Library System

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Computing in Software Development – Stage 2

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1. Introduction/overview

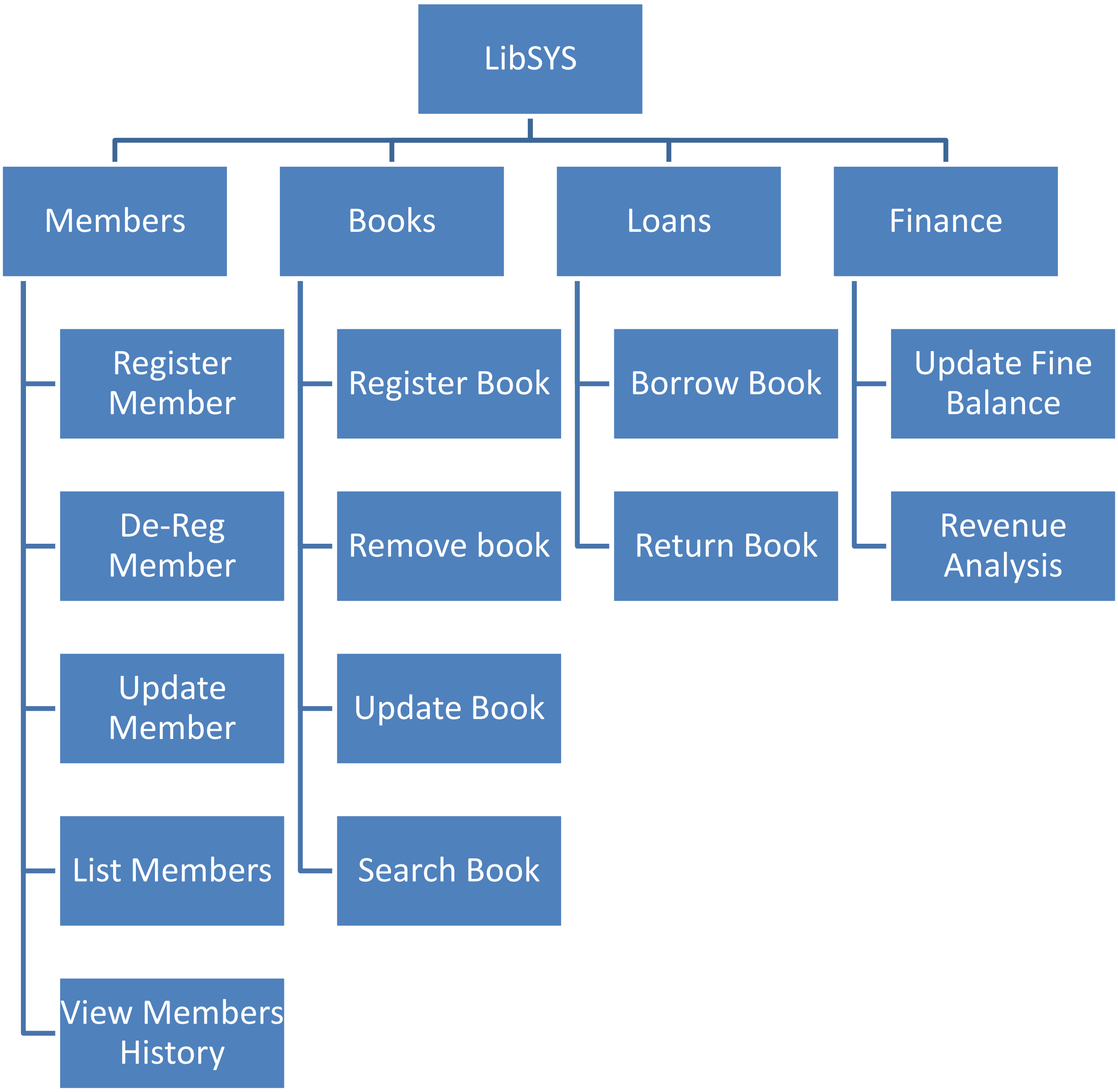
A library can be defined as an organization, a room, or a building where books are kept and referenced. It is an area of various activity on book management. It acts as a collection of books and other materials for users to read or borrow without any payment needed.

Information Technology (IT) has transformed the life of human beings' and has made the lives easier by various kinds of application or system. Nowadays all the businesses are changing to computer based system. The advantage of using computer based system is that it allowed data to be retrieved and processed much more quickly and it is very easy for users to use. This project is concerned with developing a Library System. In this system, the library management becomes much more well-organized and easier to handle (Priyantha, n.d.).

Librarian has the authority to add, delete or modify the details of a member available to/from the system. Librarian can also add, delete, or modify the details of a book to/from the system. Other than that, Librarian or Manager can also view the monthly fine collected report and monthly cost used for buying books report in the system.

2. Functional Components

The following hierarchy chart models the function requirements as a set of functional components for Library System (LibSYS).



3. User Requirements

The following requirements have been identified for Library System (LibSYS):

3.1. LibSYS will perform member administration

3.1.1. LibSYS will register a new member.
3.1.2. LibSYS will de-register a member.
3.1.3. LibSYS will allow a members' profile to be updated.
3.1.4. LibSYS will generate a member listing.
3.1.5. LibSYS will allow members' history to be viewed.

3.2. LibSYS will perform book management

3.2.1. LibSYS will register a new book.
3.2.2. LibSYS will allow a book to be removed.
3.2.3. LibSYS will allow books' information to be updated.
3.2.4. LibSYS will allow books to be searched.

3.3. LibSYS will manage loans

3.3.1. LibSYS will record a book borrowed.
3.3.2. LibSYS will record a book returned.

3.4. LibSYS will perform financial administration

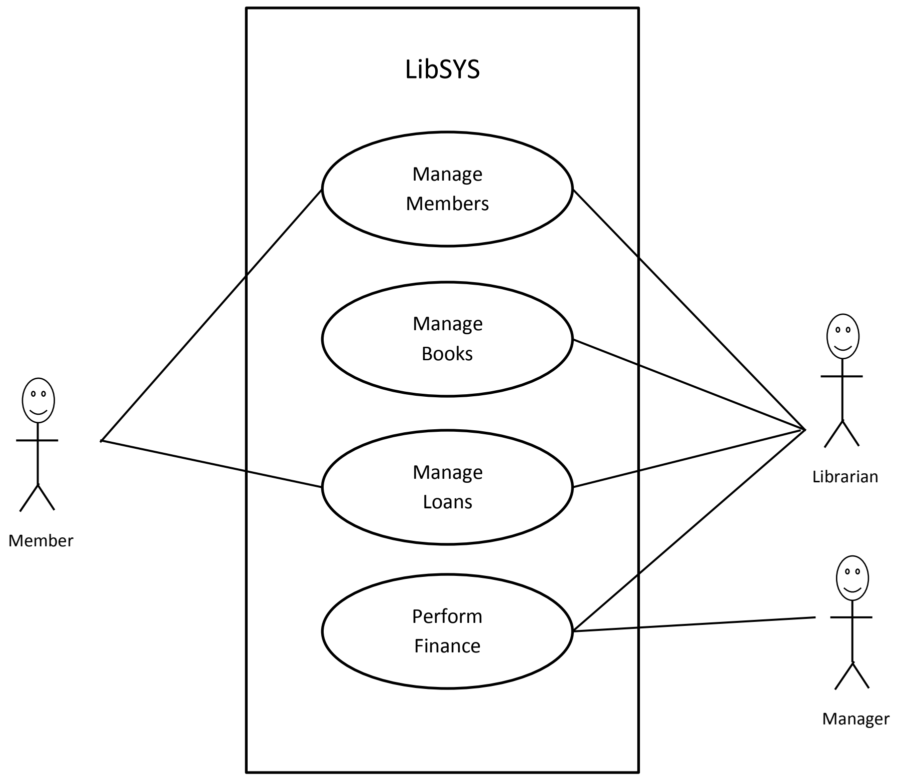
3.4.1. LibSYS will allow a member's fine balance to be updated.
3.4.2. LibSYS will generate a revenue analysis report.

4. System Requirements

The following system level use case diagram defines the communications between actors and the system. The actors involve in the Library System (LibSYS) are Member, Librarian and Manager. Each actor involves in a single task to achieve a goal.

4.1. System Level Use Case Diagram

System level UC diagram:



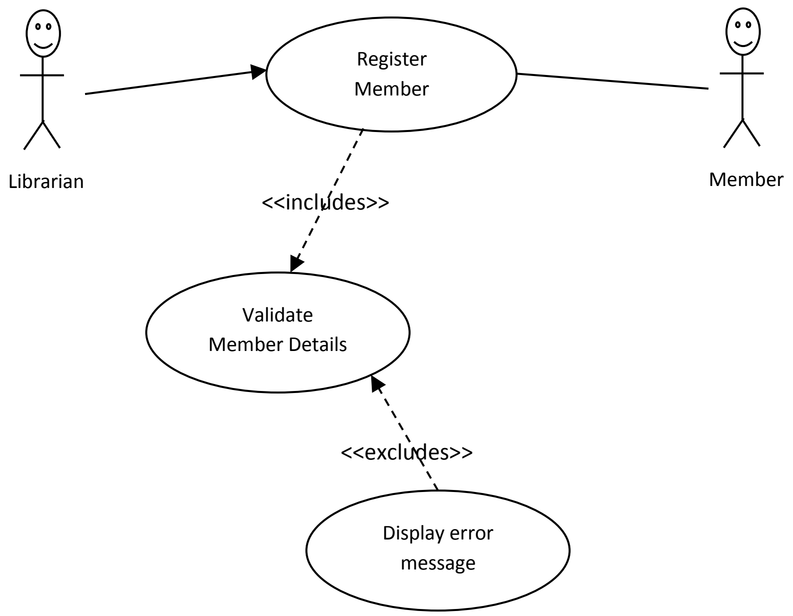
4.2. Manage members

This module contains function for register member, de-register member, update member profile, list members and view member's history.

4.2.1. Register member

Description: This function registers a member profile on the system.

Use Case Diagram:



Use Case Narrative:

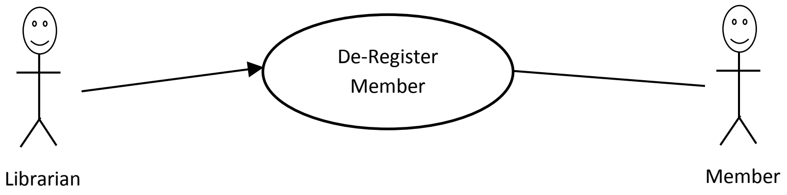
Use Case Name	Register member	
Use Case Id	1.1	
Priority	High	
Source	Librarian	
Primary Business Actor	Librarian	
Other Participating Actors	Member	
Description	This function registers a member's details on the system.	
Preconditions	Member must complete and sign a Member Registration form.	
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Register Member function	**Step 2:** Assign Member ID
		Step 3: Display UI
	Step 4: Librarian enters Member details: • PPS No. • Surname • Forename • D.O.B • Gender • Street • Town • County • Phone • Email • Register Date	
		Step 5: System validates member details: • PPS No. and Email not already registered • All fields must be entered • PPS No. must be in the correct format, e.g. 1234567AB or 1234567K • Surname, Forename, Town, and County must not contain any numeric • Member must be over 16 • Email must be in the correct format, e.g. dejong@gmail.com

		- Phone must be in the correct format, e.g. 085 4625788 **Step 6:** Assign member status a default value of 'A' (Active) **Step 7:** Assign number of books borrowed a default value of zero **Step 8:** Assign fine balance for a member a default value of zero. **Step 9:** Save Member details in **Member File.** **Step 10:** Display confirmation message. **Step 11:** Clear the UI
Alternate Scenarios	**Actor Action**	**System Response**
Invalid Data Entered		**Step 5:** Invalid data detected **Step 6:** Display appropriate error message and return to step 4.
Conclusions	Member is registered and may now make loans.	
Post conditions		
Business Rules	Member must be over 16.	
Implementation Constraints		

4.2.2. De-Register Member

Description: This function de-register a member profile on the system.

Use Case Diagram:



Use Case Narrative:

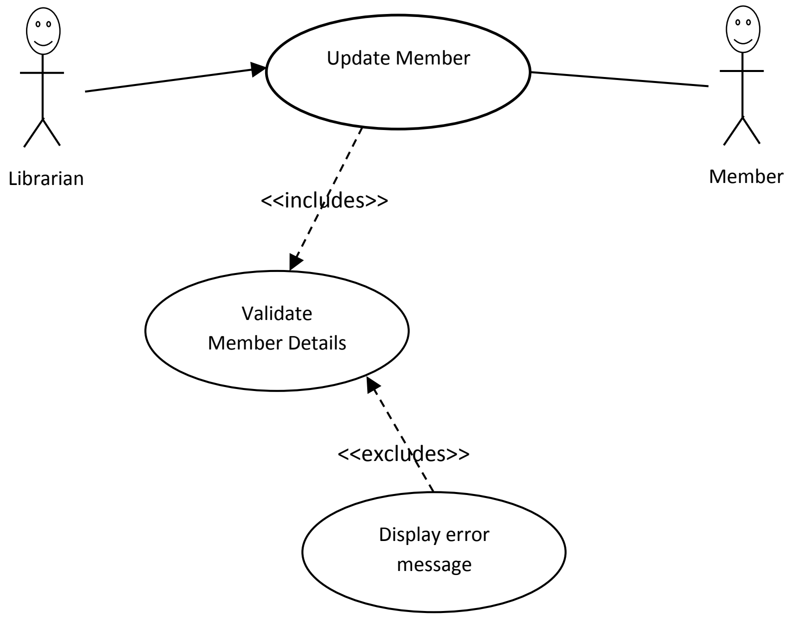
Use Case Name	De-Register Member	
Use Case Id	1.2	
Priority	High	
Source	Manager	
Primary Business Actor	Librarian	
Other Participating Actors	Member	
Description	This function changes a member's status from 'Active' to 'De-registered'	
Preconditions		
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes De-Register Member function	**Step 2:** Display UI
	Step 3: Librarian enters member's surname	**Step 4:** System retrieves ***summary details*** of all **active** members with matching surname from **Member File** and displays a list on the UI
	Step 5: Librarian selects the member to be de-registered	**Step 6:** System retrieves ***all details*** for the **selected** member from **Member File** and displays on UI.
	Step 7: Librarian confirms member to be de-registered	**Step 8:** System validates number of books borrow of the selected member in Member File if number of books borrow is equals to 0.
		Step 9: System sets de-register date to current date (System Date)
		Step 10: System sets member status to 'D' (Deregistered).
		Step 11: System updates member details in **Member File**
		Step 12: System displays confirmation message
		Step 13: System clears the UI

Alternate Scenarios	Actor Action	System Response
Invalid data entered.		**Step 4:** Invalid data detected. **Step 5:** Display appropriate error message and return to step 3.
Number of Books Borrowed is not equals to 0		**Step 8:** Total books borrow is not equals to 0. **Step 9:** Display appropriate error message and clears UI.
Conclusions	Member is de-registered and may no longer make loans.	
Post conditions		
Business Rules	Only active members and number of books borrow of the selected member is equals to zero can be de-registered.	
Implementation Constraints		

4.2.3. Update Member

Description: This function updates a member's profile on the system.

