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Course Section Number: CSCI-GA.2433-001

Final Report

Total in points (100 points total): _____

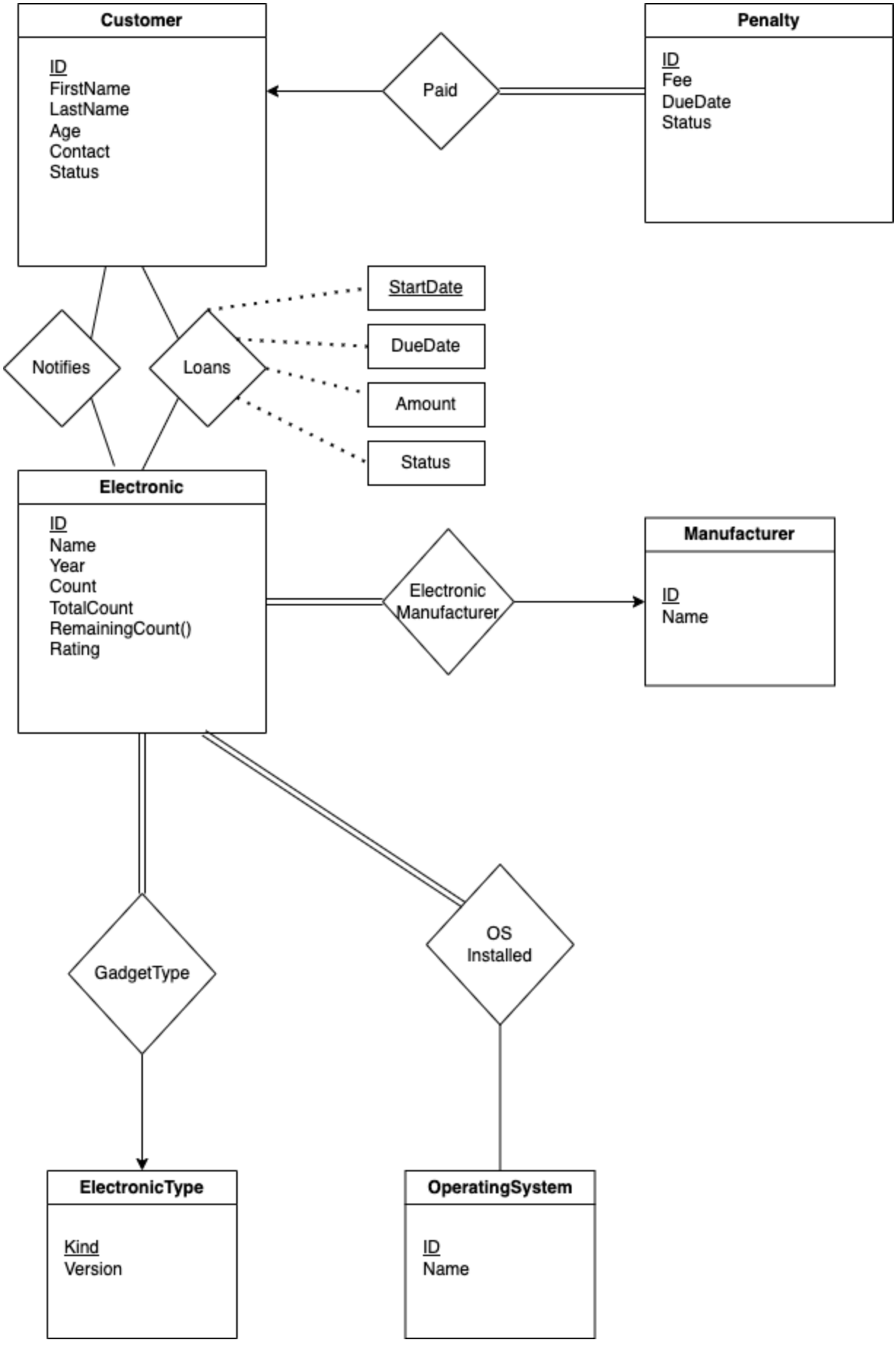
Professor's Comments:

Business Requirements

I chose a simpler business instead of an Insurance example as I am not well aware of terms mentioned involving Insurance. I chose a simple Electronics rental business as a case study for the project.

A **Customer** is any individual that has an account stored in the business's database system. Each **Customer** has a unique ID, First Name, Last Name, Age (indicates account age not customer age, i.e., active since), Contact and Status (Good and Bad) which indicates the trust level of the Customer based on their previous transactions with the rental company. Customers can loan Electronics with software (**OS**) (for this project, let's consider only Laptop, Phone and Consoles for rental) and each has **Name** (Ex: MacBook Air M1), **Manufacturer** (Ex: Apple, Dell etc), **Year** in which the item was released, **Count** number of such items, **Cost** to rent the equipment for a month, **Rating**. An Electronic device can have multiple OS (dual boot etc).

The loaner laptops data is stored as **Loan**, which has start and due date of loan, deposit amount, status whether the laptop is returned within due date otherwise the Customer will be Penalized (Penalty). If Customer doesn't return an item within the due date Customer's status will be updated to Bad until the Penalty fee is paid. If a particular laptop is unavailable, the Customers can request to be notified (Notify) once the item is available.


Customer
ID
FirstName
LastName
Age
Contact
Status
Paid
Penalty
ID
Fee
DueDate
Status
StartDate
DueDate
Amount
Status
Notifies
Loans
Electronic
ID
Name
Year
Count
TotalCount
RemainingCount()
Rating
Electronic Manufacturer
Manufacturer
ID
Name
GadgetType
OS Installed
ElectronicType
Kind
Version
OperatingSystem
ID
Name

Entity Sets

- Entity Set **Customer** has a primary key as unique ID with attributes FirstName, LastName, Age (account active since), Contact and Status
- Entity Set **Electronic** has a primary key as a unique ID (Ex: Hardware ID) with attributes Name, release Year, TotalCount, Cost per day, Rating. RemainingCount() is a derived attribute.
- Entity Set **Manufacturer** indicates the manufacturer of the corresponding Electronic gadget. It has a primary key as a unique identifier ID with attributes Name.
- Entity set **ElectronicType** indicates the type(Laptop, Phone or console) of the gadget, it has a single attribute which is primary key Kind (Laptop, Phone or Console).
- Entity set **OperatingSystem** indicates the OS installed on the electronic device and it has primary key as unique identifier ID and other attribute Name.
- If the Customer does not return the loaned device by due date he will be penalized. This is saved in entity set **Penalty** with primary key as unique ID with attributes Fee, DueDate and Status.

Relations

- Relation Loans: When a Customer **Loans** an Electronic device. This is a many-to-many relation. Relationship attribute: StartDate with other attributes DueDate, Amount and Status.
- Relation Notifies: When a Customer opts to be notified if a certain Electronic device is in stock again to be loaned. This is a many-to-many relation.
- Relation Paid: When Customer finishes paying their fee due to a penalty. Each Penalty is linked to exactly one Customer and a Customer can have multiple penalties. Therefore this is a one-to-many relationship.
- Relation OSInstalled: An Electronic device should have at least one OS installed. There is no restriction on whether if every OS should have an electronic device in the catalog.
- Relation ElectronicManufacturer: Similar to OSInstalled, an electronic device should have at least one manufacturer but every manufacturer need not have a device in the catalog. Therefore this is a many-to-one relationship.
- Finally, relation GadgetType indicates the binary relation between device and the type of device.

Logical Schema for ER model

Entities and Relations

- Customer (ID, FirstName, LastName, Age, Contact, Status)
- Penalty(ID, CustomerID, Fee, DueDate, Status) with foreign key CustomerID referring Customer(ID). Penalty data for corresponding deleted Customer can be removed. Cascade on delete.
- Electronic(ID, Name, Year, TotaCount, Rating, ManufacturerID, Kind) with foreign key ManufacturerID, Kind referencing to Manufacturer(ID) and ElectronicType(Kind)
- OperatingSystem(ID, Name)
- ElectronicType(Kind, Version)
- Manufacturer(ID, Name)
- Loans(CustomerID, ElectronicID, StartDate, DueDate, Amount, Status) with foreign keys (CustomerID, ElectronicID) referring to Customer(ID), Electronic(ID). Relation value can be deleted once the Customer/Electronic item is deleted. Cascade on Delete.
- Notifies(CustomerID, ElectronicID) foreign key CustomerID, ElectronicID referring to Customer(ID) and Electronic(ID)
- OSInstalled(ElectronicID, OperatingSystemID) foreign key ElectronicID, OperatingSystemID referring to Electronic(ID) and OperatingSystem(ID)

Implementation

Made a few name changes like ID to CustomerID, Status to Customer Status in order to avoid using SQL default terms.

