

Project2: Library Book Management System

1 Problem requirements and the conceptual model in UML

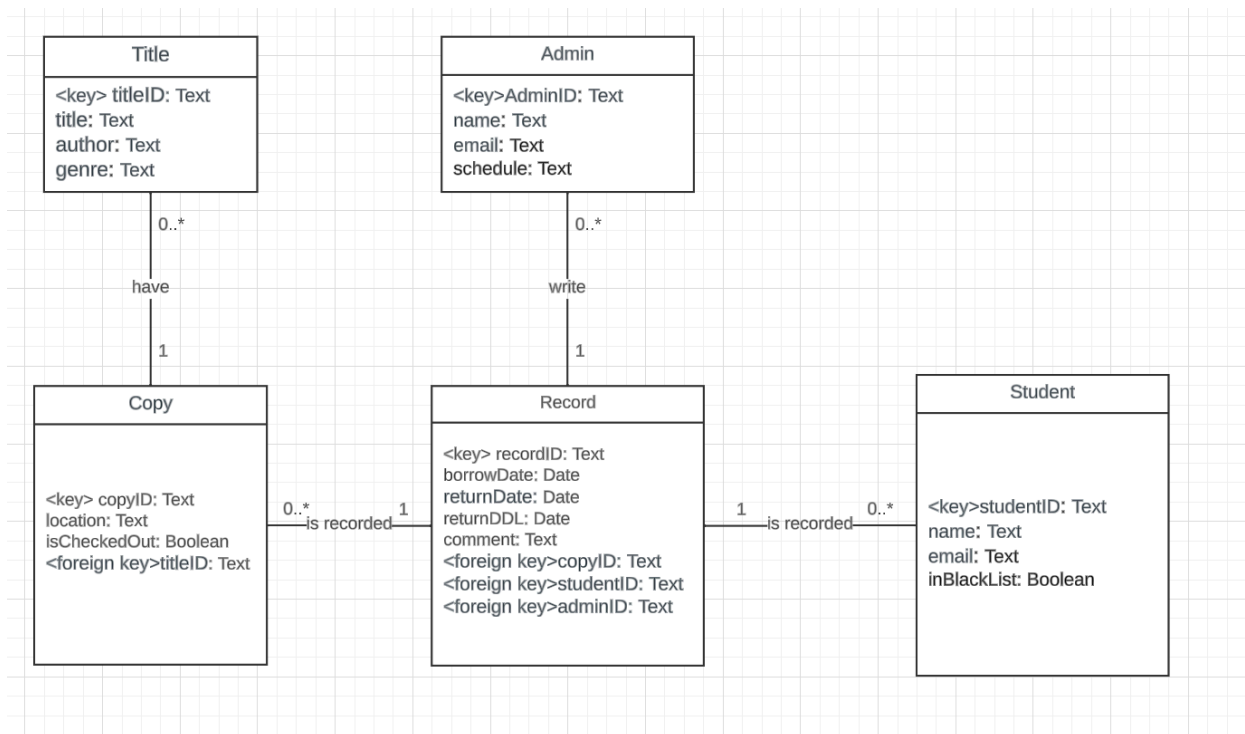
1.1 Business Rules:

- Students can borrow and return library books using the system.
- Administrators can add, delete, and modify library book information.
- Administrators can evaluate student borrowing records and blacklist students.
- Students can access library book information. They can search a specific book.
- Title refers to the basic information of a book, while copy represents a specific physical copy of the book. So one title can have 0 to many copies. Each copy can only have one title.
- Students can borrow many books at the same time.