Use Case Diagram:



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Use Case Narrative:

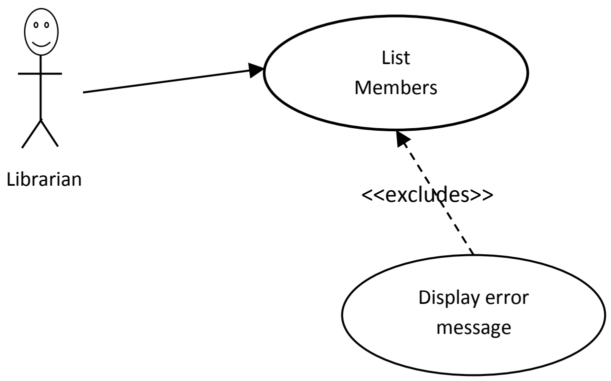
Use Case Name	Update Member	
Use Case Id	1.3	
Priority	High	
Source	Librarian	
Primary Business Actor	Librarian	
Other Participating Actors	Member	
Description	This function updates a member’s details on the system.	
Preconditions	Member must complete and sign an update details form	
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Update Member Profile function.	**Step 2:** Display UI
	Step 3: Librarian enters member surname	**Step 4:** System retrieves ***summary details*** of all **active** members with matching surname from **Member File** and displays a list on the UI
	Step 5: Librarian selects the member to be updated	**Step 6:** System retrieves ***all details*** for the **selected** member from **Member File** and displays on UI for editing.
	Step 7: Librarian changes the details of the selected member. • PPS No. • Surname • Forename • D.O.B • Gender • Street • Town • County • Phone • Email	
	Step 8: Librarian confirms update member profile	**Step 9:** System validates member details: • All fields must be entered • PPS No. and Email not already registered. • PPS No. must be in the correct format, e.g. 1234567AB or 1234567K

		• Email must be in the correct format, e.g. dejong@gmail.com • Surname, Forename, Town, and County must not contain any numeric • Phone must be in the correct format, e.g. 085 4625788 **Step 10:** System updates member details in **Member File** **Step 11:** System displays confirmation message **Step 12:** System clears the UI
Alternate Scenarios	**Actor Action**	**System Response**
Invalid Data Entered		**Step 4:** Invalid data detected **Step 5:** Display appropriate error message and return to step 3. **Step 9:** Invalid data detected **Step 10:** Display appropriate error message and return to step 7.
Conclusions	Member details is now updated	
Post conditions		
Business Rules	Only active members can be updated	
Implementation Constraints		

4.2.4. List Members

Description: This function generates a member listing as shown in Appendix A on the system in alphabetical order of Member ID, Surname, and forename

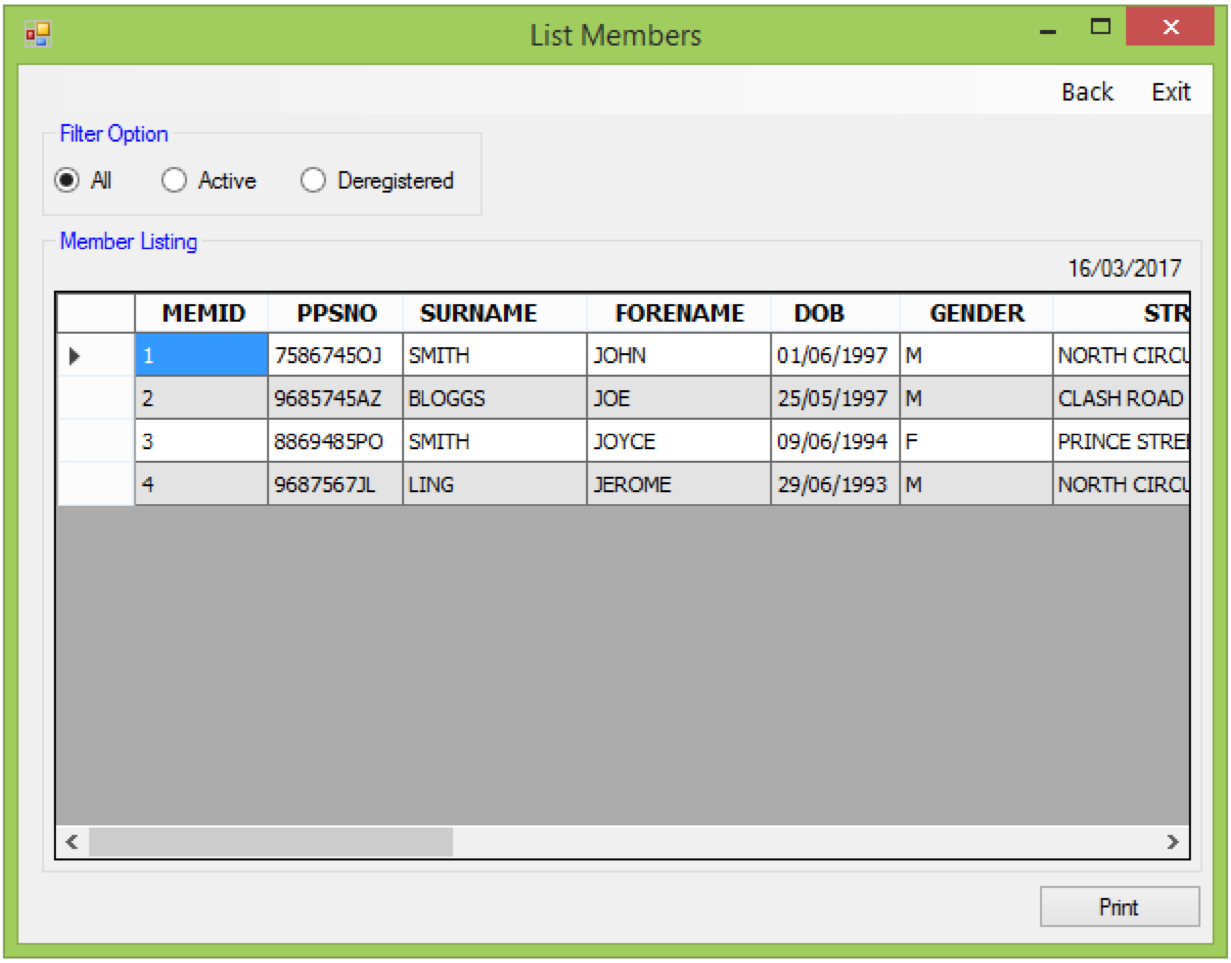
Use Case Diagram:



Use Case Narrative:

Use Case Name	List Members	
Use Case Id	1.4	
Priority	Medium	
Source	Manager	
Primary Business Actor	Librarian	
Other Participating Actors	-	
Description	This function generates a member listing on the system in ascending order of member ID, surname, and forename. The list may be printed if required	
Preconditions		
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes List Members function	**Step 2:** System retrieves details of all members from **Member File** and displays them in order of member ID, surname, and then forename on UI
	Step 3: Librarian specifies how the list is to be filtered: • All • Active • Deregistered	**Step 4:** System retrieves **all details** of **only** the **specified** members from the **Member File** and displays them in order of surname and forename
	Step 5: Librarian requests a print copy of the listing	**Step 6:** System generates a print file based on the displayed data and sends to the default print device
		Step 7: System confirms that the print job has been sent.
Alternate Scenarios	**Actor Action**	**System Response**
No Member details found		**Step 2:** System fails to retrieve member details from the **Member File.** **Step 3:** System displays appropriate error message
Conclusions	A listing of all members at the library is generated and printed	
Post conditions		
Business Rules		
Implementation Constraints		

<u>Sample of Member Listing:</u>



Filter Option

● All ○ Active ○ Deregistered

Member Listing

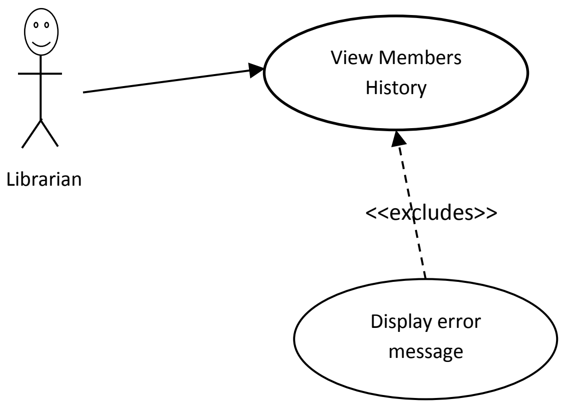
16/03/2017

	MEMID	PPSNO	SURNAME	FORENAME	DOB	GENDER	STR
▶	1	7586745OJ	SMITH	JOHN	01/06/1997	M	NORTH CIRCU
	2	9685745AZ	BLOGGS	JOE	25/05/1997	M	CLASH ROAD
	3	8869485PO	SMITH	JOYCE	09/06/1994	F	PRINCE STREI
	4	9687567JL	LING	JEROME	29/06/1993	M	NORTH CIRCU

4.2.5. View Members History

Description: This function generates a listing of books borrowed by a member as shown in Appendix A in ascending order of ISBN.

Use Case Diagram:

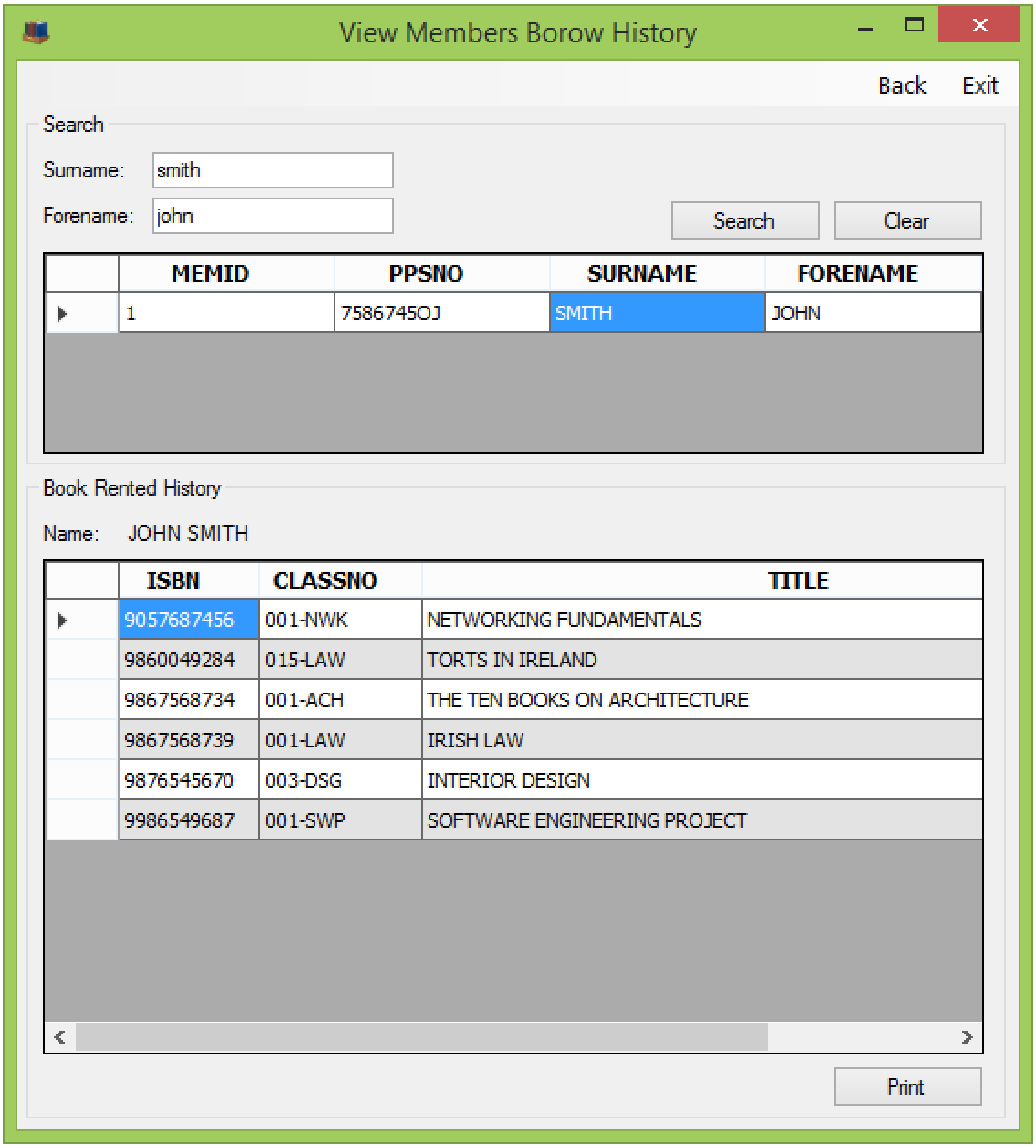


Use Case Narrative:

Use Case Name	View Members History	
Use Case Id	1.5	
Priority	Low	
Source	Member	
Primary Business Actor	Librarian	
Other Participating Actors	-	
Description	The Member requires a list of books that has been borrowed. This function generates a listing of books borrowed by a member in ascending order of ISBN. The list may be printed if required.	
Preconditions		
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes View Members History function **Step 3:** Librarian enters member's surname and forename **Step 5:** Librarian selects the member to be viewed **Step 7:** Librarian requests a print copy of the listing	**Step 2:** Display UI **Step 4:** System retrieves summary details of all members with matching surname and forename from Member File and displays a list in order of Member ID on UI. **Step 6:** System retrieves **summary details** of **all rented books** of the selected member from **Member File**, **Book File**, **Loan File**, and **Loan Items File** and displays a list of books borrowed by the member in order of ISBN on UI. **Step 8:** System generates a print file based on the displayed data and sends to the default print device. **Step 9:** System confirms that the print job has been sent. **Step 10:** System clears the UI
Alternate Scenarios	**Actor Action**	**System Response**
No Member details found		**Step 4:** No record found **Step 5:** Display appropriate error message and return to step 3

No Book details found		**Step 6:** No record found **Step 7:** Display appropriate error message and return to step 3
Conclusions	A listing of all books that a member has borrowed is generated or printed	
Post conditions		
Business Rules	Book listing is displayed and cannot be amended or deleted	
Implementation Constraints		

Sample of Members History Listing:



Surname: smith

Forename: john

MEMID	PPSNO	SURNAME	FORENAME
1	75867450J	SMITH	JOHN

Name: JOHN SMITH

ISBN	CLASSNO	TITLE
9057687456	001-NWK	NETWORKING FUNDAMENTALS
9860049284	015-LAW	TORTS IN IRELAND
9867568734	001-ACH	THE TEN BOOKS ON ARCHITECTURE
9867568739	001-LAW	IRISH LAW
9876545670	003-DSG	INTERIOR DESIGN
9986549687	001-SWP	SOFTWARE ENGINEERING PROJECT

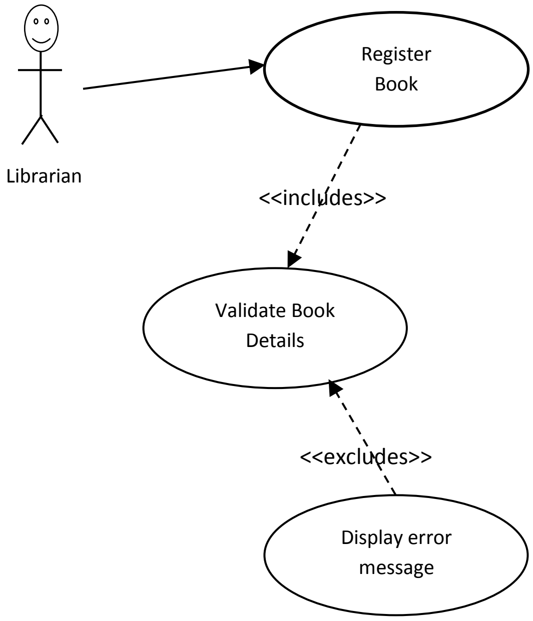
4.3. Manage Books

This module contains function for register book, remove book, update book and search book.