Code available at: https://github.com/krishnakarthiknyu/databasecourseproject

Tools used:

- Local MySQL server on Ubuntu
- Azure Data Studio as IDE for writing SQL scripts. It helped in running sql commands and queries similar to python scripts in Jupyternotebook.
- Python to convert the dataset into desired format (need numpy and pandas)
- Azure Database for MySQL flexible server

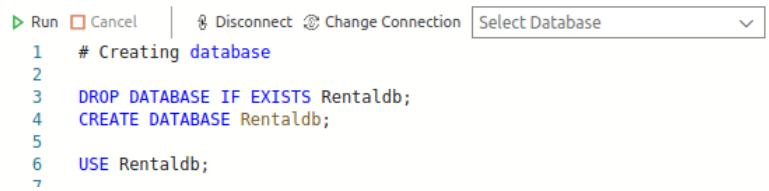
Data processing and cleaning up:

- For now, I am considering only Laptops as part of the project
- Dataset used: https://www.kaggle.com/code/danielbethell/laptop-prices-prediction/data
- It has various laptop information and price details. I've used python to clean up the data and only have the required information.
- The cleaned up data is formatted into desired format and saved as manufacturers.csv, electronics.csv, osinstalled.csv
- The above mentioned python code can be viewed here: code

Database definitions and creation of tables

SQL script: DefinitionsAndInitiation.sql

Database with the name *'Rentaldb'* is created.




```sql
# Creating database

DROP DATABASE IF EXISTS Rentaldb;
CREATE DATABASE Rentaldb;

USE Rentaldb;
```

Tables are created for each of the Entities mentioned in previous parts

Customer

```sql
CREATE TABLE Customer (
    CustomerID          INTEGER NOT NULL UNIQUE AUTO_INCREMENT,
    FirstName           VARCHAR(255) NOT NULL,
    LastName            VARCHAR(255) NOT NULL,
    Contact             VARCHAR(255) NOT NULL,
    CustomerStatus      ENUM('GOOD', 'BAD') NOT NULL,

    PRIMARY KEY(CustomerID)
);
```

Penalty

```sql
CREATE TABLE Penalty (
    PenaltyID           INTEGER NOT NULL UNIQUE AUTO_INCREMENT,
    Fee                 DECIMAL(8, 2) NOT NULL,
    CustomerID          INTEGER NOT NULL,
    DueDate             DATE NOT NULL,
    PenaltyStatus       ENUM('PENDING', 'DONE') NOT NULL,

    PRIMARY KEY(PenaltyID),
    FOREIGN KEY(CustomerID) REFERENCES Customer(CustomerID) ON DELETE CASCADE
);
```

Manufacturer

```sql
CREATE TABLE Manufacturer (
    ManufacturerID      INTEGER NOT NULL UNIQUE AUTO_INCREMENT,
    ManufacturerName    VARCHAR(255) NOT NULL,

    PRIMARY KEY(ManufacturerID)
);
```

ElectronicType

```sql
CREATE TABLE ElectronicType (
    TypeID              INTEGER NOT NULL UNIQUE AUTO_INCREMENT,
    Kind                ENUM('LAPTOP', 'PHONE', 'CONSOLE') NOT NULL,

    PRIMARY KEY(TypeID)
);
```

Electronic and Operating System

```
CREATE TABLE Electronic (
    ElectronicID        INTEGER NOT NULL UNIQUE AUTO_INCREMENT,
    ElectronicName      VARCHAR(255) NOT NULL,
    ReleaseYear         YEAR,
    Count               INTEGER,
    TotalCount          INTEGER NOT NULL,
    Rating              ENUM('GOOD', 'AVERAGE', 'BAD') NOT NULL,
    ManufacturerID      INTEGER,
    TypeID              INTEGER,

    PRIMARY KEY(ElectronicID),
    FOREIGN KEY(ManufacturerID) REFERENCES Manufacturer(ManufacturerID) ON DELETE CASCADE,
    FOREIGN KEY(TypeID) REFERENCES ElectronicType(TypeID) ON DELETE CASCADE
);

CREATE TABLE OperatingSystem (
    OperatingSystemID       INTEGER NOT NULL UNIQUE AUTO_INCREMENT,
    OSName                  ENUM('WINDOWS', 'LINUX', 'IOS', 'NO OS') NOT NULL,

    PRIMARY KEY(OperatingSystemID)
);
```

Tables are created for relations: *Loans, Notifies, OSInstalled*

```
CREATE TABLE Loans (
    CustomerID          INTEGER NOT NULL,
    ElectronicID        INTEGER NOT NULL,
    StartDate           DATE NOT NULL,
    DueDate             DATE NOT NULL,
    Amount              DECIMAL(8, 2) NOT NULL,
    LoanStatus          ENUM('PENDING', 'DONE', 'FINED') NOT NULL,

    PRIMARY KEY(CustomerID, ElectronicID, StartDate),
    FOREIGN KEY(CustomerID) REFERENCES Customer(CustomerID) ON DELETE CASCADE,
    FOREIGN KEY(ElectronicID) REFERENCES Electronic(ElectronicID) ON DELETE CASCADE
);

CREATE TABLE Notifies (
    CustomerID          INTEGER NOT NULL,
    ElectronicID        INTEGER NOT NULL,

    PRIMARY KEY(CustomerID, ElectronicID),
    FOREIGN KEY(CustomerID) REFERENCES Customer(CustomerID) ON DELETE CASCADE,
    FOREIGN KEY(ElectronicID) REFERENCES Electronic(ElectronicID) ON DELETE CASCADE
);

CREATE TABLE OSInstalled (
    ElectronicID            INTEGER NOT NULL,
    OperatingSystemID       INTEGER NOT NULL,

    PRIMARY KEY(ElectronicID, OperatingSystemID),
    FOREIGN KEY(ElectronicID) REFERENCES Electronic(ElectronicID) ON DELETE CASCADE,
    FOREIGN KEY(OperatingSystemID) REFERENCES OperatingSystem(OperatingSystemID) ON DELETE CASCADE
);
```

Couple of views are created for better viewing of the data: *ElectronicOSView and TotalPenaltyView*

```
CREATE VIEW ElectronicOSView AS
    SELECT E.ElectronicID, E.ElectronicName, GROUP_CONCAT(O.OSName) AS OperatingSystem
    FROM Electronic E
        NATURAL JOIN OSInstalled I
        NATURAL JOIN OperatingSystem O
    GROUP BY E.ElectronicID;

CREATE VIEW TotalPenaltyView AS
    SELECT C.CustomerID, CONCAT(C.FirstName, ' ', C.LastName) AS CustomerName, SUM(P.Fee) AS Total
    FROM Customer C
        NATURAL JOIN Penalty P
    WHERE P.PenaltyStatus = 'PENDING'
    GROUP BY C.CustomerID;
```

Inserting some test data into the database

SQL Script: InsertData.sql
Here I inserted few rows of data into *Customer, ElectronicType, OperatingSystem* tables

```sql
# insert data into db
# Customer and other data -> manually insert few into db
INSERT Customer (CustomerID, FirstName, LastName, Contact, CustomerStatus) VALUES
(1, 'Kaladin', 'Stormblessed', '3471234567', 'GOOD'),
(2, 'Dalinar', 'Kholin', '3471234568', 'GOOD'),
(3, 'Odium', 'Shard', '3470000000', 'BAD');

INSERT ElectronicType (TypeID, Kind) VALUES
(1, 'LAPTOP'),
(2, 'PHONE'),
(3, 'CONSOLE');

INSERT OperatingSystem (OperatingSystemID, OSName) VALUES
(1, 'WINDOWS'),
(2, 'LINUX'),
(3, 'IOS'),
(4, 'NO OS');
```

SQL

Querying the data to check

```sql
SELECT * FROM Customer LIMIT 10;
SELECT * FROM ElectronicType LIMIT 10;
SELECT * FROM OperatingSystem LIMIT 10;
```

SQL

(3 row(s) affected)

(3 row(s) affected)

(4 row(s) affected)

