

## PlantUML Sequence Diagram of the Code Flow

### Root Cause Analysis

The logs show that the code is working as expected. There are no crashes or errors.

### Observations

- The member successfully reserves a book if it is not already reserved.
- The member successfully checks out a book if it is not already lent out and the member has not checked out the maximum number of books.
- The member successfully renews a book if it is not reserved by another member.
- The member successfully returns a book.
- The member cannot reserve or check out a book that is already reserved by another member.
- The member cannot check out more than the maximum number of books allowed.
- The member cannot renew a book that is reserved by another member.

### Recommendations

- The code could be improved by adding more logging to track the status of books and reservations.
- The code could be improved by adding error handling for cases where a book is not found or a reservation cannot be created.
- The code could be improved by adding validation to ensure that members cannot check out more books than the maximum allowed.

**Plant UML image was not generated due to server error - use [planttext.com](https://planttext.com)**

```

@startuml
!include https://raw.githubusercontent.com/plantuml-stdlib/C4-PlantUML/master/C4_Context.puml

C4_Container(library_code, "Library Code", "Library Code" ) {
    C4_System_Boundary(library_system, "Library System", "Main System for managing library operations") {
        C4_Container(definitions, "Definitions", "") {
            C4_Class(BookStatus, "Enum BookStatus", "Class representing the different statuses of a book")
            C4_Class(ReservationStatus, "Enum ReservationStatus", "Class representing the different statuses of a reservation")
            C4_Class(AccountStatus, "Enum AccountStatus", "Class representing the different statuses of an account")
            C4_Class(LibConstants, "Class LibConstants", "holds library constants")
        }
        C4_Container(utilities, "Utilities", "") {
            C4_Class(utils, "Class Utils", "Provides utilities for different functions")
        }
        C4_Container(book_management, "Book Management", "") {
            C4_Container(catalog, "Catalog Module", "Provides functionality to search and manage the library catalog") {
                C4_Class(Catalog, "Class Catalog", "Provides methods to search and manage the library catalog")
                C4_Interface(Searchable, "Interface Searchable", "Defines methods for searching")
                C4_Generalization(Catalog, Searchable, "implements")
            }
            C4_Container(search, "Search Module", "Provides functionality to search the library catalog") {
                C4_Class(BookLending, "Class BookLending", "Provides functionality to manage book lending")
                C4_Class(BookReservation, "Class BookReservation", "Provides functionality to manage book reservations")
            }
            C4_Container(definitions, "Definitions", "") {
                C4_Class(BookGenre, "Enum BookFormat", "Class representing the different book formats")
                C4_Class(BookStatus, "Enum BookStatus", "Class representing the different statuses of a book")
                C4_Class(Fine, "Class Fine", "Provides functionality to manage fines")
            }
            C4_Class(Book, "Abstract Class Book", "Represents a book in the library")
            C4_Class(BookItem, "Class BookItem", "Represents a specific book item in the library")
        }
        C4_Container(library_administration, "Library Administration", "") {
            C4_Container(definitions, "Definitions Module", "Provides definitions for different objects in the library") {
                C4_Class(Address, "Class Address", "Holds the address of a person")
                C4_Class(Account, "Abstrac Class Account", "Represents an account in the library")
                C4_Class(Person, "Class Person", "Represents a person in the system")
                C4_Class(Member, "Class Member", "Represents a member in the library")
                C4_Class(Librarian, "Class Librarian", "Represents a librarian in the library")
            }
            C4_Class(Librarian, "Class Librarian", "Provides functionality for managing the library")
            C4_Class(Member, "Class Member", "Provides functionality for members to interact with the library")
            C4_Class(Account, "Abstrac Class Account", "Represents an account in the library")
            C4_Class(Fine, "Class Fine", "Provides functionality to manage fines")
        }
    }
}
@enduml

