Department of Computer Engineering
University of Peradeniya
CO527 Advanced Database Systems

Lab Number   04
Topic   : Transaction Processing
Due Date   : 21st March 2022 before 11:55 PM

Objective:
At the end of this lab session, you should understand what transactions are and when we should use them, how to manage and practice transaction based SQL actions.

Introduction

A transaction is a sequential group of database manipulation operations, which is performed as if it were one single work unit. In other words, a transaction will never be complete unless each individual operation within the group is successful. If any operation within the transaction fails, the entire transaction will fail.

Properties of Transactions

Transactions have the following four standard properties, usually referred to by the acronym ACID:
1. Atomicity – All or nothing
2. Consistency – No constraints violated.
3. Isolation – Independence.
4. Durability – Once committed, it is permanent.

SQL Commands

There are mainly 3 commands in SQL that you need to know for transactions.
- START TRANSACTION or BEGIN is used to start a transaction.
- COMMIT is used to save the changes done. It makes the changes permanent.
- ROLLBACK is used to roll back or undo all the changes. It erases all data modifications made from the start of the transaction. It also frees resources held by the transaction.

Transactions in Practice

- **Starting a new Transaction**

  MySQL server offers two modes to manage transactions:
  - Autocommit ON – default mode. Can be started with set autocommit = 1;
  - Autocommit OFF – can be started with set autocommit = 0;

  When a client program starts a new transaction it may be an implicit or explicit transaction depending on the autocommit mode. For instance, in "autocommit on" mode, "START TRANSACTION" will explicitly start a new transaction. Execute the following transaction for the salary table updates.

  ```
  start transaction;
  update salaries set salary = 1.1*salary where emp no=43624;
  select * from salaries where emp no=43624;
  rollback;
  ```

- **Ending a Transaction**
  - Running the COMMIT command will explicitly end the current transaction. Changes will be committed.
  - Running the ROLLBACK command will explicitly end the current transaction. Changes will be rolled back.
  - Running the START TRANSACTION command will explicitly end the current transaction. Changes will be committed.

  If you need to save the changes done above to the table, run commit instead of rollback.

- **Concurrent Accesses**

  What happens when two sessions try to alter the same data? Can transactions overlap? In order to demonstrate this, we need to have at least two sessions for the same database instance. You can connect to the same database using two command line windows.
  1. I of ACID
     I. Issue a select query to view the current status of the departments table in both sessions.
     II. Now, start transaction running start transaction in both sessions.
     III. Insert a new row into the departments table from the 1st session and check if the changes are visible in the second session.

       IV.   Commit changes in the 1st command window and check if you can see the updates done at 1st window in 2nd command window.

       V.   Explain your observations before and after running the commit in the 1st window.

2. Concurrent Updates
   - I. Try to do a concurrent update to the same row in departments table during two transactions
   - II. Explain what happens before ending any of the transactions.
   - III. What happens when you commit your changes in the 1st session?

What to Turn In

Use your imagination and words to write a scenario where using transactions is essential and then create the required tables and test how the transaction will effect your tables,

1. during the transaction execution.
2. after rollback statement.
3. after the commit statement.
4. during 2 concurrent transactions, both of them update a record and both of them commit it.

Submission

- Submissions have to be done within two weeks from the lab class.
- You have to test all the above commands and need to write a brief description on all the exercises with Screenshots.
  (You can also use the same database that we had used in Lab 01 for above exercises.)

Submit a single **E_1X_XXX_lab04.zip** file with one .sql file including all your SQL queries and a .pdf file with your scenario explained.