University of Management and Technology, Lahore Campus

Semester Project: Spring 2024

Course Name:	Database Systems	**Course Code:**	CC2141	Credit Hours:	4(3,1)
Course Instructor/s:	Ms. Samra Kanwal	**Program Name**	BS Computer Science		
Semester/ Section:	BSCS 4, V12	**Maximum Marks:**	10		
Submission Deadline:	Jun 23, 2024	**Moderator Signature**			

Instructions:

- Your project report should be submitted in PDF format.
- There is a ZERO tolerance policy for plagiarism. Tasks found with copy-pasted material or copied from fellows will be marked as ZERO.
- Submit your assignments on LMS within the given time frame. Emailed project will not be accepted.
- **VIVA is compulsory for every group.**
- Your project should use the approach of "**ANSI-SPARC Three-Level Architecture**":
  - **View level (External)**
  - **Logical level (Conceptual) / Logical Database Design**
  - **Physical level (Internal) / Physical Database Design**
- Create a proper project outline (Hyperlink based) in the report

Course Learning Outcomes (CLO)		
CLO-2	CLO-3	CLO-4

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Chapter 1: Introduction to the Problem

1.1 Introduction

The Problem introduction gives an explanation about the issue that is being addressed by the project. It also argues in favor of implementing the project in the proposed area in the existing conditions.

The banking industry deals with vast amounts of data daily, ranging from customer information to transaction details. Managing this data efficiently is critical to ensure smooth operations and provide high-quality service to customers. This project involves designing and implementing a relational database management system (RDBMS) for a banking institution. The primary focus is on creating a structured and efficient way to store, retrieve, and manage data related to customers, employees, branches, loans, accounts, and transactions. By organizing the data into well-defined tables and establishing relationships among them, the database ensures data integrity, reduces redundancy, and facilitates easy access to information. By implementing this system, the bank can streamline its operations, enhance data accuracy, and improve customer satisfaction.

1.2 Purpose

Define the purpose why you are developing your project what is the need and how this system or project will help in the market or in life of the society

The purpose of this banking database project is to develop a comprehensive database system that can handle various banking operations. This system aims to support the management of customer information, employee records, branch details, loans, and different types of accounts. By providing a centralized repository for all banking data, the database enhances the bank's ability to maintain accurate records, generate reports, and deliver efficient services to its customers.

1.3 Objective

Define your objectives what you want to achieve after the completion of the project

The primary objectives of this banking database project are:

1. **Data Organization**:

   To create a systematic structure for storing banking data, ensuring that information is organized in a way that supports easy retrieval and management.

2. **Data Integrity**:

   To implement constraints and relationships that maintain the accuracy and consistency of data across the database.

3. **Efficiency**:

   To design the database in a manner that optimizes the performance of data queries and transactions, making banking operations faster and more reliable.

4. **Scalability**:

   To develop a database system that can be easily expanded to accommodate future growth in data volume and complexity.

5. **User Management**:

   To facilitate the efficient management of customer and employee records, including contact information, account details, and service histories.

6. **Security**:

   To incorporate measures that protect sensitive customer and financial information from unauthorized access and breaches.

7. **Reporting and Analysis**:

   To enable the generation of comprehensive reports that help in analyzing financial performance, customer behavior, and operational efficiency.

8. **Customer Service**:

   To enhance the bank's ability to serve its customers by providing timely and accurate information about their accounts and transactions.

By achieving these objectives, the banking database project aims to improve the overall operational efficiency of the bank, support decision-making processes, and enhance customer satisfaction through better service delivery.

Chapter 2: Logical Database Design

2.1 Entities

Identify all the entities

1. Customer
2. Review
3. Branch
4. Loan
5. Payment
6. Employee
7. Serves (Associative Entity)
8. Account
9. Current Account
10. Saving Account

2.2 Attributes

Identify all the attributes against each entity. Attributes are single, multi-valued, simple, composite, and derived attributes.

1. **Customer**

   Attributes:

   - Customer_ID (Primary Key)
   - Name (Simple)
   - Date_of_Birth (Simple)
   - Age (Derived from Date_of_Birth)
   - Contact_Number (Multi-valued)
   - Address (Composite)
     - Street_Number
     - Street_Name
     - City
     - State
     - Pincode

2. **Review**

   Attributes:

   - Rating (Simple)
   - Comments (Simple)
   - Customer_ID (Foreign Key)
   - Branch (Composite)
     - Name
     - City

3. **Branch**

   Attributes:

   - Name (Simple)
   - City (Simple)
   - Liabilities (Simple)
   - Assets (Simple)

4. **Loan**

   Attributes:

   - Loan_Number (Primary Key)
   - Amount (Simple)
   - Customer_ID (Foreign Key)
   - Branch_Name (Foreign Key)

5. **Loan Payment**

   Attributes:

   - Payment_Number (Primary Key)
   - Payment_Amount (Simple)
   - Payment_Date (Simple)
   - Loan_Number (Foreign Key)

6. **Employee**

   Attributes:

   - Emp_ID (Primary Key)
   - Employee_Name (Simple)
   - Contact_Number (Simple)
   - Start_Date (Simple)
   - Year_of_Service (Derived from Start_Date

7. **Account**

   Attributes:

   - Account_Number (Primary Key)
   - Account_Type (Simple)
   - Balance (Simple)
   - Customer_ID (Foreign Key

8. **Current Account** (Subtype of Account)

   Attributes:

   - OverDraft_Amount (Simple)
   - Per_Transaction_Charges (Simple

9. **Saving Account** (Subtype of Account)

   Attributes:

   - Daily_Withdrawal_Limit (Simple)
   - Interest_Rate (Simple)

2.3 Relationships

Specify the relationship (One to one, One to many, and many to many) between entities with minimum and maximum cardinalities.