```

Logs:

```
2025-01-25 02:32:47,351 - root - INFO - class: Member, module: __init__, file:
member.py, log: Member object created., line: 19
2025-01-25 02:32:47,353 - root - INFO - class: Librarian, module:
code.library_administration.librarian, file: librarian.py, log: Book item added
successfully., line: 21
2025-01-25 02:32:47,354 - root - INFO - class: Librarian, module:
code.library_administration.librarian, file: librarian.py, log: Book item added
successfully., line: 21
2025-01-25 02:32:47,354 - root - INFO - class: Member, module: reserve_book_item,
file: member.py, log: Book item reserved successfully., line: 34
2025-01-25 02:32:47,354 - root - INFO - class: Member, module:
get_total_books_checkedout, file: member.py, log: Fetching total books checked out.,
line: 22
2025-01-25 02:32:47,355 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:32:47,355 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:32:47,355 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Lending a book, line:
17
2025-01-25 02:32:47,355 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Checking if the book is
already lent out, line: 21
2025-01-25 02:32:47,356 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Adding a new lending
record, line: 28
2025-01-25 02:32:47,356 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Book lent successfully,
line: 37
2025-01-25 02:32:47,356 - root - INFO - class: Member, module:
increment_total_books_checkedout, file: member.py, log: Incremented total books
checked out., line: 38
2025-01-25 02:32:47,356 - root - INFO - class: Member, module: checkout_book_item,
file: member.py, log: Book item checked out successfully., line: 75
2025-01-25 02:32:47,356 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Fetching lending
details, line: 42
2025-01-25 02:32:47,356 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Returning fetched
lending details, line: 49
2025-01-25 02:32:47,356 - root - INFO - class: Member, module: renew_book_item, file:
member.py, log: Due date is 2025-02-04, line: 81
2025-01-25 02:32:47,358 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:32:47,359 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:32:47,359 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Lending a book, line:
17
2025-01-25 02:32:47,359 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Checking if the book is
already lent out, line: 21
2025-01-25 02:32:47,359 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Book is already lent
out, line: 24
2025-01-25 02:32:47,359 - root - INFO - class: Member, module: renew_book_item, file:
member.py, log: Book item renewed successfully., line: 121
2025-01-25 02:32:47,359 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Fetching lending
details, line: 42
2025-01-25 02:32:47,359 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Returning fetched
lending details, line: 49
2025-01-25 02:32:47,359 - root - INFO - class: Member, module: renew_book_item, file:
member.py, log: Due date is 2025-02-04, line: 81
2025-01-25 02:32:47,359 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
```

```
2025-01-25 02:32:47,359 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:32:47,359 - root - INFO - class: Member, module: return_book_item, file:
member.py, log: Book item returned successfully., line: 103
2025-01-25 02:32:47,359 - root - INFO - class: Member, module:
get_total_books_checkedout, file: member.py, log: Fetching total books checked out.,
line: 22
2025-01-25 02:32:47,359 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:32:47,359 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:32:47,359 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Lending a book, line:
17
2025-01-25 02:32:47,359 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Checking if the book is
already lent out, line: 21
2025-01-25 02:32:47,359 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Adding a new lending
record, line: 28
2025-01-25 02:32:47,360 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Book lent successfully,
line: 37
2025-01-25 02:32:47,360 - root - INFO - class: Member, module:
increment_total_books_checkedout, file: member.py, log: Incremented total books
checked out., line: 38
2025-01-25 02:32:47,360 - root - INFO - class: Member, module: checkout_book_item,
file: member.py, log: Book item checked out successfully., line: 75
2025-01-25 02:32:47,360 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Fetching lending
details, line: 42
2025-01-25 02:32:47,360 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Returning fetched
lending details, line: 49