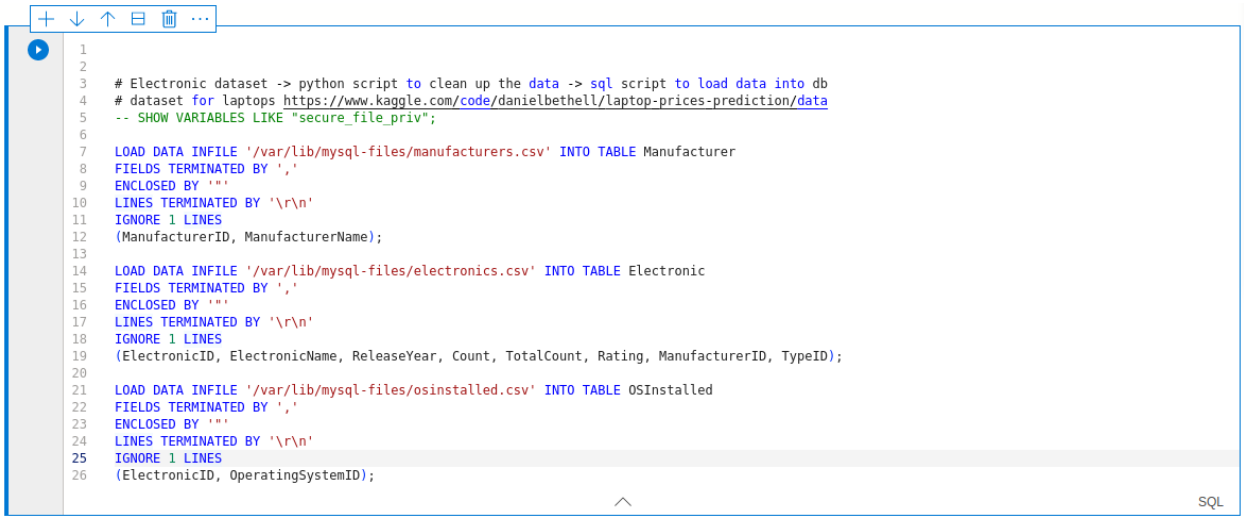
Total execution time: 00:00:00.013

	CustomerID	FirstName	LastName	Contact	CustomerStatus
1	1	Kaladin	Stormblessed	3471234567	GOOD
2	2	Dalinar	Kholin	3471234568	GOOD
3	3	Odium	Shard	3470000000	BAD

	TypeID	Kind
1	1	LAPTOP
2	2	PHONE
3	3	CONSOLE

	OperatingSystemID	OSName
1	1	WINDOWS
2	2	LINUX
3	3	IOS
4	4	NO OS

In order to upload the data from ‘manufacturers.csv’, ‘electronics.csv’ and ‘osinstalled.csv’ i used LOAD INTO command in SQL but it gave few issues as SQL only allow files inside sequre_file_priv directory which for my case is: ‘/var/lib/mysql-files/manufacturers.csv’



```sql

# Electronic dataset -> python script to clean up the data -> sql script to load data into db
# dataset for laptops https://www.kaggle.com/code/danielbethell/laptop-prices-prediction/data
-- SHOW VARIABLES LIKE "secure_file_priv";

LOAD DATA INFILE '/var/lib/mysql-files/manufacturers.csv' INTO TABLE Manufacturer
FIELDS TERMINATED BY ','
ENCLOSED BY '"'
LINES TERMINATED BY '\r\n'
IGNORE 1 LINES
(ManufacturerID, ManufacturerName);

LOAD DATA INFILE '/var/lib/mysql-files/electronics.csv' INTO TABLE Electronic
FIELDS TERMINATED BY ','
ENCLOSED BY '"'
LINES TERMINATED BY '\r\n'
IGNORE 1 LINES
(ElectronicID, ElectronicName, ReleaseYear, Count, TotalCount, Rating, ManufacturerID, TypeID);

LOAD DATA INFILE '/var/lib/mysql-files/osinstalled.csv' INTO TABLE OSInstalled
FIELDS TERMINATED BY ','
ENCLOSED BY '"'
LINES TERMINATED BY '\r\n'
IGNORE 1 LINES
(ElectronicID, OperatingSystemID);
```

SQL

Queried the data to verify.

```
1  SELECT * FROM Manufacturer LIMIT 10;
2  SELECT * FROM Electronic LIMIT 10;
3  SELECT * FROM OSInstalled LIMIT 10;
```

SQL

(10 row(s) affected)

(10 row(s) affected)

(10 row(s) affected)

Total execution time: 00:00:00.022

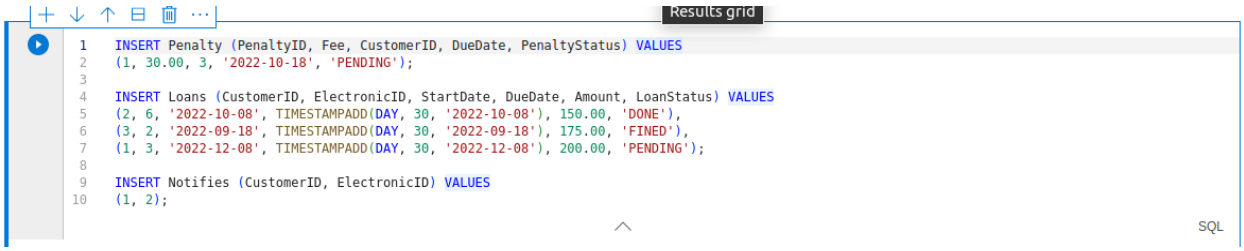
	ManufacturerID	ManufacturerName
1	1	Apple
2	2	HP
3	3	Acer
4	4	Asus
5	5	Dell
6	6	Lenovo
7	7	Chuwi
8	8	MSI
9	9	Microsoft
10	10	Toshiba

	ElectronicID	ElectronicName	ReleaseYear	Count	TotalCount	Rating	ManufacturerID	TypeID
1	1	MacBook Pro	2020	15	15	AVERAGE	1	1
2	2	Macbook Air	2021	8	8	AVERAGE	1	1
3	3	250 G6	2022	13	13	AVERAGE	2	1
4	4	MacBook Pro	2021	5	5	AVERAGE	1	1
5	5	MacBook Pro	2019	5	5	AVERAGE	1	1
6	6	Aspire 3	2021	6	6	AVERAGE	3	1
7	7	MacBook Pro	2020	9	9	AVERAGE	1	1
8	8	Macbook Air	2019	7	7	AVERAGE	1	1
9	9	ZenBook UX430UN	2020	10	10	AVERAGE	4	1
10	10	Swift 3	2019	10	10	AVERAGE	3	1

Results grid

	ElectronicID	OperatingSystemID
1	6	1
2	9	1
3	10	1
4	14	1
5	17	1
6	20	1
7	21	1
8	22	1
9	24	1
10	25	1