1. **Customer and Contact-Number**:

   - **Relationship:** One to Many
   - **Cardinality:**
     - **Customer:** 1 (min), Many (max)
     - **Contact-Number:** 1 (min), 1 (max)

2. **Customer and Review**:

   - **Relationship:** One to Many
   - **Cardinality:**
     - **Customer:** 0 (min), many (max)
     - **Review:** 1 (min), 1 (max)

3. **Customer and Serve**:

   - **Relationship:** Many to One
   - **Cardinality:**
     - **Customer:** 1 (min), many (max)
     - **Serve:** 1 (min), 1 (max)

4. **Customer and Loan**:

   - **Relationship:** Optional to Many
   - **Cardinality:**
     - **Customer:** 0 (min), many (max)
     - **Loan:** 1 (min), 1 (max)

5. **Customer and Account**:

- **Relationship:** One to Many
- **Cardinality:**
  - **Customer:** 1 (min), many (max)
  - **Account:** 1 (min), 1 (max)

6. **Loan and Branch**:

- **Relationship:** One to Many
- **Cardinality:**
  - **Loan:** 1 (min), many (max)
  - **Branch:** 1 (min), 1 (max)

7. **Loan and Payment**:

- **Relationship:** Optional to Many
- **Cardinality:**
  - **Loan:** 0 (min), 1 (max)
  - **Payment:** 1 (min), Many (max)

8. **Employee and Contact-Number**:

- **Relationship:** one to many
- **Cardinality:**
  - **Contact:** 1 (min), 1 (max)
  - **Employee:** 1 (min), Many (max)

9. **Account and Current Account/Saving Account (Is-a relationship)**:

- **Relationship:** One to One (specialization/generalization)
- **Cardinality:**
  - **Account:** 1 (min), 1 (max)
  - **Current Account/Saving Account:** 1 (min), many (max)

10. **Employee and Serve**:

- **Relationship:** Many to One
- **Cardinality:**
  - **Employee:** 1 (min), many (max)
  - **Serve:** 1 (min), 1 (max)

2.4 Functional Dependenices and Normalization

Mentioned Functional Dependencies of attributes

1. **Customer Table:**

Customer_ID → Name, Date_Of_Birth, Age, State, Pincode, Street_Number, Street_Name, City

2. **Customer_Contact_Number Table:**

   Customer_ID → Number

3. **Review Table:**

   ReviewNo → Rating, Comments, Customer_ID

4. **Branch Table:**

   BranchName → City, Liabilities, Assets

5. **Loan Table:**

   (Loan_Number, Customer_ID, Voucher_No) → Amount, BranchName

6. **Payment Table:**

   Voucher_No → Payment_Amount, Payment_Date

7. **Employee Table:**

   Emp_ID → Employee_Name, Start_Date, Year_of_Service

8. **Employee_Contact_Number Table:**

   Emp_ID → Number

9. **Account Table:**

   Account_Number → Customer_ID, Account_Type, Balance

10. **Saving_Account Table:**

    Account_Number → Daily_Withdrawal_Limit, Interest_Rate

11. **Current_Account Table:**

    Account_Number → OverDraft_Amount, Per_Transaction_Charges

12. Serve Table:

(Customer_ID, Emp_ID, Date) → Date

Mentioned how you normalize your tables (1NF,2nd NF, 3NF)

Emp_ID	Number	Employee_Name	Start_Date	Year_of_Service
1	2536266657	Ayesha Naeem	2010-01-01	14
1	7890123456	Ayesha Naeem	2010-01-01	14
2	8901234567	Bilal Hassan	2012-05-15	12
3	2357274646	Fatima Shah	2015-08-20	9
3	9012345678	Fatima Shah	2015-08-20	9
4	0123456789	Danish Ali	2018-11-10	6
5	1234567890	Zainab Farooq	2020-03-25	4
5	4646474754	Zainab Farooq	2020-03-25	4
6	2345678901	Hamza Qureshi	2022-07-05	2

Voucher_No	Loan_Number	Amount	BranchName	Customer_ID	Payment_Amount	Payment_Date
1	1	50000.00	Anarkali Branch	1	1000.00	2023-01-15
2	2	75000.00	Clifton Branch	2	2000.00	2023-02-20
3	3	30000.00	Saddar Branch	3	1500.00	2023-03-25
4	4	45000.00	Latifabad Branch	4	1200.00	2023-04-30
5	5	60000.00	Zarghoon Branch	5	1800.00	2023-05-10
6	6	80000.00	Hayatabad Branch	6	1600.00	2023-06-15

Customer_ID	Number	Name	Date_Of_Birth	Age	State	Pincode	Street_Number	Street_Name	City
1	1234567890	Ahmed Khan	1985-06-15	39	Punjab	54000	101	Iqbal Rd	Lahore
2	2345678901	Fatima Bibi	1990-09-20	33	Sindh	75500	202	Jinnah Ave	Karachi
2	6247435636	Fatima Bibi	1990-09-20	33	Sindh	75500	202	Jinnah Ave	Karachi
3	3456789012	Ayesha Malik	1975-12-05	48	Punjab	46000	303	Mall Rd	Rawalpindi
4	4347325858	Ali Raza	1980-01-25	44	Sindh	71000	404	Shahrah-e-Faisal	Hyderabad
4	4567890123	Ali Raza	1980-01-25	44	Sindh	71000	404	Shahrah-e-Faisal	Hyderabad
5	5678901234	Hassan Ahmed	1995-04-10	29	Balochistan	87300	505	Sariab Rd	Quetta
5	7453574756	Hassan Ahmed	1995-04-10	29	Balochistan	87300	505	Sariab Rd	Quetta
6	6789012345	Zara Sheikh	1988-07-30	35	Khyber Pakhtunkhwa	25000	606	University Rd	Peshawar

