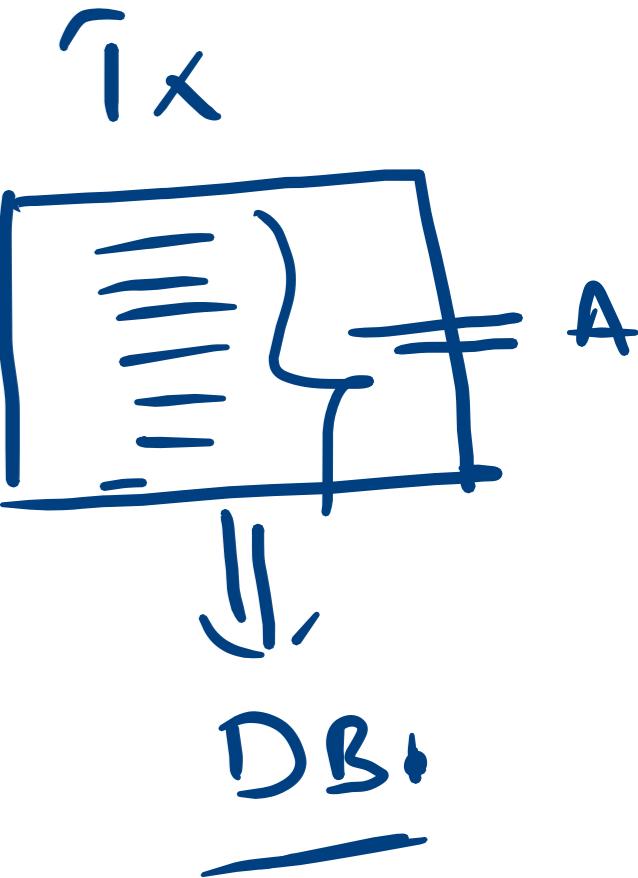


# Recovery Management

→ Memory : Store data

① Primary/main memory : volatile memory  
(DB tr. operations)



② Secondary memory : Non volatile memory  
(DB permanent)

③ Stable Storage : Theoretical  
"data never lost"

RAID

# Transaction failure:

Tx. Success : REDO ✓ (Next state)  
Tx. failure : UNDO ✓ (Previous) } DB  
consistent

Cause of  
(Tx. failure)

- ① System failure/crash : Power, n/w
- ② Transaction /System Error : division by zero,  
range overflow,
- ③ Concurrency control enforcement :  $T_1 - T_2 - T_3$

Hard  
Recovery

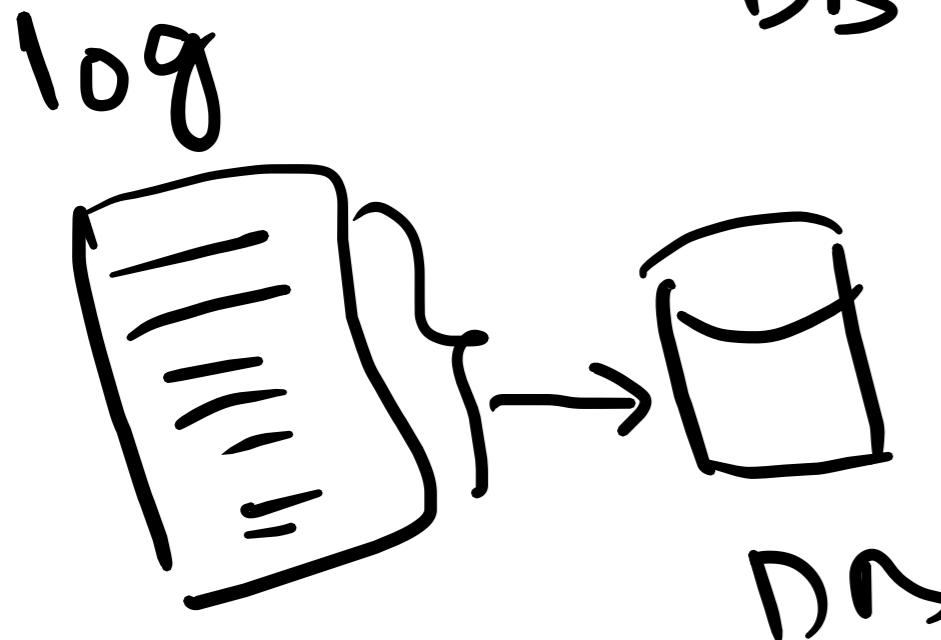
- ④ Disk failure
- ⑤ Physical problem or catastrophes

