Transaction Processing Concepts

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What is a Transaction?

- The execution of a program that accesses or changes the contents of the database.

- A unit of work in a database system. (An atomic unit of DB work) (executed in its entirety or canceled)

- Computation or program which takes the database from one consistent state to another. (Not necessary consistent during the transaction!)
Single vs. Multi-user DBMS:

- **A DBMS is single_user** if at most one user at a time can use the system. (typical stand_alone PC DBMSs).

- **A DBMS is multi-user** if many users or many applications can use the system simultaneously.
Physical vs. Logical Concurrency:

■ Physical Concurrency:
  ■ In a multiple processor system, actual simultaneous processing of multiple programs is possible.

■ Logical Concurrency:
  ■ In a single processor (CPU) system, program’s executions are interleaved.
Basic Operations of a Transaction:

- **Begin_Transaction(t-id)**
  - Marks the beginning of a transaction

- **Read(t-id, value)**

- **Write(t-id, value)**

- **End_Transaction(t-id)**
  - Marks that read and write operations have ended. It is the point at which the DBMS must determine if the changes can be applied permanently or if the transaction should be aborted and restarted.
Basic Operations of a Transaction:

- **Commit Transaction(t-id)**
  - Successful end of transaction. All changes are made permanent. (Transaction can not be undone)

- **Rollback(t-id) (or Abort(t-id))**
  - Unsuccessful end of transaction. All changes must be undone.

- **Undo(t-id)**
  - Similar to a Rollback, except only for an operation such as read or write.

- **Redo(t-id)**
  - Redo an operation such as read or write.
A Day in the Life of a Transaction:

State Transition Diagram for Transaction Execution
States:

- **Active**
  - Transaction is reading or writing.

- **Partially committed**
  - Transaction is done reading or writing, it will now either commit or abort depending of the CC algorithm’s order.

- **Failed**
  - Transaction is unsuccessful and must be terminated and possibly restarted.
States:

- **Committed**
  - Transactions is accepted by the system. All changes are made permanent.

- **Terminated**
  - Transaction ends. (Committed or Aborted)