Account_Number	Customer_ID	Account_Type	Balance	Account_Number	OverDraft_Amount	Per_Transaction_Charges	Account_Number	Daily_Withdrawal_Limit	Interest_Rate
2	2	Current	3000.00	2	5000.00	1.00	1	1000.00	2.50
4	4	Current	2000.00	4	3000.00	1.50	1	1000.00	2.50
6	6	Current	4000.00	6	7000.00	0.80	1	1000.00	2.50
8	4	Current	5000.00	8	4000.00	1.20	1	1000.00	2.50
10	5	Current	7000.00	10	6000.00	1.30	1	1000.00	2.50
12	6	Current	6000.00	12	3500.00	1.10	1	1000.00	2.50

ReviewNo	Rating	Comments	Customer_ID
1	5	Excellent service	1
2	4	Very good	2
3	3	Average experience	3
4	2	Below expectations	4
5	1	Poor service	5
6	4	Good overall	6

BranchName	City	Liabilities	Assets
Anarkali Branch	Lahore	500000.00	1000000.00
Clifton Branch	Karachi	300000.00	800000.00
Hayatabad Branch	Peshawar	400000.00	900000.00
Latifabad Branch	Hyderabad	200000.00	600000.00
Saddar Branch	Rawalpindi	700000.00	1500000.00
Zarghoon Branch	Quetta	100000.00	400000.00

Customer_ID	Emp_ID	Date
1	1	2023-01-15
2	2	2023-02-20
3	3	2023-03-25
4	4	2023-04-30
5	5	2023-05-10
6	6	2023-06-15

1st Normal Form (1NF)

Customer_ID	Name	Date_Of_Birth	Age	State	Pincode	Street_Number	Street_Name	City
1	Ahmed Khan	1985-06-15	39	Punjab	54000	101	Iqbal Rd	Lahore
2	Fatima Bibi	1990-09-20	33	Sindh	75500	202	Jinnah Ave	Karachi
3	Ayesha Malik	1975-12-05	48	Punjab	46000	303	Mall Rd	Rawalpindi
4	Ali Raza	1980-01-25	44	Sindh	71000	404	Shahrah-e-Faisal	Hyderabad
5	Hassan Ahmed	1995-04-10	29	Balochistan	87300	505	Sariab Rd	Quetta
6	Zara Sheikh	1988-07-30	35	Khyber Pakhtunkhwa	25000	606	University Rd	Peshawar

Emp_ID	Employee_Name	Start_Date	Year_of_Service
1	Ayesha Naeem	2010-01-01	14
2	Bilal Hassan	2012-05-15	12
3	Fatima Shah	2015-08-20	9
4	Danish Ali	2018-11-10	6
5	Zainab Farooq	2020-03-25	4
6	Hamza Qureshi	2022-07-05	2

Customer_ID	Number
1	1234567890
2	2345678901
2	6247435636
3	3456789012
4	4347325858
4	4567890123
5	5678901234
5	7453574756
6	6789012345

Emp_ID	Number
1	2536266657
1	7890123456
2	8901234567
3	2357274646
3	9012345678
4	0123456789
5	1234567890
5	4646474754
6	2345678901

Voucher_No	Loan_Number	Amount	BranchName	Customer_ID	Payment_Amount	Payment_Date
1	1	50000.00	Anarkali Branch	1	1000.00	2023-01-15
2	2	75000.00	Clifton Branch	2	2000.00	2023-02-20
3	3	30000.00	Saddar Branch	3	1500.00	2023-03-25
4	4	45000.00	Latifabad Branch	4	1200.00	2023-04-30
5	5	60000.00	Zarghoon Branch	5	1800.00	2023-05-10
6	6	80000.00	Hayatabad Branch	6	1600.00	2023-06-15

Account_Number	Customer_ID	Account_Type	Balance	Account_Number	OverDraft_Amount	Per_Transaction_Charges	Account_Number	Daily_Withdrawal_Limit	Interest_Rate
2	2	Current	3000.00	2	5000.00	1.00	1	1000.00	2.50
4	4	Current	2000.00	4	3000.00	1.50	1	1000.00	2.50
6	6	Current	4000.00	6	7000.00	0.80	1	1000.00	2.50
8	4	Current	5000.00	8	4000.00	1.20	1	1000.00	2.50
10	5	Current	7000.00	10	6000.00	1.30	1	1000.00	2.50
12	6	Current	6000.00	12	3500.00	1.10	1	1000.00	2.50

ReviewNo	Rating	Comments	Customer_ID
1	5	Excellent service	1
2	4	Very good	2
3	3	Average experience	3
4	2	Below expectations	4
5	1	Poor service	5
6	4	Good overall	6

BranchName	City	Liabilities	Assets
Anarkali Branch	Lahore	500000.00	1000000.00
Clifton Branch	Karachi	300000.00	800000.00
Hayatabad Branch	Peshawar	400000.00	900000.00
Latifabad Branch	Hyderabad	200000.00	600000.00
Saddar Branch	Rawalpindi	700000.00	1500000.00
Zarghoon Branch	Quetta	100000.00	400000.00

Customer_ID	Emp_ID	Date
1	1	2023-01-15
2	2	2023-02-20
3	3	2023-03-25
4	4	2023-04-30
5	5	2023-05-10
6	6	2023-06-15

2nd Normal Form (2NF)

Loan_Number	Amount	BranchName	Customer_ID
101	50000.00	Anarkali Branch	1
102	75000.00	Clifton Branch	2
103	30000.00	Saddar Branch	3
104	45000.00	Latifabad Branch	4
105	60000.00	Zarghoon Branch	5
106	80000.00	Hayatabad Branch	6

Voucher_No	Payment_Amount	Payment_Date	Loan_Number
1	1000.00	2023-01-15	101
2	2000.00	2023-02-20	102
3	1500.00	2023-03-25	103
4	1200.00	2023-04-30	104
5	1800.00	2023-05-10	105
6	1600.00	2023-06-15	106

