ICS 321 Fall 2011

The Database Language SQL (iv)

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Insertion

```
INSERT INTO R(A1, A2, ...)
        VALUES  (v1, v2, ...);
```

```
INSERT INTO Studio(name)
        SELECT DISTINCT studioname
        FROM Movies
        WHERE studioname NOT IN
                (SELECT name
                FROM Studio);
```

- If inserting results from a query, query must be evaluated prior to actual insertion

Deletion

```
DELETE FROM R
WHERE  <condition>;
```

```
DELETE FROM StarsIn
WHERE  movieTitle = 'The Maltese Falcon' AND
       MovieYear = 1942 AND
       starName='Sydney Greenstreet';
```

- Deletion specified using a where clause.
- To delete a specific tuple, you need to use the primary key or candidate keys.

Updates

```
UPDATE R
SET  <new value assignments>
WHERE <condition>;
```

```
UPDATE MovieExec
SET name='Pres. ' || name
WHERE cert# IN (
        SELECT presC#
        FROM Studio );
```

- Tuples to be updated are specified using a where clause.
- To update a specific tuple, you need to use the primary key or candidate keys.

Airline Reservation Example

Flights (fltNo , fltDate , seatNo , seatStatus)

To view available seats:

```
SELECT seatNo
FROM Flights
WHERE fltNo = 123 AND fltDate = DATE '2008-12-25'
        AND seatStatus = ' available ' ;
```

To reserve a particular seat:

```
UPDATE Flights
SET seatStatus = 'occupied'
WHERE fltNo = 123 AND fltDate = DATE '2008-12-25 '
        AND seatNo = '22A';
```

Transactions

- A *transaction* is the DBMS's abstract view of a user program: a sequence of reads and writes.
  - Eg. User 1 views available seats and reserves seat 22A.
- A DBMS supports multiple users, ie, multiple transactions may be running concurrently.
  - Eg. User 2 views available seats and reserves seat 22A.
  - Eg. User 3 views available seats and reserves seat 23D.

Concurrent Execution

- DBMS tries to execute transactions concurrently – why ?

Schedule 1

U1	U2
Finds 22A empty	
	Finds 22A empty
Reserves 22A	
	Reserves 22A

Schedule 2

U1	U2
Finds 22A empty	
Reserves 22A	
	Finds 22A taken
	Does not reserve 22A

Schedule 3

U1	U2
	Finds 22A empty
	Reserves 22A
Finds 22A taken	
Does not reserve 22A	

ACID Properties

4 important properties of transactions

- **Atomicity**: all or nothing
  - Users regard execution of a transaction as atomic
  - No worries about incomplete transactions
- **Consistency**: a transaction must leave the database in a good state
  - Semantics of consistency is application dependent
  - The user assumes responsibility
- **Isolation**: a transaction is isolated from the effects of other concurrent transaction
- **Durability**: Effects of completed transactions persists even if system crashes before all changes are written out to disk

Atomicity

- A transaction might *commit* after completing all its actions, or it could *abort* (or be aborted by the DBMS) after executing some actions.
- A very important property guaranteed by the DBMS for all transactions is that they are *atomic*. That is, a user can think of a Xact as always executing all its actions in one step, or not executing any actions at all.
  - DBMS *logs* all actions so that it can *undo* the actions of aborted transactions.

Example (Atomicity)

```
T1:     BEGIN
        A=A+100
        B=B-100
        END
```

```
T2:     BEGIN
        A=1.06*A
        B=1.06*B
        END
```

- The first transaction is transferring $100 from B's account to A's account.
- The second is crediting both accounts with a 6% interest payment
- There is no guarantee that T1 will execute before T2 or vice-versa, if both are submitted together. However, the net effect must be equivalent to these two transactions running serially in some order.

