Test Suite

1. MemberLogin()

1. Test MemberLogin()

- **Member Logs in successfully**

Input:

- MemberID: "19CS30014"
- Password: "Password" (Encrypted Version: "gAAAAABgWZnULUhCsW.....")
- MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW.....

Output:

- An LibraryMember Object (MemberID: "LIB0011"; Name: "Larry")

- **MemberID not in MEMBERS table.**

Input:

- MemberID: "19CS30056"
- Password: "Pass" (Encrypted Version: "gAAAAAasdfasdfaw.....")
- MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW.....

Output:

- Exception Thrown: MemberIDInvalid: "The MemberID is not present in the system."
- Message to the User: "Invalid MemberID inputted."

- **Password does not match with MemberID**

Input:

- MemberID: "19CS30014"
- Password: "Pass" (Encrypted Version: "gAAAAfafasgawCsW.....")
- MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW.....

Output:

- Exception Thrown: PasswordIncorrect: "The Password is incorrect."
- Message to the User: "Password is incorrect."

2. EmployeeLogin()

1. Test EmployeeLogin()

- **Employee Logs in successfully**

  Input:

  - EmployeeID: LIB0011
  - Password: "Password" (Encrypted Version: "gAAAAABgWZnULUhCsW.....")
  - EMPLOYEES table:

EmployeeID	EmployeeName	PassWD
"LIB0011"	"Larry"	gAAAAABgWZnULUhCsW.....

  Output:

  - An LibraryClerk Object (EmployeeID: "LIB0011"; Name: "Larry")

- **EmployeeID not in EMPLOYEES table.**

  Input:

  - EmployeeID: LIB0011
  - Password: "Password" (Encrypted Version: "gAAAAABgWZnULUhCsW.....")
  - EMPLOYEES table:

EmployeeID	EmployeeName	PassWD
"LIB0011"	"Larry"	gAAAAABgWZnULUhCsW.....

  Output:

  - Exception Thrown: EmployeeIDInvalid: "The EmployeeID is not present in the system."
  - Message to the User: "Invalid EmployeeID inputted."

- **Password does not match with Employee ID**

  Input:

  - EmployeeID: 19CS30056
  - Password: "Pass" (Encrypted Version: "gAAAAfafasgawCsW.....")
  - EMPLOYEES table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW.....

  Output:

  - Exception Thrown: PasswordIncorrect: "The Password is incorrect."
  - Message to the User: "Password is incorrect."

3. Library Member

1. **Test Getter Function**

   - **Getting the Member ID of the Member**

   Input: A LibraryMember object (name: Harry; memberID: 19CS30014; : None)

   Output: 19CS30014

   - **Getting the Name of the Member**

   Input: A LibraryMember object (name: Harry; memberID: 19CS30014; : None)

   Output: Harry

   - **Getting the Number of Books Issued by the Member**

   Input: A LibraryMember object (name: Harry; memberID: 19CS30014; listOfBooksIssued: [7]; numberOfBooksIssued: 1; : None)

   Output: 1

2. **Test CheckAvailabilityOfBook()**

   - **The user has an Active Reservation on this ISBN.**

   Input:

     - IBSN: 988-0789032742

     - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; : None)

     - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,"	(NULL)	"2021-04-08*19CS30014,"	"3,"	0

   Output:

     - List of ActiveReservedUIDS: [3] (Displayed along with their Rack No.)

   - **The user has a Pending Reservation on this ISBN.**

   Input:

     - IBSN: 988-0789032742

     - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; : None)

     - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,"	"19CS30014"	(NULL)	(NULL)	0

   Output:

     - Message to the User: "Your Reservation is still pending. Please wait for a few more days."

   - **The user has no reservation on this ISBN and some UIDs are available. (May have reservations on other ISBN)**

   Input:

     - IBSN: 988-0789032742

- A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "999-6666689999"; : None)

- RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7, 2,"	"1,"	(NULL)	(NULL)	(NULL)	2

Output:

- List of AvailableUIDs: [7, 2] (Displayed along with their Rack No.)

- **The user has no reservation on any ISBN and no UIDs are available.**

Input:

- IBSN: 988-0789032742

- A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: None; : None)

- RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,"	(NULL)	(NULL)	(NULL)	0

Output:

- Message to the User: 'Sorry this book is not available currently, Would you like to reserve this book?'

- **The user has a reservation on a different ISBN and no UIDs are avalaible.**

Input:

- IBSN: 988-0789032742

- A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "999-6666689999"; : None)

- RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,"	(NULL)	(NULL)	(NULL)	0

Output:

- Message to the User: "Sorry this book is not available currently, and you already have a reservation on another ISBN"

3. **Test IssueBook()**

- **Member tries to claim a book they have already issued**

Input:

- IBSN: 988-0789032742

- A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: None; listOfIssuedBook: [1]; numberOfIssuedBooks: 1)

- RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	1

Output:

- Exception Thrown: ISBNIssueLimitPerMemberExceeded : "Member cannot issue the same ISBN more than once."
- **Member has exhausted their permitted number of issues**

  Input:
  - IBSN: 988-0789032742
  - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: None; listOfIssuedBook: [1, 8]; numberOfIssuedBooks: 2)
  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	1

  Output:
  - Exception Thrown: MaxBooksAllowedExceeded : "Member cannot issue more than maxBooksAllowed"
- **Member claims a reserved book.**

  Input:
  - IBSN: 988-0789032742
  - Date.today() = 01/04/2021
  - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; : None)
  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	(NULL)	"2021-04-03*19CS30014"	"7,"	0

  Output:
  - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [7]; numberOfIssuedBooks: 1)
  - MEMBERS table: As ReservedBook is claimed, it is made NULL. The claimed book has been added to ListOfIssuedBooks

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW.....

