XIAMEN UNIVERSITY MALAYSIA

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Date:11/12/2023

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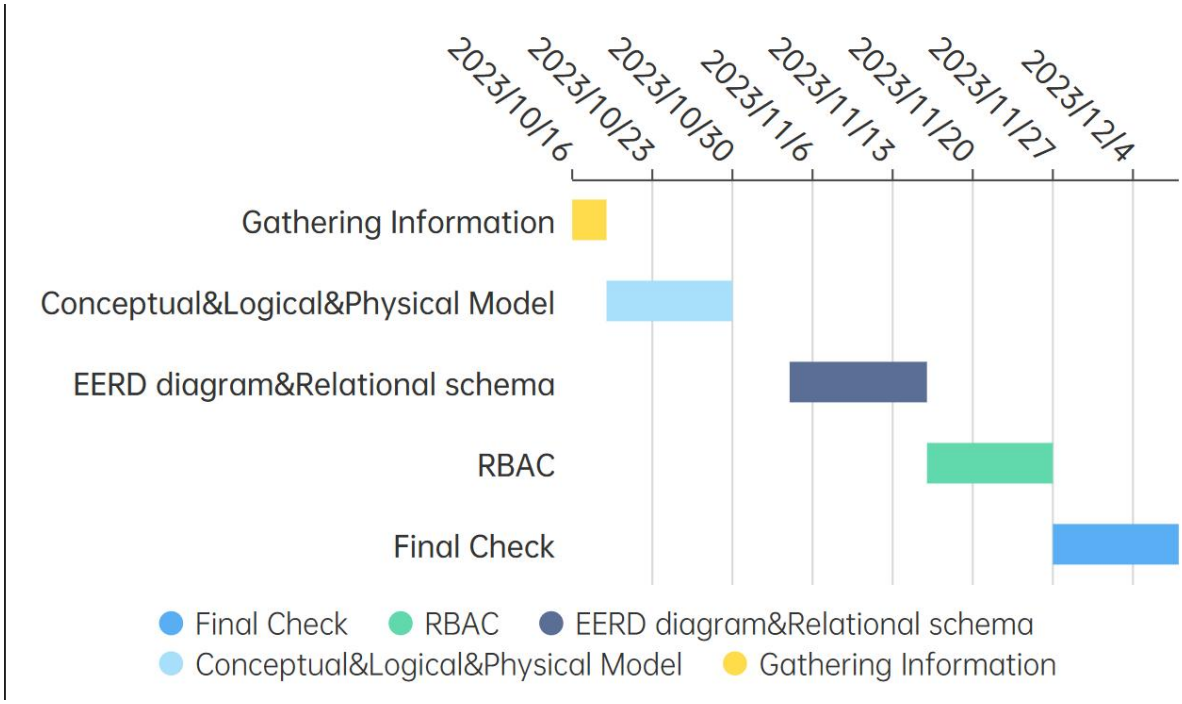
Gantt Chart and Milestones



Task	Start time	End time
Final Check	2023/11/27	2023/12/8
RBAC	2023/11/16	2023/11/27
EERD diagram&Relation schema	2023/11/4	2023/11/16
Conceptual&Logi Model	2023/10/19	2023/10/30
Gathering Information	2023/10/16	2023/10/19

Task 1: Relational Database Design

a) Objectives

To develop database management system for library management system for the user to borrow the book they want.

To improve student's efficiency to search the books they want.

To integrate all the knowledge resources of the library.

To keep track of student's library usage

b) Scope

The system only caters for student and staff of our school.

The system only covers for book payment, notification, search, reservation and loan only.

The system only supports English.

c) Boundaries

The system run on Windows only.

The system did not support payment getaway.