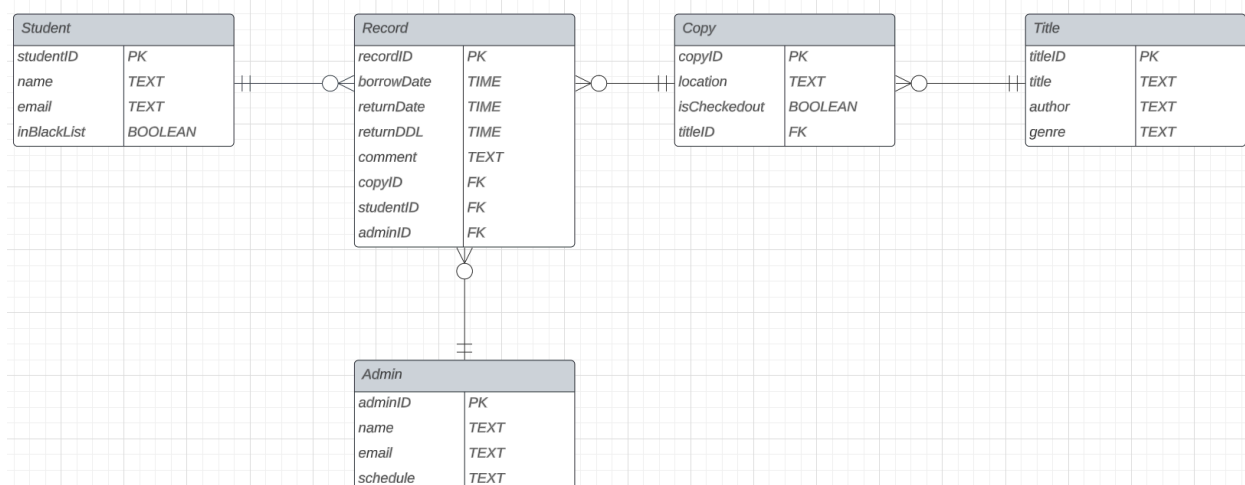
1.2 Conceptual model in UML

Explanation:

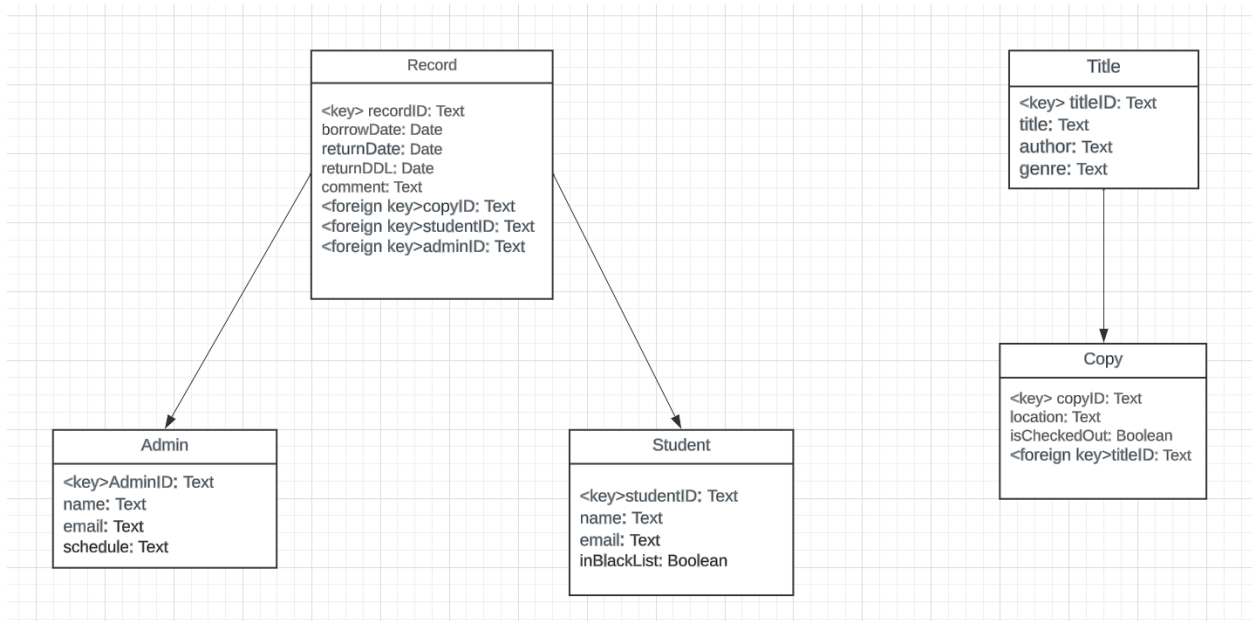
- Title refers to the basic information of a book, while Copy represents a specific physical copy of the book. The relationship between these two class is one-to-many.
- A student can borrow many copies. A copy can be borrowed by many students. The relationship between these two class is many-to-many



ERD is as follows:



2 Adapt the Logical Data model to have hierarchical tables



3 Provide a couple of JSON examples

Example of “Record” database:

```
{
  "recordID": 1,
  "borrowTime": "2023-11-25T12:00:00Z",
  "returnTime": "2023-12-01T14:00:00Z",
  "returnDDL": "2023-12-05T23:59:59Z",
  "comment": "Returned in good condition",
  "student": {
    "studentID": 1,
    "name": "John Doe",
    "email": "john@example.com",
    "inBlackList": false
  },
  "admin": {
    "adminID": 1,
    "name": "Admin Name",
    "email": "admin@example.com",
    "schedule": "Monday to Friday, 9:00 AM - 5:00 PM"
  },
  "copyID": 1
}
```