  - RESERVATIONS table: The ActiveReservation and ActiveReservedUIDs related to the Member has been removed. The claimed boo has been added to TakenUIDs

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,7,"	(NULL)	(NULL)	(NULL)	0

- **Member issues an available book.**

  Input:
  - IBSN: 988-0789032742
  - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; : None)
  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	1

Output:

- A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [7]; numberOfIssuedBooks: 1)

- MEMBERS table: The issued book has been added to ListOfIssuedBooks

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW.....

- RESERVATIONS table: The issued book is removed from AvailableUIDs and put into TakenUIDs

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,7,"	(NULL)	(NULL)	(NULL)	0

4. **Test ReserveBook()**

- **The book is available.**

   Input:

   - IBSN: 988-0789032742

   - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: None; : None)

   - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	0

Output:

- Exception Thrown: ReserveNotAllowed: "Member cannot reserve an ISBN with available UID."

- **The book is unavailable and user has made no reservation for any book.**

   Input:

   - IBSN: 988-0789032742

   - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: None; : None)

   - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	(NULL)	(NULL)	(NULL)	0

Output:

- A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; : None)

- MEMBERS table: ISBN is added in the members ReservedBook field.

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	"988-0789032742"	0	gAAAAABgWZnULUhCsW.....

- RESERVATIONS table: ISBN is added to the ISBN's pending reservations field.

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014,"	(NULL)	(NULL)	0

- **The book is unavailable and user has pending/active reservations for some other ISBN.**

  Input:

  - IBSN: 988-0789032742

  - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "999-6666689999"; : None)

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,"	(NULL)	(NULL)	(NULL)	0

  Output:

  - Exception Thrown: ReservationLimitExceeded: "Member can not reserve more than one book."

- **The book is unavailable and user has an active reservation for this book.**

  Input:

  - IBSN: 988-0789032742

  - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; : None)

  - Date.today() = 01/04/2021

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,"	(NULL)	"2021-04-03*19CS30014"	"3,"	0

  Output:

  - Exception Thrown: ReservationExists: "The member has already reserved this ISBN. "

- **The book is unavailable and user has a pending reservation for this book.**

  Input:

  - IBSN: 988-0789032742

  - A LibraryMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; : None)

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014"	(NULL)	(NULL)	0

  Output:

  - Exception Thrown: ReservationExists: "The member has already reserved this ISBN. "

5. **Test CheckForReminder()**

- **The librarian has called the SendReminder function and the Member has overdue book/s.**

  Input:

  - IBSN: 988-0789032742

  - Date.today(): 01/04/2021

  - A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	1	gAAAAABgWZnULUhCsW.....

  - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	988-0789032742	"James Bond-by-Bond James"	1	01/03/2021	0

  Output:

  - Message to the member: "You have an overdue book/s that needs to be returned."

- **The librarian has called the SendReminder function and the Member has no overdue book/s.**

  Input:

  - IBSN: 988-0789032742

  - Date.today(): 01/04/2021

  - A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	1	gAAAAABgWZnULUhCsW.....

  - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	988-0789032742	"James Bond-by-Bond James"	1	01/04/2021	(NULL)

  Output:

  - MEMBERS table: As the Member has no overdue book, GotReminder has been set to 0.

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW.....

- **The librarian has not called the SendReminder function.**

  Input:

  - IBSN: 988-0789032742

  - Date.today(): 01/04/2021

  - A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW.....

  - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	988-0789032742	"James Bond-by-Bond James"	1	01/02/2021	(NULL)

  Output:

  - No message is sent to the user.

6. **Test Search Book**

   - **No book in the system matches with the search string**

     Input/TestCase:

     - Search String: "How to"
     - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
(NULL)	(NULL)	(NULL)	(NULL)	(NULL)	(NULL)

     Output:

     - Message to the User: "There are no books present in the Library."

   - **Searching by Name of the book**

     Input/TestCase:

     - Search String: "Curry"
     - BOOKS table

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	(NULL)	0
2	999-777789999	Curry Patter and the curse of Bhindi-by-J.K.Rowling	2	(NULL)	0
3	999-888889999	Harry Potter and the Director's Curse-by-Vikram Seth	3	(NULL)	0

Output:

- List of IBSN and Names of Matching Books: [{"999-666689999", "Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling"}, {"999-777789999", "Curry Patter and the curse of Bhindi-by-J.K.Rowling"}] (Matching Books mean the names have Search String as a Sub-String)

- **Searching by Author of the Book**

  Input/TestCase:

  - Search String: "J.K. Rowl"
  - BOOKS table

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	(NULL)	0
2	999-777789999	Curry Patter and the curse of Bhindi-by-J.K.Rowling	2	(NULL)	0
3	999-888889999	Harry Potter and the Director's Curse-by-Vikram Seth	3	(NULL)	0

Output:

- List of IBSN and Names of Matching Books: [{"999-666689999", "Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling"}, {"999-777789999", "Curry Patter and the curse of Bhindi-by-J.K.Rowling"}] (Matching Books mean the names have Search String as a Sub-String)

7. **Test UpdateFromDatabase()**

- **The member has an expired ActiveReservation**

  Input:

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014"	(NULL)	(NULL)	0

  - A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

  Output:

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014"	(NULL)	(NULL)	0

  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW....