No integration with third party account.

d) Business Requirements

Entity	Description	Relationship
User	Can be regular student or staff to book reservation and loan. Users can borrow two books for free at a time and can hold for 5 days. Gold members can borrow up to 5 books for free at a time and can hold for 10 days. Diamond members can borrow up to 10 books for free at a time and can hold for 15 days. If the user does not return the	Can borrow many books. Can be upgraded to membership. Can pay many payment Can receive many notifications Can have many search record Can have many borrowing record

	book due to timeout, the account status becomes abnormal. Books cannot be borrowed when the account status is abnormal.	
Book	Books form an integral part of a library Can be reservation and loan in the library	Borrowed by one user Written by the author. Have a subject Have a publisher Reserved by user
Membership	It has two types: gold and diamond. Gold membership opens for 10RM. Diamond membership opens for 20RM.	It is the upgraded version of user Can be paid by fee payment
Fee payment	Each book is charged 1RM per overtime day, up to the original price of the book, and the original price of the book is lost. All kinds of library payment are realized through fee payment.	Can register a user multiple times for not returning a book. Can pay membership
Notification	Users can reserve books and a notification will be sent to the user when the book is returned. If the user fails to return the book due to timeout, a return reminder will be sent to the user	Can be sent to a customer
Subject	Each book has its own subject, so that users can better filter the books they want	Can be owned by book
Publisher	Publishers publish the book	Can publish many books
Author	Authors write books	Can write many books
Borrowing record	When a user borrows a book they	Can be generated after a user has

	want, a borrowing record is generated	borrowed it
Search	When the user searches for the book they want, the search history is generated	Can be generated after a user has searched a book
Reservation	Through the reservation mechanism, students can more easily know whether their favourite books have been returned	Can be generated after a user has reservation a book

e) Functional Requirement

FR	Functional Requirements	Description
FR1	Search function	Users can search ‘books’, ‘author’, ‘subject’, ‘publisher’ in the system
FR2	Search record function	Users can search ‘book record’ in the search table
FR3	Reservation	Users can have reservation in reservation table
FR4	Borrowing record	Users can check the borrowing record in the borrowing_record table
FR5	Log in/out	Users can log in/out the system
FR6	Notification function	Users can receive the notification about the returned books and overdue books
FR7	Fee payment function	Users can pay the fine or the membership fee in fee_payment table
FR8	New user registration	New users can create account in the system