Example of “Title” database:

```
{
  "titleID": 1,
  "title": "The Book Title",
  "author": "Author Name",
  "genre": "Fiction",
  "copies": [
    {
      "copyID": 1,
      "location": "Shelf A",

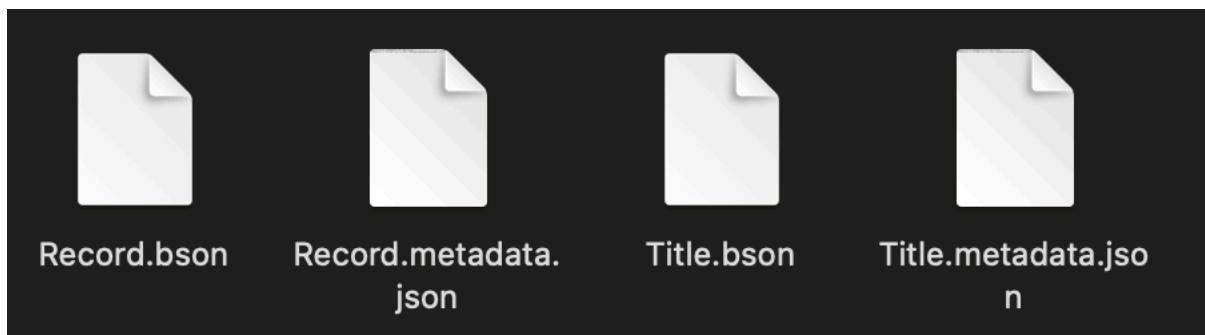
```

```
    "isCheckedOut": false
  },
  {
    "copyID": 2,
    "location": "Shelf B",
    "isCheckedOut": true
  }
]
}
```

4 Populate the tables with test data

```
> use project2
switched to db project2
> db.Title.count()
5
> db.Record.count()
5
>
```

Use mongodump to get a dump file that can be use to regenerate the database



5 Five queries that show my database

5.1 Simple query

Get all books' information

```
db.Title.find({})
```

```
[> db.Title.find({})
{ "_id" : ObjectId("656433de2f7486d45f160d6d"), "titleID" : 1, "title" : "The Gr
eat Gatsby", "author" : "F. Scott Fitzgerald", "genre" : "Fiction", "copies" : [
  { "copyID" : 1, "location" : "Shelf A", "isCheckedOut" : false }, { "copyID" :
  2, "location" : "Shelf B", "isCheckedOut" : false }, { "copyID" : 3, "location"
  : "Shelf C", "isCheckedOut" : false } ] }
{ "_id" : ObjectId("656433de2f7486d45f160d6e"), "titleID" : 5, "title" : "The Ho
bbit", "author" : "J.R.R. Tolkien", "genre" : "Fantasy", "copies" : [ { "copyID"
  : 13, "location" : "Shelf M", "isCheckedOut" : false }, { "copyID" : 14, "locat
  ion" : "Shelf N", "isCheckedOut" : false }, { "copyID" : 15, "location" : "Shelf
  O", "isCheckedOut" : false } ] }
{ "_id" : ObjectId("656433de2f7486d45f160d6f"), "titleID" : 2, "title" : "To Kil
l a Mockingbird", "author" : "Harper Lee", "genre" : "Fiction", "copies" : [ { "
copyID" : 4, "location" : "Shelf D", "isCheckedOut" : false }, { "copyID" : 5, "
location" : "Shelf E", "isCheckedOut" : false }, { "copyID" : 6, "location" : "S
helf F", "isCheckedOut" : false } ] }
{ "_id" : ObjectId("656433de2f7486d45f160d70"), "titleID" : 3, "title" : "1984",
  "author" : "George Orwell", "genre" : "Dystopian", "copies" : [ { "copyID" : 7,
  "location" : "Shelf G", "isCheckedOut" : false }, { "copyID" : 8, "location" :
  "Shelf H", "isCheckedOut" : false }, { "copyID" : 9, "location" : "Shelf I", "is
  CheckedOut" : false } ] }
{ "_id" : ObjectId("656433de2f7486d45f160d71"), "titleID" : 4, "title" : "Pride
and Prejudice", "author" : "Jane Austen", "genre" : "Romance", "copies" : [ { "c
opyID" : 10, "location" : "Shelf J", "isCheckedOut" : false }, { "copyID" : 11,
"location" : "Shelf K", "isCheckedOut" : false }, { "copyID" : 12, "location" :
  "Shelf L", "isCheckedOut" : false } ] }
```

5.2 Query with aggregation

Try to figure out each student's borrowCount

```
db.Title.aggregate([
  { $group: { _id: "$author", bookCount: { $sum: 1 } } }
])
```

```
[> db.Record.aggregate([
...   { $group: { _id: "$student.name", borrowCount: { $sum: 1 } } }
... ])
{ "_id" : "John Doe", "borrowCount" : 2 }
{ "_id" : "Jane Smith", "borrowCount" : 2 }
{ "_id" : "Bob Johnson", "borrowCount" : 1 }
>
```