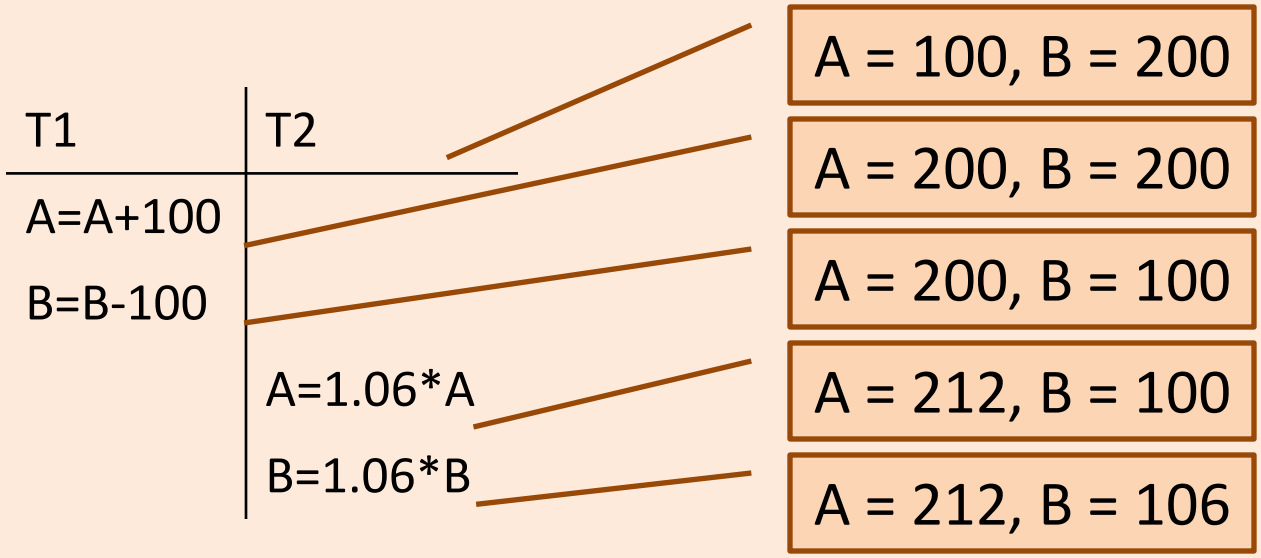
Database View of Transactions

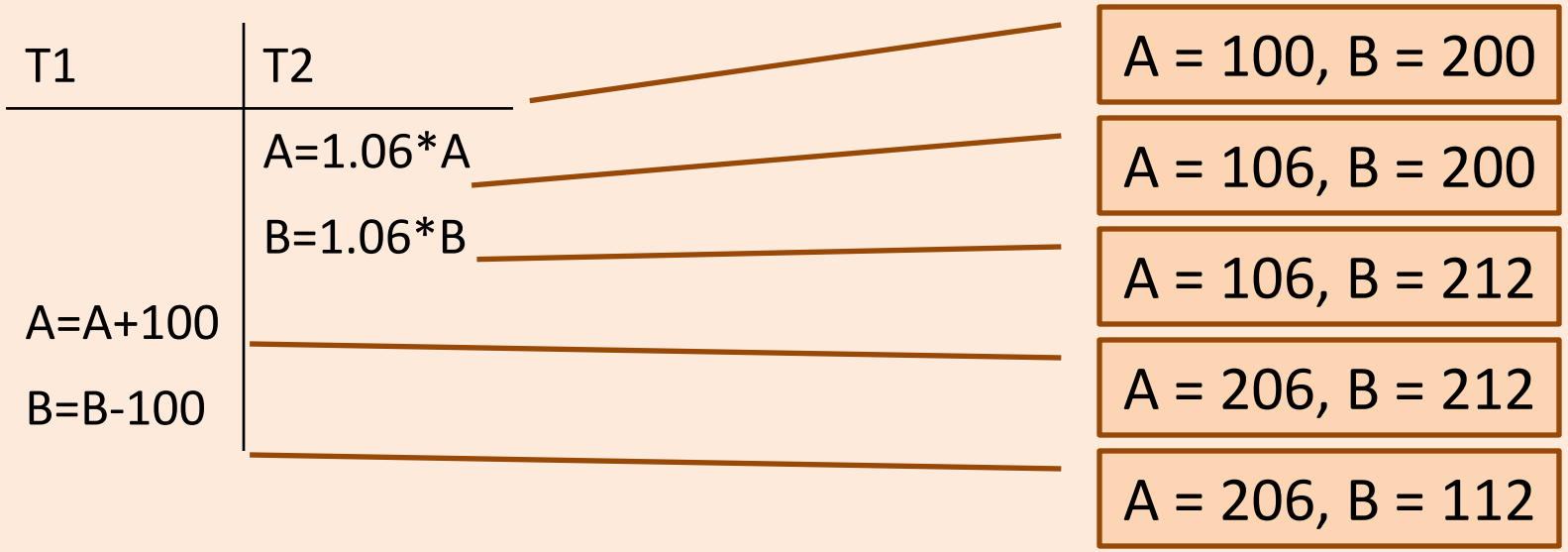
```
T1:     BEGIN
        A=A+100
        B=B-100
        END
```

```
T1:     BEGIN

        Read A from disk
        A=A+100
        Write A to disk

        Read B from disk
        B=B-100
        Write B to disk

        END
```

