JAIN UNIVERSITY
Declared as Deemed-to-be University u/s 3 of the UGC Act,1956

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Department of Computer Science & IT

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LIBRARY MANAGEMENT SYSTEM

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Introduction

A library is a collection of media, books, projects, research papers, articles, magazines, newspapers, etc. that are easily accessible for use. A library is responsible for housing information in the above modes to meet the user's needs on a daily basis. The information can either be in hard copies such as printed articles, books, journals, etc. or softcopies such as pdf or word files and many more.

This particular Library Management System is based on a Library of a University. The main aim of the system is to model the base operations which take place on a daily basis in a library of a University. These base operations include the maintenance of record of issuance and return of articles such as books, journals or project reports borrowed by its customers, i.e. the students and professors.

The Library Management System allows the user to store the article details and customer details. The system can withstand multitudes of operations provided the database is maintained and cleaned regularly. The implementation of such systems would drastically reduce the data entry time and also provide calculated reports when needed in certain cases such as calculating late return fees, etc.

This project report consists of the entities and attributes, an ER Diagram, a Schema diagram and Table details of the library Management System. Each of the aforementioned has a section dedicated to explain the concept along with the same for the system constructed in this project.

Entities and Attributes

❖ Entities and their attributes

Faculty	Student
• Faculty_Name • Faculty_ID • Hire_Date • Designation • Department • Contact_Number • Salary	• Student_Name • Student_ID • Registration_Date • Contact_Number • Class_details

Book	Project	Journal
• ISBN • Book_Name • Category • Cost_Price • Author_1 • Author_2 • Author_3 • Publisher	• Project_ID • Project_Name • Category • Author_1 • Author_2 • Author_3 • Publisher	• Journal_ID • Journal_Name • Category • Author_1 • Author_2 • Author_3 • Publisher

Faculty_Library_Card	Student_Library_Card
• Faculty_ID • Issue_Date • Return_Date • Faculty_Name	• Student_ID • Issue_Date • Return_Date • Student_Name

**The bold titles of each table are entities.*
**The bullet points are attributes of the entity listed above them.*

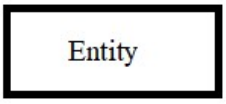
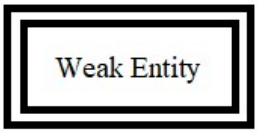
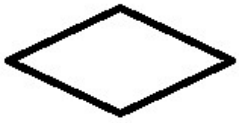
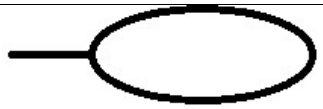
❖ Relationships and their Cardinality

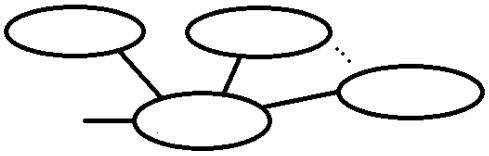
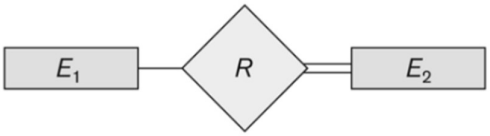
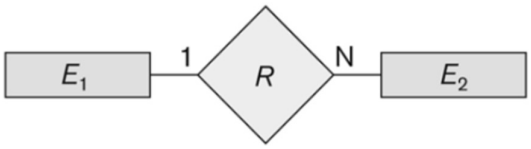
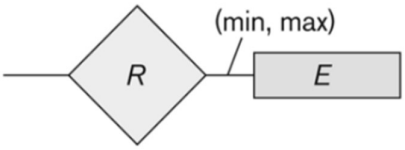
Sr. No.	Relationship	Cardinality
1	1 Student Library Card is issued to 1 Student only	(1:1)
2	1 Faculty Library Card is issued to 1 Faculty only	(1:1)
3	1 Student can borrow N number of Books	(1:N)
4	1 Student can borrow N number of Journals	(1:N)
5	1 Student can borrow N number of Project Reports	(1:N)
6	1 Faculty can borrow N number of Books	(1:N)
7	1 Faculty can borrow N number of Journals	(1:N)
8	1 Faculty can borrow N number of Project Reports	(1:N)

Entity-Relationship Model

Entity Relationship Model is also known as ER Model. It is a high level conceptual data model diagram. In short, it is a diagram that represents the relationship of entity sets stored in a database. This way, the ER Model helps in explaining the logical structure of the database. It is built by 3 foundational blocks: The entities, The attributes and the relationship between the entities.