f) Conceptual Model

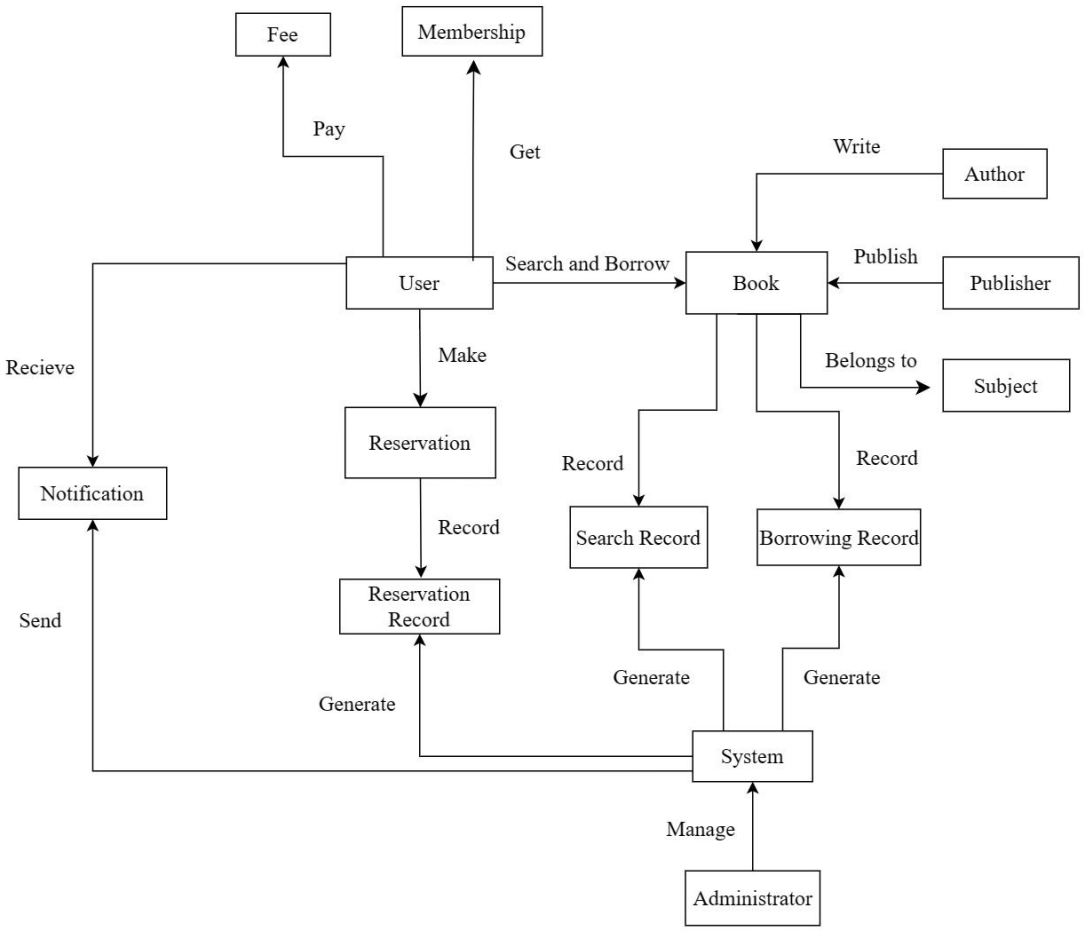


Figure 1 Conceptual Model

Only university students and staff can be the user of the library system. Users can pay to get membership to enjoy more borrowing credits as well as lower borrowing fees. Books can be borrowed online through reservation and directly fetch it. Books are published by different publishers, written by different authors and belong to different categories. Users can browse the website by categories, publishers and author, to check the status of books and make reservations. When the book is available, the system will send