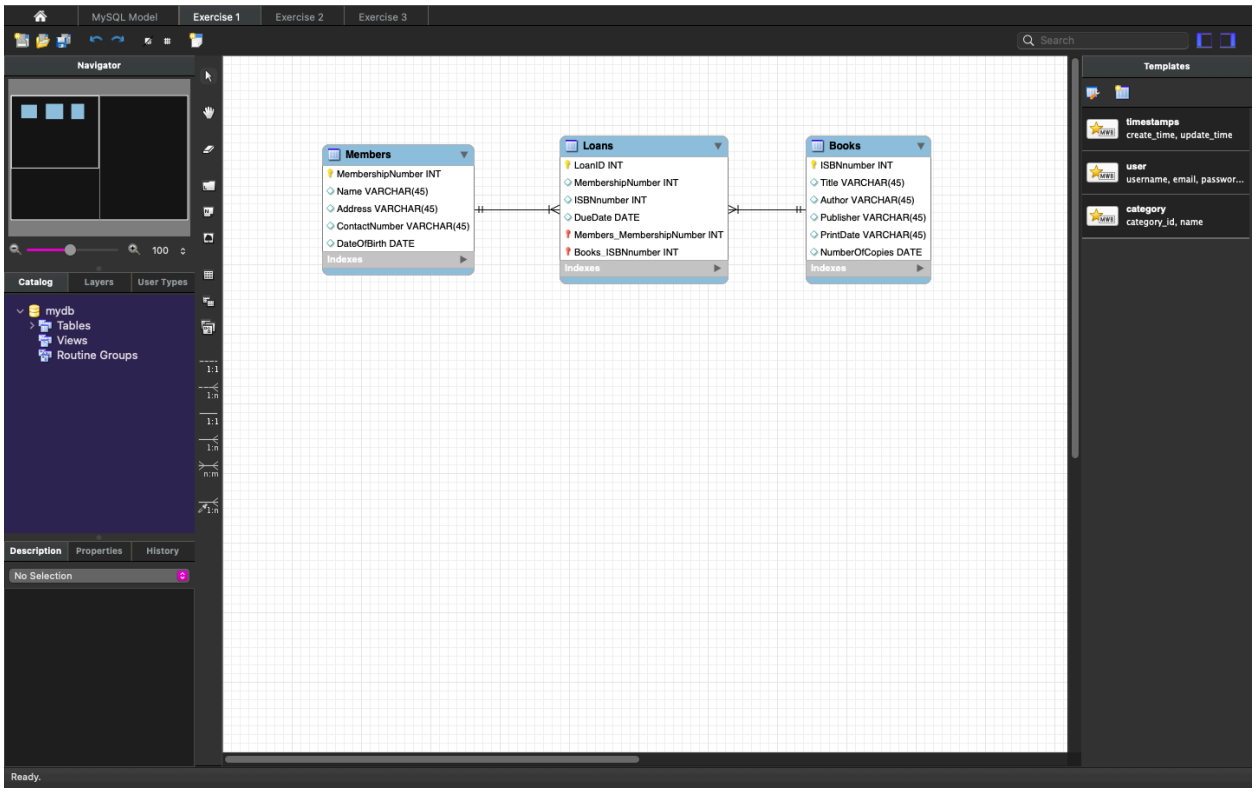
Database Lab 4

Exercise 1



Tables

Members Table

Column Name	Data Type	Constraints
membership_number	INT	PRIMARY KEY
name	VARCHAR(255)	NOT NULL
address	VARCHAR(255)	NOT NULL
contact_number	VARCHAR(20)	NOT NULL
date_of_birth	DATE	NOT NULL