ER Models use different shapes to represent different meanings. Entities are represented as rectangles, Attributes are represented as ovals/ellipses and relationships are shown in diamonds. The lines links attributes to entities and entities to other relationship types. The primary key is the attribute which is underlined. The symbols and their representations are given below:

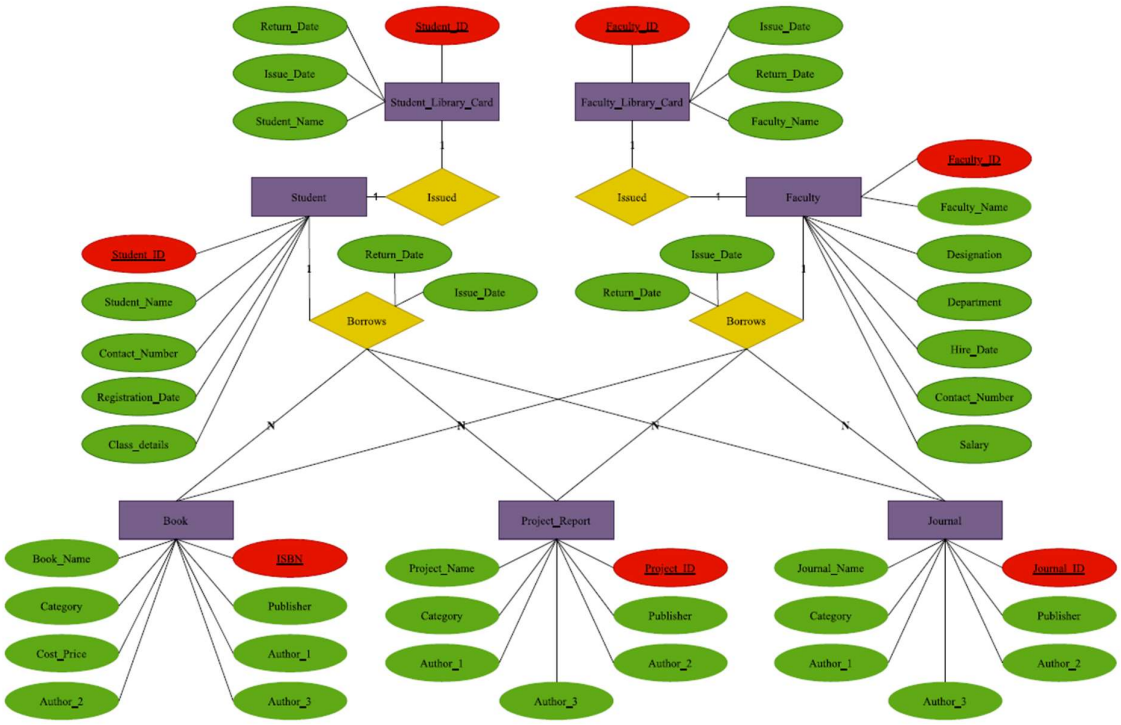
Symbol	Meaning
	An entity represents a real world object about which we want to store data in database.
	A weak entity set is an entity set that does not contain sufficient attributes to uniquely identify its entities. In other words, a primary key does not exist for a weak entity set.
	A relationship, in the context of databases, is a situation that exists between two relational database tables when one table has a foreign key that references the primary key of the other table. Relationships allow relational databases to split and store data in different tables, while linking disparate data items.
	An identifying relationship is a relationship between two entities in which an instance of a child entity is identified through its association with a parent entity, which means the child entity is dependent on the parent entity for its identity and cannot exist without it.
	In RDBMS, a table organizes data in rows and columns. The columns are known as attributes.
	A key in DBMS is an attribute or a set of attributes that help to uniquely identify a tuple (or row) in a relation (or table).
	A multivalued attribute of an entity is an attribute that can have more than one value associated with the key of the entity.