4.3.1. Register Book

Description: This function registers a book on the system.

Use Case Diagram:



Use Case Narrative:

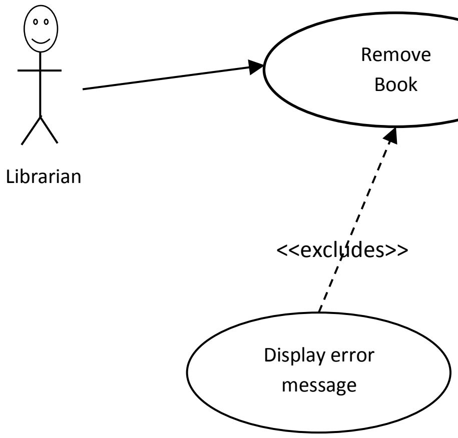
Use Case Name	Register Book	
Use Case Id	2.1	
Priority	High	
Source	Manager	
Primary Business Actor	Librarian	
Other Participating Actors	-	
Description	This function registers a book's details on the system.	
Preconditions	The book must be physically on the library before it can be registered.	
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Register Book function	**Step 2:** Assign Book ID **Step 3:** Display UI
	Step 4: Librarian enters book details: • ISBN • Class No • Subject • Title • Author • Edition • Price • No. Of Pages • Publisher's Name • Publisher's Country • Year Published	
		Step 5: System validates book details: • All fields must be entered • ISBN must be in either 10 digits or 13 digits, e.g. 1292018194 or 9783161484100 • Price, No. of Pages, and Year Published must not contain any alphabets. • Class No must be in the correct format, e.g. 007-CAY • Price must be in the correct format, e.g. 53 or 34.50

		Step 6: Assign Purchase Date a default value of current date (System Date) **Step 7:** Assign book status a default value of 'A' (Available) **Step 8:** Saves book details in **Book File** **Step 9:** System displays confirmation message **Step 10:** System clears the UI
Alternate Scenarios	**Actor Action**	**System Response**
Invalid Data Entered		**Step 5:** Invalid date detected **Step 6:** Display appropriate error message and return to step 4
Conclusions	Book is registered and may now be borrowed by Member.	
Post conditions		
Business Rules		
Implementation Constraints		

4.3.2. Remove Book

Description: This function removes a book on the system.

Use Case Diagram:



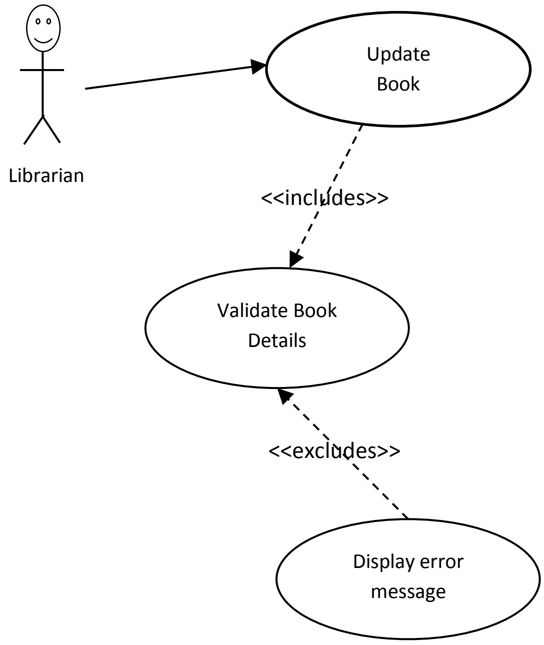
Use Case Narrative:

Use Case Name	Remove Book	
Use Case Id	2.2	
Priority	High	
Source	Librarian	
Primary Business Actor	Librarian	
Other Participating Actors	-	
Description	This function changes a book's status from 'A' (Available) to 'R' (Removed)	
Preconditions		
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Remove Book function	**Step 2:** Display UI
	Step 3: Librarian enters book's title	**Step 4:** System retrieves **summary details** of ***all available*** books with matching book title from **Book File** and displays a list on UI.
	Step 5: Librarian selects the book to be removed.	**Step 6:** System retrieves **all details** for the **selected** book from **Book File** and displays on UI.
	Step 7: Librarian confirms the book to be remove.	**Step 8:** System sets book status to 'R' (removed). **Step 9:** System updates book details in **Book File** **Step 10:** System displays confirmation message **Step 11:** System clears the UI
Alternate Scenarios	**Actor Action**	**System Response**
Invalid data entered		**Step 4:** Invalid data detected **Step 5:** Display appropriate error message and return to step 3.
Conclusions	Book is removed and may no longer available to be borrowed	
Post conditions		
Business Rules	Only available books can be removed	
Implementation Constraints		

4.3.3. Update Book

Description: This function updates a book's detail on the system.

Use Case Diagram:



Use Case Narrative:

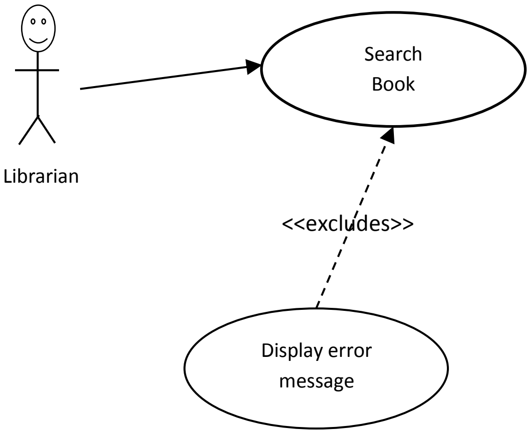
Use Case Name	Update Book	
Use Case Id	2.3	
Priority	High	
Source	Librarian	
Primary Business Actor	Librarian	
Other Participating Actors	-	
Description	This function updates a book's details on the system	
Preconditions		
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Update Book function **Step 3:** Librarian enters book's title **Step 5:** Librarian selects the book to be updated. **Step 7:** Librarian changes the details of the selected book • ISBN • Class No • Subject • Title • Author • Edition • Price • No. Of Pages • Publisher's Name • Publisher's Country • Year Published	**Step 2:** Display UI **Step 4:** System retrieves ***summary details*** of all **available** books with matching title from **Book File** and displays a list on UI. **Step 6:** System retrieves **all details** for the **selected** book from Book File and displays on UI for editing.

	Step 8: Librarian confirms the book to be update.	**Step 9:** System validates book details: • All fields must be entered • ISBN must be in either 10 digits or 13 digits, e.g. 1292018194 or 9783161484100 • Price, No. of Pages, and Year Published must not contain any alphabets. • Class No must be in the correct format, e.g. 007-CAY • Price must be in the correct format, e.g. 53 or 34.50 **Step 10:** System updates book details in **Book File** **Step 11:** System displays confirmation message **Step 12:** System clears the UI
Alternate Scenarios	**Actor Action**	**System Response**
Invalid data entered		**Step 4:** Invalid data detected **Step 5:** Display appropriate error message and return to step 3 **Step 9:** Invalid data detected **Step 10:** Display appropriate error message and return to step 7
Conclusions	Book details is now updated	
Post conditions		
Business Rules	Only books with status 'A' (Available) may be updated.	
Implementation Constraints		

4.3.4. Search Book

Description: This function generates a book listing as shown in Appendix A on the system in ascending order of Book ID.

Use Case Diagram:

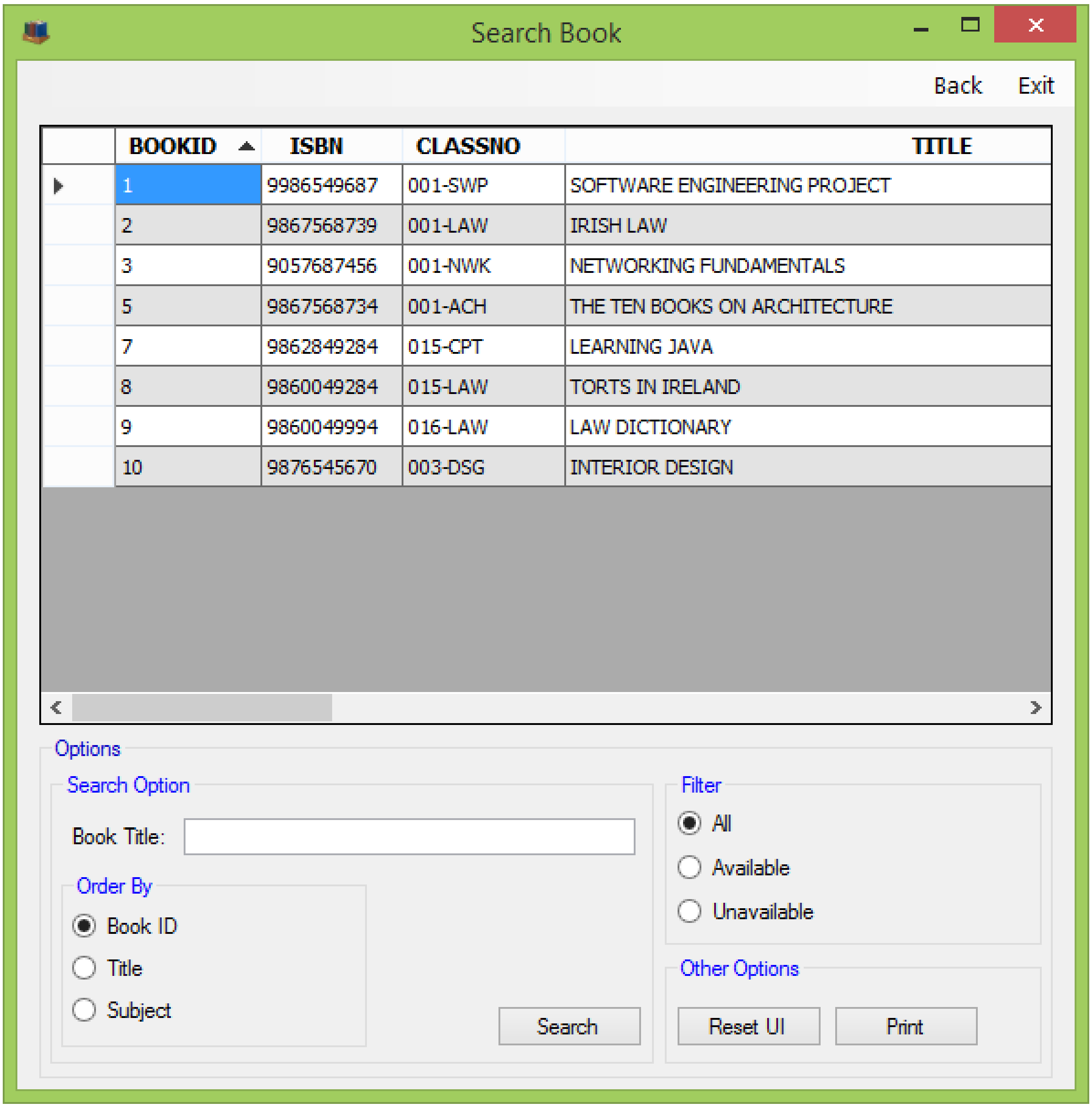


Use Case Narrative:

Use Case Name	Search Book	
Use Case Id	3.2.4	
Priority	Medium	
Source	Librarian	
Primary Business Actor	Librarian	
Other Participating Actors	-	
Description	The Librarian request to search a book in the library. This function generates a book listing on the system in ascending order of Book ID. The list may be printed if required	
Preconditions		
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Search Book function	**Step 2:** System retrieves **all details** of all **‘A’ (Available)** and **‘U’ (Unavailable)** books from **Book File** and displays them in ascending order of Book ID on UI
	Step 3: Librarian searches books by entering book’s title	
	Step 4: Librarian specifies how the list is to be ordered: • Book ID • Title • Subject Code	**Step 5:** System retrieves **all details** of books with ***matching title*** from **Book File** and displays them in ascending order of Librarian’s specification on UI.
	Step 6: Librarian specifies how the list is to be filtered: • All • Available • Unavailable	**Step 7:** System retrieves **all details** of **only** the **specified** books from **Book File** and displays them on UI.
	Step 8: Librarian requests a print copy of the listing	**Step 9:** System generates a print file based on the displayed data and sends to the default print device. **Step 10:** System confirms that the print job has been sent.
	Step 11: Librarian requests to reset the UI	**Step 12:** System resets the UI

Alternate Scenarios	Actor Action	System Response
No Book Details Found		**Step 2:** System fails to retrieve member details from the Member File. **Step 3:** Systems displays appropriate error message
Invalid data entered		**Step 4:** Invalid data detected **Step 5:** System displays appropriate error message
Conclusions	A listing of all books is generated or printed and Librarian can now search for books.	
Post conditions		
Business Rules	Book listing is displayed and cannot be amended or deleted.	
Implementation Constraints		

Example of Book Listing:



BOOKID	ISBN	CLASSNO	TITLE
1	9986549687	001-SWP	SOFTWARE ENGINEERING PROJECT
2	9867568739	001-LAW	IRISH LAW
3	9057687456	001-NWK	NETWORKING FUNDAMENTALS
5	9867568734	001-ACH	THE TEN BOOKS ON ARCHITECTURE
7	9862849284	015-CPT	LEARNING JAVA
8	9860049284	015-LAW	TORTS IN IRELAND
9	9860049994	016-LAW	LAW DICTIONARY
10	9876545670	003-DSG	INTERIOR DESIGN

Options

Search Option

Book Title:

Order By

● Book ID
○ Title
○ Subject

Filter

● All
○ Available
○ Unavailable

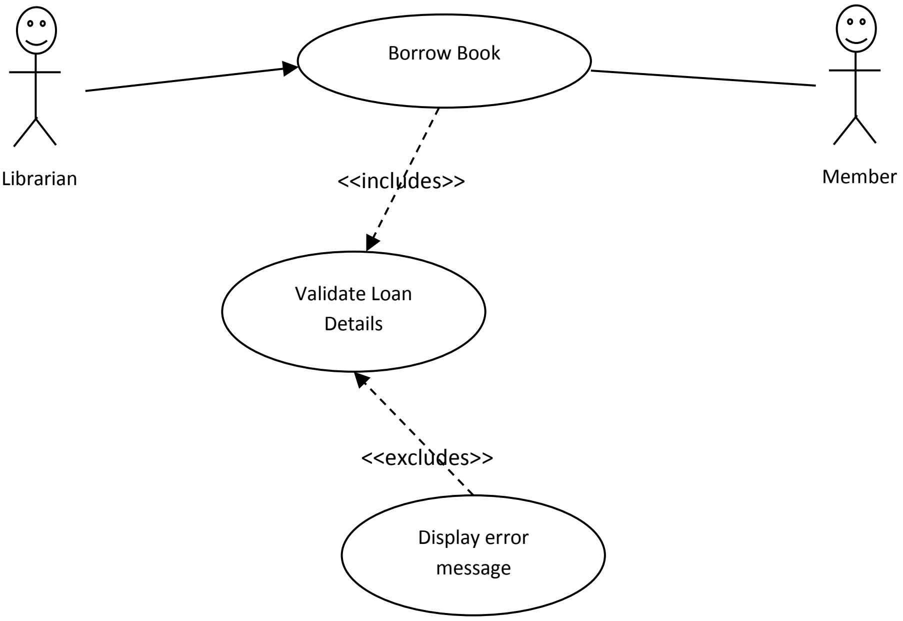
4.4. Manage Book Loans

This module contains function for borrow book and return book. When Member requests to make loans, Librarian invokes borrow book function to record loan details to the Database. When a book is returned, Librarian invokes return book function to update the loan details which includes calculating fine if a book is overdue in the Database.