Books Table

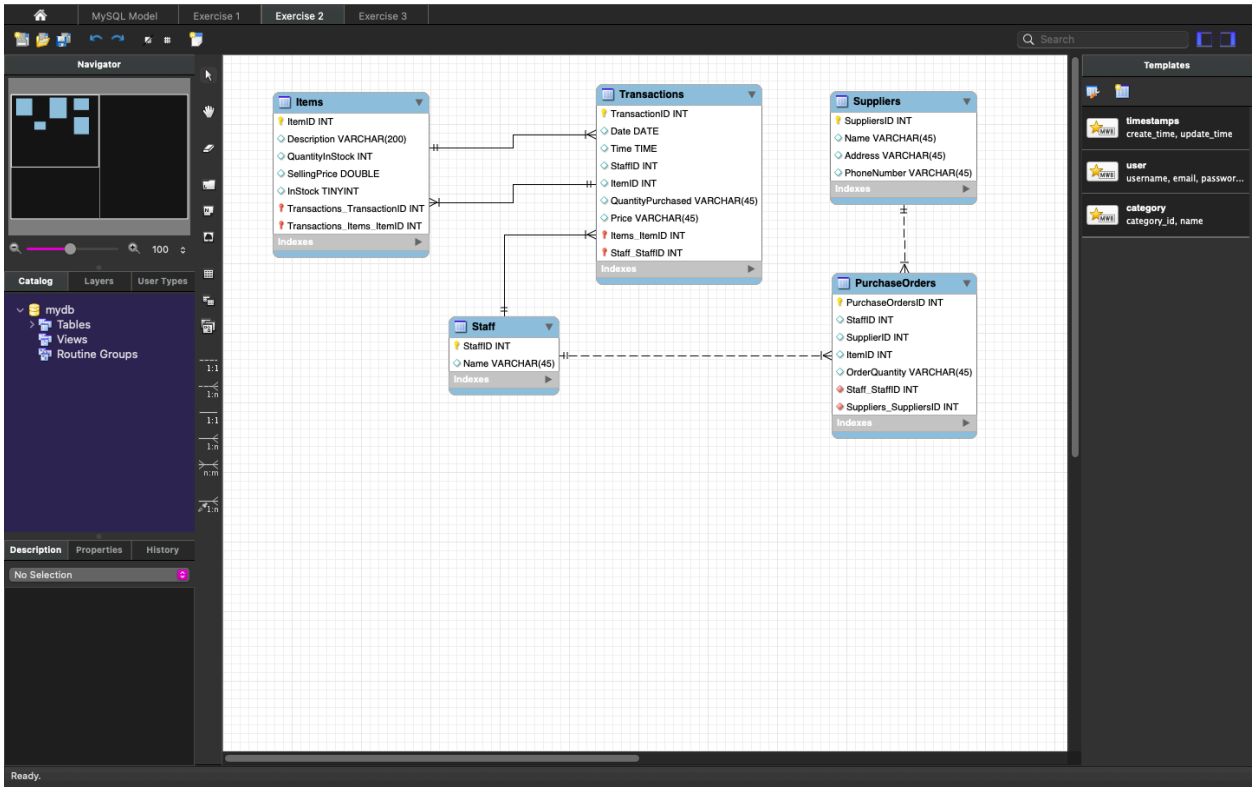
Column Name	Data Type	Constraints
ISBN	VARCHAR(13)	PRIMARY KEY
title	VARCHAR(255)	NOT NULL
author	VARCHAR(255)	NOT NULL
publisher	VARCHAR(255)	NOT NULL
print_date	DATE	NOT NULL
number_of_copies	INT	NOT NULL

Loans Table

Column Name	Data Type	Constraints
loan_ID	INT	PRIMARY KEY
membership_number	INT	FOREIGN KEY (references Members)
ISBN	VARCHAR(13)	FOREIGN KEY (references Books)
due_date	DATE	NOT NULL

Members Table: There are no transitive dependencies, as all non-primary key attributes (name, address, contact_number, date_of_birth) depend directly on the primary key (membership_number).
Books Table: There are no transitive dependencies, as all non-primary key attributes (title, author, publisher, print_date, number_of_copies) depend directly on the primary key (ISBN).
Loans Table: No transitive dependencies, since the only non-primary attribute is due_date, which depends directly on the composite key.

Exercise 2


MySQL Model
Exercise 1
Exercise 2
Exercise 3
Navigator
Catalog
Layers
User Types
mydb
Tables
Views
Routine Groups
Description
Properties
History
No Selection
Items
ItemID INT
Description VARCHAR(200)
QuantityInStock INT
SellingPrice DOUBLE
InStock TINYINT
Transactions_TransactionID INT
Transactions_Items_ItemID INT
Indexes
Transactions
TransactionID INT
Date DATE
Time TIME
StaffID INT
ItemID INT
QuantityPurchased VARCHAR(45)
Price VARCHAR(45)
Items_ItemID INT
Staff_StaffID INT
Indexes
Suppliers
SuppliersID INT
Name VARCHAR(45)
Address VARCHAR(45)
PhoneNumber VARCHAR(45)
Indexes
Staff
StaffID INT
Name VARCHAR(45)
Indexes
PurchaseOrders
PurchaseOrdersID INT
StaffID INT
SupplierID INT
ItemID INT
OrderQuantity VARCHAR(45)
Staff_StaffID INT
Suppliers_SuppliersID INT
Indexes
Templates
timestamps
create_time, update_time
user
username, email, passwor...
category
category_id, name
Ready.