Inserted relations data

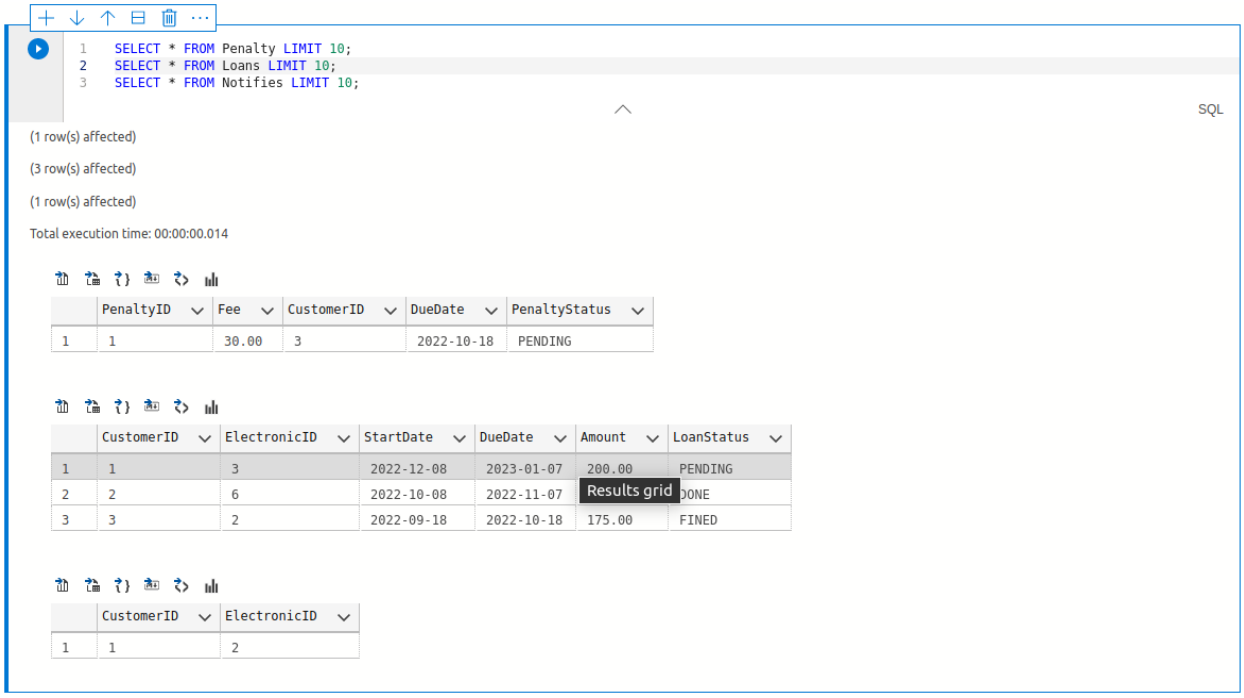


```sql
INSERT Penalty (PenaltyID, Fee, CustomerID, DueDate, PenaltyStatus) VALUES
(1, 30.00, 3, '2022-10-18', 'PENDING');

INSERT Loans (CustomerID, ElectronicID, StartDate, DueDate, Amount, LoanStatus) VALUES
(2, 6, '2022-10-08', TIMESTAMPADD(DAY, 30, '2022-10-08'), 150.00, 'DONE'),
(3, 2, '2022-09-18', TIMESTAMPADD(DAY, 30, '2022-09-18'), 175.00, 'FINED'),
(1, 3, '2022-12-08', TIMESTAMPADD(DAY, 30, '2022-12-08'), 200.00, 'PENDING');

INSERT Notifies (CustomerID, ElectronicID) VALUES
(1, 2);
```

Query



```sql
SELECT * FROM Penalty LIMIT 10;
SELECT * FROM Loans LIMIT 10;
SELECT * FROM Notifies LIMIT 10;
```

(1 row(s) affected)

(3 row(s) affected)

(1 row(s) affected)

Total execution time: 00:00:00.014

	PenaltyID	Fee	CustomerID	DueDate	PenaltyStatus
1	1	30.00	3	2022-10-18	PENDING

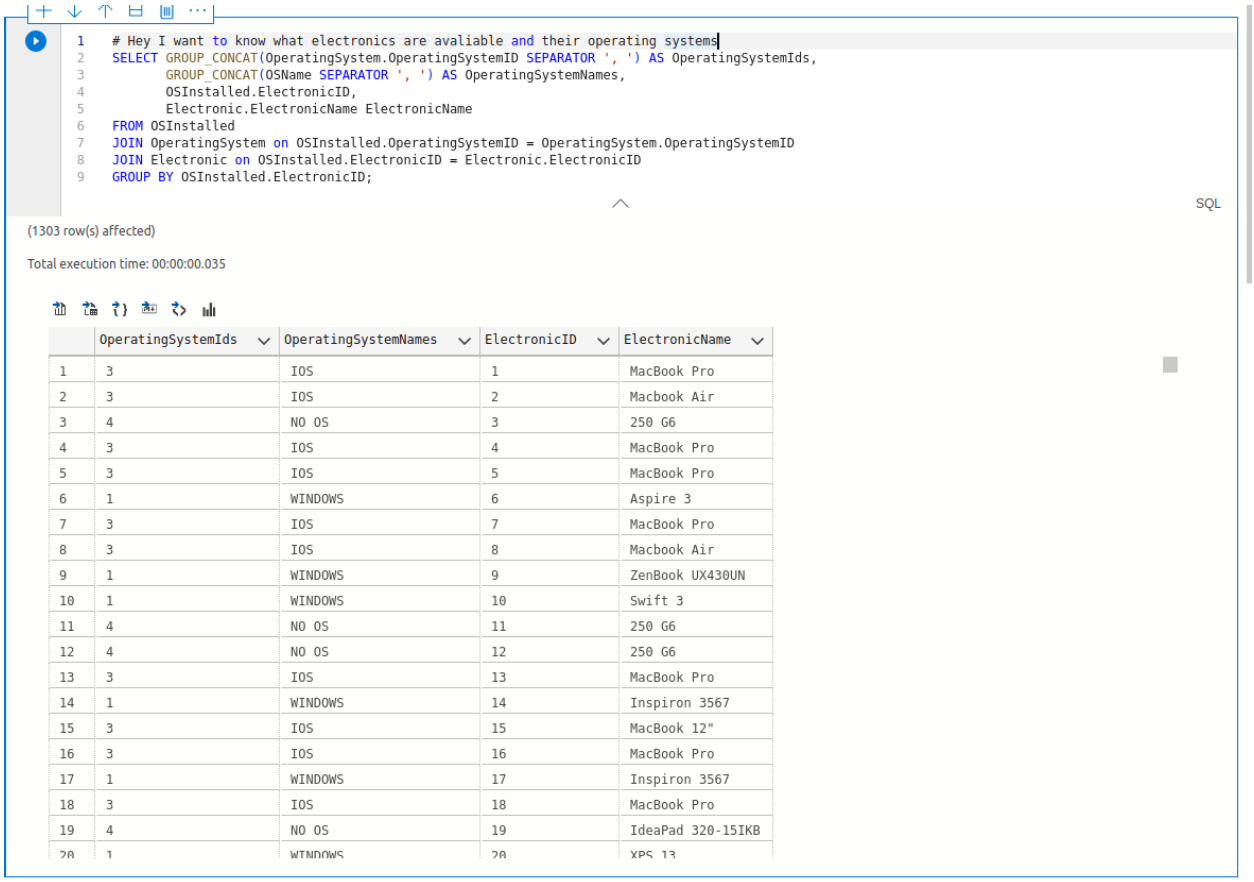
	CustomerID	ElectronicID	StartDate	DueDate	Amount	LoanStatus
1	1	3	2022-12-08	2023-01-07	200.00	PENDING
2	2	6	2022-10-08	2022-11-07	150.00	DONE
3	3	2	2022-09-18	2022-10-18	175.00	FINED

	CustomerID	ElectronicID
1	1	2

Queries and Updates essential for the business use cases

SQL Script: [Procedures_and_examples.sql]

- If we want to know what electronics are available and their operating system details



```
# Hey I want to know what electronics are avaliable and their operating systems
SELECT GROUP_CONCAT(OperatingSystem.OperatingSystemID SEPARATOR ', ') AS OperatingSystemIds,
       GROUP_CONCAT(OSName SEPARATOR ', ') AS OperatingSystemNames,
       OSInstalled.ElectronicID,
       Electronic.ElectronicName ElectronicName
FROM OSInstalled
JOIN OperatingSystem on OSInstalled.OperatingSystemID = OperatingSystem.OperatingSystemID
JOIN Electronic on OSInstalled.ElectronicID = Electronic.ElectronicID
GROUP BY OSInstalled.ElectronicID;
```

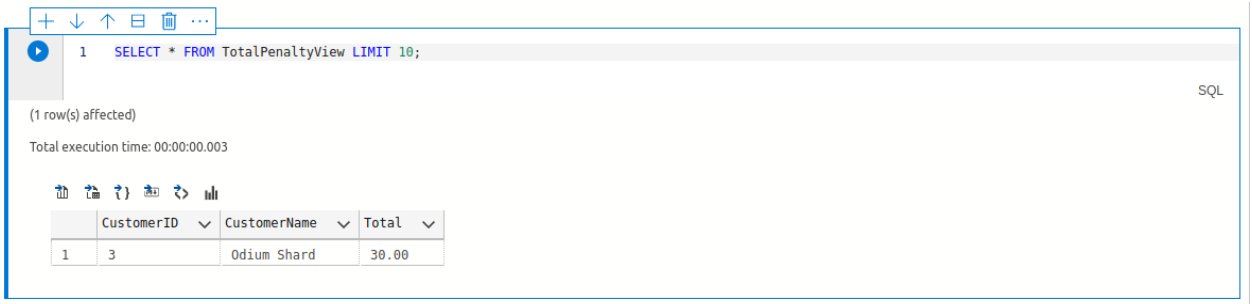
SQL

(1303 row(s) affected)