notification to the user to borrow the book. The system generates search records, book borrowing records, and reservation records to record the user's behaviour. Fee is paid for membership, fine and other items. The administrator has permission to tamper with the system information, such as password, book info etc.

g) Logical Model

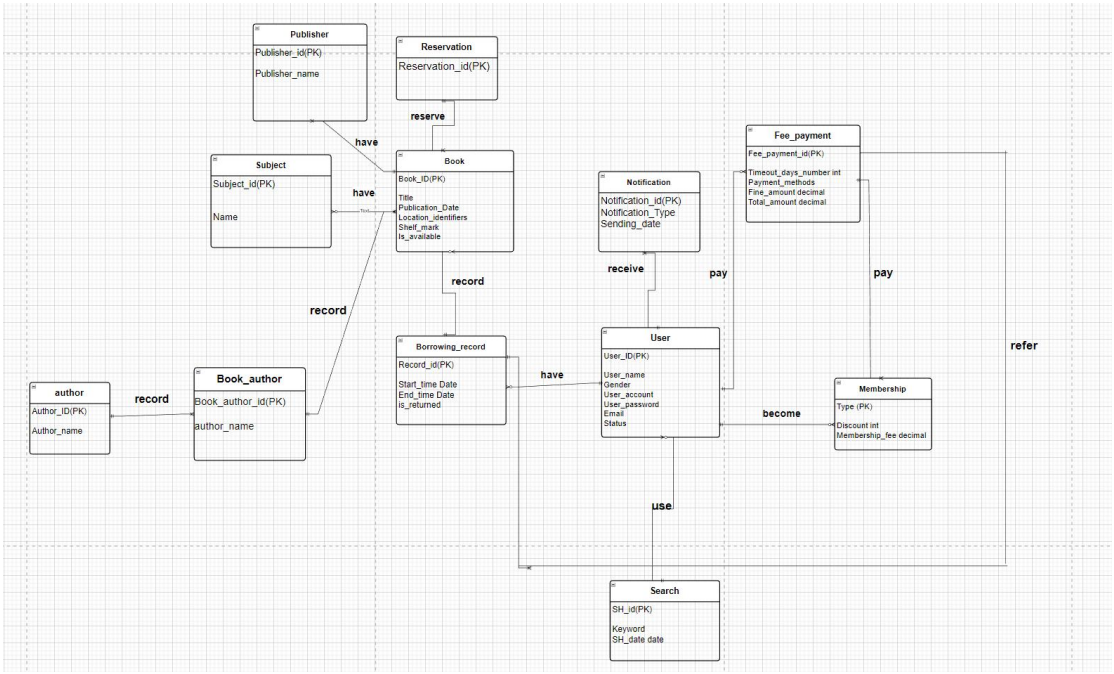


Figure 2 Logical Model

For this diagram, these fields include primary keys (PK), which uniquely identify records in a table, and some fields also appear as foreign keys (FK) in other tables, establishing relationships between them.