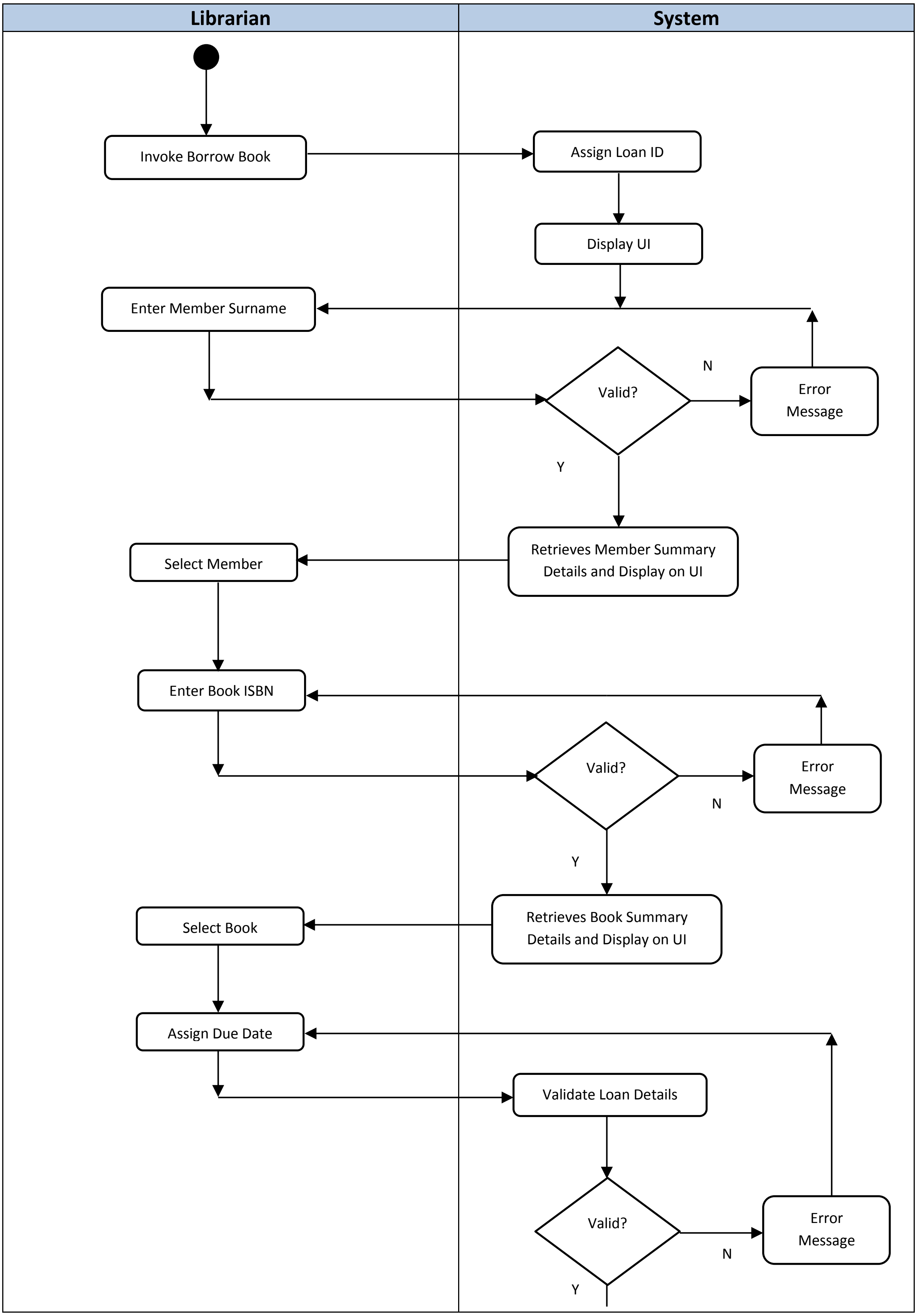
4.4.1. Borrow Book

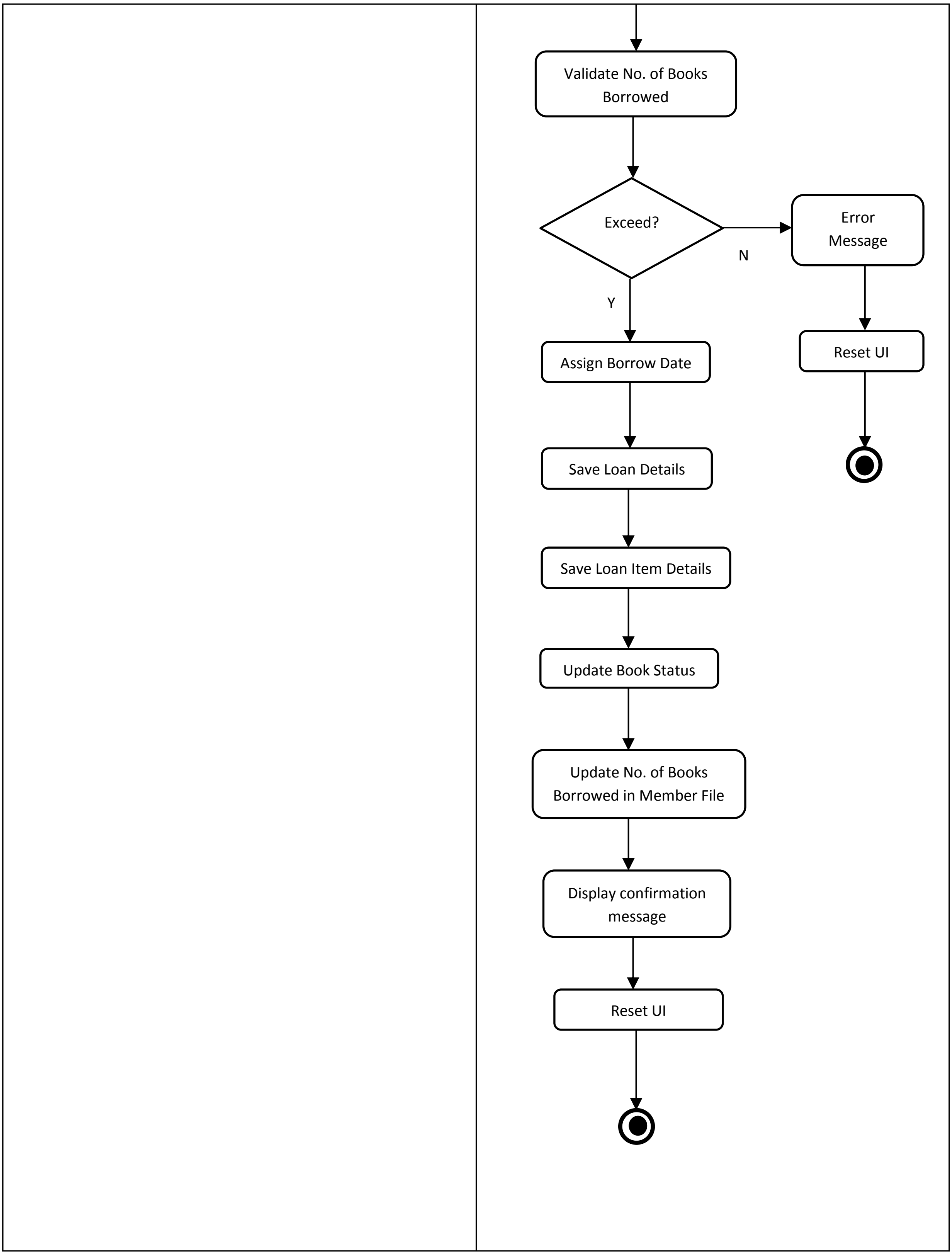
Description: This function registers a loan on the system. Assume that each Member can borrow a book at least three days from the current date.

Use Case Diagram:



Activity Diagram:




Validate No. of Books Borrowed
Exceed?
N
Y
Error Message
Reset UI
Assign Borrow Date
Save Loan Details
Save Loan Item Details
Update Book Status
Update No. of Books Borrowed in Member File
Display confirmation message
Reset UI

Use Case Narrative:

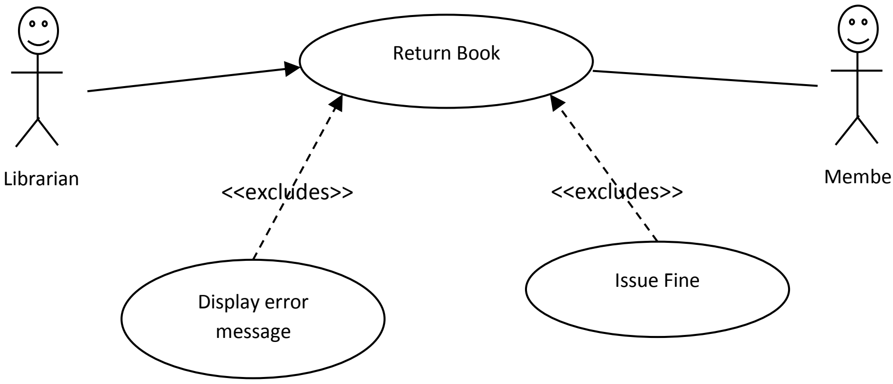
Use Case Name	Borrow Book	
Use Case Id	3.1	
Priority	High	
Source	Librarian	
Primary Business Actor	Librarian	
Other Participating Actors	Member	
Description	This function registers a loan's details on the system. Assume that each member can borrow a book at least three days from current date.	
Preconditions	Member must present a valid PPS Card and bring the book physically to the information desk.	
Trigger	-	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Borrow Book function	**Step 2:** Assign Loan ID **Step 3:** Display UI
	Step 4: Librarian enters Member Surname	**Step 5:** System retrieves **summary details** of the member with matching surname from **Member File** and displays a list on UI
	Step 6: Librarian selects Member from list	**Step 7:** System retrieves summary details of the **selected** member from **Member File** and displays on UI
	Step 8: Librarian enters book ISBN	**Step 9:** System retrieves **summary details** of all **available** book with matching ISBN from **Book File** and displays a list on UI
	Step 10: Librarian selects the book to be borrowed from Member	**Step 11:** System retrieves summary details of the **selected** book from **Book File** and displays on UI
	Step 12: Librarian assigns due date	**Step 13:** System validates loan details that value of Due Date must be at least three days from the current date (System Date). **Step 14:** System validates the number of books borrowed in **Member File** that a Member does not allow more than three books to be borrowed.

		Step 15: Assign Borrow Date a value of current date (System Date) **Step 16:** System saves loan details including due date in **Loan File** **Step 17:** System saves loan items details in **Loan Items File** **Step 18:** System updates book status of the selected book in **Book File** to 'U' (Unavailable) **Step 19:** System updates number of books borrowed in **Member File** **Step 20:** System displays confirmation message **Step 21:** Clears the UI
Alternate Scenarios	**Actor Action**	**System Response**
Invalid Data Entered		**Step 5:** Invalid data detected **Step 6:** Display appropriate error message and return to step 4 **Step 9:** Invalid data detected **Step 10:** Display appropriate error message and return to step 8
Invalid Date Entered		**Step 13**: Invalid date entered. **Step 14**: Display appropriate error message and return to step 12
Number of books borrowed exceed		**Step 14:** Display appropriate error message **Step 15:** Reset UI
Conclusions	Member has successfully borrowed the book	
Post conditions		
Business Rules	A Member does not allow more than three books to be borrowed.	
Implementation Constraints		