Customer_ID	Name	Date_Of_Birth	Age	State	Pincode	Street_Number	Street_Name	City
1	Ahmed Khan	1985-06-15	39	Punjab	54000	101	Iqbal Rd	Lahore
2	Fatima Bibi	1990-09-20	33	Sindh	75500	202	Jinnah Ave	Karachi
3	Ayesha Malik	1975-12-05	48	Punjab	46000	303	Mall Rd	Rawalpindi
4	Ali Raza	1980-01-25	44	Sindh	71000	404	Shahrah-e-Faisal	Hyderabad
5	Hassan Ahmed	1995-04-10	29	Balochistan	87300	505	Sariab Rd	Quetta
6	Zara Sheikh	1988-07-30	35	Khyber Pakhtunkhwa	25000	606	University Rd	Peshawar

Emp_ID	Employee_Name	Start_Date	Year_of_Service
1	Ayesha Naeem	2010-01-01	14
2	Bilal Hassan	2012-05-15	12
3	Fatima Shah	2015-08-20	9
4	Danish Ali	2018-11-10	6
5	Zainab Farooq	2020-03-25	4
6	Hamza Qureshi	2022-07-05	2

Customer_ID	Number
1	1234567890
2	2345678901
2	6247435636
3	3456789012
4	4347325858
4	4567890123
5	5678901234
5	7453574756
6	6789012345

Emp_ID	Number
1	2536266657
1	7890123456
2	8901234567
3	2357274646
3	9012345678
4	0123456789
5	1234567890
5	4646474754
6	2345678901

Account_Number	Customer_ID	Account_Type	Balance	Account_Number	OverDraft_Amount	Per_Transaction_Charges	Account_Number	Daily_Withdrawal_Limit	Interest_Rate
2	2	Current	3000.00	2	5000.00	1.00	1	1000.00	2.50
4	4	Current	2000.00	4	3000.00	1.50	1	1000.00	2.50
6	6	Current	4000.00	6	7000.00	0.80	1	1000.00	2.50
8	4	Current	5000.00	8	4000.00	1.20	1	1000.00	2.50
10	5	Current	7000.00	10	6000.00	1.30	1	1000.00	2.50
12	6	Current	6000.00	12	3500.00	1.10	1	1000.00	2.50

ReviewNo	Rating	Comments	Customer_ID
1	5	Excellent service	1
2	4	Very good	2
3	3	Average experience	3
4	2	Below expectations	4
5	1	Poor service	5
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BranchName	City	Liabilities	Assets
Anarkali Branch	Lahore	500000.00	1000000.00
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Saddar Branch	Rawalpindi	700000.00	1500000.00
Zarghoon Branch	Quetta	100000.00	400000.00

Customer_ID	Emp_ID	Date
1	1	2023-01-15
2	2	2023-02-20
3	3	2023-03-25
4	4	2023-04-30
5	5	2023-05-10
6	6	2023-06-15

3rd Normal Form (3NF)

Account_Number	Customer_ID	Account_Type	Balance
1	1	Saving	5000.00
2	2	Current	3000.00
3	3	Saving	7000.00
4	4	Current	2000.00
5	5	Saving	10000.00
6	6	Current	4000.00
7	1	Saving	8000.00
8	4	Current	5000.00
9	2	Saving	9000.00
10	5	Current	7000.00
11	3	Saving	6000.00
12	6	Current	6000.00

Account_Number	OverDraft_Amount	Per_Transaction_Charges
2	5000.00	1.00
4	3000.00	1.50
6	7000.00	0.80
8	4000.00	1.20
10	6000.00	1.30
12	3500.00	1.10

Account_Number	Daily_Withdrawal_Limit	Interest_Rate
1	1000.00	2.50
3	2000.00	2.00
5	1500.00	2.70
7	1000.00	2.30
9	1800.00	2.60
11	1200.00	2.40

Loan_Number	Amount	BranchName	Customer_ID
101	50000.00	Anarkali Branch	1
102	75000.00	Clifton Branch	2
103	30000.00	Saddar Branch	3
104	45000.00	Latifabad Branch	4
105	60000.00	Zarghoon Branch	5
106	80000.00	Hayatabad Branch	6

Voucher_No	Payment_Amount	Payment_Date	Loan_Number
1	1000.00	2023-01-15	101
2	2000.00	2023-02-20	102
3	1500.00	2023-03-25	103
4	1200.00	2023-04-30	104
5	1800.00	2023-05-10	105
6	1600.00	2023-06-15	106

Customer_ID	Name	Date_Of_Birth	Age	State	Pincode	Street_Number	Street_Name	City
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6	Hamza Qureshi	2022-07-05	2

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1	1234567890
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2	6247435636
3	3456789012
4	4347325858
4	4567890123
5	5678901234
5	7453574756
6	6789012345

Emp_ID	Number
1	2536266657
1	7890123456
2	8901234567
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3	9012345678
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5	4646474754
6	2345678901

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Anarkali Branch	Lahore	500000.00	1000000.00
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Saddar Branch	Rawalpindi	700000.00	1500000.00
Zarghoon Branch	Quetta	100000.00	400000.00