  - A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

- **The member has a pending reservation that becomes active.**

  Input:

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014"	(NULL)	(NULL)	0

  - A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

  Output:

  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW....

  - A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

- **When member has no reservation.**

  Input:

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014"	(NULL)	(NULL)	0

- A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

Output:

- RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014"	(NULL)	(NULL)	0

- MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"7,"	(NULL)	0	gAAAAABgWZnULUhCsW....

- A LibraryMember object (name: Harry; memberID: 19CS30014; listOfIssuedBook: [7]; numberOfIssuedBooks: 1; : None)

4. UnderGraduateStudent

1. **Test Constructor**

   - **Librarian wants to add a new Member**

   Input: Construct using -
   - Member ID: 19CS30014
   - Name of the Member: Harry

   Output: UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: None; listOfIssuedBook: None; numberOfIssuedBooks: 0)

   - **Existing Member wants to Login, Library Clerk wants to process Return**

   Input: Construct using -

   - Member ID: 19CS30014
   - Database Entries in the MEMBERS table corresponding to the Member ID

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"3,"	"988-0789032742"	0	gAAAAABgWZnULUhCsW....

   - Number of Books Issued (calculable)

   Output: UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3]; numberOfIssuedBooks: 1)

   - **Invalid Member wants to Login, Library Clerk wants to process Return for Invalid Member**

   Input: Construct using -

   - Member ID: 21CP10009 (does not exist)
   - Database Entries in the MEMBERS table corresponding to the Member ID (does not exist)
   - Number of Books Issued (calculable)

   Output: Exception thrown: InvalidMember: "This member is not registered

2. **Test CanIssue()**

- ■ **The Member has not exhausted his Book issue limit (2 Books)**

  - ■ **Input:** UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3]; numberOfIssuedBooks: 1)
  - ■ **Output:** True

- ■ **The Member has exhausted his Book issue limit (2 Books)**

  - ■ **Input:** UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3,4]; numberOfIssuedBooks: 1)
  - ■ **Output:** False

3. **Test Super Class Functionalities**

- ■ **Same scenarios as each Functions of the Super Class**

  Input:

  - ■ Call all Test Functions of LibraryMember.

  Output:

  - ■ Expected Output of the Test Functions as explained above.

5. PostGraduateStudent

1. **Test Constructor**

- ■ **Librarian wants to add a new Member**

  Input: Construct using -

  - ■ Member ID: 19CS30014
  - ■ Name of the Member: Harry

  Output: PostGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: None; listOfIssuedBook: None; numberOfIssuedBooks: 0)

- ■ **Existing Member wants to Login, Library Clerk wants to process Return**

  Input: Construct using -

  - ■ Member ID: 19CS30014
  - ■ Database Entries in the MEMBERS table corresponding to the Member ID

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"3,"	"988-0789032742"	0	gAAAAABgWZnULUhCsW....

  - ■ Number of Books Issued (calculable)

  Output: PostGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3]; numberOfIssuedBooks: 1)

- **Invalid Member wants to Login, Library Clerk wants to process Return for Invalid Member**

  Input: Construct using -

  - Member ID: 21CP10009 (does not exist)
  - Database Entries in the MEMBERS table corresponding to the Member ID (does not exist)
  - Number of Books Issued (calculable)

  Output: Exception thrown: InvalidMember: "This member is not registered"

2. **Test CanIssue()**

   - **The Member has not exhausted his Book issue limit (4 Books)**

     - **Input:** UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3,4]; numberOfIssuedBooks: 1)
     - **Output:** True
   - **The Member has exhausted his Book issue limit (4 Books)**

     - **Input:** UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3,4,5,6]; numberOfIssuedBooks: 1)
     - **Output:** False

3. **Test Super Class Functionalities**

   - **Same scenarios as each Functions of the Super Class**

   Input:

   - Call all Test Functions of LibraryMember.

   Output:

   - Expected Output of the Test Functions as explained above.

6. ResearchScholar

1. **Test Constructor**

   - **Librarian wants to add a new Member**

   Input: Construct using -

   - Member ID: 19CS30014
   - Name of the Member: Harry

   Output: ResearchScholar object (name: Harry; memberID: 19CS30014; reservedBook: None; listOfIssuedBook: None; numberOfIssuedBooks: 0)

   - **Existing Member wants to Login, Library Clerk wants to process Return**

   Input: Construct using -

   - Member ID: 19CS30014
   - Database Entries in the MEMBERS table corresponding to the Member ID

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"3,"	"988-0789032742"	0	gAAAAABgWZnULUhCsW....