	The attributes which can be divided into sub-parts are called composite attributes.
	Derived attributes are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database.
	It specifies that each entity in the entity set must compulsorily participate in at least one relationship instance in that relationship set.
	Cardinality in DBMS defines the maximum number of relationship instances in which an entity can participate. Cardinality Ratios are- Many to Many Cardinality, Many to One Cardinality, One to Many Cardinality, One to One Cardinality.
	This is a pair of numbers (m, n) that appear on the connecting line between the entities and their relationships. The minimum number of times an entity can appear in a relation is represented by m whereas, the maximum time it is available is denoted by n.

On modeling the design of the relational database we can put some restrictions like what values are allowed to be inserted in the relation, what kind of modifications and deletions are allowed in the relation. These are the restrictions we impose on the relational database. In ER Models there are mainly 4 types of constraints we mainly deal with:

- Domain Constraints
  - Datatype checks are done in these types of constraints.
- Key Constraints
  - Allotment of primary takes place in this type of constraint.
  - Not Null is also a part of key constraints as null values are not allowed in primary keys.
- Entity Integrity Constraints
  - These maintain the integrity of the entity such as not allowing null values in primary key attribute and so on.
- Referential Integrity Constraints
  - This type of constraint is specified between two tables or relations and used to maintain the consistency of the tuples among the tables.
  - Referencing of the tables using foreign key and allowing the tuples to have null values but which can't be empty.

The ER Model of the Library Management System is as shown below:



Schema Diagram

A schema diagram is a diagram which contains entities and the attributes that will define that schema. A schema diagram only shows us the database design. It does not show the actual data of the database. The Schema Diagram for the Library Management System is given below:

Student_Library_Card

Student_ID	Student_Name	Issue_Date	Return_Date

Faculty_Library_Card

Faculty_ID	Faculty_Name	Issue_Date	Return_Date

Student

Student_ID	Student_Name	Contact_Number	Registration_Date	Class_Details

Faculty

Faculty_ID	Faculty_Name	Designation	Department	Hire_Date	Contact_Number	Salary

Book

ISBN	Book_Name	Category	Publisher	Cost_Price	Author_1	Author_2	Author_3

Journal

Journal_ID	Journal_Name	Category	Publisher	Author_1	Author_2	Author_3

Project_Report

Project_ID	Project_Name	Category	Publisher	Author_1	Author_2	Author_3

Table Details

Table Name - Student_Library_Card

Attribute	Data Type	Constraints
Student_ID	Varchar	Primary Key
Student_Name	Varchar	-
Issue_Date	Date	-
Return_Date	Date	-

This table gives the information contained in the Library Card issued to the Students using which they shall borrow and return articles from the Library.

Table Name - Faculty_Library_Card

Attribute	Data Type	Constraints
Faculty_ID	Varchar	Primary Key
Faculty_Name	Varchar	-
Issue_Date	Date	-
Return_Date	Date	-

This table gives the information contained in the Library Card issued to the Faculty using which they shall borrow and return articles from the Library.

Table Name - Student

Attribute	Data Type	Constraints
Student_ID	Varchar	Primary Key
Student_Name	Varchar	-
Contact_Number	Char	-
Registration_Date	Date	-
Class_details	Varchar	-

This table gives the information about the student who will issue the articles from the library and has information such as when they registered to the library, their personal details, etc.

Table Name - Faculty

Attribute	Data Type	Constraints
Faculty_ID	Varchar	Primary Key
Faculty_Name	Varchar	-
Designation	Varchar	-
Department	Varchar	-
Hire_Date	Date	-
Contact_Number	Char	-
Salary	Int	-

This table gives the information about the faculty who will issue the articles from the library and has information such as when they registered to the library, their personal details, salary details, etc.

Table Name - Borrows

Attribute	Data Type	Constraints
Issue_Date	Date	-
Return_Date	Date	-
Article_ID	Varchar	Primary Key

This is a special type of table which is based on a relationship. It stores the issue and return date of the articles taken from the library by the Students as well as the Faculty.