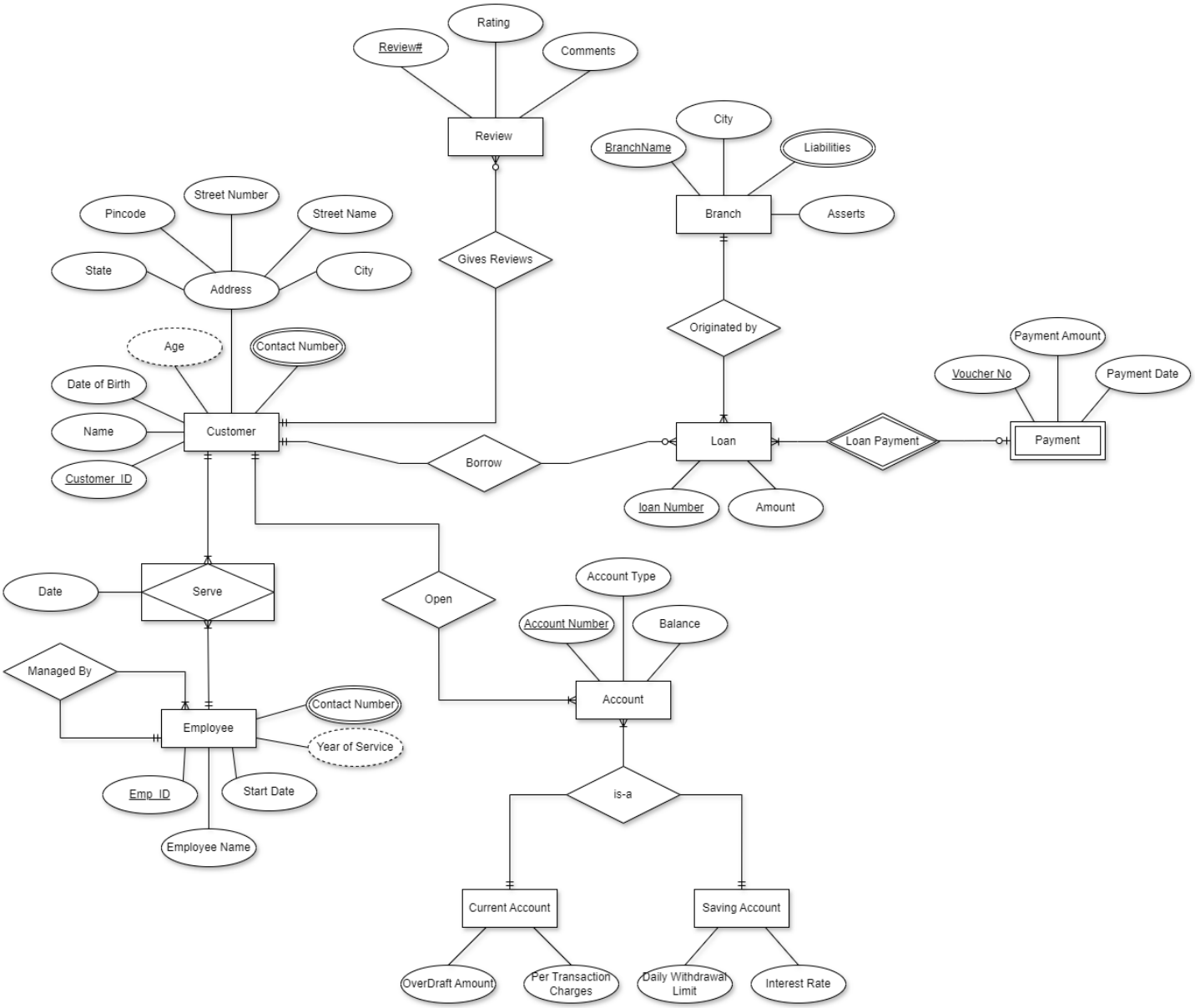
Customer_ID	Emp_ID	Date
1	1	2023-01-15
2	2	2023-02-20
3	3	2023-03-25
4	4	2023-04-30
5	5	2023-05-10
6	6	2023-06-15

2.5 Complete Enhanced Entity Relationship Diagram

Entity Relationship Diagram with complete relations with dependencies of your project.

To access Entity Relationship Diagram, please visit the provided link.

https://drive.google.com/file/d/1B8DG_mdrzI6dR5MSGp0qiNzRhudujKFC/view?usp=sharing