Total execution time: 00:00:00.035

	OperatingSystemIds	OperatingSystemNames	ElectronicID	ElectronicName
1	3	IOS	1	MacBook Pro
2	3	IOS	2	Macbook Air
3	4	NO OS	3	250 G6
4	3	IOS	4	MacBook Pro
5	3	IOS	5	MacBook Pro
6	1	WINDOWS	6	Aspire 3
7	3	IOS	7	MacBook Pro
8	3	IOS	8	Macbook Air
9	1	WINDOWS	9	ZenBook UX430UN
10	1	WINDOWS	10	Swift 3
11	4	NO OS	11	250 G6
12	4	NO OS	12	250 G6
13	3	IOS	13	MacBook Pro
14	1	WINDOWS	14	Inspiron 3567
15	3	IOS	15	MacBook 12"
16	3	IOS	16	MacBook Pro
17	1	WINDOWS	17	Inspiron 3567
18	3	IOS	18	MacBook Pro
19	4	NO OS	19	IdeaPad 320-15IKB
20	1	WINDOWS	20	XPS 13

- If we want to know total penalty due by a customer



```
SELECT * FROM TotalPenaltyView LIMIT 10;
```

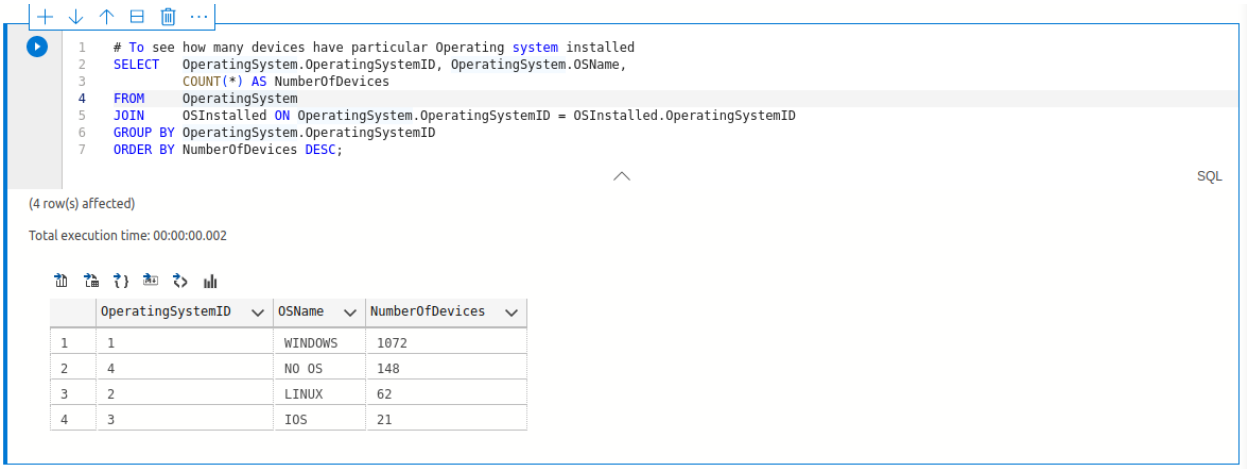
SQL

(1 row(s) affected)

Total execution time: 00:00:00.003

	CustomerID	CustomerName	Total
1	3	Odium Shard	30.00

- To view total number of devices which have a particular OS installed (A device can have multiple OS installed, dual boot etc)



```sql
# To see how many devices have particular Operating system installed
SELECT   OperatingSystem.OperatingSystemID, OperatingSystem.OSName,
         COUNT(*) AS NumberOfDevices
FROM     OperatingSystem
JOIN     OSInstalled ON OperatingSystem.OperatingSystemID = OSInstalled.OperatingSystemID
GROUP BY OperatingSystem.OperatingSystemID
ORDER BY NumberOfDevices DESC;
```

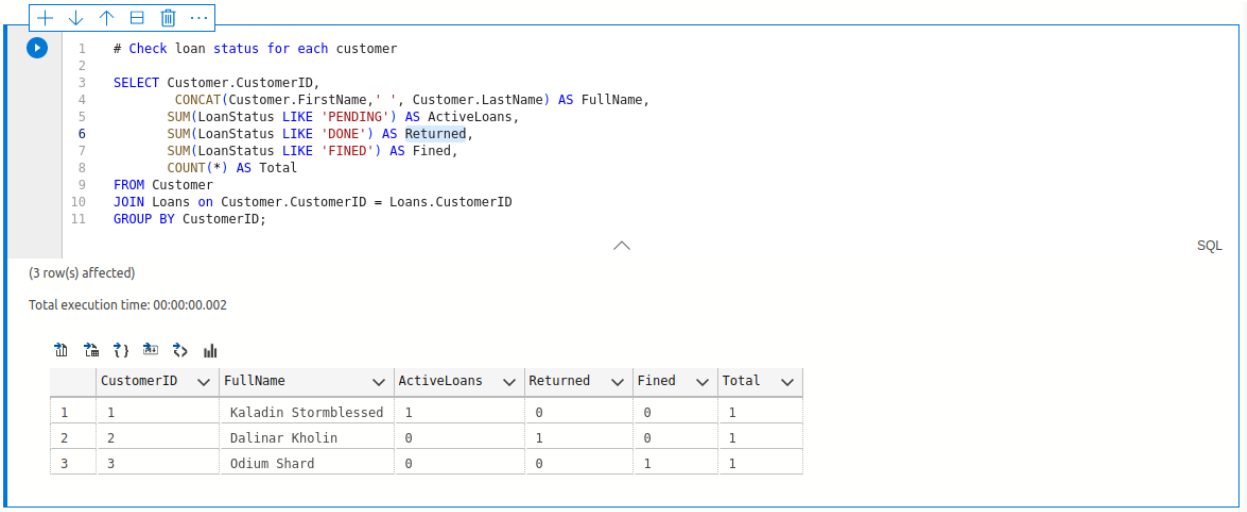
SQL

(4 row(s) affected)

Total execution time: 00:00:00.002

	OperatingSystemID	OSName	NumberOfDevices
1	1	WINDOWS	1072
2	4	NO OS	148
3	2	LINUX	62
4	3	IOS	21

- To check all customers active loans and pending loan details



```sql
# Check loan status for each customer

SELECT Customer.CustomerID,
        CONCAT(Customer.FirstName,' ', Customer.LastName) AS FullName,
       SUM(LoanStatus LIKE 'PENDING') AS ActiveLoans,
       SUM(LoanStatus LIKE 'DONE') AS Returned,
       SUM(LoanStatus LIKE 'FINED') AS Fined,
       COUNT(*) AS Total
FROM Customer
JOIN Loans on Customer.CustomerID = Loans.CustomerID
GROUP BY CustomerID;
```