   - Number of Books Issued (calculable)

Output: ResearchScholar object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3]; numberOfIssuedBooks: 1)

- **Invalid Member wants to Login, Library Clerk wants to process Return for Invalid Member**

  Input: Construct using -

  - Member ID: 21CP10009 (does not exist)
  - Database Entries in the MEMBERS table corresponding to the Member ID (does not exist)
  - Number of Books Issued (calculable)

  Output: Exception thrown: InvalidMember: "This member is not registered"

2. **Test CanIssue()**

   - **The Member has not exhausted his Book issue limit (6 Books)**

     - **Input:** UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3,4,5,6]; numberOfIssuedBooks: 1)
     - **Output:** True
   - **The Member has exhausted his Book issue limit (6 Books)**

     - **Input:** UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3,4,5,6,7,8]; numberOfIssuedBooks: 1)
     - **Output:** False

3. **Test Super Class Functionalities**

   - **Same scenarios as each Functions of the Super Class**

   Input:

   - Call all Test Functions of LibraryMember.

   Output:

   - Expected Output of the Test Functions as explained above.

7. FacultyMember

1. **Test Constructor**

- **Librarian wants to add a new Member**

  Input: Construct using -

  - Member ID: 19CS30014
  - Name of the Member: Harry

  Output: FacultyMember object (name: Harry; memberID: 19CS30014; reservedBook: None; listOfIssuedBook: None; numberOfIssuedBooks: 0)

- **Existing Member wants to Login, Library Clerk wants to process Return**

  Input: Construct using -

  - Member ID: 19CS30014
  - Database Entries in the MEMBERS table corresponding to the Member ID

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"3,"	"988-0789032742"	0	gAAAAABgWZnULUhCsW....

- Number of Books Issued (calculable)

Output: FacultyMember object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3]; numberOfIssuedBooks: 1)

- **Invalid Member wants to Login, Library Clerk wants to process Return for Invalid Member**

  Input: Construct using -

  - Member ID: 21CP10009 (does not exist)
  - Database Entries in the MEMBERS table corresponding to the Member ID (does not exist)
  - Number of Books Issued (calculable)

  Output: Exception thrown: InvalidMember: "This member is not registered"

2. **Test CanIssue()**

   - **The Member has not exhausted his Book issue limit (10 Books)**

     - **Input:** UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3,4,5,6,7,8]; numberOfIssuedBooks: 1)
     - **Output:** True
   - **The Member has exhausted his Book issue limit (10 Books)**

     - **Input:** UnderGraduateStudent object (name: Harry; memberID: 19CS30014; reservedBook: "988-0789032742"; listOfIssuedBook: [3,4,5,6,7,8,9,10,11,12]; numberOfIssuedBooks: 1)
     - **Output:** False

3. **Test Super Class Functionalities**

   - **Same scenarios as each Functions of the Super Class**

   Input:

   - Call all Test Functions of LibraryMember.

   Output:

   - Expected Output of the Test Functions as explained above.

8. **Library Clerk**

1. **Test Constructor**

   - **Employee wants to Login: The EmployeeID is of a Library Clerk**

     - **Input:** Construct using -

       - Member ID: LIB0011
       - Database entry from EMPLOYEES table corresponding to this ID

EmployeeID	EmployeeName	Password
LIB0011	Mohan	gAAAAABgWZnULUhCsW....

     - **Output**: Library Clerk object : (EmployeeID: LIB0011; name: Mohan)

- **Employee wants to Login: The EmployeeID is not of a Library Clerk**

    - **Input:** Construct using -
        - Member ID: 19CS10073
    - **Output:**

      Exception thrown: InvalidLibraryClerkID: "The Employee ID is not of a Library Clerk"

2. **Test AddBook()**

    - **The book with same ISBN already exists and few PendingReservations exist.**

    Input:
    - ISBN:"988-0789032742"
    - Name: "Motu and Patnu"
    - Author: "Narendra Modi"
    - Rack No.: 7
    - Date.today() = 01/04/2021
    - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014"	(NULL)	(NULL)	0

    Output:
    - RESERVATIONS table

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	(NULL)	"2021-04-08*19CS30014"	"7,"	0

    - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	"988-0789032742"	"Motu and Patnu-by-Narendra Modi"	7	(NULL)	(NULL)

    - **The book with same ISBN already exists and No PendingReservations exist.**

    Input:
    - ISBN:"988-0789032742"
    - Name: "Motu and Patnu"
    - Author: "Narendra Modi"
    - Rack No.: 7
    - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	(NULL)	(NULL)	(NULL)	0

    Output:
    - RESERVATIONS table

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	1

- BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	"988-0789032742"	"Motu and Patnu-by-Narendra Modi"	7	(NULL)	0

- **The book with same ISBN doesn't already exist.**

Input:

- ISBN: "988-0789032742"
- Name: "Motu and Patnu"
- Author: "Narendra Modi"
- Rack No.: 7
- RESERVATIONS table: Has no record of this ISBN.

Output:

- RESERVATIONS table: New record for the incoming book with the book made available.

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	(NULL)	(NULL)	(NULL)	(NULL)	1

- BOOKS table: New record for the incoming book has been added.