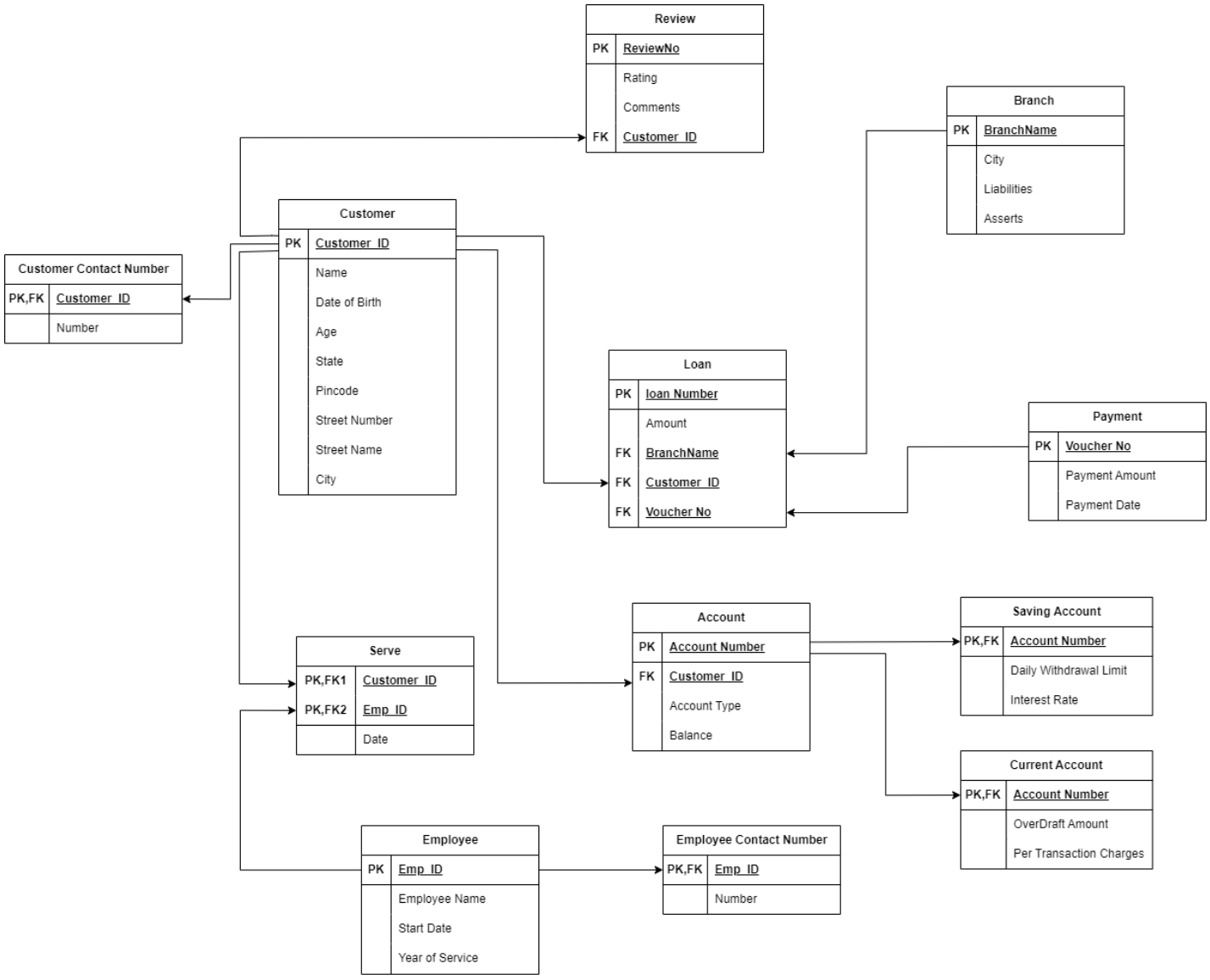


2.6 Complete Relational Model

Convert the ERD to Relational Model. Mentioned Primary Key, Super Key, Composite Key, alternative key, foreign key of each table if exist.

To access Relational Model, please visit the provided link.

https://drive.google.com/file/d/1B8DG_mdrzI6dR5MSGp0qiNzRhudujKFC/view?usp=sharing



2.7 Data Flow Diagram (DFD)

2.7.1 Level 0 DFD

2.7.2 Level 1 DFD

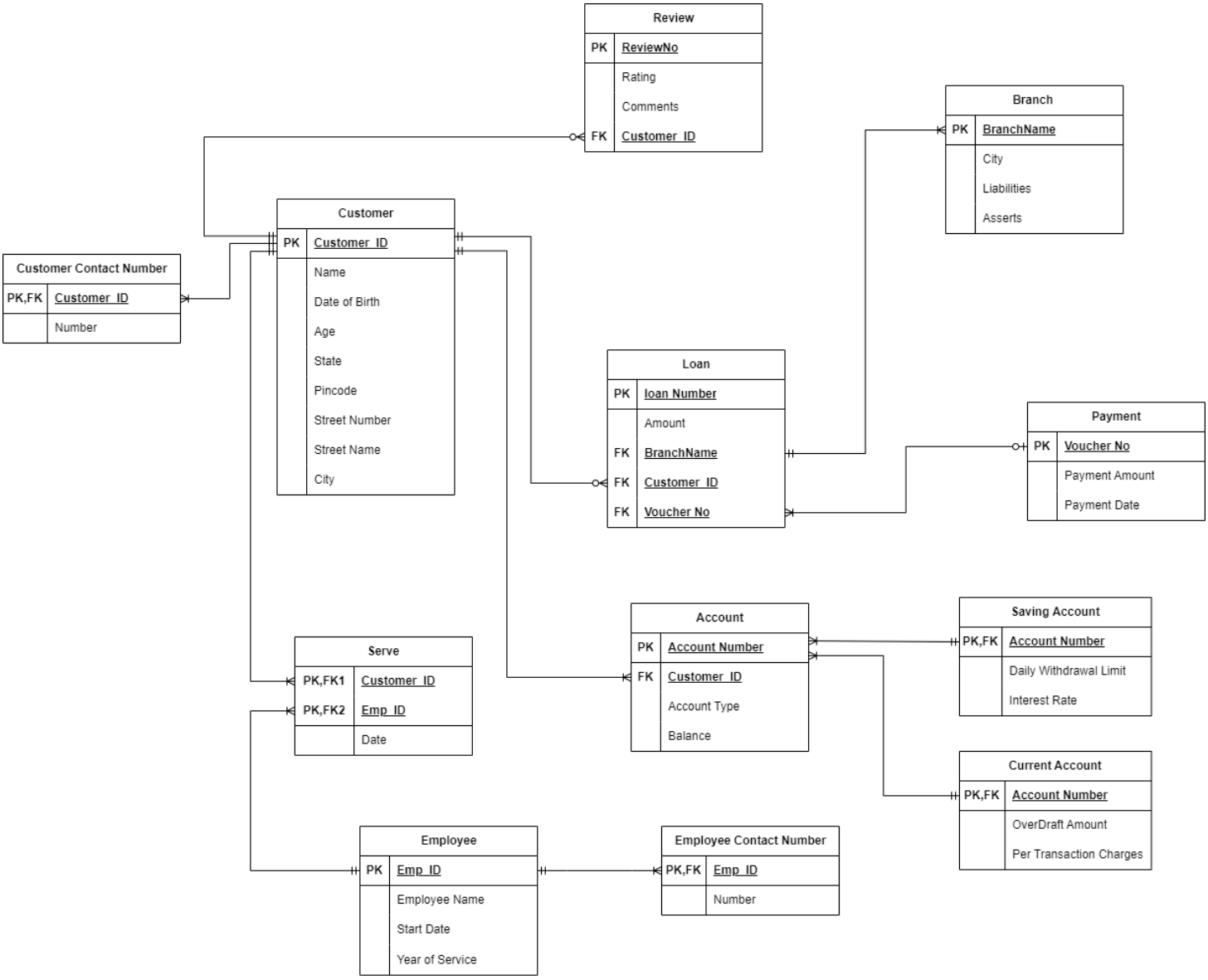
Chapter 3: Physical Database Design

3.1 Physical Data Model

Sample is given Below:

To access physical data model, please visit the provided link.

https://drive.google.com/file/d/1B8DG_mdrzI6dR5MSGp0qiNzRhudujKFC/view?usp=sharing



3.2 Physical Data Model Implementation (MySQL Workbench)

To access all the physical data model code for MySQL Workbench, please visit the provided link.

https://drive.google.com/file/d/11GBfj27dLcHFwLGJtYkntoc8Y3uCmUTf/view?usp=sharing

- **Create Query: Create all the tables**

```
-- customer table
create table customer (
    customer_id int primary key,
    name varchar(100),
    date_of_birth date,
    age int,
    state varchar(50),
    pincode varchar(10),
    street_number varchar(10),
    street_name varchar(100),
    city varchar(50)
);

-- customer_contact_number table
create table customer_contact_number (
    customer_id int,
    number varchar(15),
    primary key (customer_id, number),
    foreign key (customer_id) references customer(customer_id)
);

-- review table
create table review (
    reviewno int primary key,
    rating int,
    comments text,
    customer_id int,
    foreign key (customer_id) references customer(customer_id)
);
```

```sql
-- branch table
create table branch (
    branchname varchar(100) primary key,
    city varchar(50),
    liabilities decimal(15, 2),
    assets decimal(15, 2)
);

-- loan table
create table loan (
    loan_number int primary key,
    amount decimal(15, 2),
    branchname varchar(100),
    customer_id int,
    foreign key (branchname) references branch(branchname),
    foreign key (customer_id) references customer(customer_id)
);

-- payment table
create table payment (
    voucher_no int primary key,
    payment_amount decimal(15, 2),
    payment_date date,
    loan_number int,
    foreign key (loan_number) references loan(loan_number)
);

-- employee table
create table employee (
    emp_id int primary key,
    employee_name varchar(100),
    start_date date,
    year_of_service int
);

-- employee_contact_number table
create table employee_contact_number (
    emp_id int,
    number varchar(15),
```

```
    primary key (emp_id, number),
    foreign key (emp_id) references employee(emp_id)
);

-- account table
create table account (
    account_number int primary key,
    customer_id int,
    account_type varchar(50),
    balance decimal(15, 2),
    foreign key (customer_id) references customer(customer_id)
);

-- saving_account table
create table saving_account (
    account_number int primary key,
    daily_withdrawal_limit decimal(15, 2),
    interest_rate decimal(5, 2),
    foreign key (account_number) references account(account_number)
);

-- current_account table
create table current_account (
    account_number int primary key,
    overdraft_amount decimal(15, 2),
    per_transaction_charges decimal(5, 2),
    foreign key (account_number) references account(account_number)
);

-- serve table
create table serve (
    customer_id int,
    emp_id int,
    date date,
    primary key (customer_id, emp_id, date),
    foreign key (customer_id) references customer(customer_id),
    foreign key (emp_id) references employee(emp_id)
);
```

➢ **Insert Query: Insert atleast five records in each table**

```
-- insert into customer table
insert into customer (customer_id, name, date_of_birth, age, state,
pincode, street_number, street_name, city)
values
(1, 'ahmed khan', '1985-06-15', 39, 'punjab', '54000', '101', 'iqbal rd', 'lahore'),
(2, 'fatima bibi', '1990-09-20', 33, 'sindh', '75500', '202', 'jinnah ave', 'karachi'),
(3, 'ayesha malik', '1975-12-05', 48, 'punjab', '46000', '303', 'mall rd', 'rawalpindi'),
(4, 'ali raza', '1980-01-25', 44, 'sindh', '71000', '404', 'shahrah-e-faisal', 'hyderabad'),
(5, 'hassan ahmed', '1995-04-10', 29, 'balochistan', '87300', '505', 'sariab rd', 'quetta'),
(6, 'zara sheikh', '1988-07-30', 35, 'khyber pakhtunkhwa', '25000', '606', 'university rd',
'peshawar');

-- insert into customer_contact_number table
insert into customer_contact_number (customer_id, number)
values
(1, '1234567890'),
(2, '2345678901'),
(2, '6247435636'),
(3, '3456789012'),
(4, '4567890123'),
(4, '4347325858'),
(5, '5678901234'),
(5, '7453574756'),
(6, '6789012345');

-- insert into review table
insert into review (reviewno, rating, comments, customer_id)
values
(1, 5, 'excellent service', 1),
(2, 4, 'very good', 2),
(3, 3, 'average experience', 3),
(4, 2, 'below expectations', 4),
(5, 1, 'poor service', 5),
(6, 4, 'good overall', 6);

-- insert into branch table
insert into branch (branchname, city, liabilities, assets)
```

```sql
values
('anarkali branch', 'lahore', 500000.00, 1000000.00),
('clifton branch', 'karachi', 300000.00, 800000.00),
('saddar branch', 'rawalpindi', 700000.00, 1500000.00),
('latifabad branch', 'hyderabad', 200000.00, 600000.00),
('zarghoon branch', 'quetta', 100000.00, 400000.00),
('hayatabad branch', 'peshawar', 400000.00, 900000.00);

-- insert into loan table
insert into loan (loan_number, amount, branchname, customer_id)
values
(101, 50000.00, 'anarkali branch', 1),
(102, 75000.00, 'clifton branch', 2),
(103, 30000.00, 'saddar branch', 3),
(104, 45000.00, 'latifabad branch', 4),
(105, 60000.00, 'zarghoon branch', 5),
(106, 80000.00, 'hayatabad branch', 6);

-- insert into payment table
insert into payment (voucher_no, payment_amount, payment_date,
loan_number)
values
(1, 1000.00, '2023-01-15', 101),
(2, 2000.00, '2023-02-20', 102),
(3, 1500.00, '2023-03-25', 103),
(4, 1200.00, '2023-04-30', 104),
(5, 1800.00, '2023-05-10', 105),
(6, 1600.00, '2023-06-15', 106);

-- insert into employee table
insert into employee (emp_id, employee_name, start_date,
year_of_service)
values
(1, 'ayesha naeem', '2010-01-01', 14),
(2, 'bilal hassan', '2012-05-15', 12),
(3, 'fatima shah', '2015-08-20', 9),
(4, 'danish ali', '2018-11-10', 6),
(5, 'zainab farooq', '2020-03-25', 4),
(6, 'hamza qureshi', '2022-07-05', 2);
```

```sql
-- insert into employee_contact_number table
insert into employee_contact_number (emp_id, number)
values
(1, '7890123456'),
(1, '2536266657'),
(2, '8901234567'),
(3, '9012345678'),
(3, '2357274646'),
(4, '0123456789'),
(5, '1234567890'),
(5, '4646474754'),
(6, '2345678901');

-- insert into account table
insert into account (account_number, customer_id, account_type, balance)
values
(1, 1, 'saving', 5000.00),
(2, 2, 'current', 3000.00),
(3, 3, 'saving', 7000.00),
(4, 4, 'current', 2000.00),
(5, 5, 'saving', 10000.00),
(6, 6, 'current', 4000.00),
(7, 1, 'saving', 8000.00),
(9, 2, 'saving', 9000.00),
(11, 3, 'saving', 6000.00),
(8, 4, 'current', 5000.00),
(10, 5, 'current', 7000.00),
(12, 6, 'current', 6000.00);

-- insert into saving_account table
insert into saving_account (account_number, daily_withdrawal_limit,
interest_rate)
values
(1, 1000.00, 2.5),
(3, 2000.00, 2.0),
(5, 1500.00, 2.7),
(7, 1000.00, 2.3),
(9, 1800.00, 2.6),
```

```
(11, 1200.00, 2.4);

-- insert into current_account table
insert into current_account (account_number, overdraft_amount,
per_transaction_charges)
values
(2, 5000.00, 1.0),
(4, 3000.00, 1.5),
(6, 7000.00, 0.8),
(8, 4000.00, 1.2),
(10, 6000.00, 1.3),
(12, 3500.00, 1.1);

-- insert into serve table
insert into serve (customer_id, emp_id, date)
values
(1, 1, '2023-01-15'),
(2, 2, '2023-02-20'),
(3, 3, '2023-03-25'),
(4, 4, '2023-04-30'),
(5, 5, '2023-05-10'),
(6, 6, '2023-06-15');
```

