UML Exercise: Design a Library Management System

Problem Statement:

You are required to design a **Library Management System** using UML diagrams. The system should manage books, library members, and the borrowing process. The system should have the following capabilities:

1. **Books:**
   - Each book should have a title, author, ISBN, and publication date.
   - Books can be available in different genres (e.g., Fiction, Non-Fiction, Science, etc.).
   - The library keeps track of the number of copies of each book.
2. **Members:**
   - Library members should have a name, membership ID, contact details, and membership expiration date.
   - Members can borrow books from the library.
   - Each member can borrow up to 5 books at a time.
   - The system should track which books are currently borrowed by each member.
3. **Borrowing Process:**
   - A member can borrow a book if it is available in the library.
   - The borrowing record should include the borrow date and the due date for return.
   - Members should be able to return books, and the system should update the availability of the book.
4. **Fines:**
   - If a member returns a book after the due date, they should be fined.
   - The fine should be calculated based on the number of days overdue.

Tasks:

1. **Class Diagram:**
   - Create a class diagram to represent the system, showing the classes, their attributes, methods, and the relationships between them.
2. **Use Case Diagram:**
   - Draw a use case diagram to identify the main actors (e.g., Librarian, Member) and the key use cases (e.g., Borrow Book, Return Book, Add New Book).
3. **Sequence Diagram:**
   - Create a sequence diagram to illustrate the process of a member borrowing a book, including interactions between the member, the book, and the library system.
4. **Activity Diagram:**
   - Design an activity diagram to show the workflow of returning a book, including the steps of checking for overdue fines and updating the book's availability.

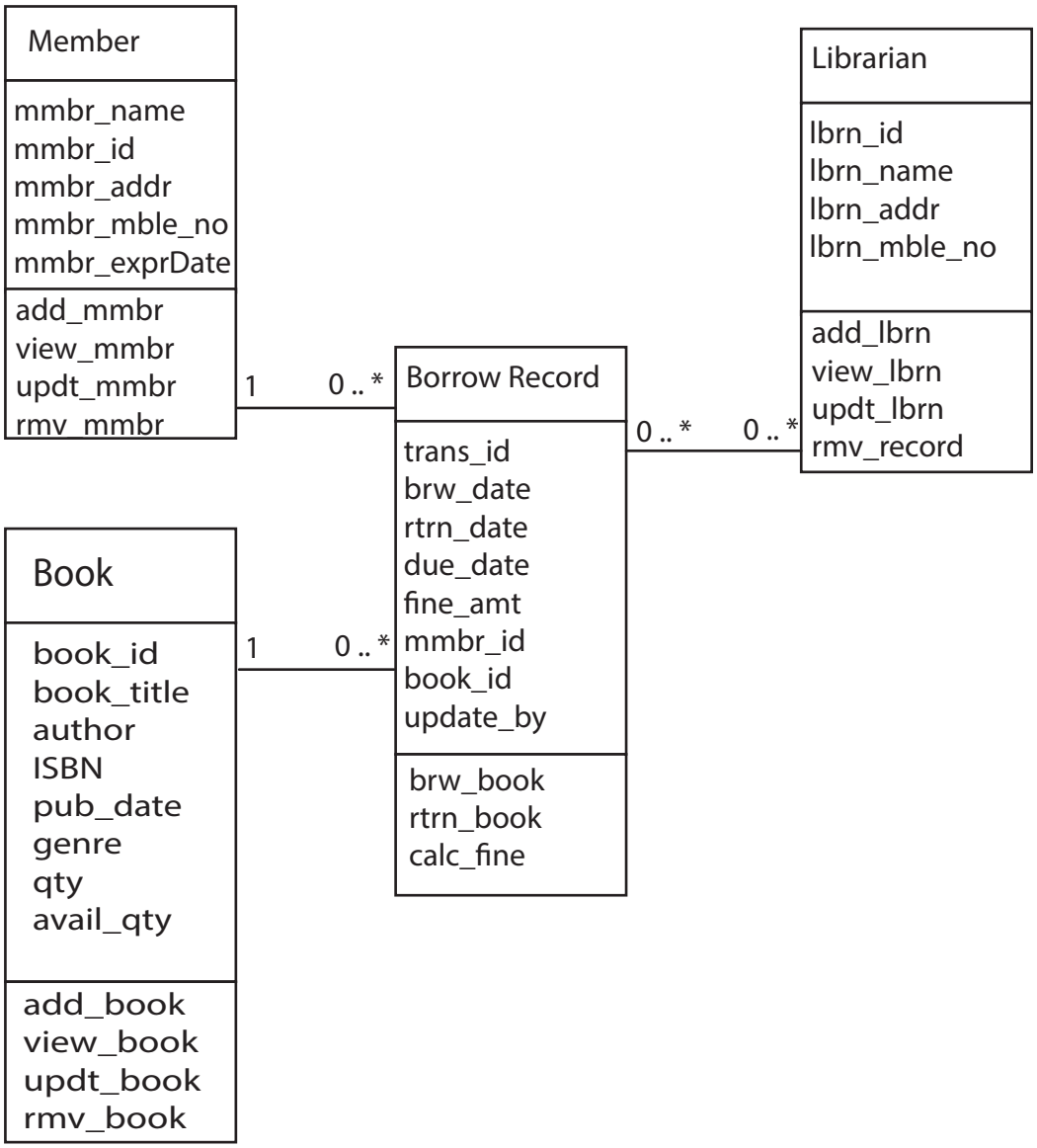
Deliverables:

- Create your UML diagrams (Class Diagram, Use Case Diagram, Sequence Diagram, and Activity Diagram) with proper annotations.
- Provide a brief explanation of each diagram, describing the design decisions and how the system fulfills the requirements.

Class Diagram

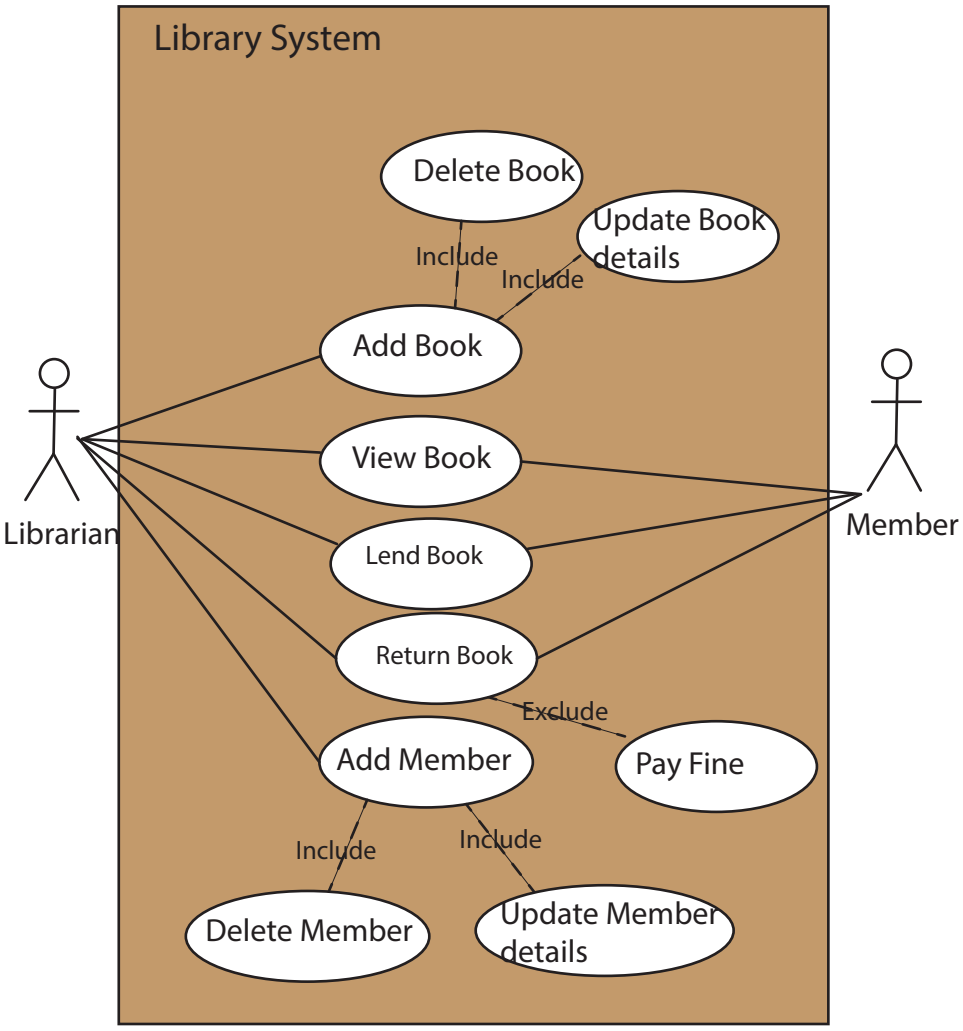
Class Diagram

- Books - will have the attributes of the book details along with the quantity in stock
    - Methods - CRUD for the books records
- Member - will have the attributes for the member details
    - Methods - CRUD for the member records
- Librarian - is the primary user of the system. Librarian attributes.
    - Methods - CRUD on Librarian records.
- Borrow Record - the attributes for this are the book_id, member_id,brw_date, rtrn_date and updt_by (lbrn_id).
    - Methods - brw_book, rtrn_book, calc_fine