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	"988-0789032742"	"Motu and Patnu-by-Narendra Modi"	7	(NULL)	0

3. **Test DeleteBook()**

- **There are some books marked as Disposed.**

Input:

- BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	(NULL)	0
2	999-777789999	Curry Patter and the curse of Bhindi-by-J.K.Rowling	2	(NULL)	1
3	999-888889999	Harry Potter and the Director's Curse-by-Vikram Seth	3	(NULL)	1

Output:

- BOOKS table: Books marked as deleted have been deleted.

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	(NULL)	0

- **There are no books marked as Disposed.**

Input:

- BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	(NULL)	0
2	999-777789999	Curry Patter and the curse of Bhindi-by-J.K.Rowling	2	(NULL)	0
3	999-888889999	Harry Potter and the Director's Curse-by-Vikram Seth	3	(NULL)	0

Output:

- BOOKS table: No books deleted as none were marked as Disposed

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	(NULL)	0
2	999-777789999	Curry Patter and the curse of Bhindi-by-J.K.Rowling	2	(NULL)	0
3	999-888889999	Harry Potter and the Director's Curse-by-Vikram Seth	3	(NULL)	0	

4. **Test ReturnBook()**

- **Member tried to return a book they haven't isssued.**

Input:

- A UnderGraduateStudent object (name: Harry; memberID: 19CS30014; :None)
- A Book object (UID: 1; ISBN: "999-666689999")

Output:

- - Exception Thrown: ReturnInvalidUID: "Cannot return a book that hasn't been issued."
- **Member tried to return a book which is not present in the library**

  Input:
  - A UnderGraduateStudent object (name: Harry; memberID: 19CS30014; :None)
  - A Book object (UID: -1; ISBN: "999-666689999"; IssueDate: 28/03/2021)

  Output:
  - Exception Thrown: InvalidUID: "UID not present in the library."
- **The book has pending reservation which moves to active.**

  Input:
  - A UnderGraduateStudent object (name: Harry; memberID: 19CS30014; listOfIssuedBooks: [7]; noOfIssuedBooks: 1; :None)
  - A Book object (UID: 7; ISBN: "988-0789032742"; IssueDate: 28/03/2021)
  - Date.today() = 01/04/2021
  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	[7]	(NULL)	0	gAAAAABgWZnULUhCsW....

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,7,"	"19CS30056"	(NULL)	(NULL)	0

  Output:
  - A UnderGraduateStudent object (name: Harry; memberID: 19CS30014; listOfIssuedBooks: None; noOfIssuedBooks: 0; :None)
  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0	gAAAAABgWZnULUhCs

  - RESERVATIONS table

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	(NULL)	"2021-04-08*19CS30056"	"7,"	0

- **The book doesn't have pending reservation.**

  Input:
  - A UnderGraduateStudent object (name: Harry; memberID: 19CS30014; listOfIssuedBooks: [7]; noOfIssuedBooks: 1; :None)
  - A Book object (UID: 7; ISBN: "988-0789032742"; IssueDate: 28/03/2021)
  - Date.today() = 01/04/2021
  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	[7]	(NULL)	0	gAAAAABgWZnULUhCs

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,7,"	(NULL)	(NULL)	(NULL)	0

Output:

- A UnderGraduateStudent object (name: Harry; memberID: 19CS30014; listOfIssuedBooks: None; noOfIssuedBooks: 0; :None)
- MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0	gAAAAABgWZnULUhC

- RESERVATIONS table

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	1

5. **Test CollectPenalty()**

- **The return date is within the due date.**

   Input:

   - A UnderGraduateStudent object (name: Harry; memberID: 19CS30014; listOfIssuedBooks: [7]; noOfIssuedBooks: 1; :None)
   - A Book object (UID: 7; ISBN: "988-0789032742"; IssueDate: 28/03/2021)
   - Date.today() = 01/04/2021

   Output:

   - No Penalty Collected.

- **The return date is beyond due date.**

   Input:

   - A UnderGraduateStudent object (name: Harry; memberID: 19CS30014; listOfIssuedBooks: [7]; noOfIssuedBooks: 1; :None)
   - A Book object (UID: 7; ISBN: "988-0789032742"; IssueDate: 24/02/2021)
   - Date.today() = 01/04/2021

   Output:

   - Penalty Collected: 7 * (PenaltyRate) (As the member is UG, the book is due on 24/03/2021. The Book is overdue by 7 days)

9. **Librarian**

   1. **Test Constructor**

   - **Employee wants to Login: The EmployeeID is of the Librarian, i.e., LIB0001 (fixed ID of Librarian)**

      - **Input:** Construct using -

         - Employee ID: LIB0001
         - Database entry from EMPLOYEES table corresponding to this ID

EmployeeID	EmployeeName	Password
LIB0001	John	gAAAAABgWZN_r9iYim....

      - **Output**: Librarian object : (employeeID: LIB0001; name: John)

- **Employee wants to Login: The EmployeeID is not of the Librarian, i.e. not LIB0001**

  - **Input:** Construct using -

    - Employee ID: LIB0068
  - **Output:**

    Exception thrown: InvalidLibrarianID: "The Employee ID is not of the Librarian"

2. **Test Super Class Functionalities**

- **Same scenarios as each Functions of the Super Class**

  Input:

  - Call all Test Functions of Library Clerk.

