EXPERIMENT: 10

NAME : RITVIJ UID : 23BCC70045

Part A: Insert Multiple Fee Payments in a Transaction

Description:

Given a table **FeePayments**, the task is to simulate a transaction where multiple payment entries are inserted at once. The goal is to demonstrate that all inserts happen successfully together as a single transaction unit (Atomicity).

Input Format:

- Table **FeePayments** with columns:
  - `payment_id` (INT, Primary Key)
  - `student_name` (VARCHAR(100))
  - `amount` (DECIMAL(10,2))
  - `payment_date` (DATE)

Output Format:

List of newly inserted payment records when the transaction is committed.

Constraints:

- Each payment has a unique ID.
- All inserts must succeed together as one unit of work.

Sample Input:

FeePayments

payment_id	student_name	amount	payment_date
1	Ashish	5000.00	2024-06-01
2	Smaran	4500.00	2024-06-02
3	Vaibhav	5500.00	2024-06-03

Sample Output:

payment_id	student_name	amount	payment_date
1	Ashish	5000.00	2024-06-01
2	Smaran	4500.00	2024-06-02
3	Vaibhav	5500.00	2024-06-03

Query:

```
DROP TABLE IF EXISTS FeePayments;


CREATE TABLE FeePayments (
    payment_id INT PRIMARY KEY,
    student_name VARCHAR(100),
    amount DECIMAL(10,2),
    payment_date DATE
);
BEGIN TRANSACTION;


INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES
(1, 'Ashish', 5000.00, '2024-06-01'),
(2, 'Smaran', 4500.00, '2024-06-02'),
(3, 'Vaibhav', 5500.00, '2024-06-03');
COMMIT;
SELECT * FROM FeePayments;
```

OUTPUT:

Explanation:

This transaction ensures that **either all inserts succeed or none do**, demonstrating **Atomicity**. The `COMMIT` makes changes durable.

Part B: Demonstrate ROLLBACK for Failed Payment Insertion

Description:

Simulate a transaction failure in a **FeePayments** table by attempting to insert an invalid payment (e.g., duplicate `payment_id`). Use `ROLLBACK` to undo the entire transaction and demonstrate **Atomicity** and **Consistency** — ensuring that no partial data is committed to the table.

Input Format:

- Table **FeePayments** with columns:
  - `payment_id` (INT, Primary Key)
  - `student_name` (VARCHAR(100))
  - `amount` (DECIMAL(10,2))
  - `payment_date` (DATE)

Output Format:

No new records should be present from the failed transaction after `ROLLBACK`.

Constraints:

- `payment_id` must be unique.
- `amount` must be a positive decimal.
- If any operation in the transaction fails, the entire transaction must be rolled back.

Sample Input:

Initial successful inserts:

payment_id	student_name	amount	payment_date
1	Ashish	5000.00	2024-06-01
2	Smaran	4500.00	2024-06-02

payment_id	student_name	amount	payment_date
3	Vaibhav	5500.00	2024-06-03

Transaction with failure (duplicate ID = 1):

Sample Output:

Only the first 3 valid records should exist after rollback:

payment_id	student_name	amount	payment_date
1	Ashish	5000.00	2024-06-01
2	Smaran	4500.00	2024-06-02
3	Vaibhav	5500.00	2024-06-03

Query:

```
DROP TABLE IF EXISTS FeePayments;

CREATE TABLE FeePayments (
    payment_id INT PRIMARY KEY,
    student_name VARCHAR(100),
    amount DECIMAL(10,2) CHECK (amount > 0),
    payment_date DATE
) ENGINE=InnoDB;

START TRANSACTION;

INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES
(1, 'Ashish', 5000.00, '2024-06-01'),
```

(2, 'Smaran', 4500.00, '2024-06-02'),

(3, 'Vaibhav', 5500.00, '2024-06-03');

COMMIT;

SELECT * FROM FeePayments;

START TRANSACTION;

INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)

VALUES

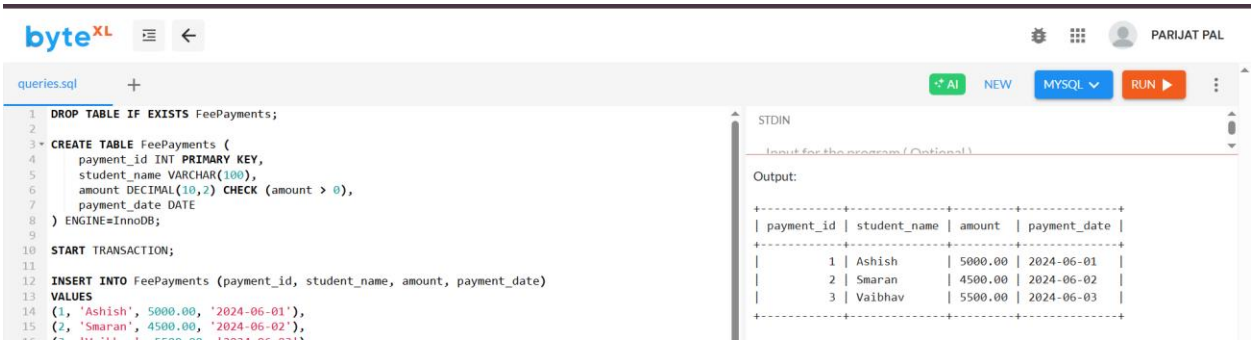
(4, 'Kiran', 4000.00, '2024-06-04'),

(1, 'Ashish', -500.00, '2024-06-05');

ROLLBACK;

SELECT * FROM FeePayments;

OUTPUT:



Explanation:

- The **first transaction** inserts 3 valid records and is committed.
- The **second transaction** attempts 2 inserts:
  - The first insert (Kiran) is valid.
  - The second insert (Ashish) **fails due to duplicate** `payment_id = 1` and **negative amount** (which violates `CHECK` constraint).