2025-01-25 02:32:47,360 - root - INFO - class: Member, module: renew_book_item, file:
member.py, log: Due date is 2025-02-04, line: 81
2025-01-25 02:32:47,360 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:32:47,360 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:32:47,360 - root - INFO - class: Member, module: return_book_item, file:
member.py, log: Book item returned successfully., line: 103
2025-01-25 02:32:47,360 - root - INFO - class: Member, module:
get_total_books_checkedout, file: member.py, log: Fetching total books checked out.,
line: 22
2025-01-25 02:32:47,360 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:32:47,360 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:32:47,360 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Lending a book, line:
17
2025-01-25 02:32:47,360 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Checking if the book is
already lent out, line: 21
2025-01-25 02:32:47,360 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Book is already lent
out, line: 24
2025-01-25 02:32:47,360 - root - INFO - class: Member, module: checkout_book_item,
file: member.py, log: Failed to checkout book item., line: 71
2025-01-25 02:32:47,360 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Fetching lending
details, line: 42
2025-01-25 02:32:47,360 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Returning fetched
lending details, line: 49
```

```
lending_details, line: 49
2025-01-25 02:32:47,360 - root - INFO - class: Member, module: renew_book_item, file:
member.py, log: Due date is 2025-02-04, line: 81
2025-01-25 02:32:47,360 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:32:47,361 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:32:47,361 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Lending a book, line:
17
2025-01-25 02:32:47,361 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Checking if the book is
already lent out, line: 21
2025-01-25 02:32:47,361 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Book is already lent
out, line: 24
2025-01-25 02:32:47,361 - root - INFO - class: Member, module: renew_book_item, file:
member.py, log: Book item renewed successfully., line: 121
2025-01-25 02:32:47,361 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Fetching lending
details, line: 42
2025-01-25 02:32:47,361 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Returning fetched
lending details, line: 49
2025-01-25 02:32:47,361 - root - INFO - class: Member, module: renew_book_item, file:
member.py, log: Due date is 2025-02-04, line: 81
2025-01-25 02:32:47,361 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:32:47,361 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:32:47,361 - root - INFO - class: Member, module: return_book_item, file:
member.py, log: Book item returned successfully., line: 103
2025-01-25 02:33:02,123 - root - INFO - class: Member, module: __init__, file:
member.py, log: Member object created., line: 19
2025-01-25 02:33:02,124 - root - INFO - class: Librarian, module:
code.library_administration.librarian, file: librarian.py, log: Book item added
successfully., line: 21
2025-01-25 02:33:02,124 - root - INFO - class: Librarian, module:
code.library_administration.librarian, file: librarian.py, log: Book item added
successfully., line: 21
2025-01-25 02:33:02,124 - root - INFO - class: Member, module:
get_total_books_checkedout, file: member.py, log: Fetching total books checked out.,
line: 22
2025-01-25 02:33:02,124 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:33:02,125 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:33:02,125 - root - INFO - class: Member, module: checkout_book_item,
file: member.py, log: Failed to checkout book item., line: 71
2025-01-25 02:33:02,125 - root - INFO - class: Member, module:
get_total_books_checkedout, file: member.py, log: Fetching total books checked out.,
line: 22
2025-01-25 02:33:02,125 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:33:02,125 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:33:02,125 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Lending a book, line:
17
2025-01-25 02:33:02,125 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Checking if the book is
already lent out, line: 21
2025-01-25 02:33:02,125 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Adding a new lending
record, line: 28
```

```
2025-01-25 02:33:02,125 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Book lent successfully,
line: 37
2025-01-25 02:33:02,125 - root - INFO - class: Member, module:
increment_total_books_checkedout, file: member.py, log: Incremented total books
checked out., line: 38