Tables

Items Table

Column Name	Data Type	Constraints
item_ID	INT	PRIMARY KEY
description	VARCHAR(255)	NOT NULL
quantity_in_stock	INT	NOT NULL
selling_price	DECIMAL(10,2)	NOT NULL

Transactions Table

Column Name	Data Type	Constraints
transaction_ID	INT	PRIMARY KEY
date	DATE	NOT NULL
time	TIME	NOT NULL
staff_ID	INT	FOREIGN KEY (references Staff)
item_ID	INT	FOREIGN KEY (references Items)
quantity_purchased	INT	NOT NULL
price	DECIMAL(10,2)	NOT NULL

Staff Table

Column Name	Data Type	Constraints
staff_ID	INT	PRIMARY KEY
name	VARCHAR(255)	NOT NULL

Suppliers Table

Column Name	Data Type	Constraints
supplier_ID	INT	PRIMARY KEY
name	VARCHAR(255)	NOT NULL
address	VARCHAR(255)	NOT NULL
phone_number	VARCHAR(20)	NOT NULL

Purchase Orders Table

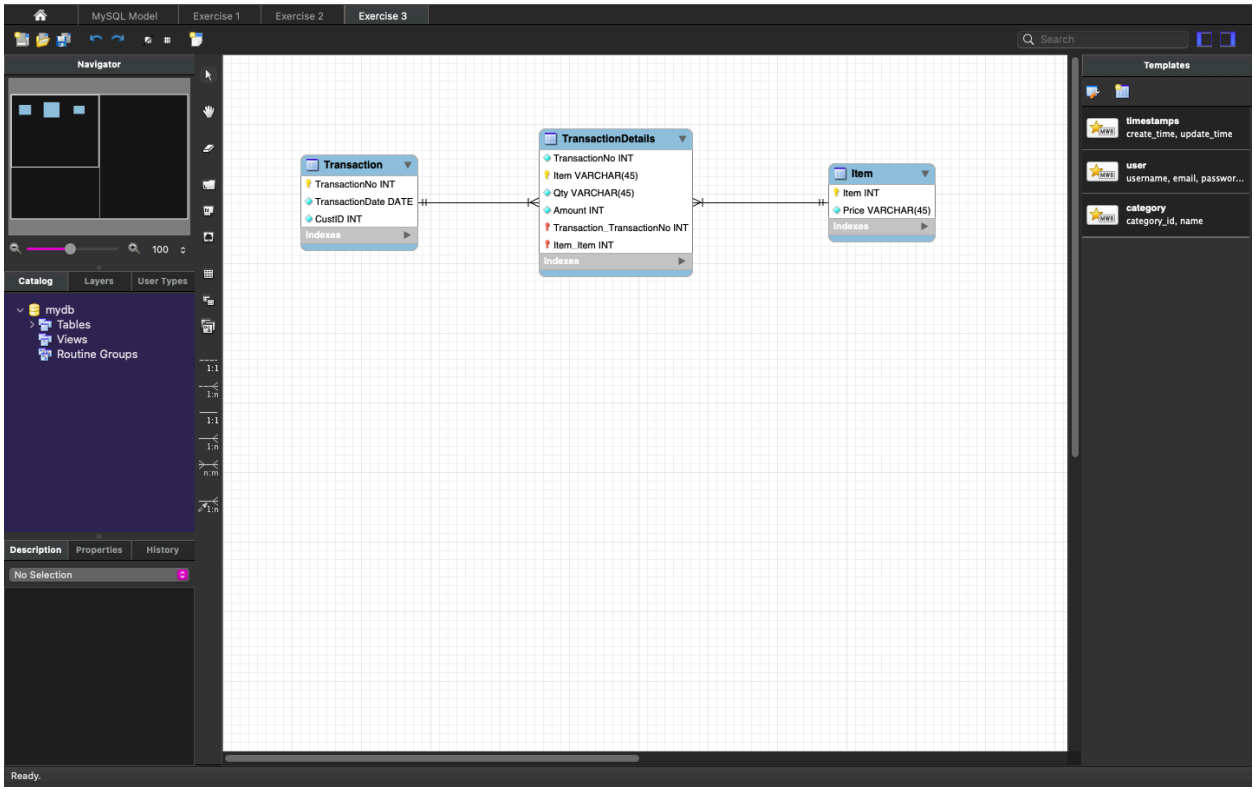
Column Name	Data Type	Constraints
purchase_order_ID	INT	PRIMARY KEY
staff_ID	INT	FOREIGN KEY (references Staff)
supplier_ID	INT	FOREIGN KEY (references Suppliers)
item_ID	INT	FOREIGN KEY (references Items)
order_quantity	INT	NOT NULL

