Experiment 10

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Subject Code:23CSP-333 UID: 23BCC70036

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1. Aim:

Transactions and Concurrency Control

- 1. Part A: To demonstrate a successful transaction where multiple INSERT statements are treated as a single, atomic unit of work using BEGIN and COMMIT.
- 2. Part B: To simulate a transaction failure due to a constraint violation and use ROLLBACK to explicitly undo all changes, preserving atomicity and consistency.
- 3. Part C: To show how a transaction automatically enters a failed state after a single invalid statement, causing a COMMIT to fail and ensuring a consistent state.
- 4. Part D: To provide a comprehensive flow that verifies all four ACID properties—Atomicity, Consistency, Isolation, and Durability—in a series of operations.

2. Theory:

A database transaction is a sequence of operations performed as a single logical unit of work. For a transaction to be reliable, it must adhere to the four ACID properties. Atomicity ensures that the transaction is "all or nothing"—either all operations succeed, or none do. Consistency guarantees that the database remains in a valid state before and after the transaction. Isolation ensures that concurrent transactions do not interfere with one another. Finally, Durability guarantees that once a transaction is committed, its changes are permanent and will survive any subsequent system failure.

3. SQL Queries:

- 1. Part A: Successful Atomic Transaction
 - Create the initial table and insert multiple records in one transaction.

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

```
BEGIN;

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

COMMIT;

SELECT * FROM feepayments;
```

- 2. Part B: Explicit ROLLBACK after Failure
 - Add a CHECK constraint to the table.

```
ALTER TABLE FeePayments

ADD CONSTRAINT chk_positive_amount CHECK (amount > 0);
```

 Attempt a transaction with an invalid record and explicitly roll it back.

```
BEGIN;

INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES (4, 'Kiran', 6000.00, '2024-06-04');

INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES (5, 'Invalid', -2000.00, '2024-06-05');

ROLLBACK;

SELECT * FROM feepayments;
```

- 3. Part C: Automatic Rollback on Partial Failure
 - Add a NOT NULL constraint to the table.

```
ALTER TABLE FeePayments
ALTER COLUMN student name SET NOT NULL;
```

 Attempt a transaction where an invalid statement causes the COMMIT to fail.

```
BEGIN;
INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES (4, 'Rohan', 6000.00, '2024-06-05');
INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES (5, NULL, 5000.00, '2024-06-06');
COMMIT;
SELECT * FROM feepayments;
```

- 4. Part D: Verifying All ACID Properties
 - Run a sequence of transactions to demonstrate A, C, I, and D.

```
BEGIN;
INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES (6, 'Anjali', 7000.00, '2024-06-08');
INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES (1, 'Duplicate', 9999.00, '2024-06-09');
COMMIT;
BEGIN;
INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
VALUES (7, 'Kavita', 6500.00, '2024-06-10');
```

```
COMMIT;

BEGIN;

UPDATE FeePayments

SET amount = 5250.00

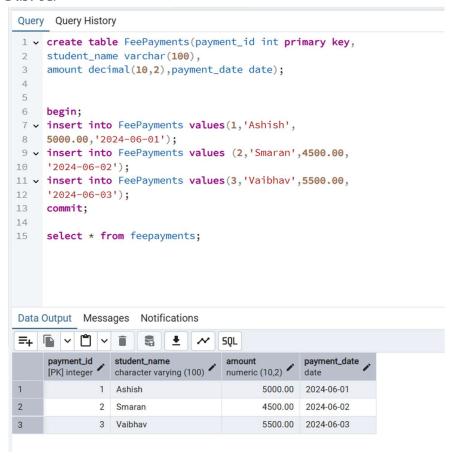
WHERE payment_id = 1;

COMMIT;
```

SELECT * FROM FeePayments;

4. Result:

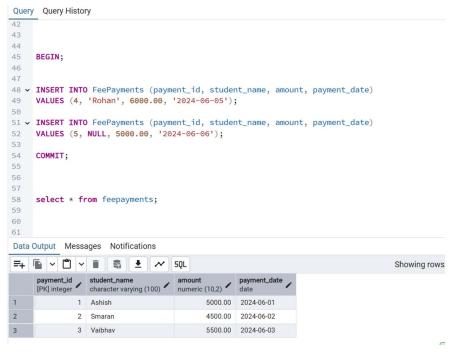
Part-A:



Part-B:

```
23
24
     BEGIN;
25
26
27 • INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
     VALUES (4, 'Kiran', 6000.00, '2024-06-04');
28
29
30
31 • INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
     VALUES (1, 'Ashish', -2000.00, '2024-06-05');
32
33
34
     ROLLBACK;
35
36
     select * from feepayments;
37
38
39
40
41
Data Output Messages Notifications
=+ 🖺 ∨ 🖺 ∨ 🛢 💲 👤 <equation-block>
                                                                                            Sho
     payment_id student_name amount numeric (10,2) payment_id character varying (100) amount numeric (10,2) date
1
               1 Ashish
                                               5000.00 2024-06-01
2
               2 Smaran
                                               4500.00 2024-06-02
3
               3 Vaibhav
                                               5500.00 2024-06-03
```

Part-C:



Part-D:

```
Query
      Query History
83 v INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
      VALUES (6, 'Anjali', 7000.00, '2024-06-08');
85
86 v INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
87
      VALUES (1, 'Duplicate', 9999.00, '2024-06-09');
88
89
      COMMIT;
90
91
      BEGIN;
92
93 v INSERT INTO FeePayments (payment_id, student_name, amount, payment_date)
      VALUES (7, 'Kavita', 6500.00, '2024-06-10');
94
95
96
      COMMIT;
97
98
      BEGIN;
99
100 ∨ UPDATE FeePayments
101 SET amount = 5250.00
Data Output Messages Notifications
    SQL
                       5
                            #
=+
                                                   payment_date
     payment_id
[PK] integer
                 student_name
                                     amount
                 character varying (100)
                                     numeric (10,2)
                                                    date
              2 Smaran
                                                    2024-06-02
1
                                            4500.00
2
               3 Vaibhav
                                            5500.00
                                                    2024-06-03
                                                    2024-06-10
3
               7
                 Kavita
                                            6500.00
4
              1
                 Ashish
                                            5250.00
                                                    2024-06-01
```