Development of an E-commerce Platform with a Recommendation System

Scenario

You are tasked with designing and implementing an e-commerce platform that includes a robust recommendation system. The goal is to suggest products to users based on their browsing and purchase history, thereby enhancing the user experience and promoting relevant products. The system needs to efficiently handle large amounts of data and provide personalized recommendations.

Requirements

- Personalized product recommendations based on user browsing and purchase history.

- Provide relevant product suggestions.

- Use at least two different data structures, including at least one non-linear data structure.

Hint:

Data Structures that can be used but not restricted to.

1. Hash Tables: For fast lookups of user and product data.
2. Graphs or Trees (Non-Linear Data Structure): For managing the recommendation logic and relationships between products and users

System Components

1. **User Management**: Handle user registration, login, and profile management.
2. **Product Management**: Manage product information, categories, and inventory.
3. **Browsing History Tracker**: Track and store user browsing history.
4. **Purchase History Tracker**: Track and store user purchase history.
5. **Recommendation Engine**: Analyze browsing and purchase data to generate personalized recommendations.

Operations Needed

To efficiently manage these components, the system should support the following operations:

- **Add User**: Register a new user.
- **Add Product**: Add a new product to the catalog.

- **Track Browsing History**: Record user interactions with products.
- **Track Purchase History**: Record user purchases.
- **Generate Recommendations**: Suggest products to users based on their history.
- **Retrieve User Data**: Access user data for personalized experiences.
- **Retrieve Product Data**: Access product data for displaying recommendations.

Development Plan

User Management

- **Data Structure**: Hash Table
- **Operations**:
    - Add user
    - Retrieve user information
    - Update user information

Product Management

- **Data Structure**: Hash Table
- **Operations**:
    - Add product
    - Retrieve product information
    - Update product information

Browsing and Purchase History Tracking

- **Data Structure**: Graph or Tree
- **Operations**:
    - Record browsing history
    - Record purchase history
    - Retrieve history for analysis

Recommendation Engine

- **Data Structure**: Graph or Tree
- **Operations**:
    - Analyze user data to identify patterns
    - Generate personalized recommendations based on identified patterns

Implementation

1. **User Management Module**:

- Implement a hash table to store user data.
- Provide functions for adding, retrieving, and updating user information.

2. **Product Management Module**:
    - Implement a hash table to store product data.
    - Provide functions for adding, retrieving, and updating product information.
3. **Browsing and Purchase History Module**:
    - Implement a graph or tree to track user interactions with products.
    - Record each browsing and purchase event in the data structure.
    - Provide functions to retrieve and analyze the history data.
4. **Recommendation Engine**:
    - Implement algorithms to analyze the browsing and purchase history data.
    - Use the graph or tree structure to identify patterns and relationships between users and products.
    - Generate a list of recommended products for each user based on the analysis