In the diagram, entities are connected by lines, illustrating the relationships between them. For instance, the “Book” entity is linked to the “author” entity via the “Book_author” association, indicating a many-to-many relationship between books and authors; the relationship between “Book” and “Borrowing_record” suggests that a book can have multiple borrowing records.

Moreover, the diagram includes operational terms like “reserve,” “record,” “receive,” “pay,” and “use,” often with arrows pointing towards entities, indicating the actions that users can perform within the system or the dynamic interactions between entities, such as users being able to reserve books, log borrowing information, receive notifications, make payments, and utilize a search function.

In summary, this diagram thoroughly presents the data structure and processes of a library management system, covering aspects from book management to user interactions.

h) Physical Model

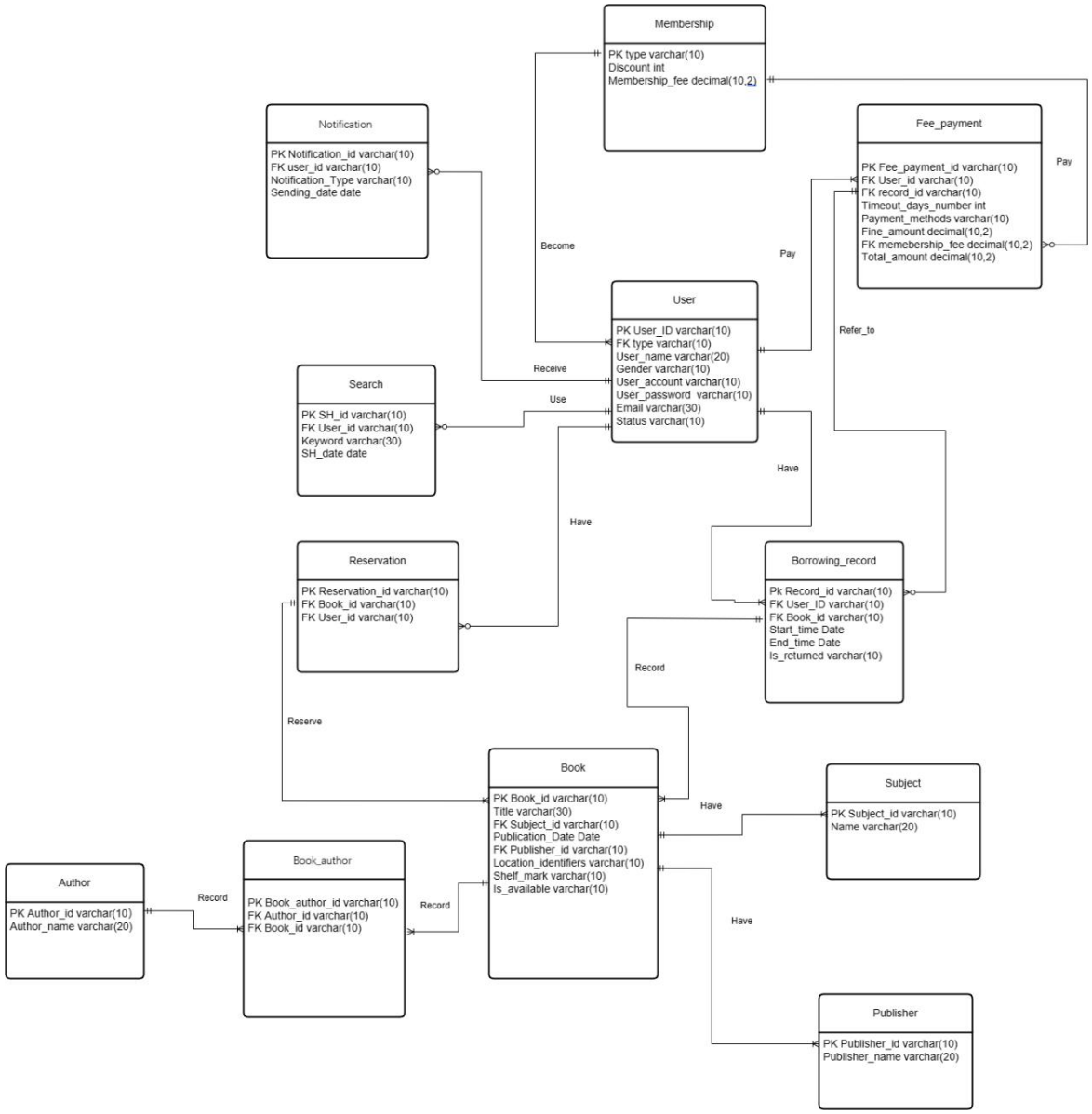


Figure 3 Physical Model

The User table will store the gender, account, password, email address, account status and membership type of the user. The Membership table will store the membership fee and the discount of the membership type. The Notification table will store the sending date of the notification, the type of the notification and the user id of the user who will receive the notification. The Search table will record the user id of the user, the keyword the user wants to search and the search date. The Borrowing_record table will record the start date and the end date of user's borrowing. And record the user id and book id for Fee_payment table. The

Fee_payment table will store the information of the fee that user should pay. Like membership fee and fine. It can refer to the Borrowing_record table to automatically calculate the amount of fine based on the FK record_id. The Reservation table will store the book if of the book the user wants to reserve, and the user id of the user for the notification. The Book table will store the information of books, which include title, subjects, publishers, authors, shelf mark, location identifier and whether the book is available. The Subject table and the Publisher table is to implement one-to-many relationships, because one subject can have many books and one publisher can publish many books. The author table and the book_author table is to implement many-to-many relationship, because one book can have many authors and one author can write many books. And MySQL cannot directly implement many-to-many relationship, so we need the Book_author table to implement many-to-many.