2025-01-25 02:33:02,125 - root - INFO - class: Member, module: checkout_book_item,
file: member.py, log: Book item checked out successfully., line: 75
2025-01-25 02:33:02,126 - root - INFO - class: Member, module: reserve_book_item,
file: member.py, log: Book item reserved successfully., line: 34
2025-01-25 02:33:02,126 - root - INFO - class: Member, module: __init__, file:
member.py, log: Member object created., line: 19
2025-01-25 02:33:02,126 - root - INFO - class: Member, module: reserve_book_item,
file: member.py, log: Book item reserved successfully., line: 34
2025-01-25 02:33:02,126 - root - INFO - class: Member, module:
get_total_books_checkedout, file: member.py, log: Fetching total books checked out.,
line: 22
2025-01-25 02:33:02,126 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
details., line: 14
2025-01-25 02:33:02,126 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:33:02,126 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Lending a book, line:
17
2025-01-25 02:33:02,126 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Checking if the book is
already lent out, line: 21
2025-01-25 02:33:02,126 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Adding a new lending
record, line: 28
2025-01-25 02:33:02,127 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Book lent successfully,
line: 37
2025-01-25 02:33:02,127 - root - INFO - class: Member, module:
increment_total_books_checkedout, file: member.py, log: Incremented total books
checked out., line: 38
2025-01-25 02:33:02,127 - root - INFO - class: Member, module: checkout_book_item,
file: member.py, log: Book item checked out successfully., line: 75
2025-01-25 02:33:02,127 - root - INFO - class: Member, module:
increment_total_books_checkedout, file: member.py, log: Incremented total books
checked out., line: 38
2025-01-25 02:33:02,127 - root - INFO - class: Member, module:
increment_total_books_checkedout, file: member.py, log: Incremented total books
checked out., line: 38
2025-01-25 02:33:02,127 - root - INFO - class: Member, module:
increment_total_books_checkedout, file: member.py, log: Incremented total books
checked out., line: 38
2025-01-25 02:33:02,127 - root - INFO - class: Member, module:
increment_total_books_checkedout, file: member.py, log: Incremented total books
checked out., line: 38
2025-01-25 02:33:02,127 - root - INFO - class: Member, module:
get_total_books_checkedout, file: member.py, log: Fetching total books checked out.,
line: 22
2025-01-25 02:33:02,127 - root - INFO - class: Member, module: checkout_book_item,
file: member.py, log: User has already checked out the maximum number of books., line:
60
2025-01-25 02:33:02,127 - root - INFO - class: Member, module: reserve_book_item,
file: member.py, log: Book item reserved successfully., line: 34
2025-01-25 02:33:02,127 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Fetching lending
details, line: 42
2025-01-25 02:33:02,127 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Returning fetched
lending details, line: 49
2025-01-25 02:33:02,127 - root - INFO - class: Member, module: renew_book_item, file:
member.py, log: Due date is 2025-02-04, line: 81
2025-01-25 02:33:02,129 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: Fetching reservation
```

```
details., line: 14
2025-01-25 02:33:02,129 - root - INFO - class: BookReservation, module:
fetch_reservation_details, file: book_reservation.py, log: No reservation details
found., line: 24
2025-01-25 02:33:02,129 - root - INFO - class: Member, module: return_book_item, file:
member.py, log: Book item returned successfully., line: 103
2025-01-25 02:33:02,129 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Fetching lending
details, line: 42
2025-01-25 02:33:02,130 - root - INFO - class: BookLending, module:
code.book_management.book_lending, file: book_lending.py, log: Returning fetched
lending details, line: 49
2025-01-25 02:33:02,130 - root - INFO - class: Fine, module:
code.library_administration.fine, file: fine.py, log: Initializing Fine instance,
line: 5
2025-01-25 02:33:02,130 - root - INFO - class: Fine, module:
code.library_administration.fine, file: fine.py, log: Collecting fine, line: 11
2025-01-25 02:33:02,130 - root - INFO - class: Fine, module:
code.library_administration.fine, file: fine.py, log: Fine collected: $0 for 0 overdue
days, line: 14
2025-01-25 02:33:02,130 - root - INFO - class: Catalog, module:
code.book_management.catalog, file: catalog.py, log: Initializing Catalog instance,
line: 7
```

**This is an LLM generated report - please be aware of hallucinations  
(Esp if you provide an incorrect prompt/insufficient data)**