SQL

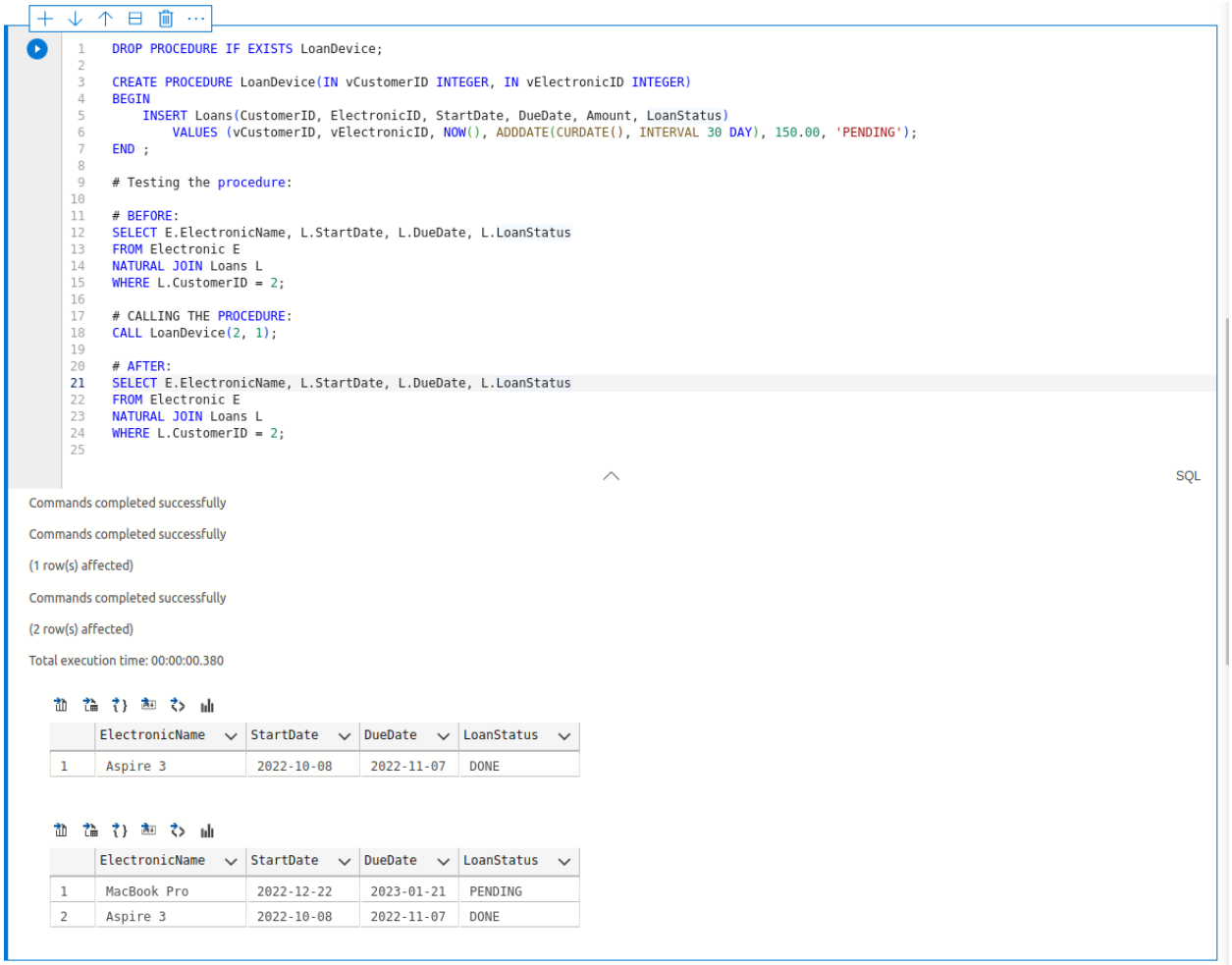
(3 row(s) affected)

Total execution time: 00:00:00.002

	CustomerID	FullName	ActiveLoans	Returned	Fined	Total
1	1	Kaladin Stormblessed	1	0	0	1
2	2	Dalinar Kholin	0	1	0	1
3	3	Odium Shard	0	0	1	1

Other Procedures and Events

- Procedure for loaning a device to a customer.



```
DROP PROCEDURE IF EXISTS LoanDevice;

CREATE PROCEDURE LoanDevice(IN vCustomerID INTEGER, IN vElectronicID INTEGER)
BEGIN
    INSERT Loans(CustomerID, ElectronicID, StartDate, DueDate, Amount, LoanStatus)
        VALUES (vCustomerID, vElectronicID, NOW(), ADDDATE(CURDATE(), INTERVAL 30 DAY), 150.00, 'PENDING');
END ;

# Testing the procedure:

# BEFORE:
SELECT E.ElectronicName, L.StartDate, L.DueDate, L.LoanStatus
FROM Electronic E
NATURAL JOIN Loans L
WHERE L.CustomerID = 2;

# CALLING THE PROCEDURE:
CALL LoanDevice(2, 1);

# AFTER:
SELECT E.ElectronicName, L.StartDate, L.DueDate, L.LoanStatus
FROM Electronic E
NATURAL JOIN Loans L
WHERE L.CustomerID = 2;
```

SQL

Commands completed successfully

Commands completed successfully

(1 row(s) affected)

Commands completed successfully

(2 row(s) affected)

Total execution time: 00:00:00.380

	ElectronicName	StartDate	DueDate	LoanStatus
1	Aspire 3	2022-10-08	2022-11-07	DONE

	ElectronicName	StartDate	DueDate	LoanStatus
1	MacBook Pro	2022-12-22	2023-01-21	PENDING
2	Aspire 3	2022-10-08	2022-11-07	DONE

- Procedure to penalize customers if they missed the due date.

```sql
# When this procedure is caled it looks into all the loans and their due dates. If any loan is past due date
# it creates a penalty

DROP PROCEDURE IF EXISTS CreatePenalty;

CREATE PROCEDURE CreatePenalty()
BEGIN
    START TRANSACTION;
        INSERT INTO Penalty (CustomerID, Fee, DueDate, PenaltyStatus)
            SELECT CustomerID, 100.00, CURDATE(), 'PENDING' FROM Loans L
            WHERE L.LoanStatus = 'PENDING' AND DATEDIFF(L.DueDate, CURDATE()) < 0;

        UPDATE Loans L SET LoanStatus = 'FINED'
        WHERE L.LoanStatus = 'PENDING' AND DATEDIFF(L.DueDate, CURDATE()) < 0;
    COMMIT;
END;

# Testing the procedure with transaction:

# BEFORE:
SELECT E.ElectronicName, L.StartDate, L.DueDate, L.LoanStatus
FROM Electronic E
NATURAL JOIN Loans L
WHERE L.CustomerID = 1;

SELECT * FROM Penalty P WHERE P.CustomerID = 1;

# CREATE TEST CONDITIONS:
UPDATE Loans L SET L.StartDate = ADDDATE(CURDATE(), -40)
WHERE L.CustomerID = 1 AND L.ElectronicID = 3;

UPDATE Loans L SET L.DueDate = ADDDATE(CURDATE(), -10)
WHERE L.CustomerID = 1 AND L.ElectronicID = 3;

# CALLING THE PROCEDURE:
CALL CreatePenalty();

# AFTER:
SELECT E.ElectronicName, L.StartDate, L.DueDate, L.LoanStatus
FROM Electronic E
NATURAL JOIN Loans L
WHERE L.CustomerID =1;

SELECT * FROM Penalty P WHERE P.CustomerID = 1;
```

SQL

Before penalty:

	ElectronicName	StartDate	DueDate	LoanStatus
1	250 G6	2022-12-08	2023-01-07	PENDING

	PenaltyID	Fee	CustomerID	DueDate	PenaltyStatus

After penalty:

	ElectronicName	StartDate	DueDate	LoanStatus
1	250 G6	2022-11-12	2022-12-12	FINED

	PenaltyID	Fee	CustomerID	DueDate	PenaltyStatus
1	2	100.00	1	2022-12-22	PENDING

- If a customer has a pending loan and request for new loan - Deny

```sql
# Cases when customer has pending loans and request for new device for loan or device out of stock

DROP TRIGGER IF EXISTS Check_loans_before_granting;

CREATE TRIGGER Check_loans_before_granting
BEFORE INSERT ON Loans FOR EACH ROW
BEGIN
    DECLARE LoanedCount, TotalCount, ActiveLoansOfDevice INTEGER DEFAULT 0;
    SELECT COUNT(*) INTO LoanedCount FROM Loans L
    WHERE L.ElectronicID = NEW.ElectronicID AND L.LoanStatus != 'DONE'
    GROUP BY ElectronicID;
    SELECT E.TotalCount INTO TotalCount FROM Electronic E WHERE E.ElectronicID = NEW.ElectronicID;
    IF (LoanedCount >= TotalCount)
        THEN SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Device out of stock';
    END IF;
    SELECT COUNT(*) INTO ActiveLoansOfDevice FROM Loans L
    WHERE L.ElectronicID = NEW.ElectronicID AND L.CustomerID = NEW.CustomerID AND L.LoanStatus != 'DONE'
    GROUP BY L.ElectronicID;
    IF (ActiveLoansOfDevice != 0)
        THEN SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'Customer already loaned device';
    END IF;
END;
```

SQL

Test

```sql
CALL LoanDevice(2, 1);
```

SQL

```
(1644, 'Customer already loaned device')

Total execution time: 00:00:00.004
```

- Respond device out of stock if the electronic item is all loaned out

```sql
CALL LoanDevice(1, 5);
```