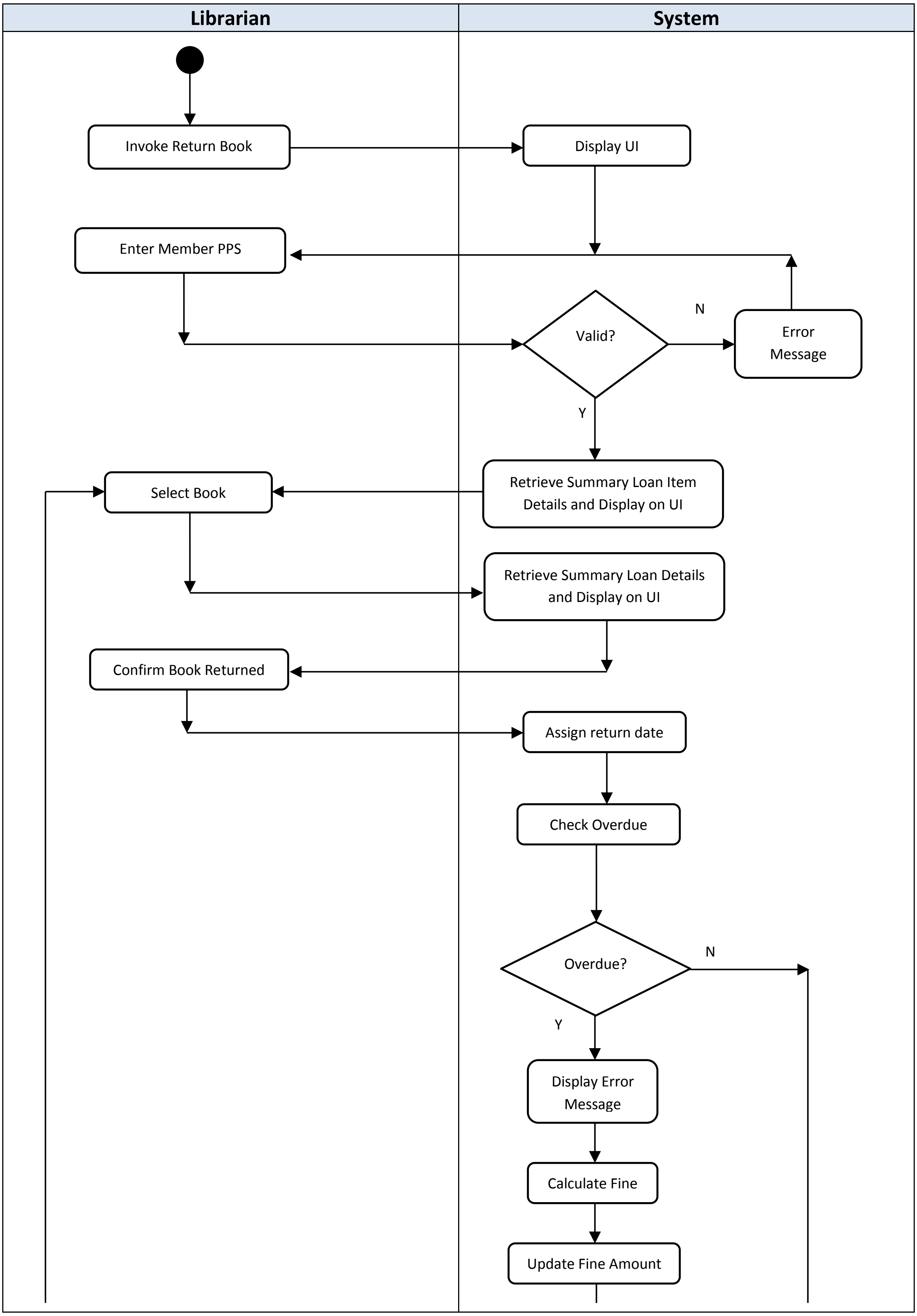
4.4.2. Return Book

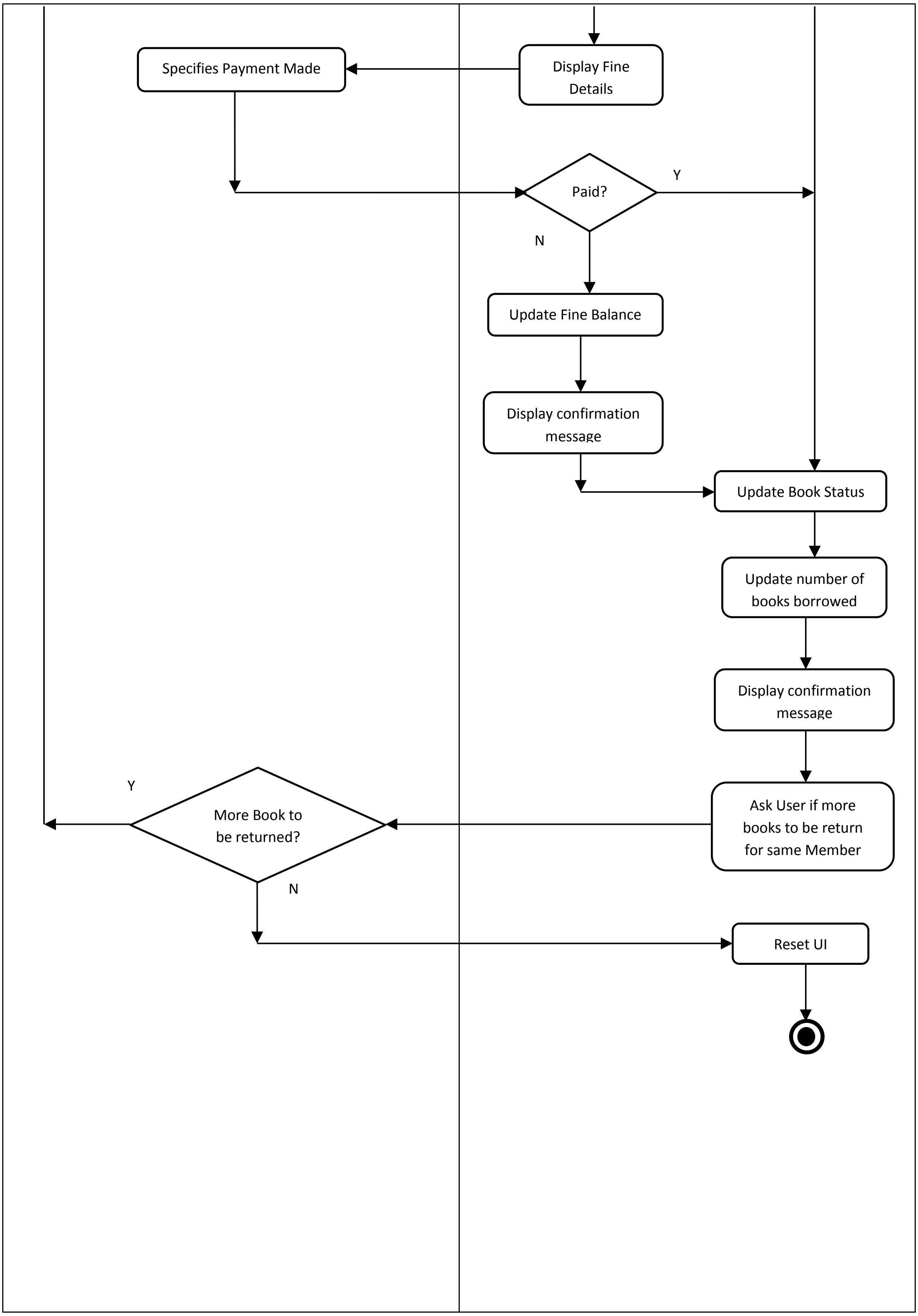
Description: This function updates a loan item details of a member on the system and calculates fine upon book returned if book returned is overdue.

Use Case Diagram:



Activity Diagram:




Specifies Payment Made
Display Fine Details
Paid?
Y
N
Update Fine Balance
Display confirmation message
Update Book Status
Update number of books borrowed
Display confirmation message
Y
More Book to be returned?
Ask User if more books to be return for same Member
N
Reset UI

Use Case Narrative:

Use Case Name	Return Book	
Use Case Id	3.2	
Priority	High	
Source	Librarian	
Primary Business Actor	Librarian	
Other Participating Actors	Member	
Description	This function updates a loan item details on the system and calculate fine upon book returned if book returned is overdue. Fine may be issued and recorded if required.	
Preconditions	Member must present a valid PPS Card and return the book physically to the information desk.	
Trigger	-	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Return Book function	**Step 2:** Display UI
	Step 3: Librarian enters member PPS	**Step 4:** System retrieves **summary details** of loan items with matching PPS from **Loan Items File, Loan File, Books File, and Member File** and displays a list on UI in ascending order of Loan ID
	Step 5: Librarian selects the book to be returned	**Step 6:** System retrieves **summary** loan details of the **selected** book in **Loan File** and displays on UI
	Step 7: Librarian confirms the book to be returned	**Step 8:** Assign return date a value of current date (System Date)
		Step 9: System checks if book returned is overdue.
		Step 10: System updates book status of the returned book in **Book File** to 'A' (Available)
		Step 11: System updates number of books borrowed in **Member File**
		Step 12: System displays confirmation message
		Step 13: System prompts User if more books to be return for the same Member

	Step 14: Librarian selects either ‘Yes’ or ‘No’ option.	**Step 15:** If Librarian selects ‘Yes’, return to step 5 else if Librarian selects ‘No’, proceed to step 16 **Step 16:** Reset UI
Alternate Scenarios	**Actor Action**	**System Response**
Invalid data entered		**Step 4:** Invalid data detected **Step 5:** Display appropriate error message and return to step 3
Book Overdue	**Step 13:** Librarian specifies payment is either Paid or Owed	**Step 9:** System displays appropriate error message. **Step 10:** System calculates fine **Step 11:** System updates fine amount of the selected loan items in **Loan Items File** **Step 12:** Display Fine Details on UI **Step 14:** System updates fine balance of the member in **Member File** if the payment specified by librarian is owed. **Step 15:** System displays confirmation message and return to Step 10.
Conclusions	Member has successfully returned the book and fine is calculated upon book returned if book returned is overdue.	
Post conditions		
Business Rules	A penalty of €0.20 for every day late return from due date	
Implementation Constraints		

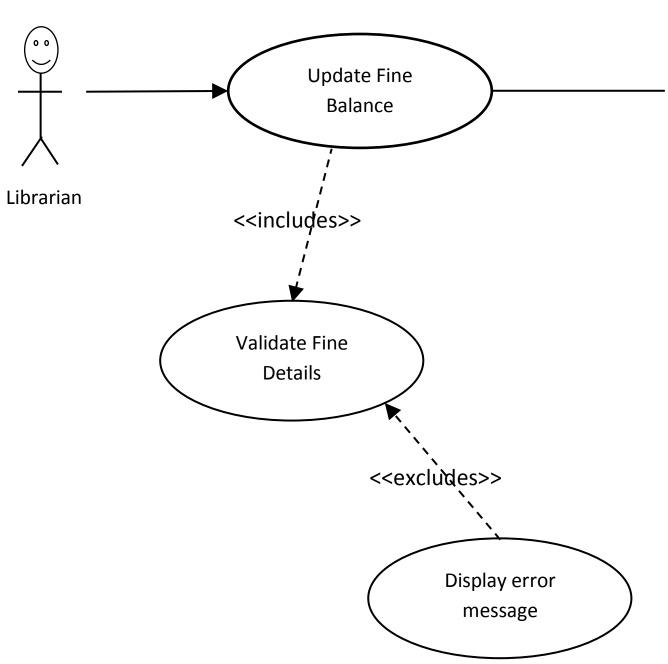
4.5. Perform Finance

This module contains function that allows a Member's fine balance to be updated and perform revenue analysis which analysed the total amount of book bought and the total amount of fine issued for each month.

4.5.1. Update Fine Balance

Description: This function updates fine balance of a Member if the Member does not make fine payment upon book returned if fine is issued to the Member.

Use Case Diagram:



Use Case Narrative:

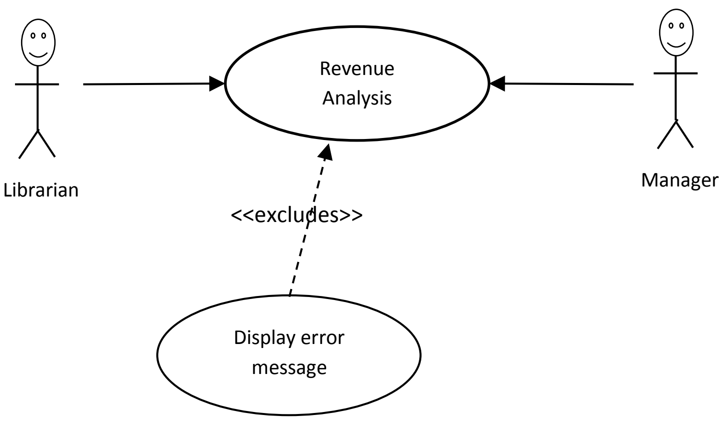
Use Case Name	Update Fine Balance	
Use Case Id	4.2	
Priority	High	
Source	Librarian	
Primary Business Actor	Librarian	
Other Participating Actors	Member	
Description	This function updates fine balance of a Member if a Member does not make the fine payment upon book returned if fine is issued to the Member.	
Preconditions	Member must pay the amount of fine to the Librarian at the information desk.	
Trigger	-	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Librarian invokes Update Fine Balance function.	**Step 2:** Display UI
	Step 3: Librarian enters member surname.	**Step 4:** System retrieves **summary details** of all **<u>active</u>** members with matching surname from **Member File** and display a list on UI in order of Member ID, Surname, and Forename.
	Step 5: Librarian selects the member to be updated	**Step 6:** System retrieves **summary details** for the **<u>selected</u>** member from **Member File** and displays on UI for editing
	Step 7: Librarian enters the amount of fine paid	
	Step 8: Librarian confirms update fine balance of the selected member.	**Step 9:** System validates fine update details: • The amount of fine paid must be less than or equal to the fine balance recorded for that member. **Step 10:** System updates member details in **Member File** **Step 11:** System displays confirmation message **Step 12:** System clears the UI

Alternate Scenarios	**Actor Action**	**System Response**
No record found		**Step 4:** No such record found.
		Step 5: System displays appropriate error message and return to step 3
No Fine Balance		**Step 6:** Fine balance of the selected member is equal to 0
		Step 7: System displays an appropriate information message and return to step 3
Invalid data entered		**Step 9:** Invalid data entered
		Step 10: System displays an appropriate error message and return to step 7
Conclusions	Fine Balance of a Member is now updated.	
Post conditions	-	
Business Rules	-	
Implementation Constraints	-	

4.5.2. Revenue Analysis

Description: This function generates a report as shown in Appendix B on the system that analysed the total cost used for buying books and the total amount of fine issued to member for each month. The report may be printed if required.

Use Case Diagram:

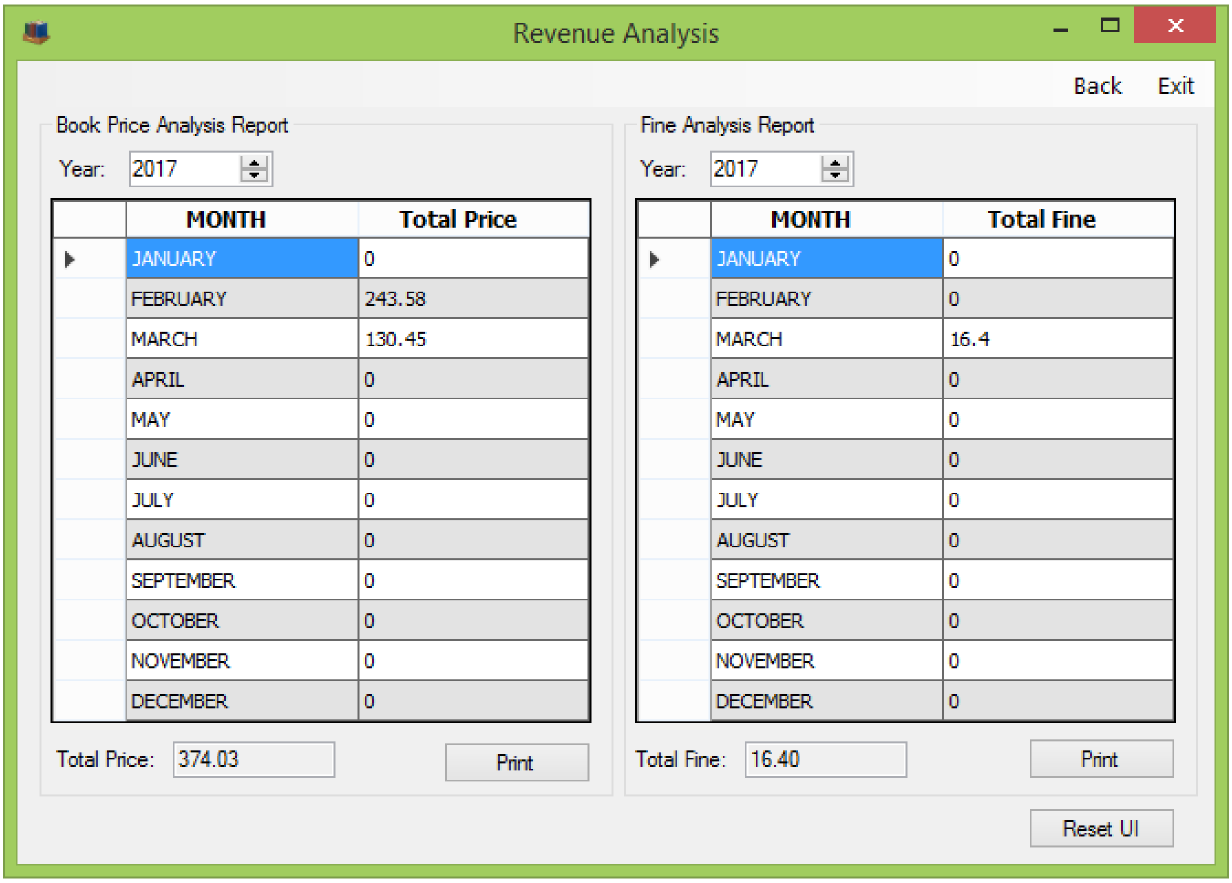


Use Case Narrative:

Use Case Name	Revenue Analysis	
Use Case Id	4.2	
Priority	High	
Source	Manager	
Primary Business Actor	Manager, Librarian	
Other Participating Actors	-	
Description	This function generates a revenue analysis report on the system which analysed the total cost used for buying books and the total amount of fine issued to member for each month. The report may be printed if required.	
Preconditions		
Trigger	None	
Expected Scenario	**Actor Action**	**System Response**
	Step 1: Manager or Librarian invokes Revenue Analysis function	**Step 2:** System retrieves book price details from **Book File** and generates a monthly cost report on current year and display them in order of month on UI **Step 3:** System retrieves fine details from **Loan Items File** and generates a monthly fine report on current year and display them in order of month on UI
	Step 4: Librarian or Manager specifies the year to be viewed on monthly cost report	**Step 5:** System retrieves details of **only** the **specified** year from **Book File** and displays them in order of month
	Step 6: Librarian or Manager specifies the year to be viewed on month fine report	**Step 7:** System retrieves details of **only** the **specified** year from **Loan Items File** and displays them in order of month
	Step 8: Librarian or Manager requests a print copy of the report	**Step 9:** System generates a print file based on the displayed data and sends to the default print device **Step 10:** System confirms that the print job has been sent
	Step 11: Librarian or Manage requests to reset UI	**Step 12:** System resets UI