Table Name - Book

Attribute	Data Type	Constraints
ISBN	Varchar	Primary Key
Book_Name	Varchar	-
Category	Varchar	-
Publisher	Varchar	-
Cost_Price	Int	-
Author_1	Varchar	-
Author_2	Varchar	-
Author_3	Varchar	-

This table gives description of the book and the necessary details to keep track of it in the management system.

Table Name - Project Report

Attribute	Data Type	Constraints
Project_ID	Varchar	Primary Key
Project_Name	Varchar	-
Category	Varchar	-
Publisher	Varchar	-
Author_1	Varchar	-
Author_2	Varchar	-
Author_3	Varchar	-

This table gives description of the Project Report and the necessary details to keep track of it in the management system.

Table Name - Journal

Attribute	Data Type	Constraints
Journal_ID	Varchar	Primary Key
Journal_Name	Varchar	-
Category	Varchar	-
Publisher	Varchar	-
Author_1	Varchar	-
Author_2	Varchar	-
Author_3	Varchar	-

This table gives description of the Journal and the necessary details to keep track of it in the management system.

Creating the Database using MySQL

Input	create database Library;
	use Library;
	
	create table Student_Library_Card (Student_ID varchar(20) not null, Student_Name varchar(40) not null, Issue_Date date not null, Return_Date date not null, constraint pk_SLC primary key(Student_ID));
	
	create table Faculty_Library_Card (Faculty_ID varchar(20) not null, Faculty_Name varchar(40) not null, Issue_Date date not null, Return_Date date not null, constraint pk_FLC primary key(Faculty_ID));
	
	create table Student (Student_ID varchar(20) not null, Student_Name varchar(40) not null, Contact_Number char(10) not null, Registration_Date date not null, Class_Details varchar(100), constraint pk_Student primary key(Student_ID));
	
	create table Faculty (Faculty_ID varchar(20) not null, Faculty_Name varchar(40) not null, Designation varchar(100), Department varchar(100), Hire_Date date not null, Contact_Number char(10) not null, Salary int, constraint pk_Faculty primary key(Faculty_ID));
	
	create table Book (ISBN varchar(20) not null, Book_Name varchar(100) not null, Category varchar(50), Publisher varchar(100), Cost_Price float, Author_1 varchar(20), Author_2 varchar(20), Author_3 varchar(20), constraint pk_Book primary key(ISBN));
	
	create table Project_Report (Project_ID varchar(20) not null, Project_Name varchar(100) not null, Category varchar(50), Publisher varchar(100), Author_1 varchar(20), Author_2 varchar(20), Author_3 varchar(20), constraint pk_Project_Report primary key(Project_ID));
	
	create table Journal (Journal_ID varchar(20) not null, Journal_Name varchar(100) not null, Category varchar(50), Publisher varchar(100), Author_1 varchar(20), Author_2 varchar(20), Author_3 varchar(20), constraint pk_Journal primary key(Journal_ID));
	
	create table S_Borrows (Article_ID varchar(20), Student_ID varchar(20), Issue_Date date, Return_Date date);
	
	create table F_Borrows (Article_ID varchar(20), Faculty_ID varchar(20), Issue_Date date, Return_Date date);

Input	insert into Student_Library_Card values('19BSR06024', 'Vinit R Iyer', '2021-01-01', '2021-01-15');
	insert into Student_Library_Card values('19BSR06043', 'Ashmitha Nagesh', '2021-02-01', '2021-02-15');
	insert into Student_Library_Card values('19BSR06044', 'Aaron R Bradley', '2021-01-015', '2021-01-30');
	insert into Student_Library_Card values('19BSR06016', 'R Bhargavi Prakalya', '2021-03-14', '2021-03-29');
	insert into Student_Library_Card values('19BSR06022', 'Arsen', '2021-01-01', '2021-01-15');
	