  Output:

  - Expected Output of the Test Functions as explained above.

3. **Test AddMember()**

- **The librarian wants to add a new member.**

  Input:

  - A LibraryMember object (MemberID: "19CS30014", Name: "Harry", Type: "UG", :None)
  - MEMBERS table: No record with MemberID present.
  - Password: "gAAAAABgWZnULUhCsW...." (encrypted form)

  Output:

  - MEMBERS table: New Record added.

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0	gAAAAABgWZnULUhCsW....

- **The librarian tries to add a person who is already a member**

  Input:

  - A LibraryMember object (MemberID: "19CS30014", Name: "Harry", Type: "UG", :None)
  - MEMBERS table: A record with MemberID present.

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0	gAAAAABgWZnULUhCsW....

  - Password: "gAAAAABgWZnULUhCsW...." (encrypted form)

  Output:

  - Exception thrown: MemberAlreadyExists: "A member with same MemberID already exists."
- **Name is missing**

  Input:

  - Password: "adjfaldjflajglajawwerwerq..." (Encrypted Form)
  - A LibraryMember object (MemberID: "19CS30014", Name: "", Type: "UG", :None)

  Output:

- Exception Thrown: InsufficientArguments: "Required Arguments missing."
  - **MemberID is missing**

    Input:

    - Password: "adjfaldjflajglajawwerwerq..." (Encrypted Form)
    - A LibraryMember object (MemberID: "", Name: "Harry", Type: "UG", :None)

    Output:

    - Exception Thrown: InsufficientArguments: "Required Arguments missing."
  - **Type is missing**

    Input:

    - Password: "adjfaldjflajglajawwerwerq..." (Encrypted Form)
    - A LibraryMember object (MemberID: "", Name: "Harry", Type: None, :None)

    Output:

    - Exception Thrown: InsufficientArguments: "Required Arguments missing."
  - **Password is Missing**

    Input:

    - Password: "" (Empty)
    - A LibraryMember object (MemberID: "19CS30014", Name: "Harry", Type: None, :None)

4. **Test Delete Members**

   - **Delete a existing member**

     Input:

     - A LibraryMember object (MemberID: "19CS30014", Name: "Harry", Type: "UG", :None)
     - MEMBERS table

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0	gAAAAABgWZnULUhCsW....

     Output:

     - MEMBERS table: Empty table as the only member is deleted.
   - **Delete a person who is not a member**

     Input:

     - A LibraryMember object (MemberID: "19CS30037", Name: "Harry", Type: "UG", :None)
     - MEMBERS table

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0	gAAAAABgWZnULUhCsW....

     Output:

     - Exception Thrown: MemberIDInvalid: "No member present with this member ID."

- **Deletion of a member with overdue books or un-returned books.**

  Input:
  - A LibraryMember object (MemberID: "19CS30014", Name: "Harry", Type: "UG", :None)
  - Date.today()= 01/04/2021
  - MEMBERS table

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	"1,"	(NULL)	0	gAAAAABgWZnULUhCsW....

  - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	"988-0789032742"	"Motu and Patnu-by-Narendra Modi"	7	2019-04-01	0

  Output:
  - Exception Thrown: MemberWithUnreturnedBook: "This member can not be deleted as they have overdue books or un-returned books."

5. **Test Sending Reminders**

   - **Send Reminder to all Members**

     Input:
     - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0
"19CS30056"	"Ron"	"PG"	(NULL)	(NULL)	0
"19CS10055"	"Hermonie"	"RS"	"1,"	(NULL)	1

     Output:
     - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	1
"19CS30056"	"Ron"	"PG"	(NULL)	(NULL)	1
"19CS10055"	"Hermonie"	"RS"	"1,"	(NULL)	1

6. **Test Viewing Book Statistics**

   - **All books have been issued in the last 5 years.**

     Input:
     - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2021-04-01	0
2	999-777789999	Curry Patter and the curse of Bhindi-by-J.K.Rowling	2	2020-04-01	0
3	999-888889999	Harry Potter and the Director's Curse-by-Vikram Seth	3	2019-04-01	0

Output:

- Empty List is returned as all books have been issues in the last 5 years.

- **Few books have not been issued in the last 5 years.**

Input:

- BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2021-04-01	0
2	999-777789999	Curry Patter and the curse of Bhindi-by-J.K.Rowling	2	2010-04-01	0
3	999-888889999	Harry Potter and the Director's Curse-by-Vikram Seth	3	2019-04-01	0

Output:

- List: [{"2", Curry Patter and the curse of Bhindi-by-J.K.Rowling", "2010-04-01"}]

7. **Test Dispose Book**

- **UID does not exist**

  Input:

  - UID: 3
  - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2010-04-01	0

  Output:

  - Exception Thrown: UIDInvalid: "The UID does not exist in the system."
- **The UID has been issued in last 5 years**

  Input:

  - UID: 1
  - BOOKS table:

  Output:

  - Exception Thrown: CannotDispose: "The UID has been issued in the last 5 years, hence cannot be disposed."
- **The UID has not been issued in the last 5 years**

  Input:

  - UID: 3
  - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2010-04-01	0

  Output:

  - BOOKS table: Book has been marked as disposed.