Alternate Scenarios	Actor Action	System Response
No Record Found		**Step 2:** System fails to retrieve book price details from **Book Files.** **Step 3:** System displays appropriate error message **Step 3:** System fails to retrieve monthly fine details in **Loan Items File.** **Step 4:** System displays appropriate error message.
Conclusions	Revenue analysis report is generated or printed.	
Post conditions		
Business Rules	Report is displayed and cannot be amended or deleted.	
Implementation Constraints		

Sample of Revenue Analysis



Book Price Analysis Report

Year: 2017

MONTH	Total Price
JANUARY	0
FEBRUARY	243.58
MARCH	130.45
APRIL	0
MAY	0
JUNE	0
JULY	0
AUGUST	0
SEPTEMBER	0
OCTOBER	0
NOVEMBER	0
DECEMBER	0

Total Price: 374.03

Fine Analysis Report

Year: 2017

MONTH	Total Fine
JANUARY	0
FEBRUARY	0
MARCH	16.4
APRIL	0
MAY	0
JUNE	0
JULY	0
AUGUST	0
SEPTEMBER	0
OCTOBER	0
NOVEMBER	0
DECEMBER	0

Total Fine: 16.40

5. System Model

The following dataflow diagrams have been produced for the system:

DFD Elements:

External Entities:

Member

Data Stores:

D1 Member File

D2 Book File

D3 Loan File

D4 Loan Items File

Processes:

P1 Manage Members

P1.1 Register Member
P1.2 De-register Member
P1.3 Update Member
P1.4 List Members
P1.5 View Member History

P2 Manage Books

P2.1 Register Book
P2.2 Remove Book
P2.3 Update Book
P2.4 Search Book

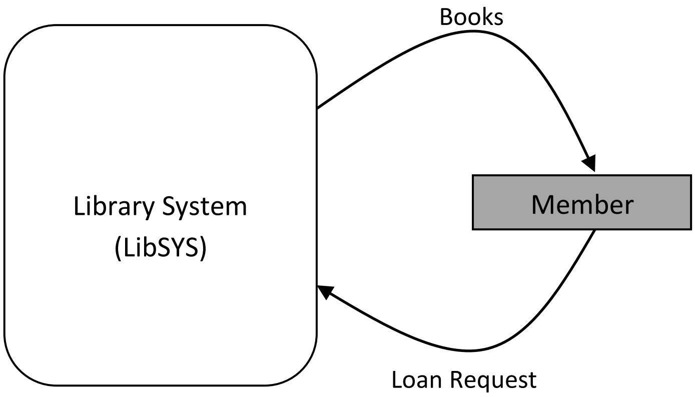
P3 Manage Loans

P3.1 Borrow Book
P3.2 Return Book

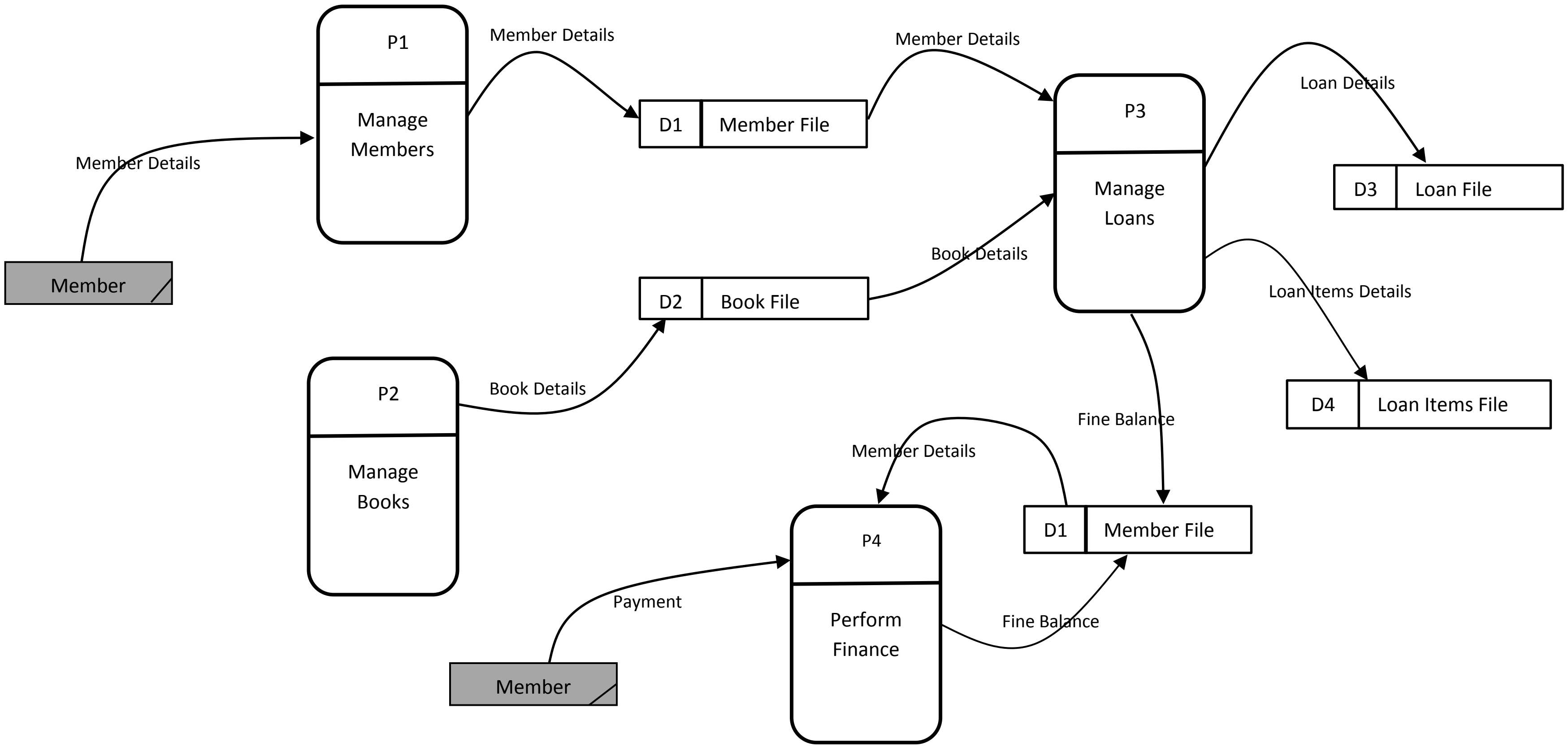
P4 Process Fines

P4.1 Record Fine
P4.2 Revenue Analysis

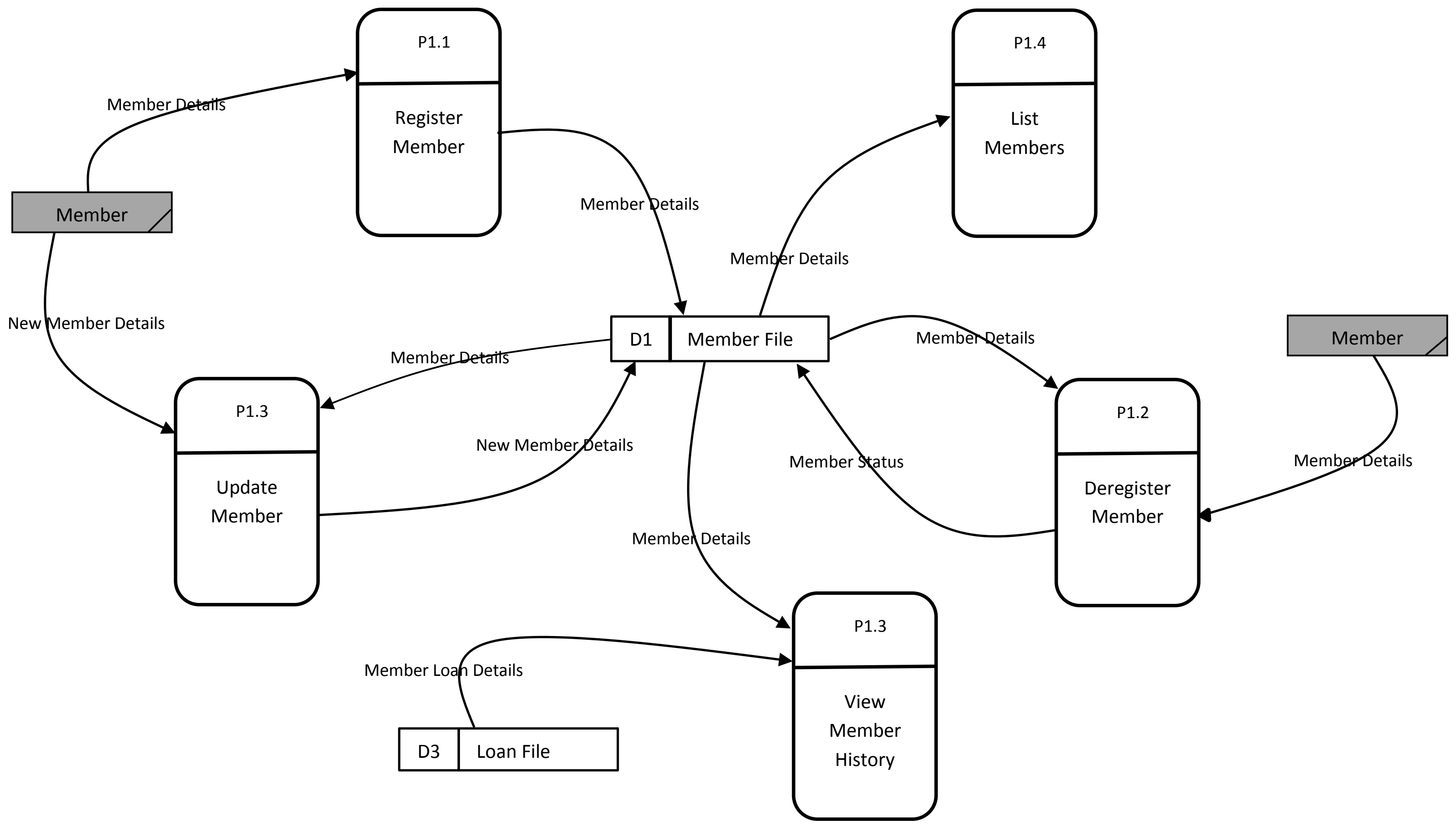
5.1. Level-0 DFD



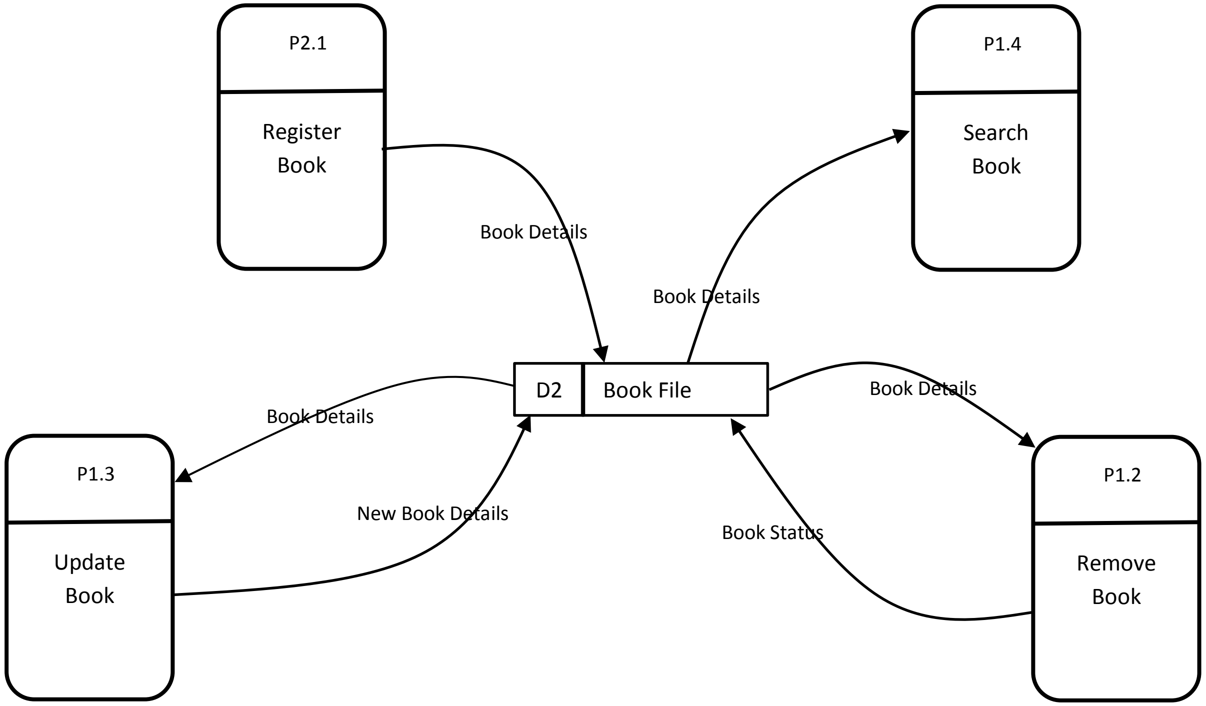
5.2. Level-1 DFD



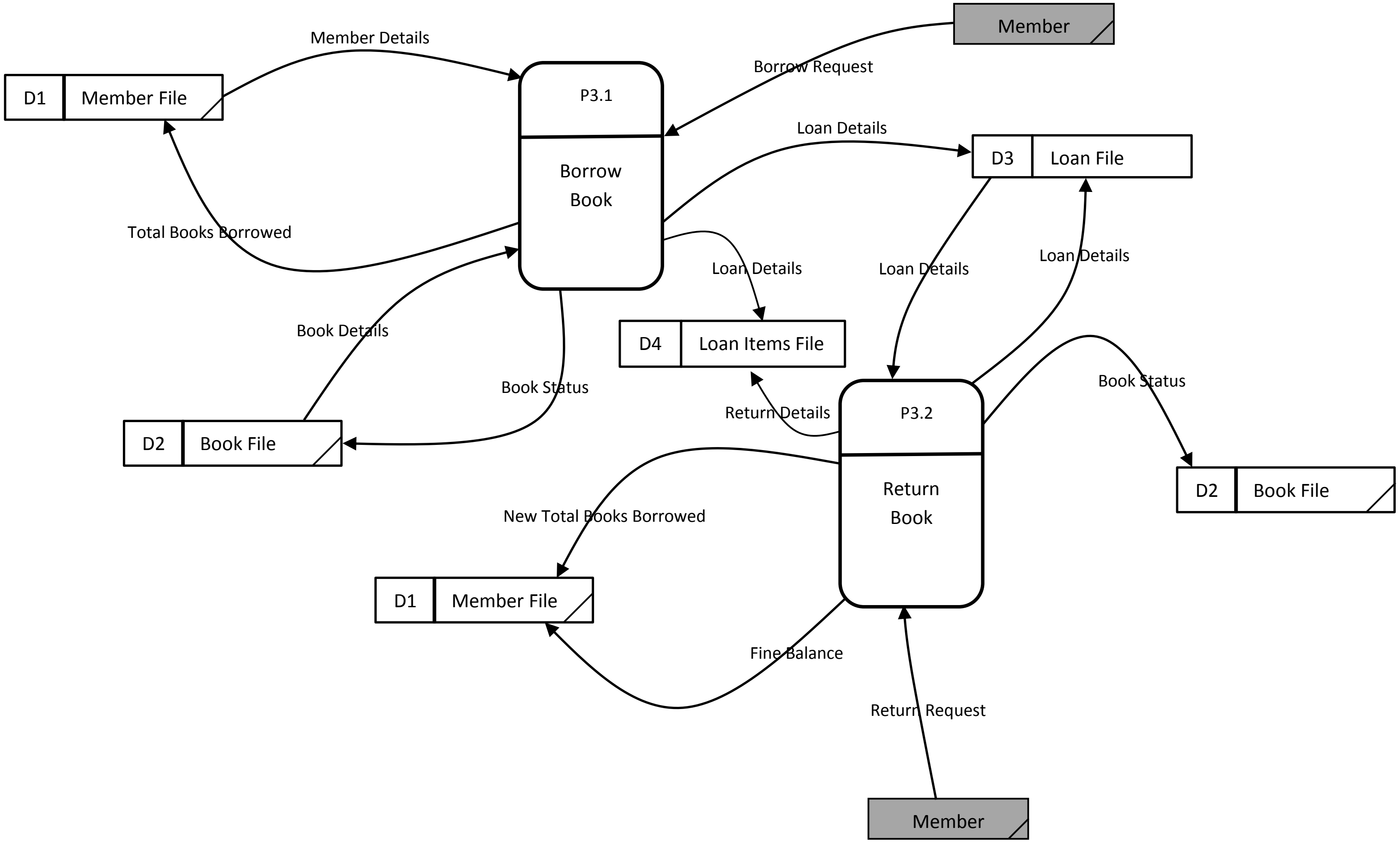
5.3. Level-2 DFD (Process P1: Manage Members)



