

Name:	Sameer Rana
UID:	23bcs13430
Subject:	ADBMS
Section:	622-B

Ans 4.3:

**Code:**

```
CREATE TABLE StudentEnrollments (  
  student_id INT PRIMARY KEY,  
  student_name VARCHAR(100),  
  course_id VARCHAR(10),  
  enrollment_date DATE  
);  
  
INSERT INTO StudentEnrollments (student_id, student_name, course_id,  
enrollment_date)  
  
VALUES  
  
(1, 'Ashish', 'CSE101', '2024-06-01'),
```

```
(2, 'Smaran', 'CSE102', '2024-06-01'),  
(3, 'Vaibhav', 'CSE103', '2024-06-01');
```

#Part A

```
START TRANSACTION;
```

```
-- Step 1: Lock row with student_id = 1
```

```
UPDATE StudentEnrollments
```

```
SET course_id = 'CSE201'
```

```
WHERE student_id = 1;
```

```
-- Step 2: Later tries to lock student_id = 2
```

```
UPDATE StudentEnrollments
```

```
SET course_id = 'CSE301'
```

```
WHERE student_id = 2;
```

#Part B

```
START TRANSACTION;
```

```
-- Step 1: Lock row with student_id = 2
```

```
UPDATE StudentEnrollments
```

```
SET course_id = 'CSE202'
```

```
WHERE student_id = 2;
```

```
-- Step 2: Later tries to lock student_id = 1
```

```
UPDATE StudentEnrollments
```

```
SET course_id = 'CSE302'
```

```
WHERE student_id = 1;
```

## #Part B: Applying MVCC to Prevent Conflicts

--Transaction 1 (User A - Reader)

START TRANSACTION ISOLATION LEVEL REPEATABLE READ;

-- Reads snapshot data

SELECT student\_id, student\_name, course\_id, enrollment\_date

FROM StudentEnrollments

WHERE student\_id = 1;

--**Transaction 2 (User B - Writer)**

START TRANSACTION;

-- Updates same row

UPDATE StudentEnrollments

SET enrollment\_date = '2024-07-10'

WHERE student\_id = 1;

COMMIT;

## # Part C: Comparing Locking vs MVCC

START TRANSACTION;

SELECT \* FROM StudentEnrollments WHERE student\_id = 1 FOR UPDATE;

UPDATE StudentEnrollments

```
SET course_id = 'CSE401'
WHERE student_id = 1;
START TRANSACTION;
SELECT * FROM StudentEnrollments WHERE student_id = 1;

-- This is BLOCKED until T1 commits
```

### **Scenario 2: MVCC (Snapshot Isolation)**

#### **Transaction 1 (Writer):**

```
START TRANSACTION;
UPDATE StudentEnrollments
SET course_id = 'CSE402'
WHERE student_id = 1;
-- Not committed yet
```

#### **Transaction 2 (Reader):**

```
START TRANSACTION ISOLATION LEVEL REPEATABLE READ;
SELECT * FROM StudentEnrollments WHERE student_id = 1;
```

Output:  
(A)

20	19:00:36	UPDATE StudentEnrollments SET course_id = 'CSE301' WHERE student_id = 2	Error Code: 2013. Lost connection to MySQL server during query	30.016 sec
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**The error “Lost connection to MySQL server during query” occurs because Tab 1 tried to update a row that was already locked by Tab 2.**

## PART B:

22	19:56:03	SET SESSION TRANSACTION ISOLATION LEVEL REPEATABLE READ	0 row(s) affected	0.000 sec
23	19:56:03	START TRANSACTION	0 row(s) affected	0.000 sec
24	19:56:03	SELECT student_id, student_name, course_id, enrollment_date FROM StudentEnrollments WHERE student_id = 1 LIMIT 0, 1000	1 row(s) returned	0.000 sec / 0.000 sec
25	19:56:43	SELECT student_id, student_name, course_id, enrollment_date FROM StudentEnrollments WHERE student_id = 1 LIMIT 0, 1000	1 row(s) returned	0.000 sec / 0.000 sec
26	19:56:43	COMMIT	0 row(s) affected	0.000 sec

## PART C:

### Scenario 1

#### Session A (Transaction 1 - Locks row)

11	19:09:12	START TRANSACTION	0 row(s) affected	0.000 sec
4	12	19:09:12	SELECT * FROM StudentEnrollments WHERE student_id = 1 LIMIT 0, 1000 FOR UPDATE	Running... 7 / 7

12	19:09:12	SELECT * FROM StudentEnrollments WHERE student_id = 1 LIMIT 0, 1000 FOR UPDATE	Error Code: 2013. Lost connection to MySQL server during query	30.016 sec
----	----------	--------------------------------------------------------------------------------	----------------------------------------------------------------	------------

### Scenario 2

#### Session A(Writer)

31	19:12:58	START TRANSACTION	0 row(s) affected	0.016 sec
32	19:12:58	UPDATE StudentEnrollments SET course_id = 'CSE402' WHERE student_id = 1	1 row(s) affected Rows matched: 1 Changed: 1 Warnings: 0	0.000 sec
33	19:13:36	COMMIT	0 row(s) affected	0.000 sec

#### Session B(reader)

31	19:12:58	START TRANSACTION	0 row(s) affected	0.016 sec
32	19:12:58	UPDATE StudentEnrollments SET course_id = 'CSE402' WHERE student_id = 1	1 row(s) affected Rows matched: 1 Changed: 1 Warnings: 0	0.000 sec
33	19:13:36	COMMIT	0 row(s) affected	0.000 sec