Part C: Simulate Partial Failure and Ensure Consistent State

Description:

Demonstrate how inserting one valid and one invalid record within a transaction causes the entire operation to be rolled back, keeping the table in a consistent state.

Input Format:

- Table **FeePayments** as before.

Output Format:

payment_id	student_name	amount	payment_date
1	Ashish	5000.00	2024-06-01
2	Smaran	4500.00	2024-06-02
3	Vaibhav	5500.00	2024-06-03

Constraints:

- Transactions must fail completely if any operation fails.

Sample Input:

Invalid record has NULL in `student_name`.

Sample Output:

No new records inserted.

Query:

```
DROP TABLE IF EXISTS FeePayments;

CREATE TABLE FeePayments (
    payment_id INT PRIMARY KEY,
    student_name VARCHAR(100) NOT NULL,
    amount DECIMAL(10,2) CHECK (amount > 0),
    payment_date DATE
) ENGINE=InnoDB;

START TRANSACTION;

INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES
(1, 'Ashish', 5000.00, '2024-06-01'),
(2, 'Smaran', 4500.00, '2024-06-02'),
(3, 'Vaibhav', 5500.00, '2024-06-03');

COMMIT;

SELECT * FROM FeePayments;

START TRANSACTION;
```

INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)

VALUES

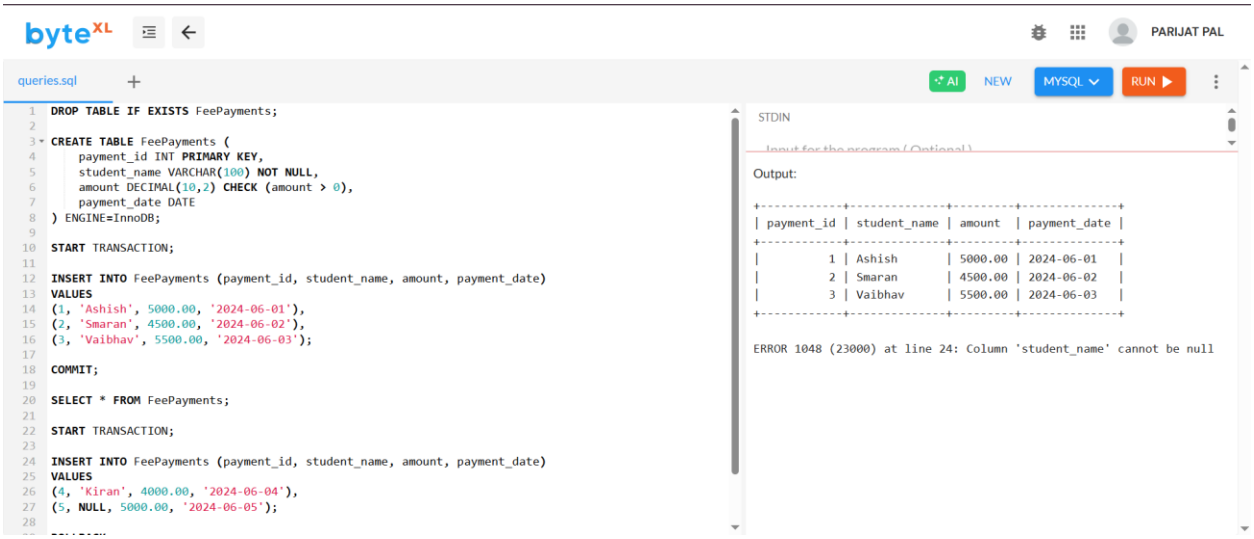
(4, 'Kiran', 4000.00, '2024-06-04'),

(5, NULL, 5000.00, '2024-06-05');

ROLLBACK;

SELECT * FROM FeePayments;

OUTPUT:



Explanation:

Even though the first insert was valid, the **second insert fails**, causing the **entire transaction to rollback**, proving **Atomicity** and **Consistency**.

Part D: Verify ACID Compliance with Transaction Flow

Description:

Combine all transaction techniques into one example and verify that all ACID properties — **Atomicity**, **Consistency**, **Isolation**, and **Durability** — are preserved.

Input Format:

- Table **FeePayments**

Output Format:

Final state of the table reflecting successful committed transactions only.

Constraints:

- All four ACID properties should be demonstrated.
- Isolation can be simulated using sessions if DBMS supports.

Sample Input:

Valid inserts and a failed one using the same `payment_id`.

