OOP Assignment 2

Name:	Syed Muhammad Raza Ali
Enrolment:	02-134231-028
Course:	Object Oriented Programming
Faculty:	Miss Sameena Javaid

QUESTION NO. 2

(CLO2, PLO2, C3)

Develop an object-oriented programming case study involving a Library Management System. In this case study, we'll apply the concepts of Association, Aggregation, Composition, and Inheritance to model the relationships between various entities in the library system.

Entities in the Library Management System:

1. Library

   - Attributes: Name, Address
   - Relationships: Aggregates Books, Aggregates Librarians

2. Book

   - Attributes: Title, Author, ISBN, Genre
   - Relationships: Associated with Library
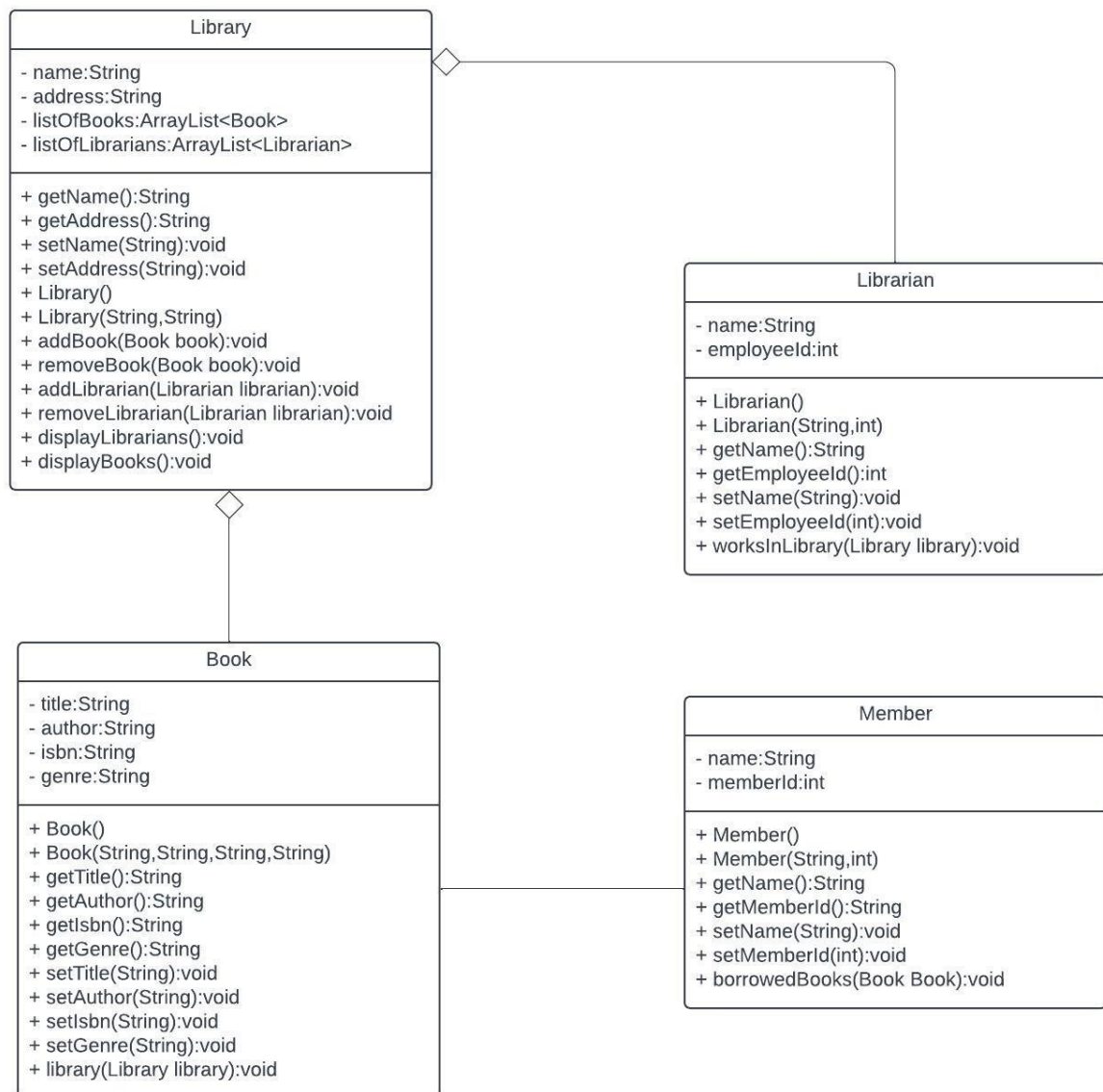
3. Librarian