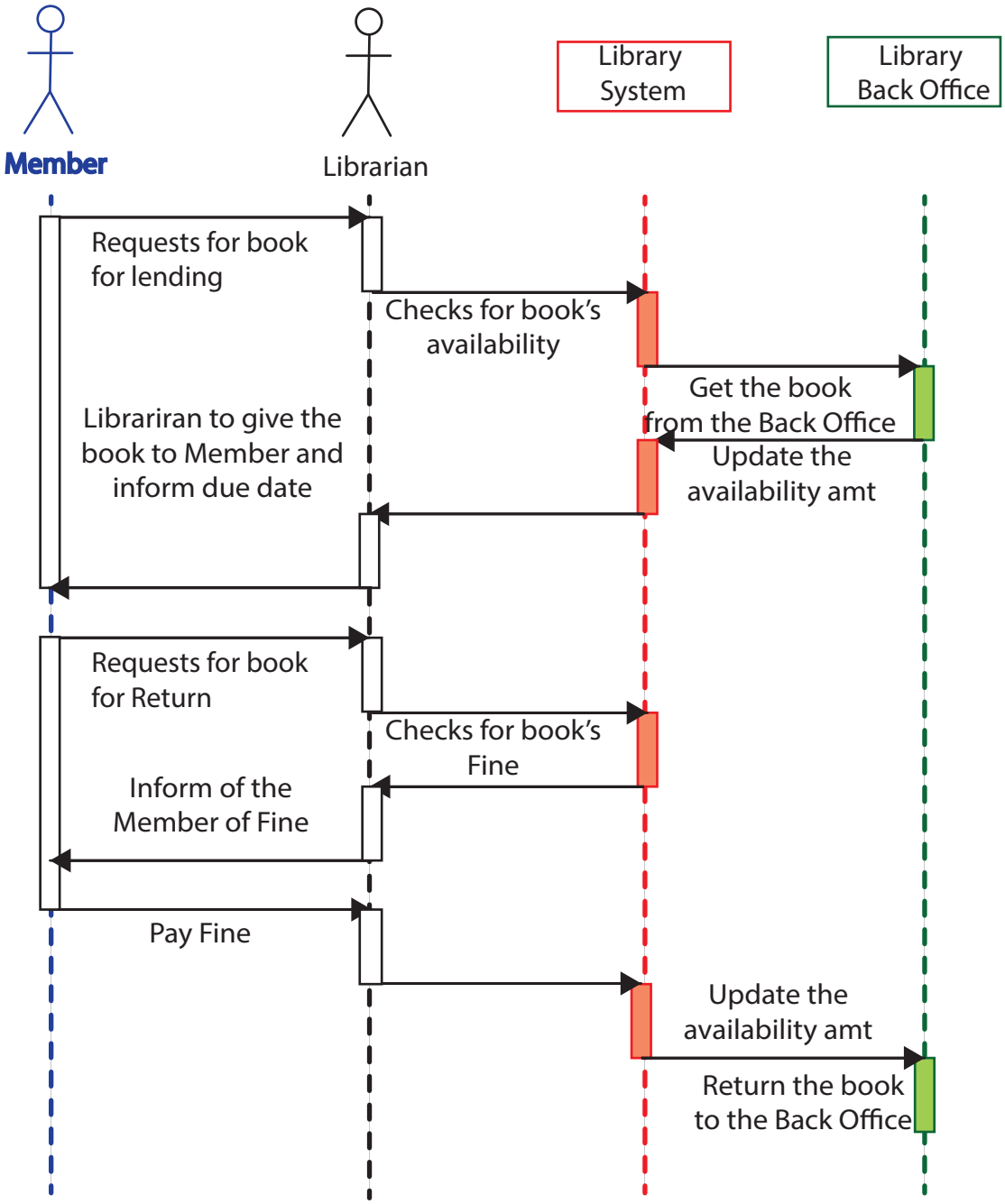
Use Case Diagram

Use Case	Case Description
Add Book	Librarian enters detail of the Book into the system and creates a record.
View Book	Librarian or Member views the details of a book if it is available for lending.
Update Book Details	Librarian updates the details of the book. Specifically the quantity of the available stock.
Delete Book	Librarian deletes the record of the Book from the system.
Add Member	Librarian will add the Members Record.
Update Member Details	Librarian to update the details of the Member.
Delete Member	Librarian deletes the record of the Member from the system.
Lend Book	Member to request for book for lending.
Return Book	Member to return the book that was lent.
Pay Fine for Overdue	Member will need to pay a fine if the book is overdue.
View Book	Librarian and Member can check the details of a book and see the available quantity of stock.



Sequence Diagram

The Sequence diagram below showcase the flow of the activities on Borrowing and Returning books in the system.



Activity Diagram

The Activity diagram documents how an interaction will be one with a new Member borrowing a book.
It also shows how the activity of returning the book will happen with the additional logic of checking the fine.