



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Discover. Learn. Empower.

Experiment 5

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Subject Name: Full Stack

Subject Code: 23CSH-382

1. Title:

Application Testing & Debugging

2. Aim:

To optimize the performance of the EcoTrack React application using memoization techniques and code splitting, and to enhance the user interface using enterprise-grade Material UI components.

3. Objective:

After completing this experiment and its follow-up tasks, the student will be able to:

1. Understand the purpose of automated testing in frontend applications
2. Write unit tests for JavaScript utility functions using Jest
3. Use different Jest matchers to validate expected outputs and behaviors
4. Test React components using React Testing Library
5. Verify UI rendering by querying elements from the DOM
6. Implement asynchronous testing using findBy and waitFor methods
7. Apply mocking to simulate API or external data responses in tests
8. Perform snapshot testing to detect unintended UI changes
9. Debug failing tests and application logic using browser Developer Tools and breakpoints
10. Analyze application behavior and errors systematically rather than manual checking.

4. Implementation/Code:

- logSlice.jsx:

```
import { createSlice, createAsyncThunk } from "@reduxjs/toolkit";

export const initialState = {
  data: [],
  status: "idle",
  error: null,
};

export const fetchLogs = createAsyncThunk(
  "logs/fetchLogs",
  async (_, { rejectWithValue }) => {
    try {
      await new Promise((resolve) => setTimeout(resolve, 1000));

      return [
        { id: 1, activity: "Car Travel", carbon: 4 },
        { id: 2, activity: "Electricity Usage", carbon: 6 },
        { id: 3, activity: "Cycling", carbon: 0 },
      ];
    } catch (error) {
      return rejectWithValue("Failed to fetch logs");
    }
  }
);

const logsSlice = createSlice({
  name: "logs",
  initialState,
  reducers: {
    resetLogs: () => initialState,
  },
  extraReducers: (builder) => {
    builder
      .addCase(fetchLogs.pending, (state) => {
        state.status = "loading";
        state.error = null;
      })
      .addCase(fetchLogs.fulfilled, (state, action) => {
        state.status = "success";
        state.data = action.payload;
      })
      .addCase(fetchLogs.rejected, (state, action) => {
        state.status = "failed";
        state.error = action.payload || action.error.message;
      });
  },
});

export const { resetLogs } = logsSlice.actions;
export default logsSlice.reducer;
```

- Logs.jsx:

```

import { useEffect, useCallback } from "react";
import { useDispatch, useSelector } from "react-redux";
import { fetchLogs } from "../store/logSlice";
import LoadingSpinner from "../components>Loading";
import CarbonCard from "../components/CarbonCard";
import { calculateTotalCarbon } from "../utils/carbon";

const Logs = () => {
  const dispatch = useDispatch();
  const { data, status, error } = useSelector((state) => state.logs);

  const handleRefresh = useCallback(() => {
    dispatch(fetchLogs());
  }, [dispatch]);

  useEffect(() => {
    if (status === "idle") {
      dispatch(fetchLogs());
    }
  }, [status, dispatch]);

  if(status === "loading"){
    return <LoadingSpinner />;
  }
  if(status === "failed"){
    return <p>Error: {error}</p>;
  }
  const totalCarbon = calculateTotalCarbon(data);

  return (
    <div>
      <h1>Logs</h1>

      {data.map((log) => (
        <CarbonCard
          key={log.id}
          activity={log.activity}
          carbon={log.carbon}
        />
      ))}

      <h3 data-testid="total-carbon">
        Total Carbon: {totalCarbon} kg CO2
      </h3>

      <button onClick={handleRefresh}>Refresh</button>
    </div>
  );
};

export default Logs;

```

- CarbonCards.jsx:

```
const CarbonCard = ({ activity, carbon }) => {
  return (
    <div>
      <h4>{activity}</h4>
      <p>{carbon} kg CO2</p>
    </div>
  );
};

export default CarbonCard;
```