   - Attributes: Name, Employee ID
   - Relationships: Associated with Library

4. Member

   - Attributes: Name, Member ID
   - Relationships: Borrowed Books (Association)

Develop UML and a Java program and the problem must be implemented by applying the concepts of Association, Aggregation, Composition, and Inheritance.

****

UML Diagram

Library

- name:String
- address:String
- listOfBooks:ArrayList<Book>
- listOfLibrarians:ArrayList<Librarian>

+ getName():String
+ getAddress():String
+ setName(String):void
+ setAddress(String):void
+ Library()
+ Library(String,String)
+ addBook(Book book):void
+ removeBook(Book book):void
+ addLibrarian(Librarian librarian):void
+ removeLibrarian(Librarian librarian):void
+ displayLibrarians():void
+ displayBooks():void

Librarian

- name:String
- employeeId:int

+ Librarian()
+ Librarian(String,int)
+ getName():String
+ getEmployeeId():int
+ setName(String):void
+ setEmployeeId(int):void
+ worksInLibrary(Library library):void

Book

- title:String
- author:String
- isbn:String
- genre:String

+ Book()
+ Book(String,String,String,String)
+ getTitle():String
+ getAuthor():String
+ getIsbn():String
+ getGenre():String
+ setTitle(String):void
+ setAuthor(String):void
+ setIsbn(String):void
+ setGenre(String):void
+ library(Library library):void

Member

- name:String
- memberId:int

+ Member()
+ Member(String,int)
+ getName():String
+ getMemberId():String
+ setName(String):void
+ setMemberId(int):void
+ borrowedBooks(Book Book):void

Code:

Library Class

```java
import java.util.ArrayList;

public class Library{
   //attributes
   private String name,address;
   private ArrayList<Book> listOfBooks = new ArrayList<Book>();
   private ArrayList<Librarian> listOfLibrarians = new ArrayList<Librarian>();

   //Constructor
   public Library() {
   }

   public Library(String name, String address) {
      this.name = name;
      this.address = address;
   }

   //getters

   public String getName() {
      return name;
   }

   public String getAddress() {
      return address;
   }
   //setters

   public void setName(String name) {
      this.name = name;
   }

   public void setAddress(String address) {
      this.address = address;
   }
```

```java
  //methods
  public void addBook(Book book){
     listOfBooks.add(book);
  }
  public void removeBook(Book book){
     listOfBooks.remove(book);
  }
  public void addLibrarian(Librarian librarian){
     listOfLibrarians.add(librarian);
  }
  public void removeLibrarian(Librarian librarian){
     listOfLibrarians.remove(librarian);
  }
  public void displayLibrarians(){
     System.out.println("======== Librarians ========");
     for(int i=0;i<listOfLibrarians.size();i++){
        System.out.println("* Librarian : "+(i+1)+"\n"
            + "Librarian name : "+listOfLibrarians.get(i).getName()+"\n"
            + "Librarian Id : "+listOfLibrarians.get(i).getEmployeeId());
     }
  }
  public void displayBooks(){
     System.out.println("======= Books =======");
     for(int i = 0;i<listOfBooks.size();i++){
        System.out.println("* Book "+(i+1)+"\n Book title : "+listOfBooks.get(i).getTitle()+
            "\n Book author : "+listOfBooks.get(i).getAuthor()+"\n"
            + "Book ISBN : "+listOfBooks.get(i).getIsbn()+"\n"
            +"Book Genre : "+listOfBooks.get(i).getGenre());
     }
  }
}
```

