

ACID

- **Atomic** - Transactions are indivisible. No intermediate values are seen
- **Consistent** - The transactions always leave the system in a consistent state
- **Isolated** - One transaction does not affect another. Serially equivalent
- **Durable** - Once committed, the change is permanent

Two phase locking

- Method of concurrency control.
- No new locks are acquired after a lock is released.
- All interleaving of parallel transactions using two phase locking are serializable.

Strict Two Phase Locking

- Once a lock is acquired, it is kept until the end of the transaction.
- All locks are released at the end of the transaction.
- Simple for the transaction
- Objects are locked when accessed and released at termination

Timestamp Ordering

- An alternative to locking.
- Each transaction has one unique timestamp based on when the transaction starts. This timestamp does not change.
- A transaction is aborted if it might interfere with another or generate inconsistencies.
- There is no locking and no deadlocks.

Pessimistic Timestamp Ordering

- All data items have read and write timestamps.
- Data timestamps are set to the transaction's timestamp when read or written.
- A transaction is aborted if it accesses data that has been accessed by another transaction since the first transaction started.

Read Rules

- If a transaction attempts to read data whose write timestamp is greater than the transaction timestamp, the transaction is aborted.
- Otherwise the read occurs and the data read timestamp is updated if it is less than the transaction timestamp.

Write Rules

- If a transaction attempts to write data whose read timestamp is greater than the transaction timestamp, the transaction is aborted.
- Otherwise the write occurs (tentatively) and the data write timestamp is updated if it is less than the transaction timestamp.

Optimistic Timestamp Ordering

- Don't check for problems during a transactions execution.
- At the end, abort the transaction if any accessed data item has been changed since the transaction started.
- Works well if interference is unlikely.