- Loading.jsx:

```
const Loading = () => {
  return <p>Loading...</p>;
};

export default Loading;
```

- NotFound.jsx:

```
const NotFound = () => {
  return <h2>404 - Page Not Found</h2>;
};

export default NotFound;
```

- Store.jsx:

```
import { configureStore } from "@reduxjs/toolkit";
import logsReducer from "./logSlice"

const store = configureStore({
  reducer : {
    logs : logsReducer,
  },
});

export default store;
```

- AuthContext.jsx:

```
import { createContext, useContext, useState } from "react";

const AuthContext = createContext(null);

export const AuthProvider = ({children}) => {
    const [isAuthenticated, setIsAuthenticated] = useState(false);

    return (
        <AuthContext.Provider value = {{isAuthenticated, setIsAuthenticated}}>
            <children>
        </AuthContext.Provider>
    )
}

export const useAuth = () => useContext(AuthContext);
```

- ProtectedRoute.jsx:

```
import { Navigate } from "react-router-dom";
import { useAuth } from "../context/AuthContext";
import { children } from "react";

const ProtectedRoute = ({children}) => {
    const {isAuthenticated} = useAuth();

    if(!isAuthenticated) {
        return <Navigate to = "/login" replace/>
    }
    return children;
}

export default ProtectedRoute;
```

- Login.jsx:

```
import { useAuth } from "../context/AuthContext";
import { useNavigate } from "react-router-dom";

const Login = () => {
  const { setIsAuthenticated } = useAuth();
  const navigate = useNavigate();

  const handleLogin = () => {
    setIsAuthenticated(true);
    navigate("/");
  }

  return (
    <>
      <h3>Login</h3>
      <button data-testid="login-button" onClick={handleLogin}>Login</button>
    </>
  )
}

export default Login;
```

- Logout.jsx:

```
import { useEffect } from "react";
import { useNavigate } from "react-router-dom";
import { useAuth } from "../context/AuthContext";

const Logout = () => {
  const { setIsAuthenticated } = useAuth();
  const navigate = useNavigate();

  useEffect(() => {
    setIsAuthenticated(false);
    navigate("/login");
  }, [setIsAuthenticated, navigate]);

  return <p>Logging you out...</p>;
}

export default Logout;
```

- DashboardSettings, DashboardSummary, DashboardAnalytics:

```

const DashboardSettings = () => {
  return (
    <h3>These are the settings</h3>
  )
}

export default DashboardSettings;

const DashboardSummary = () => {
  return (
    <h3>This is a Summary</h3>
  )
}

export default DashboardSummary;

import { useSelector } from "react-redux";
import { calculateTotalCarbon, classifyCarbon } from "../utils/carbon";

const DashboardAnalytics = () => {
  const logs = useSelector((state) => state.logs.data);

  const total = calculateTotalCarbon(logs);
  const category = classifyCarbon(total);

  return (
    <div>
      <h3>Analytics</h3>
      <p>Total Carbon: {total} kg CO2</p>
      <p>Impact Level: {category}</p>
    </div>
  );
}

export default DashboardAnalytics;

```

- DashboardLayout.jsx:

```

import { Link, Outlet } from "react-router-dom";
import { Container, Button, Stack, Typography } from "@mui/material";

const DashboardLayout = () => {
  return [
    <Container>
      <Typography variant="h4" gutterBottom>
        Dashboard
      </Typography>

      <Stack direction="row" spacing={2} marginBottom={2}>
        <Button variant="contained" component={Link} to="settings">
          Settings
        </Button>

        <Button variant="contained" component={Link} to="summary">
          Summary
        </Button>

        <Button variant="contained" component={Link} to="analytics">
          Analytics
        </Button>
      </Stack>

      <Outlet />
    </Container>
  ];
}

export default DashboardLayout;