	insert into Faculty_Library_Card values('JGIJCP01', 'M Sudhakar Reddy', '2021-10-12', '2021-10-27');
	insert into Faculty_Library_Card values('JGIJCP02', 'Asha Rajiv', '2021-11-12', '2021-11-27');
	insert into Faculty_Library_Card values('JGIJCM01', 'Arathi Sudarshan', '2022-01-12', '2022-01-27');
	insert into Faculty_Library_Card values('JGIJCM02', 'J V Ramanaraju', '2022-05-01', '2022-05-15');
	insert into Faculty_Library_Card values('JGIJCCS01', 'B R Sampangi Rama Reddy', '2021-10-12', '2021-10-27');
	
	insert into Student values('19BSR06024', 'Vinit R Iyer', '9820331239', '2019-06-15', 'BSc PMCs');
	insert into Student values('19BSR06043', 'Ashmitha Nagesh', '9824241239', '2019-06-15', 'BSc PMCs');
	insert into Student values('19BSR06044', 'Aaron R Bradley', '8820421239', '2019-06-15', 'BSc PMCs');
	insert into Student values('19BSR06016', 'R Bhargavi Prakalya', '7210331239', '2019-06-15', 'BSc PMCs');
	insert into Student values('19BSR06022', 'Arsen', '8420332139', '2019-06-15', 'BSc PMCs');
	
	insert into Faculty values('JGIJCP01', 'M Sudhakar Reddy', 'Head of Department', 'Physics', '2010-06-01', '9820331348', 60000);
	insert into Faculty values('JGIJCP02', 'Asha Rajiv', 'Director', 'Physics', '2010-06-01','9820331348', 100000);
	insert into Faculty values('JGIJCM01', 'Arathi Sudarshan', 'Head of Department', 'Mathematics', '2010-06-01','9820331348', 60000);
	insert into Faculty values('JGIJCM02', 'J V Ramanaraju', 'Professor', 'Mathematics', '2010-06-01', '9820331348', 55000);
	insert into Faculty values('JGIJCCS01', 'B R Sampangi Rama Reddy', 'Head of Department', 'Computer Science and IT', '2010-06-01', '9820331348', 60000);

Input	insert into Book values('JU835483', 'Simplified Mathematics', 'Education', 'S Chand', 220, 'G K Ranganath', '', '');
	insert into Book values('JU837133', 'Simplified Physics', 'Education', 'Penguin Bookhouse', 740, 'El Matador', 'Aurobindo Ghosh', '');
	insert into Book values('JU421083', 'Think and Grow Rich', 'Self Development', 'Penguin Bookhouse', 550, 'Napoleon Hill', '', '');
	insert into Book values('JU832453', 'Simplified RDBMS', 'Education', 'Lozon Express', 375, 'Joe McMillan', '', '');
	insert into Book values('JU853431', 'Atomic Habits', 'Self Development', 'The Gritz', 600, 'James Clear', '', '');
	
	insert into Project_Report values('JUP001', 'Linear Regression Model', 'Machine Learning', 'Jain University', 'Vinit R Iyer', 'Ashmitha Nagesh', '');
	insert into Project_Report values('JUP002', 'Logistic Regression Model', 'Machine Learning', 'Jain University', 'Vinit R Iyer', 'R Bhargavi Prakalya', 'Rakhi Kumari');
	insert into Project_Report values('JUP003', 'Networking Models', 'Computer Networks', 'Jain University', 'Aaron R Bradley', 'Ashmitha Nagesh', 'Vinit R Iyer');
	insert into Project_Report values('JUP004', 'Library Management System', 'RDBMS', 'Jain University', 'Vinit R Iyer', 'Ashmitha Nagesh', '');
	insert into Project_Report values('JUP005', 'Decision Tree Algorithm', 'Machine Learning', 'Jain University', 'Ashmitha Nagesh', 'Vinit R Iyer', 'Aaron R Bradley');
	