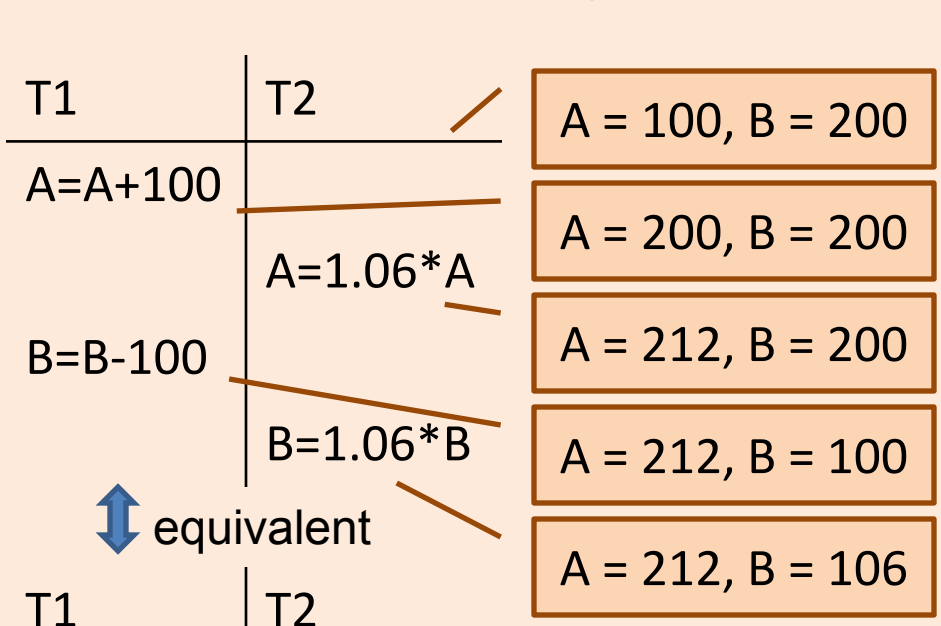
```
T1:     BEGIN
        R(A)
        W(A)
        R(B)
        W(B)
        END
```

Serial Executions

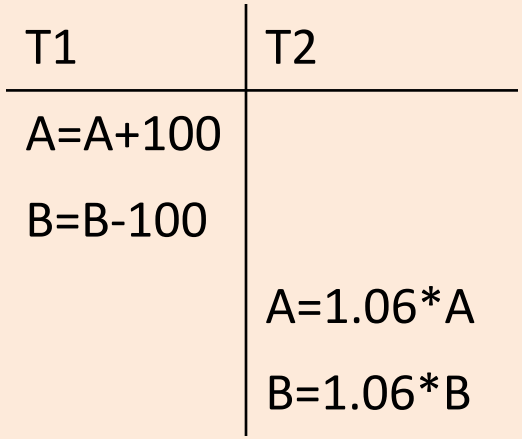


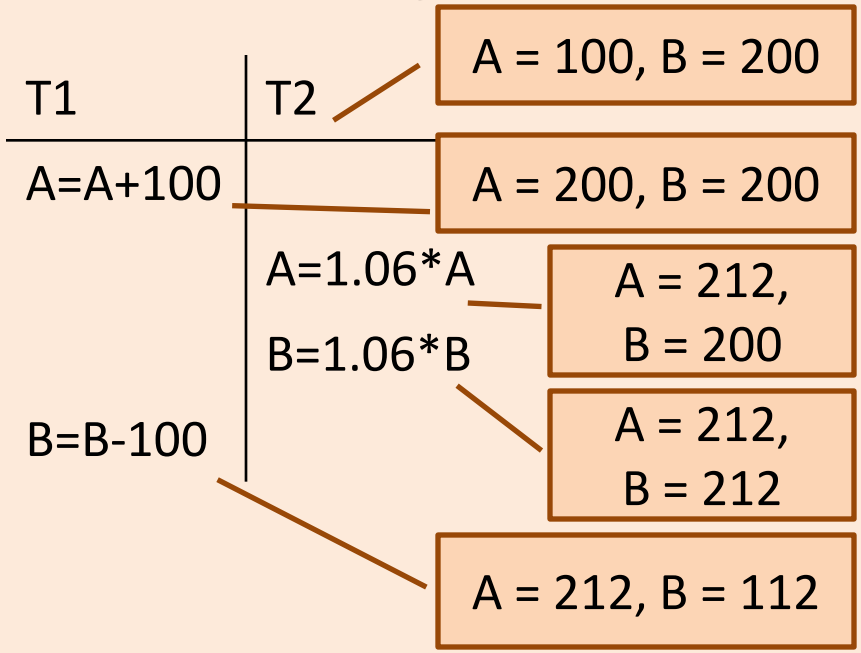


Example (Serializability)



equivalent





Scheduling Transactions

- *Serial schedule:* Schedule that does not interleave the actions of different transactions.
- *Equivalent schedules*: For any database state, the effect (on the set of objects in the database) of executing the first schedule is identical to the effect of executing the second schedule.
- *Serializable schedule*: A schedule that is equivalent to some serial execution of the transactions.

(Note: If each transaction preserves consistency, every serializable schedule preserves consistency.)