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	999-666689999	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2010-04-01	1

10. Book Handler

1. **Test Create() Function**

   - **No specific scenarios, only called to create a reference to Singleton BookHandler Object whenever required.**

   Input:

   - None

   Output:

   - Singleton BookHandler Object with empty data members.

2. **Test OpenBook()**

   - **Called with the ISBN when UID is irrelevant for the function calling OpenBook()**

   Input:

   - Book object (ISBN: "999-666689999", UID: "1")
   - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"999-666689999"	"7,9,"	"1,"	(NULL)	(NULL)	(NULL)	2

   Output:

   - Singleton BookHandler Object
     - currUID: 1
     - currISBN: "999-666689999"
     - availableUIDs: [7, 9]
     - takenUIDs: [1]
     - pendingReservations: None
     - activeReservations: None
     - activeReservedUIDs: None
     - numberOfCopies: 2

   - **Called with the Book Object when UID is relevent for the function calling OpenBook()**

   Input:

   - ISBN: "999-666689999"
   - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"999-666689999"	"7,9,"	"1,"	(NULL)	(NULL)	(NULL)	2

   Output:

   - Singleton BookHandler Object
     - currUID: None
     - currISBN: "999-666689999"
     - availableUIDs: [7, 9]
     - takenUIDs: [1]
     - pendingReservations: None
     - activeReservations: None
     - activeReservedUIDs: None

- numberOfCopies: 2

3. Test Singleton Nature of the Object

- ○ **Call Create() twice and compare address of the objects returned by them**

  Input:

  - Call Create() twice.

  Output:

  - The addresses of the both the objects are equal.

4. **Test Update Book**

- ○ **Pending reservations are there, Some active reservations are expired.**

  Input:

  - BookHandler object currently is populated with information of IBSN: 988-0789032742.
  - Date.today() = 01/04/2021
  - MEMBERS table

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	"988-0789032742"	0	gAAAAABgWZnULUhCsW.....

  - RESERVATIONS table

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,9,"	"1,"	"19CS10074,19CS30056,"	"2021-04-01*19CS30014,"	"3,"	2

  Output:

  - MEMBERS table: The members active reservation has expired, hence the field value as been removed.

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0	gAAAAABgWZnULUhCsW.....

  - RESERVATIONS table: An active reservation has expired. The first of pending reservations has upgraded into ActiveReservation.

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,9,"	"1,"	"19CS30056,"	"2021-04-08*19CS10074,"	"3,"	2

- ○ **Pending reservation are there, No active reservations are expired.**

  Input:

  - BookHandler object currently is populated with information of IBSN: 988-0789032742.
  - Date.today() = 01/04/2021
    - MEMBERS table

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	"988-0789032742"	0	gAAAAABgWZnULUhCsW.....

    - RESERVATIONS table

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,9,"	"1,"	"19CS10074,19CS30056,"	"2021-04-03*19CS30014,"	"3,"	2

Output:

- MEMBERS table: Unchanged as ActiveReservation hasn't expired

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	"988-0789032742"	0	gAAAAABgWZnULUhCsW.....

- RESERVATIONS table: Unchanged as ActiveReservation hasn't expired

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,9,"	"1,"	"19CS10074,19CS30056,"	"2021-04-03*19CS30014,"	"3,"	2

- **No pending reservations are there, Some active reservations are expired.**

  Input:

  - MEMBERS table:

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	"988-0789032742"	0	gAAAAABgWZnULUhCsW.....

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,9,"	"1,"	(NULL)	"2021-04-01*19CS30014"	"3,"	2

  Output:

  - MEMBERS table: The members active reservation has expired, hence the field value as been removed.

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	(NULL)	0	gAAAAABgWZnULUhCsW.....

  - RESERVATIONS table: As the active reservation expired, it has been removed from active reservation. As no pending reservation are present, the UID has been made available.

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,9,3,"	"1,"	(NULL)	(NULL)	(NULL)	3

- **No pending reservation are there, No active reservations are expired.**

  Input:

  - BookHandler object currently is populated with information of IBSN: 988-0789032742.

  - Date.today() = 01/04/2021

  - MEMBERS table

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	"988-0789032742"	0	gAAAAABgWZnULUhCsW.....

  - RESERVATIONS table

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,9,"	"1,"	(NULL)	"2021-04-03*19CS30014,"	"3,"	2

Output:

- MEMBERS table: Unchanged as ActiveReservation hasn't expired

MemberID	MemberName	MemberType	ListOfBooksIssued	ReservedBook	GotReminder	PassWD
"19CS30014"	"Harry"	"UG"	(NULL)	"988-0789032742"	0	gAAAAABgWZnULUhCsW.....