Task 2: Enhanced Entity Relationship Diagram, Relational Database and Schema

EERD Diagram

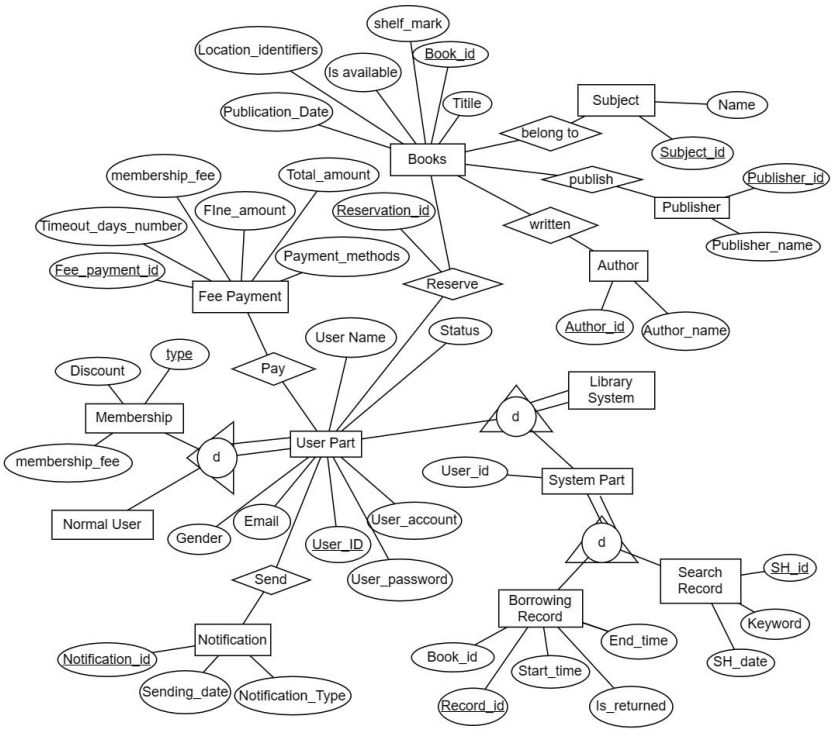


Figure 4 EERD of Library System

The Extended Entity-Relationship Diagram (EERD) provides a detailed view of a library system's database architecture, showcasing various entities such as books, users, fee payments, and borrowing records, along with their interrelationships. Within the diagram, the "Books" entity encompasses all books in the library, related to "Author" and "Publisher" entities, illustrating the linkage of books to their authors and publishers. Users, represented by the "User Part," can engage with books via the "Reserve" relationship, indicating they can make reservations. They are also involved with "Fee Payment" entities, signifying obligations like membership fees and overdue fines. The "Borrowing Record" entity tracks the lending and return of books, while the "Search Record" entity logs users' search history within the system. The user section includes "Notification," likely pertaining to overdue alerts or system updates. Additionally, arrows between entities indicate inheritance and participation types. For instance, the inheritance relationship between "Membership" and "Normal User" suggests that all normal users are members, potentially with varying types of memberships.

Relation Schema

a) Option D:

User (**User_ID,** User_name, Gender,User_account, User_password, Email,Statues, **fee_paymentflag,** Fee_payment_id, Timeout_days_number, payment_methods, Fine_amount, Membership_fee, Total_amount, **notificationfalg,** Notification_id ,Notification_Type, Sending_date, **searchflag**SH_id, Keyword,SH_date, DATE, **borrowing_recordflag,** Record_id, Start_time DATE, End_time DATE, Is_returned, **reservationflag,** Reservation_id)

Membership (**Type,** Discount, Membership_fee, **Userflag,** User_ID, User_name, Gender, User_account, User_password, Email Status)

Borrowing_record (**Record_id,** Start_time, DATE, End_time, DATE, is_returned, **fee_paymentflag,** Fee_payment_id, Timeout_days_number, payment_methods, Fine_amount, Membership_fee, Total_amount)

Book (**Book_ID,** Title, Publication_DATE, Location_identifiers, Shelf_mark, Is_available, borrowing_record, Record_id, Start_time DATE, End_time DATE, is_returned **reservationflag,** Reservation_id, **book_authorflag,** Book_author_id)

Author (**Author_ID,** Author_name, **book_authorflag,** Book_author_id)

Publisher (**Publisher_id,** Publisher_name, **bookflag,** Book_ID, Title, Publication_DATE, Location_identifiers, Shelf_mark, Is_available, borrowing_record, Record_id, Start_time DATE, End_time DATE, is_returned)

Subject (**Subject_id,** Name, **bookflag,** Book_ID, Title, Publication_DATE, Location_identifiers, Shelf_mark, Is_available, borrowing_record, Record_id, Start_time DATE, End_time DATE, is_returned)

b) Relationship

Set 1:1

1.Book:Subject

2.Book:Publisher

3.Book:Book_author

4.Book_author:Author

Set 1:M

1.Notification:User

2.User:Membership

3.Search:User

4.Reservation:User

5.Fee_Payment:User

6.Borrowing_record:User

7. Fee_Payment: Membership

8. Fee_Payment: Borrowing_record

9.Reservation:Book

10. Borrowing_record:Book

c) Identify primary, alternate and foreign keys

User

Primary keys:User_ID

Alternate keys:User_name, Gender, User_account, User_password, Email Statues

Foreign keys:Type

Fee_payment

Primary keys:Fee_payment_id

Alternate keys:Timeout_days_number, payment_methods,Fine_amount, Membership_fee Total_amount

Foreign keys:User_ID Record_id

Membership

Primary keys:Type

Alternate keys:Discount, Membership_fee

Foreign keys:

Notification

Primary keys:Notification_id

Alternate keys:Notification_Type, Sending_date

Foreign keys:User_ID

Search

Primary keys:SH_id

Alternate keys:Keyword, SH_date DATE

Foreign keys:User_ID

Borrowing_record

Primary keys:Record_id

Alternate keys:Start_time DATE, End_time DATE, Is_returned

Foreign keys:Book_ID, User_ID

Book

Primary keys:Book_ID

Alternate keys:Title, Publication_DATE, Location_identifiers, Shelf_mark, Is_available, borrowing_record, Record_id, Start_time DATE, End_time DATE, is_returned