5.3 Query with complex search criterion

Try to get the genre is “Fiction” and the author is “F. Scott Fitzgerald”

```
db.Title.find({ genre: "Fiction", author: "F. Scott Fitzgerald" })
```

```
> db.Title.find({ genre: "Fiction", author: "F. Scott Fitzgerald" })
{ "_id" : ObjectId("656433de2f7486d45f160d6d"), "titleID" : 1, "title" : "The Gr
eat Gatsby", "author" : "F. Scott Fitzgerald", "genre" : "Fiction", "copies" : [
  { "copyID" : 1, "location" : "Shelf A", "isCheckedOut" : false }, { "copyID" :
2, "location" : "Shelf B", "isCheckedOut" : false }, { "copyID" : 3, "location"
: "Shelf C", "isCheckedOut" : false } ] }
>
```

5.4 Counting documents for an specific user

Try to know how many records are related to “John Doe”

```
db.Record.countDocuments({ "student.name": "John Doe" })
```

```
> db.Record.countDocuments({ "student.name": "John Doe" })
2
```

5.5 Updating a document

Update the status of a book’s copy to “isCheckedOut”

```
db.Title.updateOne(
  { title: "The Great Gatsby" },
  { $set: { "copies.0.isCheckedOut": true } }
)
```

```
> db.Title.updateOne(
...   { title: "The Great Gatsby" },
...   { $set: { "copies.0.isCheckedOut": true } }
[... ]
{ "acknowledged" : true, "matchedCount" : 1, "modifiedCount" : 1 }
>
```


6 Create a basic Node + Express application

6.1 display tables

Library System

Find books and their copies

Add a Book

Book ID: 2

Title: To Kill a Mockingbird

Author: Harper Lee

Genre: Fiction

[View copies](#) [Edit](#) [Delete](#)

Book ID: 3

Title: 1984

Author: George Orwell

Genre: Dystopian

[View copies](#) [Edit](#) [Delete](#)

Book ID: 5

Title: The Hobbit

Author: J.R.R. Tolkien

Genre: Fantasy

[View copies](#) [Edit](#) [Delete](#)

Book ID: 1

Title: The Great Gatsby

Author: F. Scott Fitzgerald

Genre: Fiction

[View copies](#) [Edit](#) [Delete](#)

Book ID: 4

Title: Pride and Prejudice

Author: Jane Austen

Genre: Romance

[View copies](#) [Edit](#) [Delete](#)

Find all copies of this book

Add a copy

Copy ID: 4

Location: Shelf D

Copy ID: 5

Location: Shelf E

Copy ID: 6

Location: Shelf F

6.2 Add

Library System

Create Title

Title

test

Author

ywhf

Genre

test

Create

Library System

Find books and their copies

Add a Book

Book ID: 2

Title: To Kill a Mockingbird

Author: Harper Lee

Genre: Fiction

[View copies](#) [Edit](#) [Delete](#)

Book ID: 3

Title: 1984

Author: George Orwell

Genre: Dystopian

[View copies](#) [Edit](#) [Delete](#)

Book ID: 5

Title: The Hobbit

Author: J.R.R. Tolkien

Genre: Fantasy

[View copies](#) [Edit](#) [Delete](#)

Book ID: 1

Title: The Great Gatsby

Author: F. Scott Fitzgerald

Genre: Fiction

[View copies](#) [Edit](#) [Delete](#)

Book ID: 4

Title: Pride and Prejudice

Author: Jane Austen

Genre: Romance

[View copies](#) [Edit](#) [Delete](#)

Book ID: 6

Title: test

Author: ywhf

Genre: test

[View copies](#) [Edit](#) [Delete](#)

6.3 delete

Library System

Find books and their copies

Book deleted

Add a Book

Book ID: 3

Title: 1984

Author: George Orwell

Genre: Dystopian

[View copies](#) [Edit](#) [Delete](#)

Book ID: 1

Title: The Great Gatsby

Author: F. Scott Fitzgerald

Genre: Fiction

[View copies](#) [Edit](#) [Delete](#)

Book ID: 6

Title: test

Author: ywhf

Genre: test

[View copies](#) [Edit](#) [Delete](#)

6.4 Modify

Library System

Title Edit 3

Title

1984modified

Author

George Orwell

Genre

Dystopian

Edit

Library System

Find books and their copies

Add a Book

Book ID: 3

Title: 1984modified

Author: George Orwell

Genre: Dystopian

[View copies](#) [Edit](#) [Delete](#)

Book ID: 1

Title: The Great Gatsby

Author: F. Scott Fitzgerald

Genre: Fiction

[View copies](#) [Edit](#) [Delete](#)

Book ID: 6

Title: test

Author: ywhf

Genre: test

[View copies](#) [Edit](#) [Delete](#)