

React.JS CheatSheet



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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:

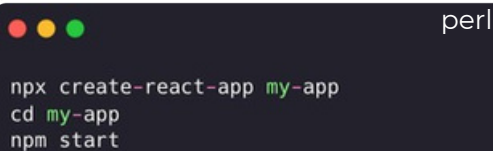
A terminal window with a dark background and three colored window control buttons (red, yellow, green) in the top-left corner. The title bar of the terminal is labeled 'nginx'. The terminal shows two commands: 'node -v' and 'npm -v', both followed by a prompt character.

```
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:

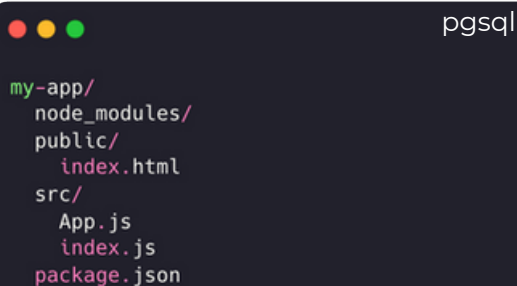
A terminal window with a dark background and three colored window control buttons (red, yellow, green) in the top-left corner. The title bar of the terminal is labeled 'perl'. The terminal shows three commands: 'npx create-react-app my-app', 'cd my-app', and 'npm start', each followed by a prompt character.

```
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:

A terminal window with a dark background and three colored window control buttons (red, yellow, green) in the top-left corner. The title bar of the terminal is labeled 'pgsql'. The terminal shows the directory structure of a React app, listing folders and files with their relative paths.

```
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 three colored window control buttons (red, yellow, green) in the top-left corner. The text 'perl' is visible in the top-right corner of the terminal. The terminal contains the following commands:

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

```
perl
```

- 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`.

```
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

```
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.

```
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:

```
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:

```
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.

```
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:

```
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.

```
{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.

```
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

```
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

Use Case	Tool
Small data like theme/user	Context
Big apps with many updates	Redux

15. STYLING IN REACT

15.1 CSS Modules

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

15.2 Inline Styling

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

15.3 Styled Components

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

15.4 Tailwind CSS

```
npm install -D tailwindcss
```

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

15.5 SASS / SCSS

```
npm install sass
```

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

16. REACT LIFECYCLE (CLASS COMPONENTS)

- In class components, lifecycle methods let your code execute 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



```
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: Modalwith 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

```
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`

```
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:

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

23.3 Another Example: `useWindowSize`

```
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:

```
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:

A terminal window with a dark background and three colored window control buttons (red, yellow, green) in the top-left corner. The title bar of the window says "env". The text inside the terminal is "REACT_APP_API_URL=https://example.com/api" in a green monospace font.

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

- Use in code:

A terminal window with a dark background and three colored window control buttons (red, yellow, green) in the top-left corner. The title bar of the window says "jsx". The text inside the terminal is "const url = process.env.REACT_APP_API_URL;" in a green monospace font.

```
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> Include the correct dependencies or use <code>[]</code> for run-once
Incorrect <code>useEffect</code> usage	Missing dependency array can cause infinite loops	Always call hooks at the top level of the component
Calling hooks conditionally	Breaks the rules of hooks	Use context or state where appropriate
Overusing props instead of state	Can lead to prop drilling	

31.2 Practice Tasks for Beginners

#	Task	Concepts Practiced
1	Counter with +/- buttons	<code>useState</code> , events
2	Form with submit handler	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 Learners

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