Worksheet 2.4

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Q.1 Design a class diagram for the following scenario

Library domain model

Purpose: Describe domain area for an Integrated Library System (ILS), also known as a Library Management System (LMS) - Library, Catalog, Book, Patron, Account.

Summary: Library Domain Model describes main classes and relationships which could be used during analysis phase to better understand domain area for ILS or LMS.

Ans: -   Library Domain Model: -
UML Class Diagram Example: -

Library Domain Model describes main classes and relationships which could be used during analysis phase to better understand domain area for Integrated Library System (ILS), also known as a Library Management System (LMS).

Each physical library item - book, tape cassette, CD, DVD, etc. could have its own item number. To support it, the items may be barcoded. The purpose of barcoding is to provide a unique and scannable identifier that links the barcoded physical item to the electronic record in the catalog. Barcode must be physically attached to the item, and barcode number is entered into the corresponding field in the electronic item record.

Barcodes on library items could be replaced by RFID tags. The RFID tag can contain item's identifier, title, material type, etc. It is read by an RFID reader, without the need to open a book cover or CD/DVD case to scan it with barcode reader.
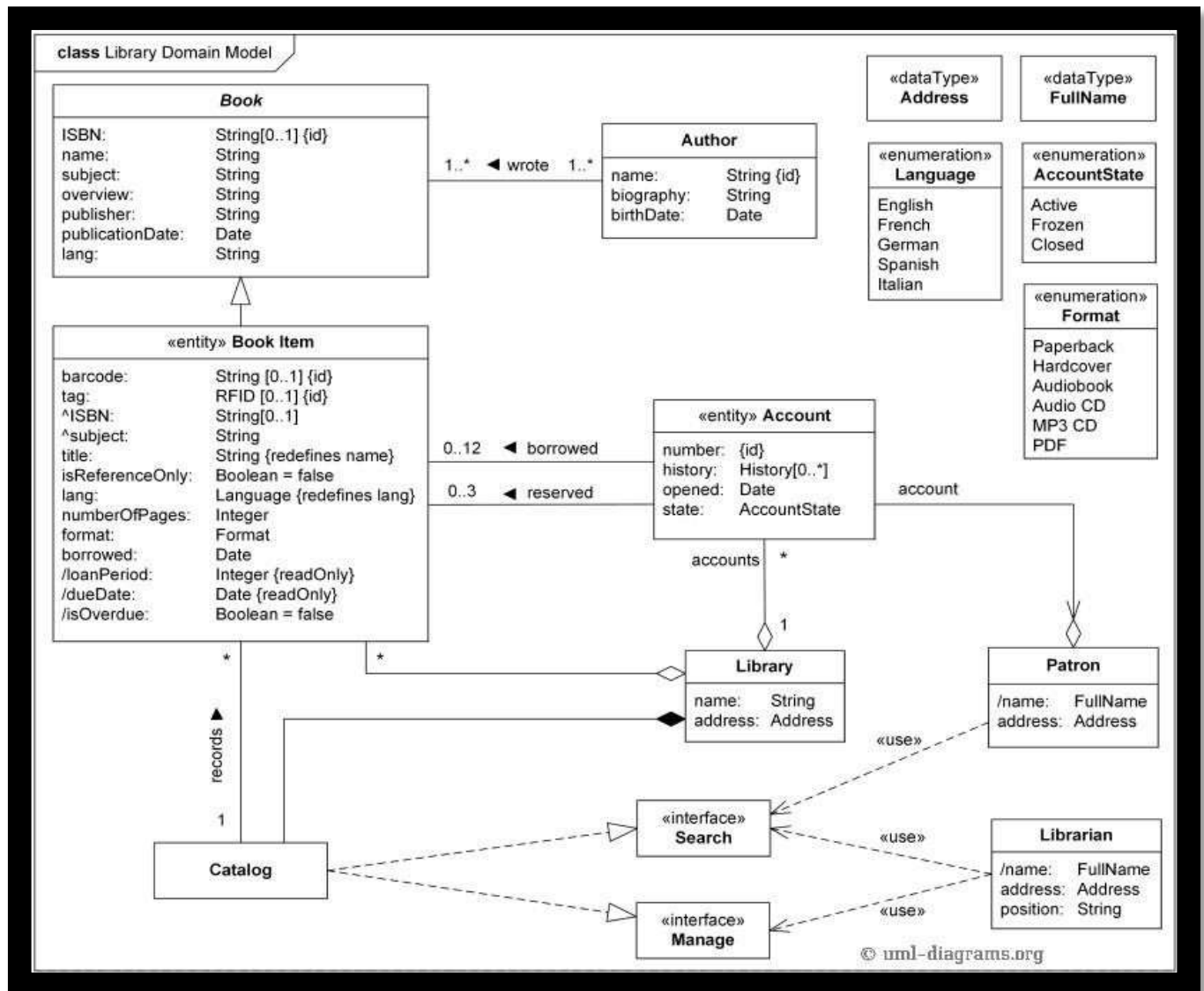
This Figure shows UML class example of the Library Domain Model.

