Library Book Management System

1 Problem Requirements

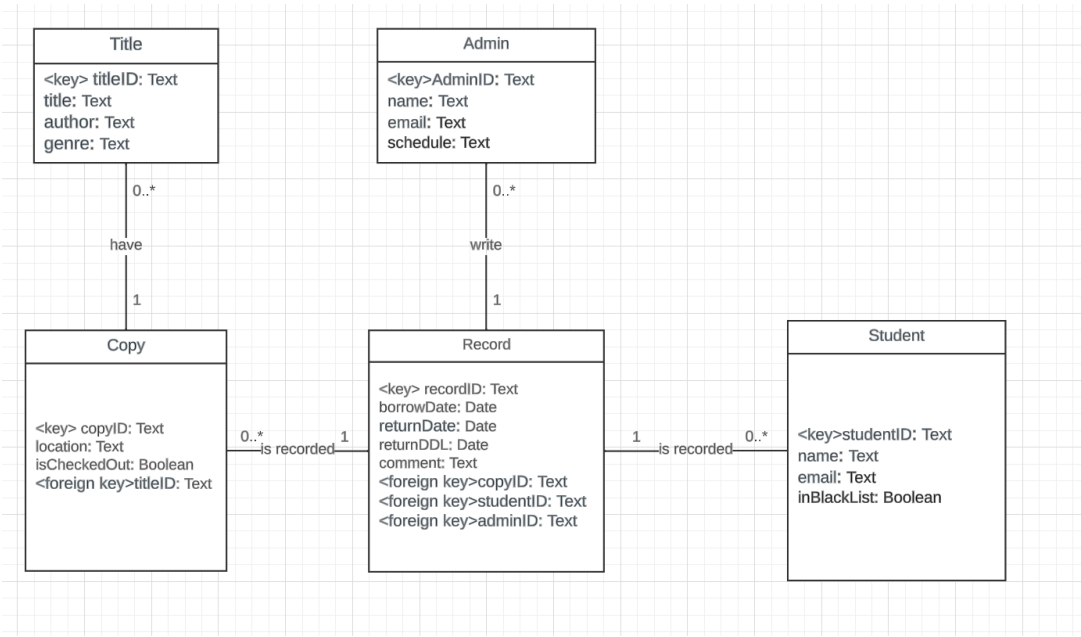
1.1 Business Rules:

- 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.

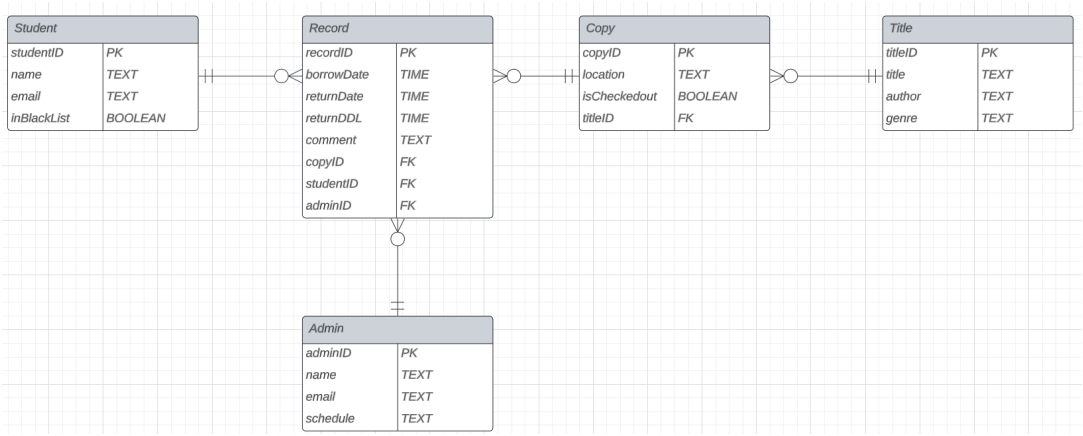
1.2 Conceptual model in UML

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



1.3 ERD



1.4 Functionalities be used with Redis

I plan to store each book's copies in Redis as this part can be queried frequently in real life. The logic is as follows:

If we query a book's copy, then we first look to Redis. If we find the result, just return to the front-end; Otherwise we read data from Sqlite and save the result to Redis, then return to the front-end.

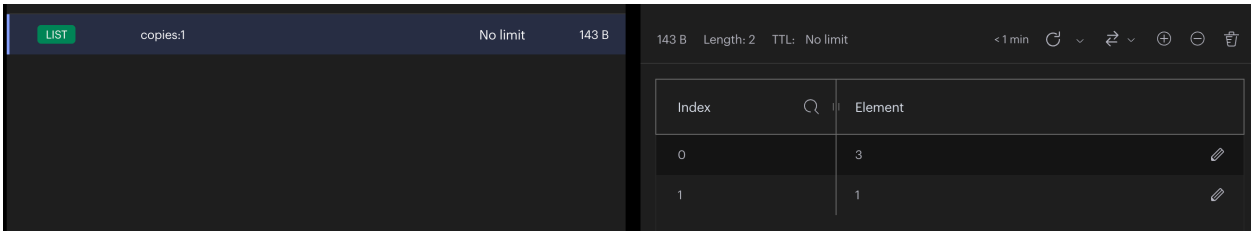
If we add a book's copy, we add it both in Redis and Sqlite.

If we modify a book's copy, we modify it both in Redis and Sqlite.

