

2. Describe the UML representation of interactions in a Library Management System's book borrowing process, emphasizing actor roles, event flow, decision points, and ensuring scalability for future system enhancements.

A use case diagram for a Library Management System (LMS) in UML (Unified Modelling Language) helps to depict the various interactions between users and the system. Use case diagrams illustrate the functionalities of a system and the relationships between different actors and use cases. In the context of an LMS, common actors might include Librarian, Member, and Guest. Here's a brief description of the key elements in a use case diagram for a Library Management System:

Use Case Diagram:

1. Actors:

- **Librarian:** The Librarian is a primary actor who manages the overall functioning of the library system. They have access to administrative functionalities such as adding or removing books, managing memberships, and handling fines.
- **Member:** The Member is a registered user of the library who can borrow and return books. They have access to functionalities like searching for books, checking their account status, and placing holds.
- **Guest:** A Guest is an unregistered user who can browse the available books but has limited functionalities compared to a Member.

2. Use Cases:

- **Search for Books:** Users (Members and Guests) can search for books based on various criteria such as title, author, or genre.
- **Borrow Book:** Members can borrow books from the library by selecting available copies of a book.
- **Return Book:** Members can return borrowed books to the library.
- **Membership:** Librarians can manage user memberships, including registering new Members, updating member information, and deactivating memberships.
- **Add/Remove Books:** Librarians can add new books to the library inventory or remove books that are no longer available.
- **Check Account Status:** Members can check their account status, including borrowed books, due dates, and any fines incurred.
- **Place Hold:** Members can place a hold on a book that is currently checked out by another member.

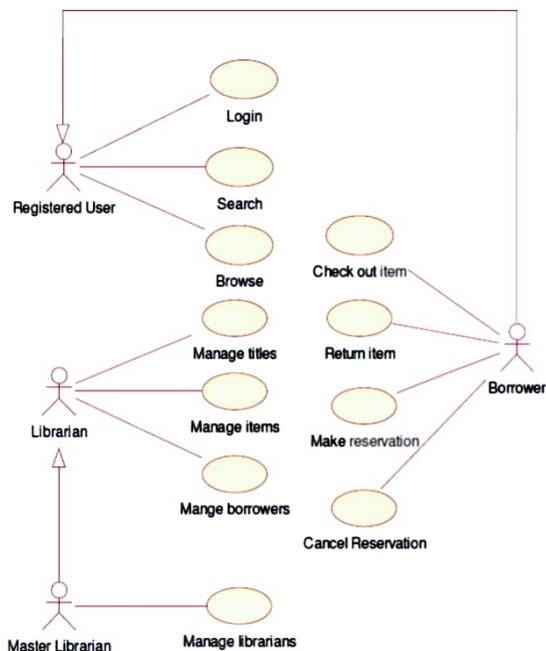
3. Associations:

- **Association between Librarian and Manage Membership:** Indicates that the Librarian is associated with the "Manage Membership" use case.
- **Association between Member and Borrow Book/Return Book:** Indicates that Members can interact with the system to borrow and return books.
- **Association between Guest and Search for Books:** Indicates that Guests can search for books in the library.

4. Include and Extend Relationships:

- **Include relationship between Borrow Book and Check Account Status:** Indicates that when a member borrows a book, their account status is automatically checked to ensure eligibility.
- **Extend relationship between Place Hold and Borrow Book:** Indicates that placing a hold is an optional extension of the borrowing process.

This use case diagram provides a high-level overview of the interactions within the Library Management System and helps in understanding the system's functionality from the perspective of different actors.



Activity Diagram:

An activity diagram for a Library Management System (LMS) in UML (Unified Modelling Language) helps to depict the flow of activities within the system as users interact with it. Activity diagrams are especially useful for modelling the workflow and sequential steps involved in various processes. Below is a description of an activity diagram for a Library Management System:

1. Activity Diagram for Library Management System:

- The diagram begins with a start node, representing the initiation of the Library Management System.

2. User Login:

The first activity is the "User Login" process. This involves users (Librarian, Member, or Guest) providing their credentials to access the system.

3. Branch Based on User Type:

After successful login, the system determines the user type (Librarian, Member, or Guest).

4. Librarian Activities:

If the user is identified as a Librarian, the following activities occur:

- **Manage Membership:** The Librarian can manage user memberships, including adding new members, updating member information, and deactivating memberships.
- **Add/Remove Books:** The Librarian can add new books to the library inventory or remove books that are no longer available.

5. Member Activities:

If the user is identified as a Member, the following activities occur:

- **Search for Books:** Members can search for books based on criteria such as title, author, or genre.
- **Borrow Book:** Members can select available copies of a book and borrow them.
- **Return Book:** Members can return borrowed books to the library.
- **Check Account Status:** Members can check their account status, including borrowed books, due dates, and any fines incurred.

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- **Place Hold:** Members can place a hold on a book that is currently checked out by another member.

6. Guest Activities:

If the user is identified as a Guest, the following activities occur:

- **Search for Books:** Guests can browse the available books in the library but have limited functionalities compared to Members.

7. End:

The diagram concludes with an end node, indicating the completion of the activities.

Additional Considerations:

- **Decision Points:** Decision points may be included to represent conditions, such as checking whether a user is a Librarian, Member, or Guest.
- **Loops:** Loops can be added to represent repetitive activities, such as searching for multiple books or borrowing multiple books.
- **Parallel Activities:** Parallel activities may be depicted to show simultaneous processes, such as a Librarian managing memberships while a Member searches for books.

This activity diagram provides a visual representation of the sequential activities within the Library Management System, highlighting the interactions between users and the system.

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