Name:	Aditi Tyagi
UID:	23BCS10641
Subject:	ADBMS
Section:	622-A

Part A: Simulating a Deadlock Between Two Transactions

```
IF OBJECT_ID('dbo.StudentEnrollments', 'U') IS NOT NULL
   DROP TABLE dbo.StudentEnrollments;
GO

CREATE TABLE dbo.StudentEnrollments (
   student_id INT PRIMARY KEY,
   student_name VARCHAR(100),
   course_id VARCHAR(10),
   enrollment_date DATE
);
GO

INSERT INTO dbo.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');
GO

BEGIN TRAN;

SELECT * FROM dbo.StudentEnrollments WITH (UPDLOCK, HOLDLOCK) WHERE
student_id = 1;

SELECT * FROM dbo.StudentEnrollments WITH (UPDLOCK, HOLDLOCK) WHERE
student_id = 2;

COMMIT TRAN;
```

Output:

```
student_id  student_name                                                                                                  course_id  enrollment_date
----------- ------------------------------------------------------------------------------------------------------------- ---------- ---------------
          1 Ashish                                                                                                        CSE101           2024-06-01
student_id  student_name                                                                                                  course_id  enrollment_date
----------- ------------------------------------------------------------------------------------------------------------- ---------- ---------------
          2 Smaran                                                                                                        CSE102           2024-06-01
```

Part B: Applying MVCC to Prevent Conflicts During Concurrent Reads/Writes

```
IF OBJECT_ID('dbo.StudentEnrollments', 'U') IS NOT NULL
   DROP TABLE dbo.StudentEnrollments;
GO

CREATE TABLE dbo.StudentEnrollments (
   student_id INT PRIMARY KEY,
   student_name VARCHAR(100),
   course_id VARCHAR(10),
   enrollment_date DATE
);
GO

INSERT INTO dbo.StudentEnrollments VALUES
(1, 'Ashish', 'CSE101', '2024-06-01');
GO
BEGIN TRANSACTION;

UPDATE dbo.StudentEnrollments
SET enrollment_date = '2024-07-10'
WHERE student_id = 1;

BEGIN TRANSACTION;

-- Will block until Session 1 commits
SELECT enrollment_date
FROM dbo.StudentEnrollments WITH (UPDLOCK, HOLDLOCK)
WHERE student_id = 1;

COMMIT TRANSACTION;
```

Output:

```
enrollment_date
---------------
      2024-07-10
```

Part C: Comparing Behavior With and Without MVCC in High-Concurrency

```
IF OBJECT_ID('dbo.StudentEnrollments', 'U') IS NOT NULL
    DROP TABLE dbo.StudentEnrollments;

CREATE TABLE dbo.StudentEnrollments (
    student_id INT PRIMARY KEY,
    student_name VARCHAR(100),
    course_id VARCHAR(10),
    enrollment_date DATE
);

INSERT INTO dbo.StudentEnrollments VALUES
(1, 'Ashish', 'CSE101', '2024-06-01');
BEGIN TRANSACTION;

UPDATE dbo.StudentEnrollments
SET enrollment_date = '2024-07-10'
WHERE student_id = 1;

BEGIN TRANSACTION;
SELECT *
FROM dbo.StudentEnrollments WITH (ROWLOCK, UPDLOCK)
WHERE student_id = 1;


COMMIT TRANSACTION;
```

Output:

student_id	student_name	course_id	enrollment_date
1	Ashish	CSE101	2024-07-10