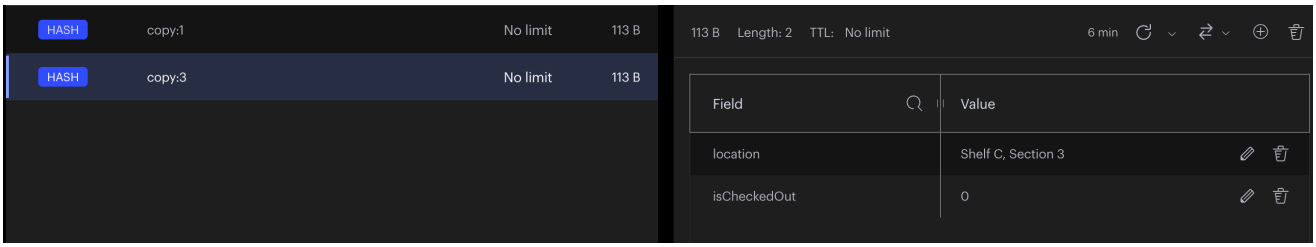
If we delete a book's copy, we delete it both in Redis and Sqlite.

2 Describe the Redis data structures

In Redis, because a book can have many copies, we decide to use list to store this information, where the key is book's id and value is a list of copy id. Just like this:



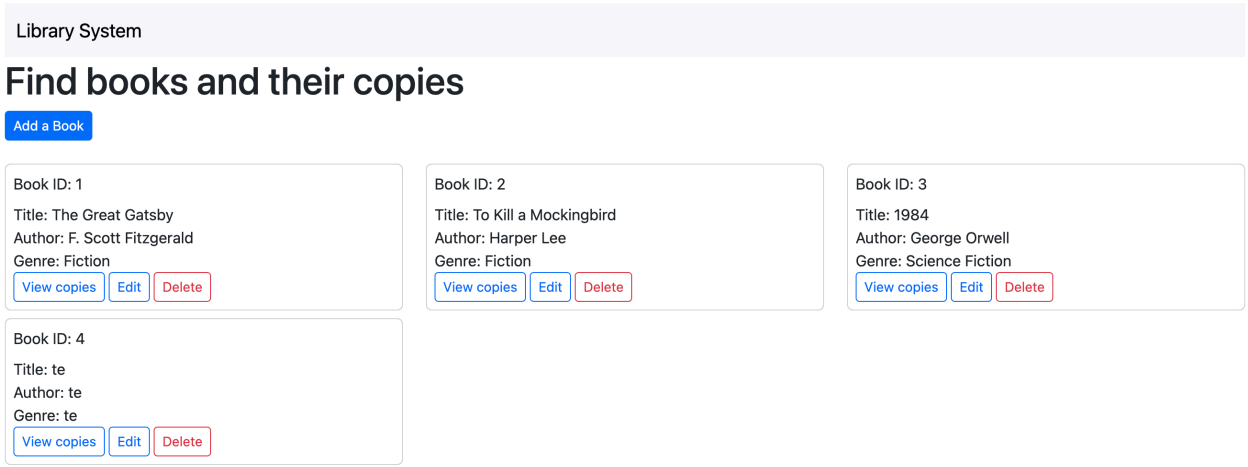
Then for each copy id ,we use it as key to find a hashTable. In this hashTable, the key is the field in copy(location, isCheckedOut…) Just like this:



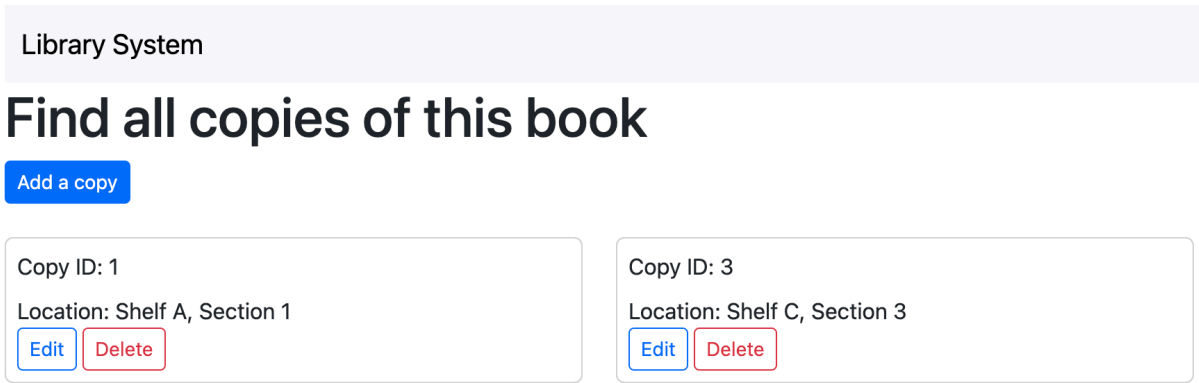
3 Create a basic Node + Express application

This is the log in page

In this page, we can find all books and their copies.
The operations are “add new book”, “delete a book” or “edit a book”



In this page, we can see all the copies of a specific book. And we can also add, edit or delete a copy



There are codes about Redis when querying the copies:

```
// check whether the Redis has the infromation, if not, update Redis
const test = await redisClient.get("copy"+titleID);
if (test === null) {
  console.log(copies)
  const copyIds = [];
  for (const copy of copies) {
    copyIds.push(copy.copyID);
  }
  console.log(copyIds)
  // create list of copyId in redis
  for (const copyId of copyIds) {
    await redisClient.LPUSH(`copies:${titleID}`, copyId.toString());
  }
  // create copyID-->hashtable(location,isCheckedOut) in redis
  copies.forEach((copy) => {
    const hashKey = `copy:${copy.copyID}`;
    const hashData = {
      location: copy.location,
      isCheckedOut: copy.isCheckedOut,
    };
    redisClient.HSET(hashKey, hashData, (hashError) => {
      if (hashError) {
        return callback(hashError);
      }
      console.log(`Hash created for copy ID ${copy.id} successfully.`);
    });
  });

}
```