- RESERVATIONS table: Unchanged as ActiveReservation hasn't expired

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,9,"	"1,"	(NULL)	"2021-04-03*19CS30014,"	"3,"	2

5. Test Issue Selected Book

- **The book being issued is a ready-to-be-claimed UID.**

  Input:

  - MemberID: 19CS30014

  - BookHandler Object (currISBN: "988-0789032742"; currUID: 7; TakenUIDs: [1, 3]; ActiveReservations: [{19CS30014, 2021-04-01}]; ActiveReservationUID= [7]; : None)

  - Date.today() = 01/04/2021

  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	(NULL)	"2021-04-01*19CS30014"	"7,"	1

  Output:

  - BookHandler Object (currISBN: "988-0789032742"; currUID: 7; AvailableUIDs: None; TakenUIDs: [1, 3, 7]; NumberOfBooksAvailable: 0; : None)

  - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	988-0789032742	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2021-04-01	0

  - RESERVATIONS table: The issued book is removed from AvailableUIDs and put into TakenUIDs

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,7,"	(NULL)	(NULL)	(NULL)	0

- **The book being issued is an available UID.**

  Input:

  - MemberID: 19CS30014

  - BookHandler Object (currISBN: "988-0789032742"; currUID: 7; AvailableUIDs: [7]; TakenUIDs: [1, 3]; NumberOfBooksAvailable: 1: None)

- Date.today() = 01/04/2021
- RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	1

- **The book being issued is an available UID.**

  Input:

  - MemberID: 19CS30014
  - BookHandler Object (currISBN: "988-0789032742"; currUID: 7; AvailableUIDs: [7]; TakenUIDs: [1, 3]; NumberOfBooksAvailable: 1: None)
  - Date.today() = 01/04/2021
  - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	1

  Output:

  - BookHandler Object (currISBN: "988-0789032742"; currUID: 7; AvailableUIDs: None; TakenUIDs: [1, 3, 7]; NumberOfBooksAvailable: 0: None)
  - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	988-0789032742	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2021-04-01	0

  - RESERVATIONS table: The issued book is removed from AvailableUIDs and put into TakenUIDs

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,7,"	(NULL)	(NULL)	(NULL)	0

6. **Test Return Selected Book**

   - **There is a pending reservation upon return.**

   Input:

   - MemberID: 19CS30014
   - BookHandler Object (currISBN: "988-0789032742"; currUID: 7; TakenUIDs: [1, 3, 7]; PendingReservation: [19CS30056]: None)
   - Date.today() = 01/04/2021
   - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,7,"	"19CS30056,"	(NULL)	(NULL)	1

Output:

- BookHandler Object (currISBN: "988-0789032742"; currUID: 7; AvailableUIDs: None; TakenUIDs: [1, 3]; ActiveReservations: [ActiveReservation(19CS30013, 08-04-2021)]; ActiveReservationUIDs: "7,"; : None)

- BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	988-0789032742	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2021-04-01	0

- RESERVATIONS table: The issued book is removed from AvailableUIDs and put into TakenUIDs

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	(NULL)	"2021-04-08*19CS30056"	"7,"	0

○ **There is no pending reservation upon return.**

Input:

- MemberID: 19CS30014

- BookHandler Object (currISBN: "988-0789032742"; currUID: 7; TakenUIDs: [1, 3, 7]; PendingReservation: None: None)

- Date.today() = 01/04/2021

- RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,7,"	(NULL)	(NULL)	(NULL)	1

Output:

- BookHandler Object (currISBN: "988-0789032742"; currUID: 7; AvailableUIDs: [7]; TakenUIDs: [1, 3]; NumberOfAvailableBooks: 1; : None)

- BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
7	988-0789032742	Curry Patter and the adventures of Aloo Sabzi-by-J.K.Rowling	1	2021-04-01	0

- RESERVATIONS table: The issued book is removed from AvailableUIDs and put into TakenUIDs

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	"7,"	"1,3,"	(NULL)	(NULL)	(NULL)	1

7. **Test Reserve Selected Book**

   - **No books are available and the reservation needs to be made.**

   Input:

   - MemberID: 19CS30014
   - BookHandler Object (currISBN: "988-0789032742"; currUID: -1; AvailableUIDs: None; TakenUIDs: [1, 3]; NumberOfAvailableBooks: 0; PendingReservations: None; : None)
   - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	(NULL)	(NULL)	(NULL)	0

   Output:

   - BookHandler Object (currISBN: "988-0789032742"; currUID: -1; AvailableUIDs: None; TakenUIDs: [1, 3]; NumberOfAvailableBooks: 0; PendingReservations: "19CS30014"; : None)
   - RESERVATIONS table:

ISBN	AvailableUIDs	TakenUIDs	PendingReservations	ActiveReservations	ActiveReservedUIDs	NumberOfCopies
"988-0789032742"	(NULL)	"1,3,"	"19CS30014,"	(NULL)	(NULL)	0

11. # Book

    1. **Test Constructor**

       - **Book is created for adding**

    Input:

    - UID: 1
    - BOOKS table:

UID	ISBN	BookName	RackNo	LastIssued	IsDisposed
1	"999-666689999"	"James Bond-by-Bond James"	1	01/04/2021	0

    Output:

    - A constructed Book Object (UID: 1; ISBN: "999-666689999"; DateOfIssue: "2021-04-01")

12. # ActiveReservation

    1. **Test Constructor**

- **ActiveReservation object is made at any time in the run**

  - **Input:** Construct using -

    Member ID: 19CS30014

    Claim by Date: 2021-04-01

  - **Output:**

    ActiveReservation object : (memberID: 19CS30014, claimByDate: 2021-04-01)