Library book attributes *ISBN* and *subject* are inherited from *Book* and shown with prepended caret '^' symbol.

The *title* attribute explicitly redefines *name*. While type of the attributes is the same, name is different. The *lang* attribute is explicitly redefined with different type. Original type was free text String, while redefined attribute is more specific (e.g. enumerated) *Language* class. We used explicit redefinition in this case because attribute types *String* and *Language* are not related. *Language* is enumeration type.

Library has some rules on what could be *borrowed* and what is for *reference only*. Rules are also defined on how many books could be borrowed by *patrons* and how many could be reserved.

Library book attributes *loanPeriod*, *dueDate*, and *isOverdue* are derived. Length of time a library book may be borrowed (loan period) depends on library policy and varies based on a kind of book and who is borrowing it. For example, in a university library undergraduates could borrow book for 30 days, graduate students for a quarter, and faculty staff for a year. In a public library normal loan period for a book could be 3 weeks, while it could be lowered to 2 weeks for new books. Book return due date will be calculated based on the borrow date and loan period. If due date is past the current date, *isOverdue* Boolean flag which is false by default will be set to true.

Library *Catalog* provides access for the library patrons and staff to all sources of information about library items, allows to search by a particular author, on a particular topic, or in a particular format, that the library has. It tells the user where materials meeting their specific needs can be found

Class Diagram for Library Management System :
Aggregation and Multiplicity are two important points that need to take into consideration while designing a Class Diagram. Let us understand in detail.

Aggregation –
Aggregation simply shows a relationship where one thing can exist independently of other thing. It means to create or compose different abstractions together in defining a class. Aggregation is represented as a part of relationship in class diagram. In diagram given below, we can see that aggregation is represented by an edge with a diamond end pointing towards superclass. The "Library Management System" is superclass that consists of various classes.

These classes are User, Book, and Librarian as shown in diagram. Further, for "Account" class, "User" is a superclass. All of these, share a relationship and these relationships are known as aggregate relationships. Multiplicity –

Multiplicity means that number of elements of a class is associated with another class. These relations can be one-to-one, many-to-many, and many-to-one or one-to-many. For denoting one element we use 1, for zero elements we use 0, and for many elements we use *. We can see in diagram; many users are associated with many books denoted by * and this represents a many-tomany type of relationship. One user has only one account that is denoted by 1 and this represents a one-to-one type of relationship.

Many books are associated with one librarian and this represents many-to-one or one-to-many type of relationship. All these relationships are shown in diagram.

Class Diagram for Library Management System simply describes structure of Library Management System class, attributes, methods or operations, relationship among objects. Classes of Library Management System :

Library Management System class : -

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It manages all operations of Library Management System. It is central part of organization for which software is being designed.

User Class –

It manages all operations of user.

Librarian Class – It manages all operations of Librarian.

Book Class –

It manages all operations of books. It is basic building block of system.

Account Class –

It manages all operations of account.

Library database Class –

It manages all operations of library database.

Staff Class –

It manages all operations of staff.

Student Class –

It manages all operations of student.

Attributes of Library Management System :-

Library Management System Attributes –

UserType, Username, Password

User Attributes – Name,

Id

Librarian Attributes –

Name, Id, Password, SearchString

Book Attributes –

Title, Author, ISBN, Publication

Account Attributes –

no_borrowed_books, no_reserved_books, no_returned_books, no_lost_books fine_amount

Library database Attributes – List_of_books

Staff Class Attributes –

Dept

Student Class Attributes –

Class

Methods of Library Management System :

Library Management System Methods – Login(),

Register(), Logout()

User Methods –

Verify(), CheckAccount(), get_book_info()

Librarian Methods –

Verify_librarian(), Search()

Book Methods –

Show_duedt(), Reservation_status(), Feedback(), Book_request(), Renew_info()

Account Methods – Calculate_fine()

Library database Methods –

Add(), Delete(), Update(), Display(), Search()