- **Alter Query: alter a few things in your project tables**

```
-- add a new column for email
alter table customer add email varchar(100);

-- change the datatype of amount
alter table loan modify amount decimal(20, 2);

-- Drop a column in customer table
alter table customer drop column email;

-- Rename a column in the customer table
alter table customer change column street_number street_no varchar(10);

-- Rename the customer table
alter table customer rename to clients;
```

```
alter table clients rename to customer;
```

- **Select Query: Retrieve data from single table or multiple tables**

```
-- all columns from customer table
select * from clients;

-- where clause
select * from clients where city = 'lahore';

select C.Customer_ID, N.Number, C.Name, C.Date_Of_Birth
 from Customer_Contact_Number N natural join customer C;

select E.Emp_ID, N.Number, E.Employee_Name, E.Start_Date
 from employee_Contact_Number N natural join employee E;

select * from loan natural join payment;

select A.Account_Number, C.per_transaction_charges, S.interest_rate
 from account A inner join Current_Account C inner join saving_account S
 on A.Account_Number = C.Account_Number = S.Account_Number;

-- specific columns from customer table
select name, date_of_birth, city from clients;

-- data from multiple tables using join
select c.name, r.rating, r.comments
 from clients c inner join review r
 on c.customer_id = r.customer_id;
```

- **Must write atleast one query of each clause and each topic discussed in class (i.e. orderby, having, like, limit etc…)**

```
-- like clause
select * from clients where name like 'a%';

-- order by to sort results
select * from clients order by age desc;

-- limit clause
select * from clients limit 5;
```

```sql
-- Select customers with ages between 25 and 35
select * from clients where age between 25 and 35;

-- Select customers who live in specific cities
select * from clients where city in ('lahore', 'karachi', 'peshawar');

-- Select customers who live in Los Angeles and are older than 30
select * from clients where city = 'lahore' and age > 30;

-- Select customers who live in Los Angeles or are older than 30
select * from clients where city = 'lahore' or age > 30;

-- Select distinct cities from the clients table
select distinct city from clients;

-- Select the maximum balance from the account table
select max(balance) from account;

-- total balance across all accounts
select sum(balance) from account;
```

- **Apply Referential Integrity Constraint**

```sql
alter table loan
 add constraint fk_voucher foreign key (voucher_no)
  references payment(voucher_no);

alter table saving_account
 add constraint fk_account_saving foreign key (account_number)
  references account(account_number);

alter table current_account
 add constraint fk_account_current foreign key (account_number)
  references account(account_number);
```

- **Apply Joins between tables (ALL TYPES)**

```sql
-- Inner join
select c.name, a.account_type, a.balance
 from clients c
  inner join account a on c.customer_id = a.customer_id;

-- Left join
select c.name, a.account_type, a.balance
```

```
 from clients c
  left join account a on c.customer_id = a.customer_id;

-- Right join
select c.name, a.account_type, a.balance
 from clients c
  right join account a on c.customer_id = a.customer_id;

-- Full outer join (note: full outer join is not directly supported in
mysql, use union)
select c.name, a.account_type, a.balance
 from clients c
  left join account a on c.customer_id = a.customer_id
union
select c.name, a.account_type, a.balance
 from clients c
  right join account a on c.customer_id = a.customer_id;
```

- **Apply Views, Index, stored procedures, triggers**