SQL

```
(1644, 'Device out of stock')

Total execution time: 00:00:00.002
```

- At EOD check for all late due loans and create penalties for each of them

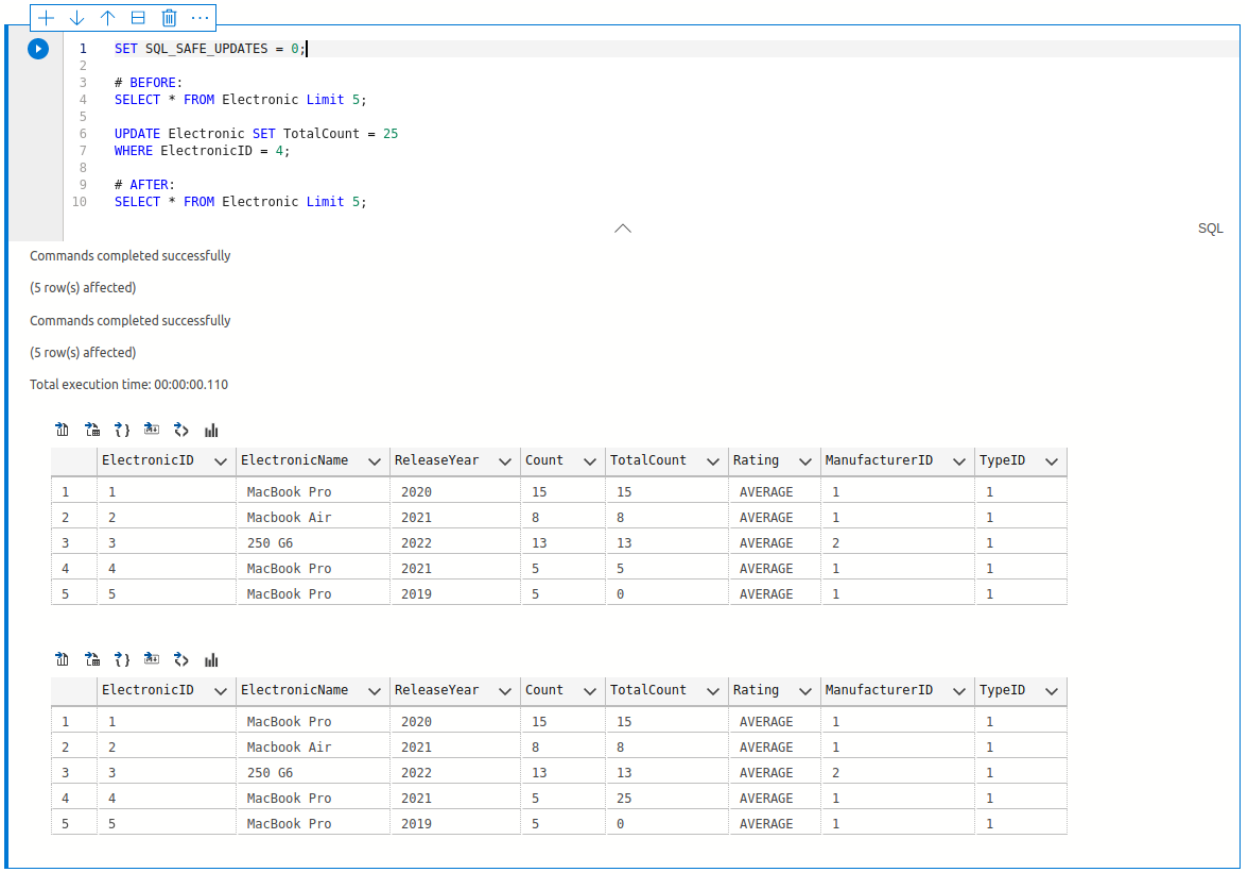
```sql
# Schedule create penalties at end of each DAY

SET GLOBAL event_scheduler = 1;
DROP EVENT IF EXISTS CreateFinesEvent;

CREATE EVENT CreateFinesEvent ON SCHEDULE EVERY 1 DAY
DO
BEGIN
    CALL CreatePenalty();
END;
```

SQL

- Some updates on tables



```sql
SET SQL_SAFE_UPDATES = 0;

# BEFORE:
SELECT * FROM Electronic Limit 5;

UPDATE Electronic SET TotalCount = 25
WHERE ElectronicID = 4;

# AFTER:
SELECT * FROM Electronic Limit 5;
```

SQL

Commands completed successfully

(5 row(s) affected)

Commands completed successfully

(5 row(s) affected)

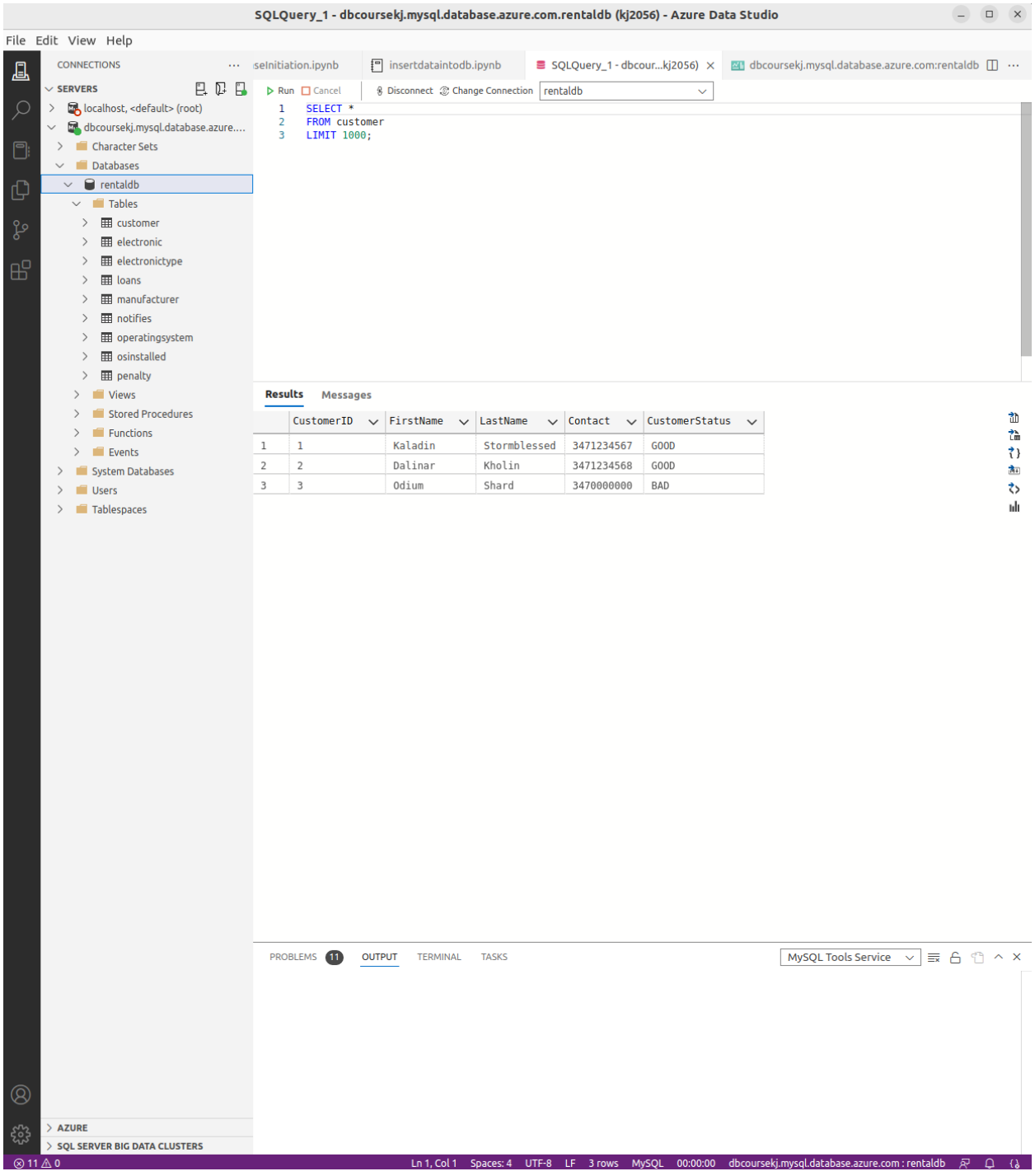
Total execution time: 00:00:00.110

	ElectronicID	ElectronicName	ReleaseYear	Count	TotalCount	Rating	ManufacturerID	TypeID
1	1	MacBook Pro	2020	15	15	AVERAGE	1	1
2	2	Macbook Air	2021	8	8	AVERAGE	1	1
3	3	250 G6	2022	13	13	AVERAGE	2	1
4	4	MacBook Pro	2021	5	5	AVERAGE	1	1
5	5	MacBook Pro	2019	5	0	AVERAGE	1	1

	ElectronicID	ElectronicName	ReleaseYear	Count	TotalCount	Rating	ManufacturerID	TypeID
1	1	MacBook Pro	2020	15	15	AVERAGE	1	1
2	2	Macbook Air	2021	8	8	AVERAGE	1	1
3	3	250 G6	2022	13	13	AVERAGE	2	1
4	4	MacBook Pro	2021	5	25	AVERAGE	1	1
5	5	MacBook Pro	2019	5	0	AVERAGE	1	1

Update on implementation progress

All these are done in local db and later planning to do it on Azure MySQL server. For now, I was able to insert some of the data into the cloud.