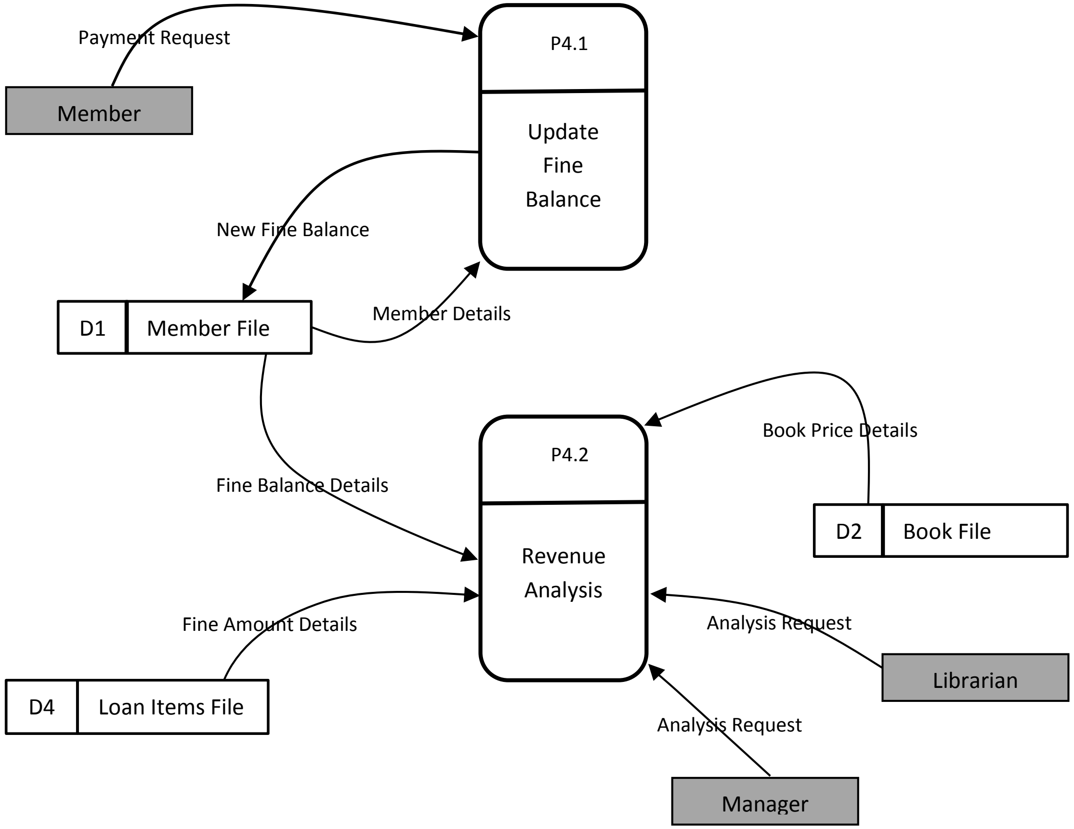
5.4. Level-2 DFD (Process P2: Manage Books)



5.5. Level-2 DFD (Process P3: Manage Loans)



5.6. Level-2 DFD (Process P4: Perform Finance)



6. Data Model (Class Diagram)

Data Modelling is fundamental entities to introduce abstraction in a DBMS. Data Models define how data is connected to each other and how they are processed and stored inside the system (Tutorialspoint, n.d.). For this project, Entity-Relationship (ER) Model is used. ER Model refers to a collection of data requirements. The ER model contains Entities, Relationships, and attributes. The notation used for this project to produce the ER diagrams is the Unified Modelling Language (UML) Class Diagram.

Entity is a ‘thing’ which the organisation recognises as being capable of an independent existence, uniquely identified and is an abstraction for some domain and is an aspect of the real world that have properties called attributes. Each entity has a logical association called relationship. Relationships are mapped with entities in various ways. Mapping cardinalities defined the number of association between two entities. It is either one to one, one to many, many to one or many to many. Entities in this project are: Member, Book, Rental, Fine

Normalisation is the process of testing the correctness of a logical data model to reduce redundancy of data (Techopedia, n.d.) and remove the possibility of update anomalies. There are three main types of normalization, which is 1NF, 2NF and 3NF.

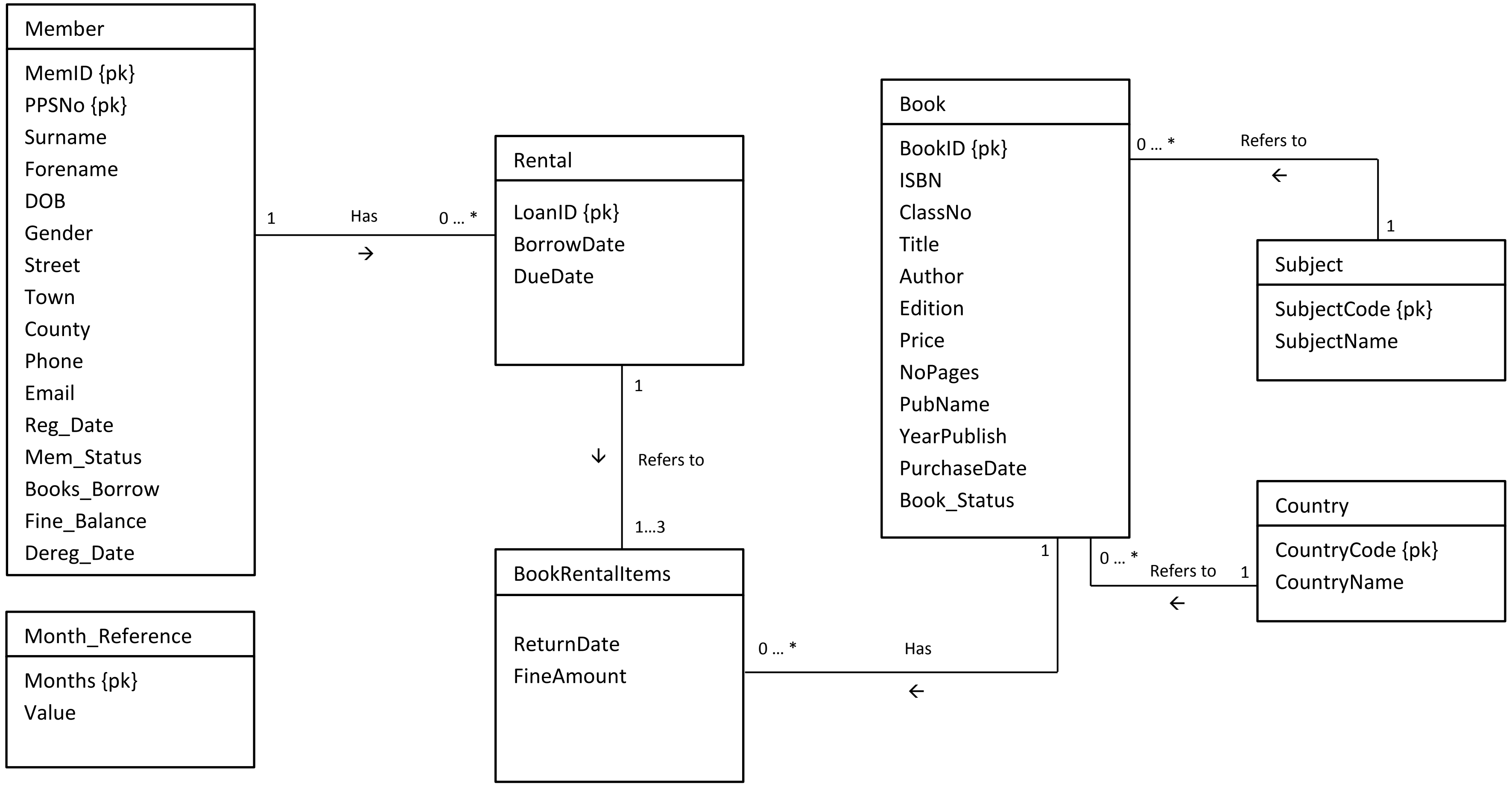
1NF where the relation contains no repeating groups and all non-key attributes are functionally dependent on the primary key.

2NF where the relation is in 1NF and all non-key attributes are fully functionally dependent on the primary key.

3NF where the relation is in 2NF and the pairs of non-key attributes are not transitively dependent on the primary key.

6.1. Class Diagram

Library System UML Diagram



Where:

Gender is either ‘M’ (Male) or ‘F’ (Female)

Member Status is either ‘A’ (Active) or ‘D’ (Deregistered)

Book Status is either ‘A’ (Available), ‘U’ (Unavailable), or ‘R’ (Removed)

Dates are in the format dd-MM-yyyy (e.g. 12-DEC-2016)

Only Dereg_Date and Return Date can be NULL

6.2. Relational Schema

Members (MemID, PPSNo, Surname, Forename, DOB, Gender, Street, Town, County, Phone, Email, Reg_Date, Mem_Status, Books_Borrow, Fine_Balance, Dereg_Date)

Books (BookID, ISBN, ClassNo, Title, SubjectCode, Author, Edition, Price, NoPages, PubName, CountryCode, YearPublish, PurchaseDate, Book_Status)

Rentals (LoanID, MemID, BorrowDate, DueDate)

BookRentalItems (LoanID, BookID, ReturnDate, FineAmount)

Countries (CountryCode, CountryName)

Subjects (SubjectCode, SubjectName)

Month_Reference (Months, Value)

6.3. Database Schema

Relation: Members
Attributes:
MemberID numeric(3)
PPSNo char(9) NOT NULL UNIQUE
Surname char(25) NOT NULL
Forename char(25) NOT NULL
DOB Date NOT NULL
Gender char(1) NOT NULL
Street char(30) NOT NULL
Town char(30) NOT NULL
County char(20) NOT NULL
Phone char(14) NOT NULL
Email char(40) NOT NULL UNIQUE
Reg_Date DATE NOT NULL
Mem_Status char(1) NOT NULL
Books_Borrow numeric(1) DEFAULT 0
Fine_Balance numeric(5,2) DEFAULT 0
Dereg_Date DATE
Primary Key: MemberID

Relation: Books
Attributes:
BookID numeric(4)
ISBN numeric(13) NOT NULL
ClassNo char(6) NOT NULL
Title char(110) NOT NULL
SubjectCode char(3) NOT NULL
Author char(35) NOT NULL
Edition numeric(2) NOT NULL
Price numeric(5,2) NOT NULL
NoPages numeric(3) NOT NULL
PubName char(35) NOT NULL
CountryCode char(3) NOT NULL
YearPublish char(4) NOT NULL
PurchaseDate DATE NOT NULL
Book_Status char(1) NOT NULL
Primary Key: BookID
Foreign Key: SubjectCode References Subjects
Foreign Key: CountryCode References Countries

Relation: Rentals

Attributes:

LoanID numeric(5)
MemID numeric(4) NOT NULL
BorrowDate DATE NOT NULL
DueDate DATE NOT NULL

Primary Key: LoanID

Foreign Key: MemID References Members

Relation: BookRentalItems

Attributes:

LoanID numeric(5)
BookID numeric(4)
ReturnDate DATE
FineAmount numeric(4,2) DEFAULT 0

Primary Key: LoanID, BookID

Foreign Key: LoanID References Rentals

Foreign Key: BookID References Books (BookID)

Relation: Countries

Attributes:

CountryCode char(3)
CountryName char(45) NOT NULL

Primary Key: CountryCode

Relation: Subjects

Attributes:

SubjectCode char(3)
SubjectName char(110) NOT NULL

Primary Key: SubjectCode

Relation: Month_Reference

Attributes:

Months char(9)
Value numeric(6,2) DEFAULT 0

Primary Key: Months

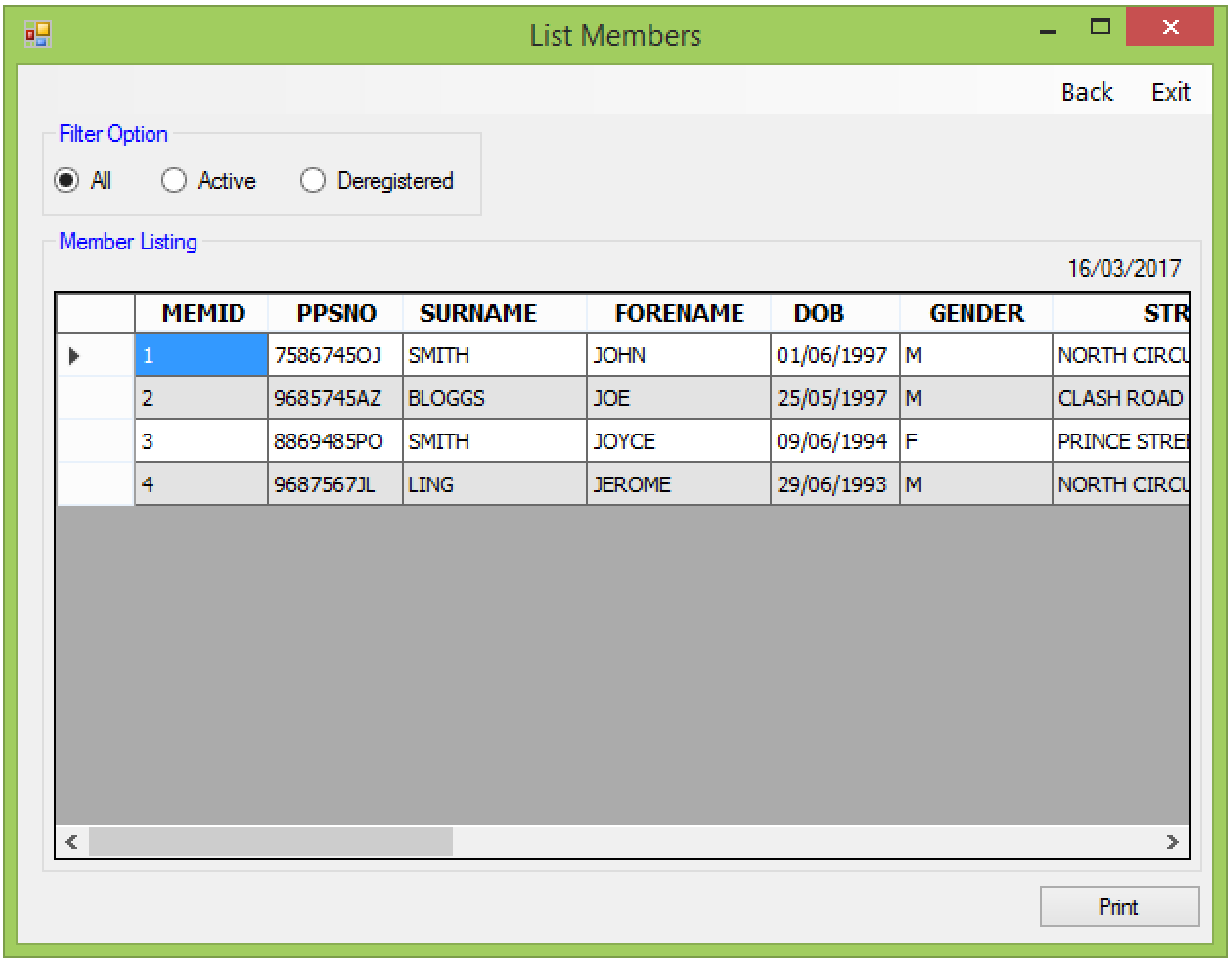
7. Conclusion

In a nutshell, the Library system allows librarian to register a member, de-register a member, update member's profile, list members and view members borrow history. The system also allows librarian to register a book, remove a book, update a book and search for a book in the system which improve the efficient of book management. This system can also manage loans by recording member's details and book's details into the system. Lastly, the system can also update fine balance due to late return and performs revenue analysis which analysed the monthly fine collected and total cost used for buying books that are recorded in the system.