	insert into Journal values('JUJ001', 'Heat SHields', 'Engineering', 'Stanford University', 'Deepthi Narasimhan', 'Vinit R Iyer', 'Aravind Nagesh');
	insert into Journal values('JUJ002', 'Rocket Trajectories', 'Engineering', 'Harvard University', 'Aaron R Bradley', 'Ashmitha Nagesh', 'Vinit R Iyer');
	insert into Journal values('JUJ003', 'Navier Stokes Equation', 'Fluid Mechanics', 'Oxford University', 'Vinit R Iyer', 'Ashmitha Nagesh', 'Aaron R Bradley');
	insert into Journal values('JUJ004', 'Increasing Qubits', 'Quantum Mechanics', 'Stanford University', 'Ashmitha Nagesh', '', '');
	insert into Journal values('JUJ005', 'Extraterrestrial Civilizations', 'Astrobiology', 'Princeton University', 'Vivek Nagapatnam', 'Vinit R Iyer', 'Lara Mox');
	
	insert into S_Borrows values('JU832453', '19BSR06024', '2021-01-01', '2021-01-15');
	insert into S_Borrows values('JU835483', '19BSR06043', '2021-02-01', '2021-02-15');
	insert into S_Borrows values('JUP004', '19BSR06044', '2021-01-015', '2021-01-30');
	insert into S_Borrows values('JUJ005', '19BSR06016', '2021-03-14', '2021-03-29');
	insert into S_Borrows values('JUJ001', '19BSR06022', '2021-01-01', '2021-01-15');
	
	insert into F_Borrows values('JU837133', 'JGIJCP01', '2021-10-12', '2021-10-27');
	insert into F_Borrows values('JUP002', 'JGIJCP02', '2021-11-12', '2021-11-27');
	insert into F_Borrows values('JUP003', 'JGIJCM01', '2022-01-12', '2022-01-27');
	insert into F_Borrows values('JUj002', 'JGIJCM02', '2022-05-01', '2022-05-15');
	insert into F_Borrows values('JU853431', 'JGIJCCS01', '2021-10-12', '2021-10-27');

Input	select * from Student_Library_Card;
Output	

Student_ID	Student_Name	Issue_Date	Return_Date
19BSR06016	R Bhargavi Prakalya	2021-03-14	2021-03-29
19BSR06022	Arsen	2021-01-01	2021-01-15
19BSR06024	Vinit R Iyer	2021-01-01	2021-01-15
19BSR06043	Ashmitha Nagesh	2021-02-01	2021-02-15
19BSR06044	Aaron R Bradley	2021-01-15	2021-01-30
NULL	NULL	NULL	NULL

Input	select * from Faculty_Library_Card;
Output	

Faculty_ID	Faculty_Name	Issue_Date	Return_Date
JGIJCCS01	B R Sampangi Rama Reddy	2021-10-12	2021-10-27
JGIJCM01	Arathi Sudarshan	2022-01-12	2022-01-27
JGIJCM02	J V Ramanaraju	2022-05-01	2022-05-15
JGIJCP01	M Sudhakar Reddy	2021-10-12	2021-10-27
JGIJCP02	Asha Rajiv	2021-11-12	2021-11-27
NULL	NULL	NULL	NULL

Input	select * from Student;
Output	

Student_ID	Student_Name	Contact_Number	Registration_Date	Class_Details
19BSR06016	R Bhargavi Prakalya	7210331239	2019-06-15	BSc PMCs
19BSR06022	Arsen	8420332139	2019-06-15	BSc PMCs
19BSR06024	Vinit R Iyer	9820331239	2019-06-15	BSc PMCs
19BSR06043	Ashmitha Nagesh	9824241239	2019-06-15	BSc PMCs
19BSR06044	Aaron R Bradley	8820421239	2019-06-15	BSc PMCs
NULL	NULL	NULL	NULL	NULL

Input	select * from Faculty;
Output	

Faculty_ID	Faculty_Name	Designation	Department	Hire_Date	Contact_Number	Salary
JGIJCCS01	B R Sampangi Rama Reddy	Head of Department	Computer Science and IT	2010-06-01	9820331348	60000
JGIJCM01	Arathi Sudarshan	Head of Department	Mathematics	2010-06-01	9820331348	60000
JGIJCM02	J V Ramanaraju	Professor	Mathematics	2010-06-01	9820331348	55000
JGIJCP01	M Sudhakar Reddy	Head of Department	Physics	2010-06-01	9820331348	60000
JGIJCP02	Asha Rajiv	Director	Physics	2010-06-01	9820331348	100000
NULL	NULL	NULL	NULL	NULL	NULL	NULL