Improvements and Future work

- For current implementation, the laptop data processing and cleaning up is done in external python script. Ideally this can be done as a service function, where when a data dump is received, it automatically processes the data.
- More details about the electronic devices like RAM, CPU etc can be maintained in future also devices other than laptops (like mobiles, consoles etc) should be added.
- Predictions for right pricing of devices can be made in future based on popularity and depreciation from its release year.
- Simple secure login and UI could be useful to view.
- When a customer subscribes to be notified when an out of stock device is back in stock, the business should be able to notify the customer through his contact details.

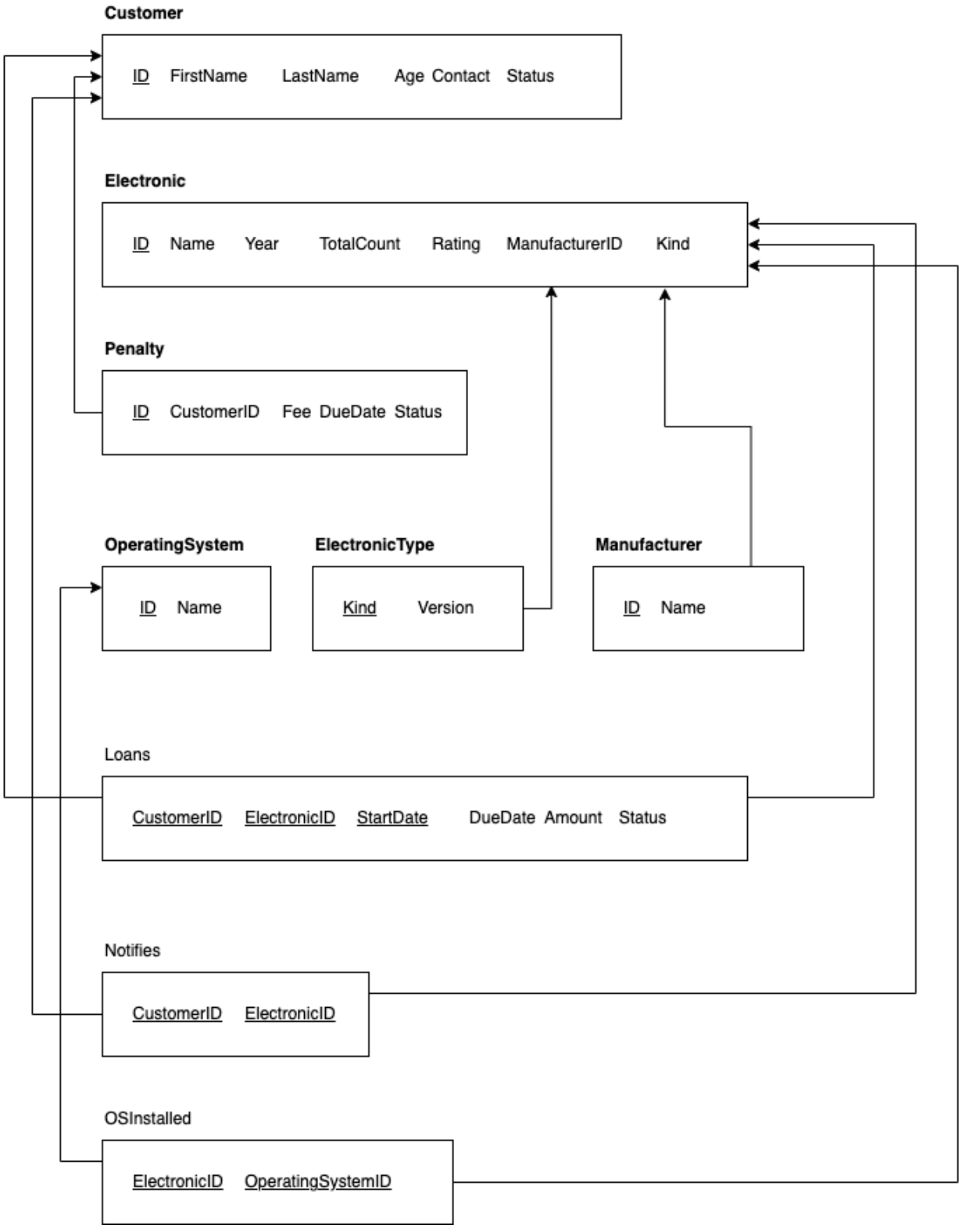
How to run this locally

1. For the laptop pricing data, we need Python3, numpy and pandas. Or you can find the required CSV files in codebase 'data/' directory.
    a. RUN `python laptopdataprocessing.py`
    b. to generate the required data in csv format.
2. MySQL server running
3. Run `DatabaseInitiation.sql` SQL script that will create the database and the tables
4. Run `InsertData.sql` script to insert data into the tables. Before running the script make sure to
    a. Find out the secure file directory by `SHOW VARIABLES LIKE "secure_file_priv"`
    b. Move the csv files created in step 1 to the above directory
    c. Or we can skip a, b if we use sql management studio and upload the CSV files.
5. Run `procedures_and_examples.sql` to run some example queries and updates.

References and Tools

- Dataset: https://www.kaggle.com/code/danielbethell/laptop-prices-prediction/data
- Cleaning up dataset: https://www.kaggle.com/code/danielbethell/laptop-prices-prediction/notebook
- Inspired from library catalog system

Azure Data Studio


Customer
ID FirstName LastName Age Contact Status
Electronic
ID Name Year TotalCount Rating ManufacturerID Kind
Penalty
ID CustomerID Fee DueDate Status
OperatingSystem
ID Name
ElectronicType
Kind Version
Manufacturer
ID Name
Loans
CustomerID ElectronicID StartDate DueDate Amount Status
Notifies
CustomerID ElectronicID
OSInstalled
ElectronicID OperatingSystemID

Normalization and extensions

At least 3NF is required for all to not suffer from update anomalies in the database.

- Customer (ID, FirstName, LastName, Age, Contact, Status)
  All attributes are atomic and it has a single attribute as primary key, hence at least 2NF.
  As there are no transitive dependency for non-primary attributes and 2NF, therefore it satisfies 3NF

- Penalty(ID, CustomerID, Fee, DueDate, Status)
  All attributes are atomic and it has a single attribute as primary key, hence at least 2NF.
  Non-primary key attributes have no transitive dependency so it satisfies 3NF

- Electronic(ID, Name, Year, TotaCount, Rating, ManufacturerID, Kind)
  All attributes are atomic and it has a single attribute as primary key, hence at least 2NF.
  Non-primary key attributes have no transitive dependency so it satisfies 3NF

- OperatingSystem(ID, Name)
  All attributes are atomic and it has a single attribute as primary key, hence at least 2NF.
  Non-primary key attributes have no transitive dependency so it satisfies 3NF

- ElectronicType(Kind, Version)
  All attributes are atomic and it has a single attribute as primary key, hence at least 2NF.
  Non-primary key attributes have no transitive dependency so it satisfies 3NF

- Manufacturer(ID, Name)
  All attributes are atomic and it has a single attribute as primary key, hence at least 2NF.
  Non-primary key attributes have no transitive dependency so it satisfies 3NF

- Loans(CustomerID, ElectronicID, StartDate, DueDate, Amount, Status)
  All attributes are atomic and non-primary key attributes are not partially dependent on the candidate key.
  Non-primary key attributes have no transitive dependency so it satisfies 3NF

- Notifies(CustomerID, ElectronicID)
  All attributes are atomic and no non-primary keys so at least 3NF.

- OSInstalled(ElectronicID, OperatingSystemID)
  Similar to Notifiedz, this is at least 3NF.