8. Appendices

8.1. Appendix A – Listings

Member Listing

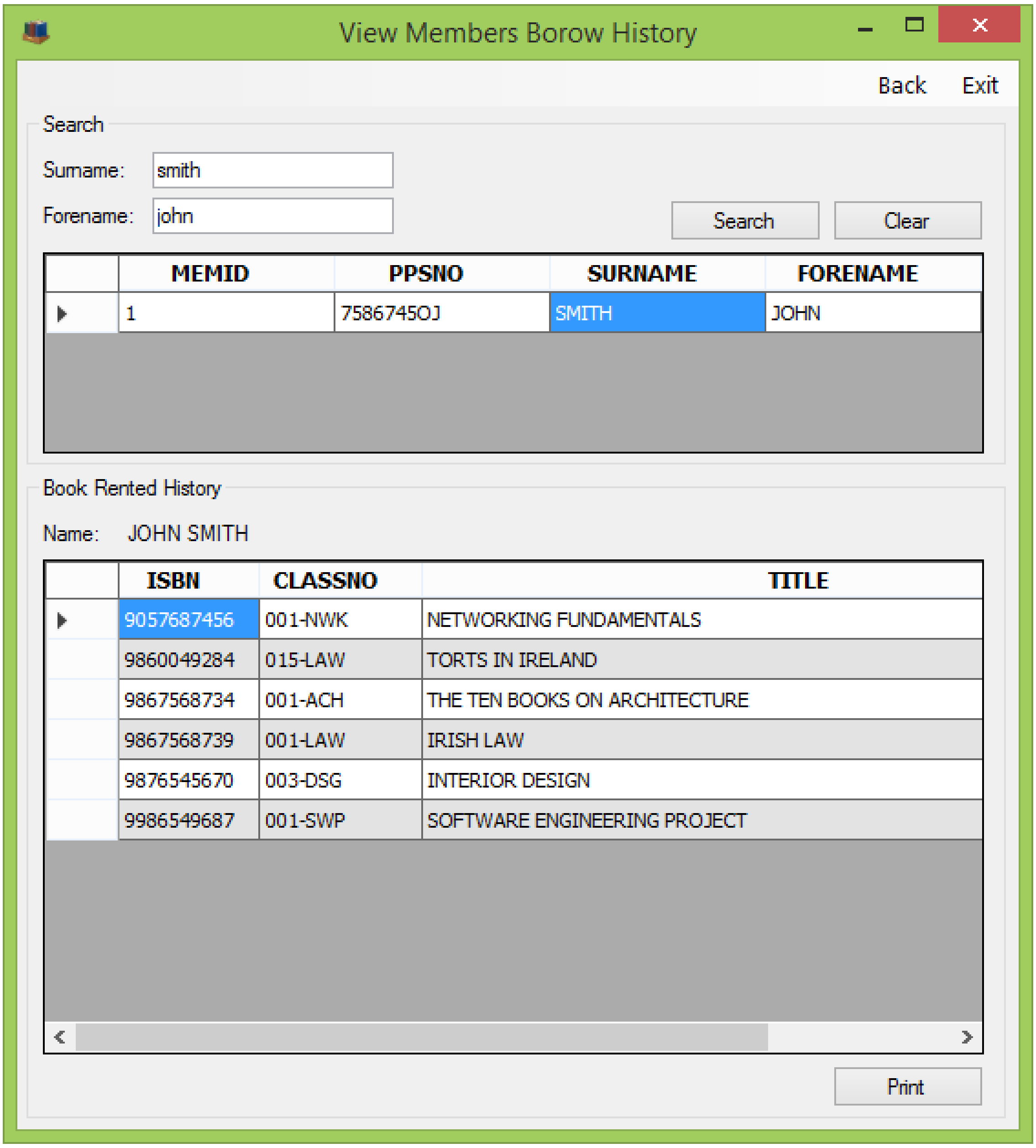


● All ○ Active ○ Deregistered

16/03/2017

	MEMID	PPSNO	SURNAME	FORENAME	DOB	GENDER	STR
▶	1	7586745OJ	SMITH	JOHN	01/06/1997	M	NORTH CIRCU
	2	9685745AZ	BLOGGS	JOE	25/05/1997	M	CLASH ROAD
	3	8869485PO	SMITH	JOYCE	09/06/1994	F	PRINCE STREI
	4	9687567JL	LING	JEROME	29/06/1993	M	NORTH CIRCU

Member's History Listing



Surname: smith

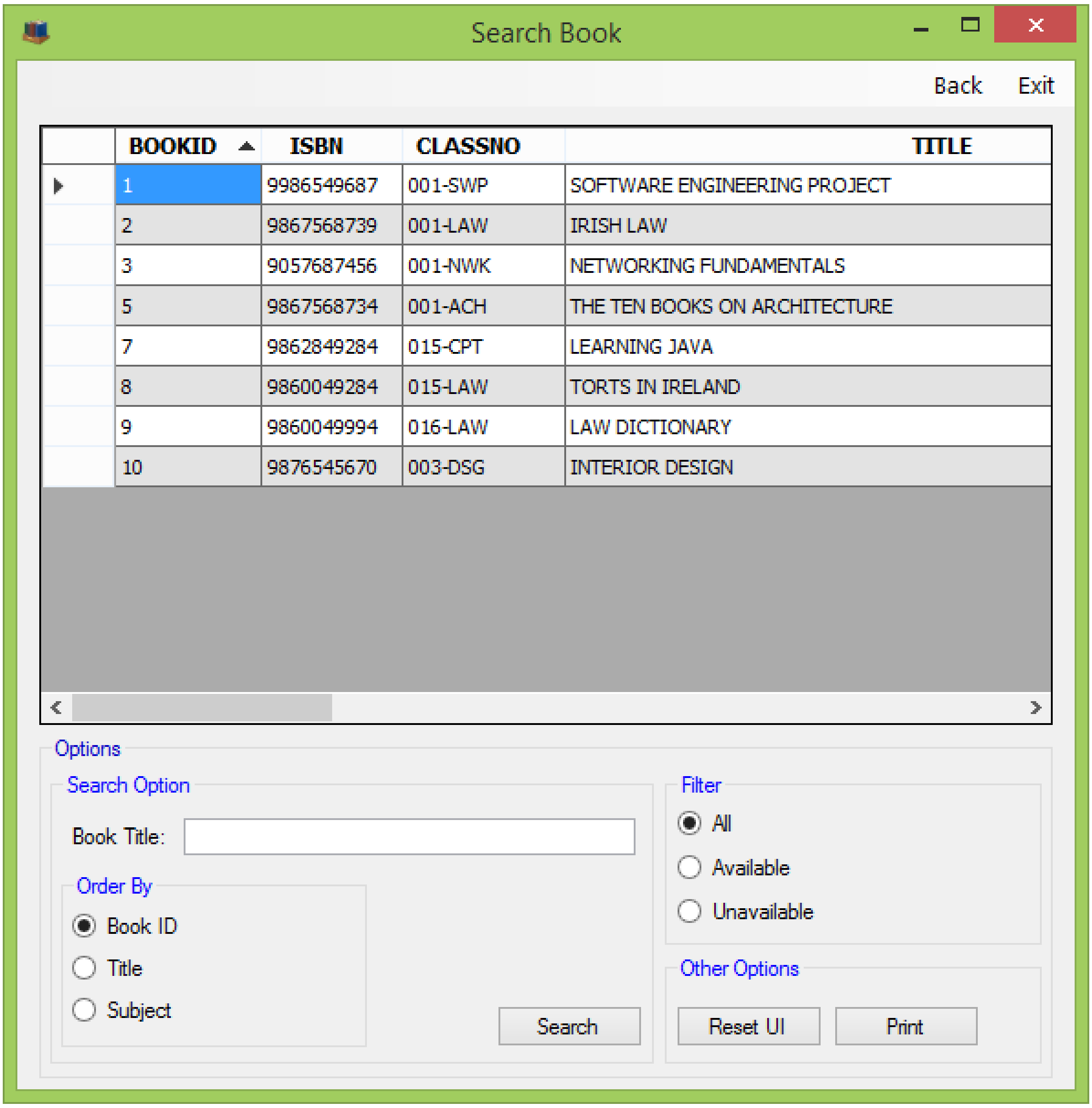
Forename: john

	MEMID	PPSNO	SURNAME	FORENAME
▶	1	7586745OJ	SMITH	JOHN

Name: JOHN SMITH

	ISBN	CLASSNO	TITLE
▶	9057687456	001-NWK	NETWORKING FUNDAMENTALS
	9860049284	015-LAW	TORTS IN IRELAND
	9867568734	001-ACH	THE TEN BOOKS ON ARCHITECTURE
	9867568739	001-LAW	IRISH LAW
	9876545670	003-DSG	INTERIOR DESIGN
	9986549687	001-SWP	SOFTWARE ENGINEERING PROJECT

Book Listing



BOOKID	ISBN	CLASSNO	TITLE
1	9986549687	001-SWP	SOFTWARE ENGINEERING PROJECT
2	9867568739	001-LAW	IRISH LAW
3	9057687456	001-NWK	NETWORKING FUNDAMENTALS
5	9867568734	001-ACH	THE TEN BOOKS ON ARCHITECTURE
7	9862849284	015-CPT	LEARNING JAVA
8	9860049284	015-LAW	TORTS IN IRELAND
9	9860049994	016-LAW	LAW DICTIONARY
10	9876545670	003-DSG	INTERIOR DESIGN

Options

Search Option

Book Title:

Order By

● Book ID
○ Title
○ Subject

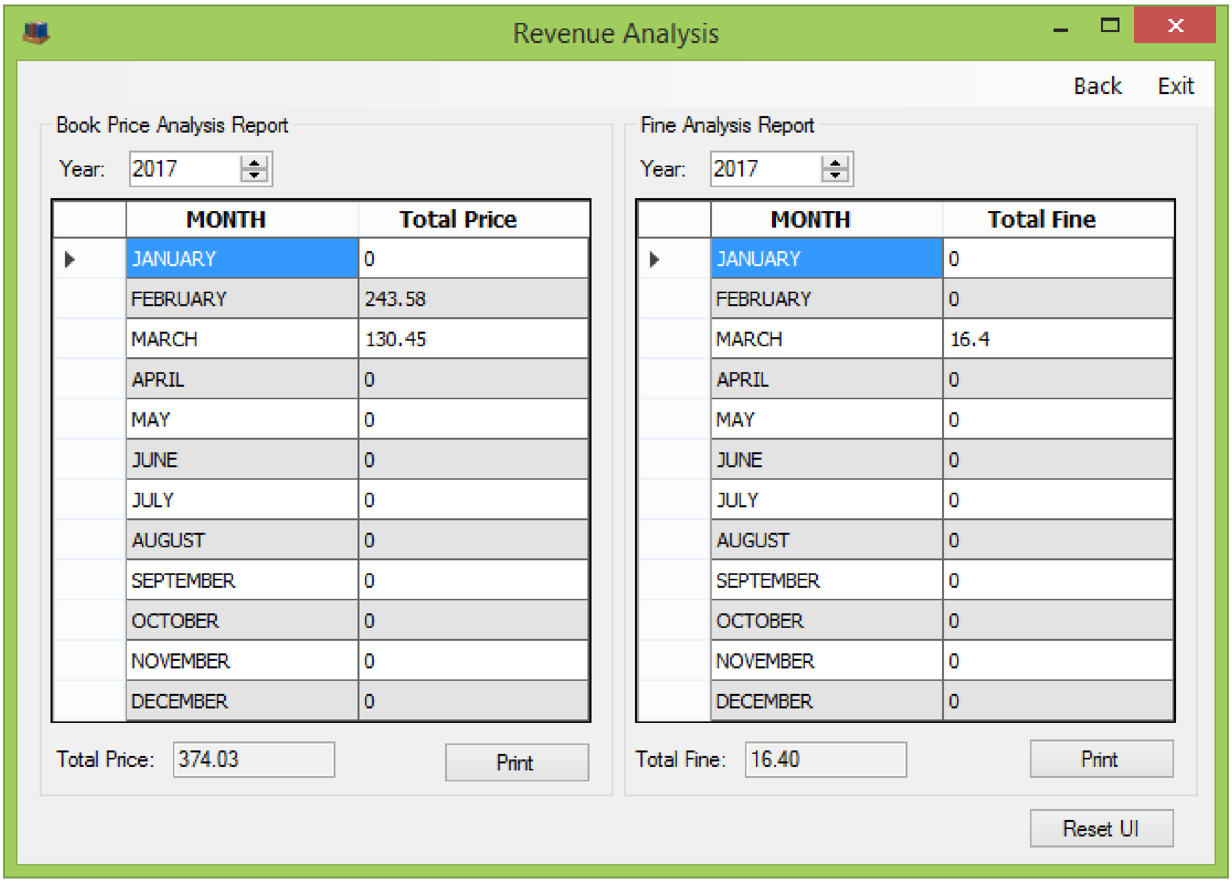
Filter

● All
○ Available
○ Unavailable

Other Options

8.2. Appendix B – Reports

Revenue Analysis Report



Book Price Analysis Report

Year: 2017

MONTH	Total Price
JANUARY	0
FEBRUARY	243.58
MARCH	130.45
APRIL	0
MAY	0
JUNE	0
JULY	0
AUGUST	0
SEPTEMBER	0
OCTOBER	0
NOVEMBER	0
DECEMBER	0

Total Price: 374.03

Fine Analysis Report

Year: 2017

MONTH	Total Fine
JANUARY	0
FEBRUARY	0
MARCH	16.4
APRIL	0
MAY	0
JUNE	0
JULY	0
AUGUST	0
SEPTEMBER	0
OCTOBER	0
NOVEMBER	0
DECEMBER	0

Total Fine: 16.40

9. References

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