Book Class
```java
package com.mycompany.librarymanagementsystem;

public class Book{
  //attributes
  private String title,author,isbn,genre;
```

```java
//constructors

public Book() {
}

public Book(String title, String author, String isbn, String genre) {
    this.title = title;
    this.author = author;
    this.isbn = isbn;
    this.genre = genre;
}
//getters

public String getAuthor() {
    return author;
}

public String getGenre() {
    return genre;
}

public String getIsbn() {
    return isbn;
}

public String getTitle() {
    return title;
}
//setters

public void setAuthor(String author) {
    this.author = author;
}

public void setGenre(String genre) {
    this.genre = genre;
}

public void setIsbn(String isbn) {
```

```java
        this.isbn = isbn;
    }

    public void setTitle(String title) {
        this.title = title;
    }
    //methods
    public void library(Library library){
        System.out.println("This Book is available in Library : "+library.getName());
    }
}
```

Librarian Class:

```java
public class Librarian{
    //attributes
    private String name;
    private int employeeId;
    //getters

    public String getName() {
        return name;
    }

    public int getEmployeeId() {
        return employeeId;
    }
    //setters

    public void setName(String name) {
        this.name = name;
    }

    public void setEmployeeId(int employeeId) {
        this.employeeId = employeeId;
    }
    //Constructor

    public Librarian() {
```

```java
    }

    public Librarian(String name, int employeeId) {
        this.name = name;
        this.employeeId = employeeId;
    }
    //methods
    public void worksInLibrary(Library library){
        System.out.println(this.getName()+" Works is a Librarian in "+library.getName()+" Library");
    }
}
```

Member Class

```java
public class Member{
    private String name;
    private int memberId;
    //Constructor

    public Member() {
    }

    public Member(String name, int memberId) {
        this.name = name;
        this.memberId = memberId;
    }
    //getters

    public String getName() {
        return name;
    }

    public int getMemberId() {
        return memberId;
    }
    //setters

    public void setName(String name) {
```

CSC-210: OOP   Assignment 02

```java
    this.name = name;
  }


  public void setMemberId(int memberId) {
    this.memberId = memberId;
  }
  //methods
  public void borrowedBooks(Book book){
    System.out.println("======= Borrowed Book =======+ \n Book title : "+book.getTitle()+
           "\n Book author : "+book.getAuthor()+"\n"
            + "Book ISBN : "+book.getIsbn()+"\n"
           +"Book Genre : "+book.getGenre());
  }
}
```

Application Class

```java
package com.mycompany.librarymanagementsystem;



public class LibraryManagementSystem {

  public static void main(String[] args) {
    //obj of Library
    Library myLibrary = new Library("CT Library","Gulshan-e-Iqbal block 6");


    //three obj of books
    Book book1 =  new Book("It ends with us ","Collen Hoover","13387","Romance");
    Book book2 = new Book("Fundamentals of Physics","Halliday Resnick","97349","Science");
    Book book3 = new Book("Diary of a Wimpy Kid","Jeff Kinney","29390","young adult
fiction");


    //four objs of librarians
    Librarian librarian1 = new Librarian("Aimen", 1400321);
    Librarian librarian2 = new Librarian("Muskan", 1400320);
    Librarian librarian3 = new Librarian("Huzaifa", 1200319);
    Librarian librarian4 = new Librarian("Raza", 1400318);
```

```
//two objs of members
    Member member1 = new Member("Hasan", 134571);
    Member member2 = new Member("Ali", 133574);

    //assigning books
    myLibrary.addBook(book1);
    myLibrary.addBook(book2);
    myLibrary.addBook(book3);

    //assigning Libraries
    myLibrary.addLibrarian(librarian1);
    myLibrary.addLibrarian(librarian2);
    myLibrary.addLibrarian(librarian3);
    myLibrary.addLibrarian(librarian4);

    //printing books and librarians
    myLibrary.displayBooks();
    myLibrary.displayLibrarians();

    //borrowed books
    member1.borrowedBooks(book1);
    member2.borrowedBooks(book3);
  }
}
```