Foreign keys:Subject_id, Publisher_id

Reservation

Primary keys:Reservation_id

Alternate keys:

Foreign keys:Book_ID, User_ID

Subject

Primary keys:Subject_id

Alternate keys:Name

Foreign keys:

Book_author

Primary keys:Book_author_id
Alternate keys:
Foreign keys:Author_id Book_id

Author
Primary keys:Author_ID
Alternate keys:Author_name
Foreign keys:

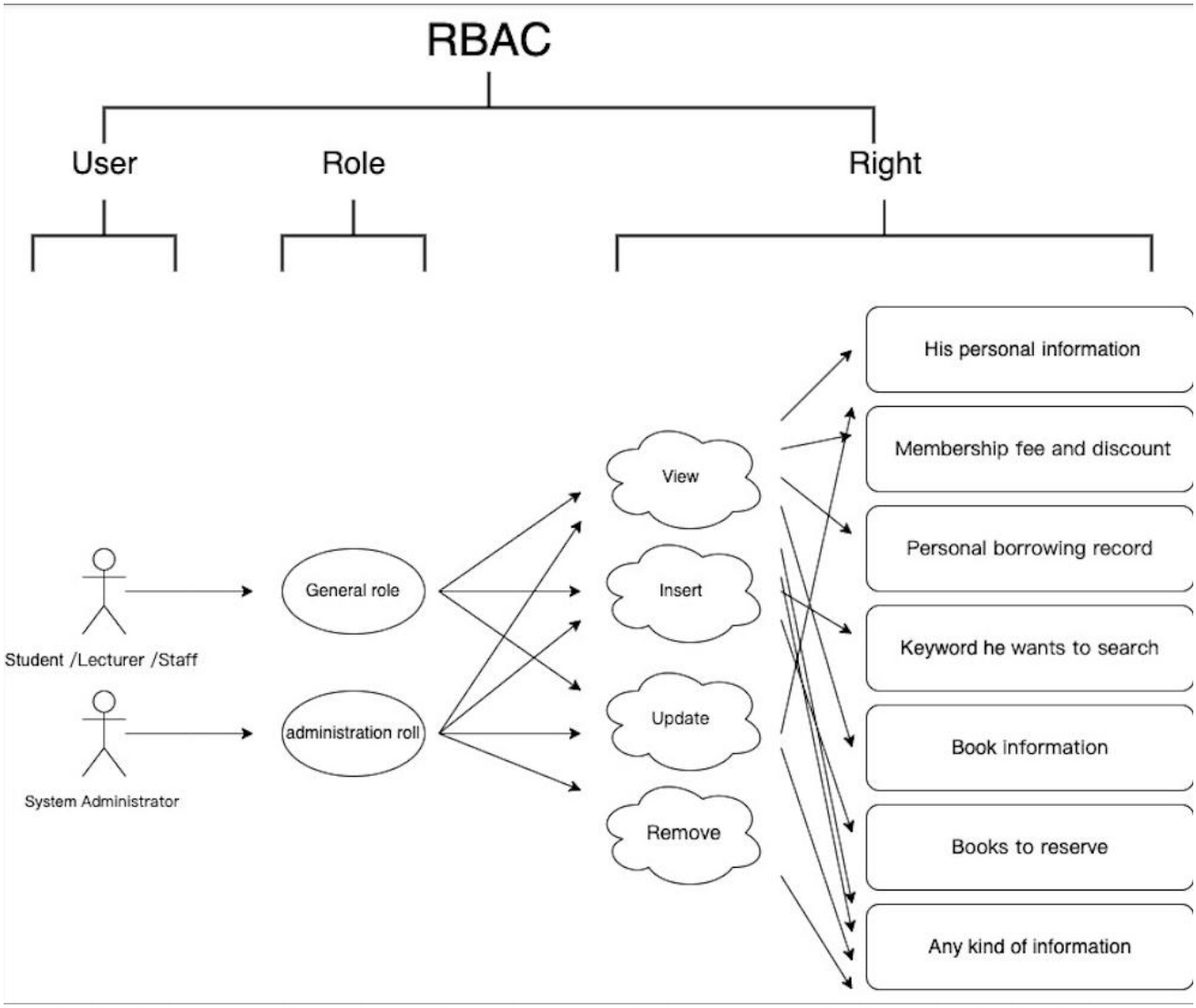
Publisher
Primary keys:Publisher_id
Alternate keys:Publisher_name
Foreign keys:

Task 3: Role and Access Control

a) The reason why we choose RBAC

We implement Role Based Access Control in our database. Because in our system, we only have three types of users, which are student, lecturer and staff in XMUM. And these three types of user all assigned same role, which is typical user. So RBAC can help us easily give them permissions that typical user need. And we can easily give permissions to our system administrator to manage our system.

b) Access control diagram



c) Access control table

User	Role	Permission	Operations	Table
Student /Lecturer /Staff	Typical User	Has limited permission to view, update and insert in certain tables	View Insert Update	Able to view and update his personal information in User table. Able to view the Membership fee and discount in Membership table. Able to view the personal borrowing record in the Borrowing_record table. Able to insert the keyword he wants to search into the search table. Able to view the information in Book table, Subject table, Author table and Publisher table. To get some basic information of books. Able to in the reservation table. Able to view the personal payment information in the Fee_payment table.
System Administrator	Administrator	Has permission to perform all operations on all tables	View Insert Update Remove	All tables: User, Book, Subject, Publisher, Author, Book_author, Borrowing_record, Reservation, Search, Notification, Membership and Fee_payment.

Reference

APPENDIX 1

MARKING RUBRICS

Component Title	Assignment (Group)				Percentage (%)	22.5%	
Criteria	Score and Descriptors					Weight (%)	Marks
	5	3 - 4		0 - 2			
	Excellent (5)	Good (4)	Average (3)	Need Improvement (2)	Poor (1)		
TASK 1 (40 Marks)							
Gathering information	Demonstrate a very high level of understanding of the scenario given. Entities and relationship descriptions were explaied with lnogic and detail.		Show high- level ability to comprehend the scenario. Entities and relationship descriptions were explained with less logic.		Demonstrate an adequate level of understanding. Entities and relationship descriptions were explained in a poor/ adequate manner.	10	
Conceptual Database Design/ Model	Demonstrate ability to perform the task to the highest standard.		Demonstrate a consistent ability to complete the task.		Demonstrate ability to perform the task	10	
Logical Database Design/ Model	Demonstrate ability to perform the task to the highest standard.		Demonstrate a consistent ability to complete the task.		Show poor/ adequate development	10	
Physical Database Design/ Model	Show innovative and highly appropriate development. Proper data types were assigned.		Show sound and appropriate development		Show poor/ adequate development	10	

Component Title	Assignment (Group)				Percentage (%)	22.5%	
Criteria	Score and Descriptors					Weight (%)	Marks
	5	3 - 4		0 - 2			
	Excellent (5)	Good (4)	Average (3)	Need Improvement (2)	Poor (1)		
TASK 2 (30 Marks)							
Enhanced ERD	Show innovative and highly appropriate Enhanced ERD diagram was shown. Diagram captures all attributes and primary keys necessary for a database. Diagram captures all cardinality and participation constraints.		The tone of the diagram is primarily professional. Diagram captures most attributes and primary keys necessary for a database. Diagram captures most of the cardinality and participation constraints.		The diagram appears to be unprofessional. Diagram captures none or few of the attributes and primary keys necessary for a database. Diagram captures none or few of the cardinality and participation constraints.	**20**	
Relational database schema	All entity sets and relationships from the team's E-R diagram are captured concerning schemas. Any suggested revisions that are not accepted, as well as any deviations from the original design, are accompanied by a convincing explanation.		Most entity sets and relationships from the team's E-R diagram are captured concerning schemas, which also account for the majority of suggested diagram revisions.		Relation schemas are used to capture a limited number of entity sets and relationships from a team's E-R diagram.	**10**	
TASK 3 (20 Marks)							
Role and access control	Detail roles and access control were provided with clear examples		Role and access control were discussed moderately. Lack of example provided		There is no clear explanation were given based on role and access control	**20**	
					TOTAL	**90**	

Note to students: Please include the marking rubric when submitting your coursework.