Sample Output:

payment_id	student_name	amount	payment_date
1	Ashish	5000.00	2024-06-01T00:00:00.000Z
2	Smaran	4500.00	2024-06-02T00:00:00.000Z
3	Vaibhav	5500.00	2024-06-03T00:00:00.000Z
7	Sneha	4700.00	2024-06-08T00:00:00.000Z
8	Arjun	4900.00	2024-06-09T00:00:00.000Z

QUERY:

```
DROP TABLE IF EXISTS FeePayments;


CREATE TABLE FeePayments (
    payment_id INT PRIMARY KEY,
    student_name VARCHAR(100) NOT NULL,
    amount DECIMAL(10,2) CHECK (amount > 0),
    payment_date DATETIME
) ENGINE=InnoDB;


START TRANSACTION;
INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES
(1, 'Ashish', 5000.00, '2024-06-01 00:00:00'),
(2, 'Smaran', 4500.00, '2024-06-02 00:00:00'),
(3, 'Vaibhav', 5500.00, '2024-06-03 00:00:00');
COMMIT;


DELIMITER $$
CREATE PROCEDURE DuplicateInsert()
BEGIN
    DECLARE EXIT HANDLER FOR SQLEXCEPTION
    BEGIN
        ROLLBACK;
    END;
```

```
    START TRANSACTION;
    INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
    VALUES
    (4, 'Kiran', 4000.00, '2024-06-04'),
    (1, 'Ashish', 5000.00, '2024-06-05');
    COMMIT;
END$$
DELIMITER ;
CALL DuplicateInsert();
DELIMITER $$
CREATE PROCEDURE NullInsert()
BEGIN
    DECLARE EXIT HANDLER FOR SQLEXCEPTION
    BEGIN
        ROLLBACK;
    END;
    START TRANSACTION;
    INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
    VALUES
    (5, 'Rohan', 6000.00, '2024-06-06'),
    (6, NULL, 4500.00, '2024-06-07');
    COMMIT;
END$$
DELIMITER ;
```

CALL NullInsert();

START TRANSACTION;

INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)

VALUES

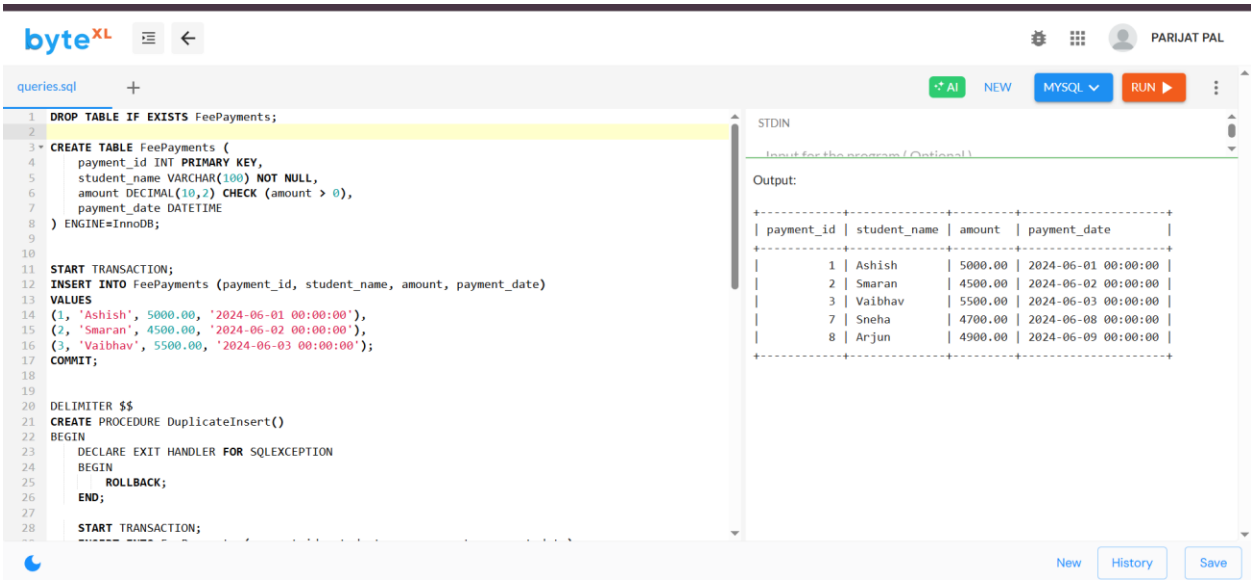
(7, 'Sneha', 4700.00, '2024-06-08 00:00:00'),

(8, 'Arjun', 4900.00, '2024-06-09 00:00:00');

COMMIT;

SELECT * FROM FeePayments;

OUTPUT:



LEARNING OUTCOME:

- **Atomicity:** Learned how transactions either fully commit or fully rollback when an error occurs.
- **Consistency:** Observed that database constraints (PRIMARY KEY, NOT NULL, CHECK) maintain valid data.
- **Isolation:** Transactions executed sequentially demonstrate how uncommitted changes do not affect others.
- **Durability:** Committed transactions remain in the database permanently even after failures elsewhere.