Input	select * from Book;
Output	

ISBN	Book_Name	Category	Publisher	Cost_Price	Author_1	Author_2	Author_3
JU421083	Think and Grow Rich	Self Development	Penguin Bookhouse	550	Napoleon Hill		
JU832453	Simplified RDBMS	Education	Lozon Express	375	Joe McMillan		
JU835483	Simplified Mathematics	Education	S Chand	220	G K Ranganath		
JU837133	Simplified Physics	Education	Penguin Bookhouse	740	El Matador	Aurobindo Ghosh	
JU853431	Atomic Habits	Self Development	The Gritz	600	James Clear		
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Input	select * from Project_Report;
Output	

Project_ID	Project_Name	Category	Publisher	Author_1	Author_2	Author_3
JUP001	Linear Regression Model	Machine Learning	Jain University	Vinit R Iyer	R Bhargavi Prakalya	Rakhi Kumari
JUP002	Logistic Regression Model	Machine Learning	Jain University	Vinit R Iyer	R Bhargavi Prakalya	Rakhi Kumari
JUP003	Networking Models	Computer Networks	Jain University	Aaron R Bradley	Ashmitha Nagesh	Vinit R Iyer
JUP004	Library Management System	RDBMS	Jain University	Vinit R Iyer	Ashmitha Nagesh	
JUP005	Decision Tree Algorithm	Machine Learning	Jain University	Ashmitha Nagesh	Vinit R Iyer	Aaron R Bradley
NULL	NULL	NULL	NULL	NULL	NULL	NULL

Input	select * from Journal;
Output	

Journal_ID	Journal_Name	Category	Publisher	Author_1	Author_2	Author_3
JUJ001	Heat SHields	Engineering	Stanford University	Deepthi Narasimhan	Vinit R Iyer	Aravind Nagesh
JUJ002	Rocket Trajectories	Engineering	Harvard University	Aaron R Bradley	Ashmitha Nagesh	Vinit R Iyer
JUJ003	Navier Stokes Equation	Fluid Mechanics	Oxford University	Vinit R Iyer	Ashmitha Nagesh	Aaron R Bradley
JUJ004	Increasing Qubits	Quantum Mechanics	Stanford University	Ashmitha Nagesh		
JUJ005	Extraterrestrial Civilizations	Astrobiology	Princeton University	Vivek Nagapatnam	Vinit R Iyer	Lara Mox
NULL	NULL	NULL	NULL	NULL	NULL	NULL

Input	select * from S_Borrows;
Output	

Article_ID	Student_ID	Issue_Date	Return_Date
JU832453	19BSR06024	2021-01-01	2021-01-15
JU835483	19BSR06043	2021-02-01	2021-02-15
JUP004	19BSR06044	2021-01-15	2021-01-30
JUJ005	19BSR06016	2021-03-14	2021-03-29
JUJ001	19BSR06022	2021-01-01	2021-01-15

Input	select * from F_Borrows;
Output	

Article_ID	Faculty_ID	Issue_Date	Return_Date
JU837133	JGIJCP01	2021-10-12	2021-10-27
JUP002	JGIJCP02	2021-11-12	2021-11-27
JUP003	JGIJCM01	2022-01-12	2022-01-27
JUj002	JGIJCM02	2022-05-01	2022-05-15
JU853431	JGIJCCS01	2021-10-12	2021-10-27

Critical Analysis

1. A new attribute which gives the details of the library staff can be included whose responsibilities are to issue the library cards, books and fine.
2. A limit can be placed on the number of articles (Books, Journal and Project Reports) that can be borrowed from the Library.
3. A new attribute which will give fine details for late return of articles (Books, Journals and Project Reports) can be created to give details for each library member.
4. A new attribute which denotes the location of the articles (Books, Journals and Project Reports) can be added which gives the precise location, that is, the shelf and rack number, etc.
5. A new attribute which demarcates the articles, especially the books into ones that can be issued or just referenced. Reference books being the ones, that can't be taken away from the library.