Items: No transitive dependencies exist. Each attribute is directly dependent on the primary key (item_ID).
Transactions: All attributes are dependent only on the transaction_ID. There are no attributes depending on other non-key attributes.
Staff: No transitive dependencies here.
Suppliers: No transitive dependencies.
Purchase Orders: All attributes (staff_ID, supplier_ID, item_ID, order_quantity) depend directly on the purchase_order_ID. No transitive dependencies exist.

Exercise 3

Table 1Non-normalised relation

TransactionNo	Transaction Date	CustID	Item	Qty	Amount
T10	01/10/2014	4	Paint	2	60
T10	01/10/2014	4	Paint Brushes	4	30
T30	02/10/2014	9	Sealer	1	25



Normalize

Convert to 1NF (First Normal Form)

1NF Definition: A table is in 1NF if it contains only atomic values (i.e., no repeating groups or arrays) and each entry contains a single value.

Tables in 1NF:

In the given table, all the values are atomic (no repeating groups or multi-valued attributes). Therefore, the table is already in 1NF.

Convert to 2NF (Second Normal Form)

Tables:

Transaction Table (2NF)

TransactionNo	Transaction Date	CustID
T10	01/10/2014	4
T30	02/10/2014	9

TransactionDetails Table (2NF)

TransactionNo	Item	Qty	Amount
T10	Paint	2	60
T10	Paint Brushes	4	30
T30	Sealer	1	25

2NF Definition:

1. It is already in 1NF.
2. All non-key attributes depend on the whole primary key, not just a part of it.

Identifying the Primary Key:

- Here, the **TransactionNo** alone is not unique, as it repeats for different items in the same transaction.
- A composite primary key is required: **(TransactionNo, Item)** can uniquely identify each row.

Partial Dependency Issue:

- **CustID** and **TransactionDate** depend only on **TransactionNo**, not on the entire composite key.

- These attributes violate 2NF because they depend only on part of the primary key.

Solution:

- Split the table into two:
    1. **Transaction Table**: This will store transaction-level information.
    2. **Transaction Details Table**: This will store item-specific information for each transaction.

Tables in 2NF:

1. **Transaction Table**:
    - **TransactionNo** (Primary Key)
    - **TransactionDate**
    - **CustID**
2. **Transaction Details Table**:
    - **TransactionNo** (Foreign Key)
    - **Item** (Composite Primary Key)
    - **Qty**
    - **Amount**

Convert to 3NF (Third Normal Form)

Tables:

Transaction Table

TransactionNo	Transaction Date	CustID
T10	01/10/2014	4
T30	02/10/2014	9

TransactionDetails Table

TransactionNo	Item	Qty
T10	Paint	2
T10	Paint Brushes	4
T30	Sealer	1

Item Table

Item	Price
Paint	30
Paint Brushes	7.5
Sealer	25

3NF Definition:

1. It is already in 2NF.
2. There are no transitive dependencies (i.e., non-key attributes do not depend on other non-key attributes).

Transitive Dependency Issue:

- **Amount** depends on **Qty** and the price of the item, meaning that the **Item** has an implicit price that is not stored in the table.
- This creates a transitive dependency.

Solution:

- Create an **Item Table** to store the price of each item separately.

Tables in 3NF:

1. **Transaction Table**:
    - **TransactionNo** (Primary Key)
    - **TransactionDate**
    - **CustID**
2. **Transaction Details Table**:
    - **TransactionNo** (Foreign Key)
    - **Item** (Composite Primary Key)
    - **Qty**
3. **Item Table**:
    - **Item** (Primary Key)
    - **Price**