```

- Header.jsx:

```
import React from "react";
import { AppBar, Toolbar, Typography, Button } from "@mui/material";
import { Link } from "react-router-dom";
import { useAuth } from "../context/AuthContext";

const Header = () => {
  const { isAuthenticated } = useAuth();

  return (
    <AppBar position="static">
      <Toolbar>
        <Typography variant="h6" sx={{ flexGrow: 1 }}>
          | EcoTrack
        </Typography>

        <Button color="inherit" component={Link} to="/">
          | Dashboard
        </Button>

        <Button color="inherit" component={Link} to="/logs">
          | Logs
        </Button>

        {isAuthenticated ? (
          <Button color="inherit" component={Link} to="/logout">
            Logout
          </Button>
        ) : (
          <Button color="inherit" component={Link} to="/login">
            Login
          </Button>
        )}
      </Toolbar>
    </AppBar>
  );
};

export default React.memo(Header);
```

- App.jsx:

```
import { Route, Routes } from "react-router-dom";
import { Suspense, lazy } from "react";
import ProtectedRoute from "./routes/ProtectedRoute";
import Header from "./components/Header";
import NotFound from "./pages/NotFound";

const Login = lazy(() => import("./pages/Login"));
const Logout = lazy(() => import("./pages/Logout"));
const DashboardLayout = lazy(() => import("./pages/DashboardLayout"));
const DashboardSummary = lazy(() => import("./pages/DashboardSummary"));
const DashboardSettings = lazy(() => import("./pages/DashboardSettings"));
const DashboardAnalytics = lazy(() => import("./pages/DashboardAnalytics"));
const Logs = lazy(() => import("./pages/Logs"));

function App() {
  return (
    <>
      <Header />
      <Suspense fallback={<h2>Loading...</h2>}>
        <Routes>
          <Route path="/login" element={<Login />} />
          <Route path="/logout" element={<Logout />} />
          <Route
            path="/"
            element={
              <ProtectedRoute>
                <DashboardLayout />
              </ProtectedRoute>
            }
          >
            <Route index element={<DashboardSummary />} />
            <Route path="settings" element={<DashboardSettings />} />
            <Route path="summary" element={<DashboardSummary />} />
            <Route path="analytics" element={<DashboardAnalytics />} />
            <Route path="*" element={<NotFound />} />
          </Route>
          <Route
            path="/logs"
            element={
              <ProtectedRoute>
                <Logs />
              </ProtectedRoute>
            }
          >
            </Routes>
          </Suspense>
        </>
      );
}

export default App;
```

5. Output

The figure consists of three vertically stacked screenshots of a React-based application named "EcoTrack".

- Login Screen:** A blue header bar with the "EcoTrack" logo. Below it, the word "Login" is displayed in bold black font. A "Login" button is centered below the text.
- Logs Screen:** A blue header bar with the "EcoTrack" logo. To the right, there are links for "DASHBOARD", "LOGS", and "LOGOUT". Below the header, the word "Logs" is in bold black font. A list of activities with their CO2 emissions follows:
 1. Car Travel: 4 kg CO2
 2. Electricity Usage: 6 kg CO2
 3. Cycling: 0 kg CO2A "Total Carbon: 10 kg CO2" summary is shown, along with a "Refresh" button.
- Dashboard Screen:** A blue header bar with the "EcoTrack" logo. Below it, the word "Dashboard" is in large bold black font. Three blue buttons labeled "SETTINGS", "SUMMARY", and "ANALYTICS" are positioned horizontally. Under the "ANALYTICS" section, the heading "Analytics" is in bold black font. Below it, the "Total Carbon: 10 kg CO2" summary is displayed again, followed by the "Impact Level: High Impact" message.

6. Learning Outcome

- We learnt about React Apps and how to create them.
- We learnt about redux and its components.
- We learnt about the use of thunks and Slices.
- We learnt about Authentication and index pages
- We learnt about React testing library and its components.
- We learnt about the use and implementation of snapshot testing.