
│   └── logo.png
└── App.jsx
```

## 28. REACT WITH TYPESCRIPT (BONUS)

### 28.1 Why Use TypeScript?

- Catch errors before runtime
- Better developer experience with IntelliSense
- Safer code with types

### 28.2 Typing Props and State

```
tsx

type Props = {
  name: string;
};

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

```
tsx

const [count, setCount] = useState<number>(0);
```

### 28.3 Typing useEffect and useRef

```
tsx

useEffect(() => {
  // Your logic
}, []);

const inputRef = useRef<HTMLInputElement>(null);
```

### 28.4 Interfaces and Types

```
tsx

interface User {
  name: string;
  age: number;
}

const user: User = {
  name: "Ravi",
  age: 20,
};
```

## 29. POPULAR UI LIBRARIES FOR REACT

### Material UI (MUI)

- Google's design system
- Prebuilt styled components

```
bash
npm install @mui/material @emotion/react @emotion/styled
```

### Ant Design

- Enterprise UI with lots of components

```
bash
npm install antd
```

### Chakra UI

- Easy-to-use, accessible components

```
bash
npm install @chakra-ui/react @emotion/react @emotion/styled framer-motion
```

### Tailwind CSS

- Utility-first CSS framework

```
bash
npm install -D tailwindcss
npx tailwindcss init
```

### ShadCN/UI

- Beautiful components built with Tailwind, Radix UI

```
bash
npm install @shadcn/ui
```

## 30. COMMON MISTAKES & PRACTICE TASKS (BONUS SECTION)

### 31.1 Common Beginner Mistakes in React

Mistake	Why It's a Problem	Correct Approach
Mutating state directly	React won't detect changes and re-render	Always use <code>setState()</code> or <code>setSomething()</code>
Missing key in lists	React has trouble tracking items	Use unique key props in <code>.map()</code>
Incorrect <code>useEffect</code> usage	Missing dependency array can cause infinite loops	Include the correct dependencies or use <code>[]</code> for run-once
Calling hooks conditionally	Breaks the rules of hooks	Always call hooks at the top level of the component
Overusing props instead of state	Can lead to prop drilling	Use context or state where appropriate

### 31.2 Practice Tasks for Beginners

#	Task	Concepts Practiced   Counter
1	Counter with +/– buttons	<code>useState</code> , events
2	Form with submit handler Forms	Forms, controlled inputs
3	Render a favorite movie list	<code>.map()</code> , JSX, keys
4	Toggle dark/light mode	<code>useState</code> , conditional rendering
5	Joke fetcher app	<code>useEffect</code> , fetch API
6	Basic login page	Input handling, form validation
7	Like button toggle	<code>useState</code> , events
8	Dropdown list	JSX, select elements
9	Timer/Stopwatch	<code>useEffect</code> , <code>setInterval</code> , <code>clearInterval</code>
10	Weather app	API integration, conditional UI Tip for

#### Tip for Learners

- Try one small project every 2–3 days. Don't aim for perfection. Aim for progress.