## Recovery :

1) Shadow Paging ✓

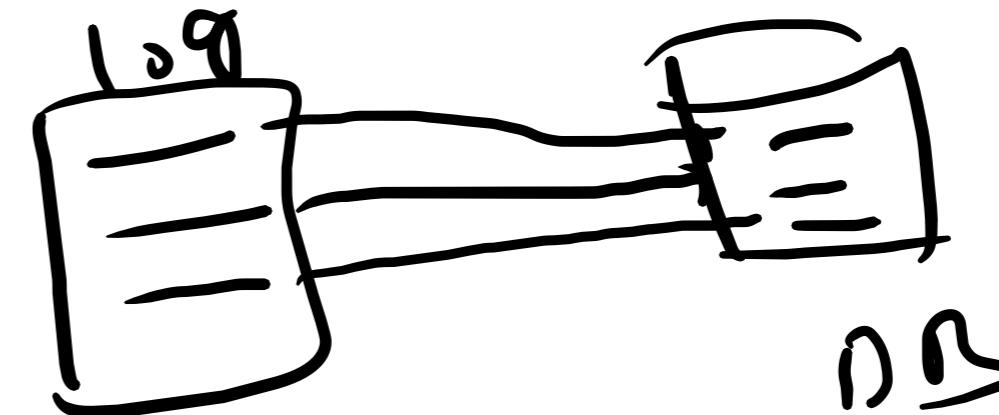
2) Log Based Alg's.

Deferred  
DB modification

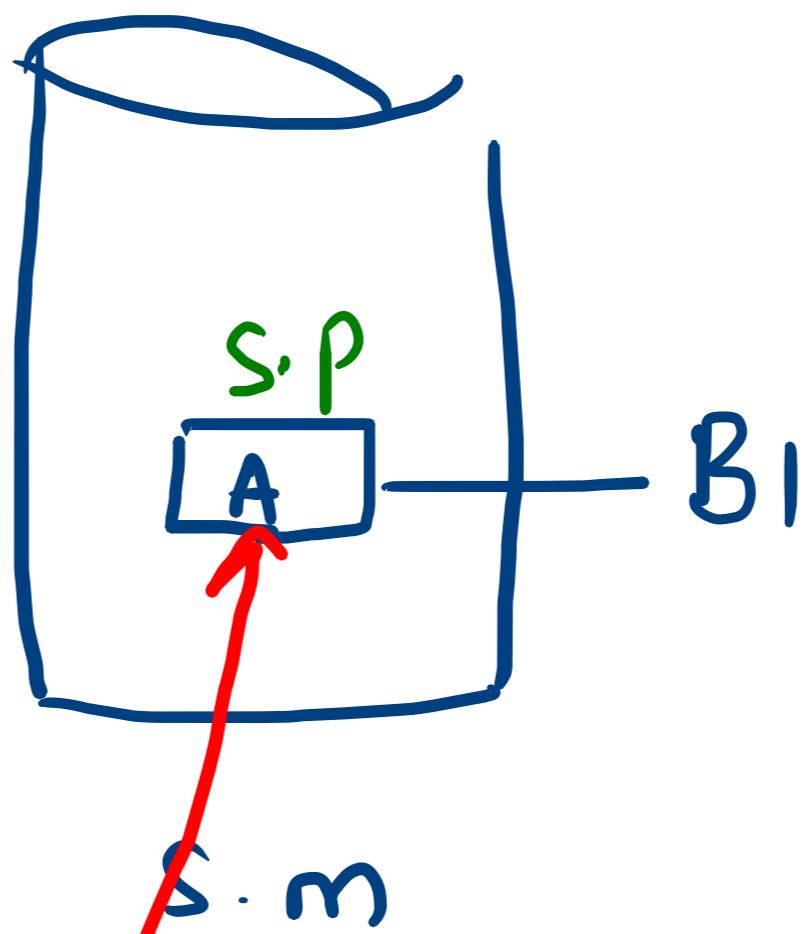
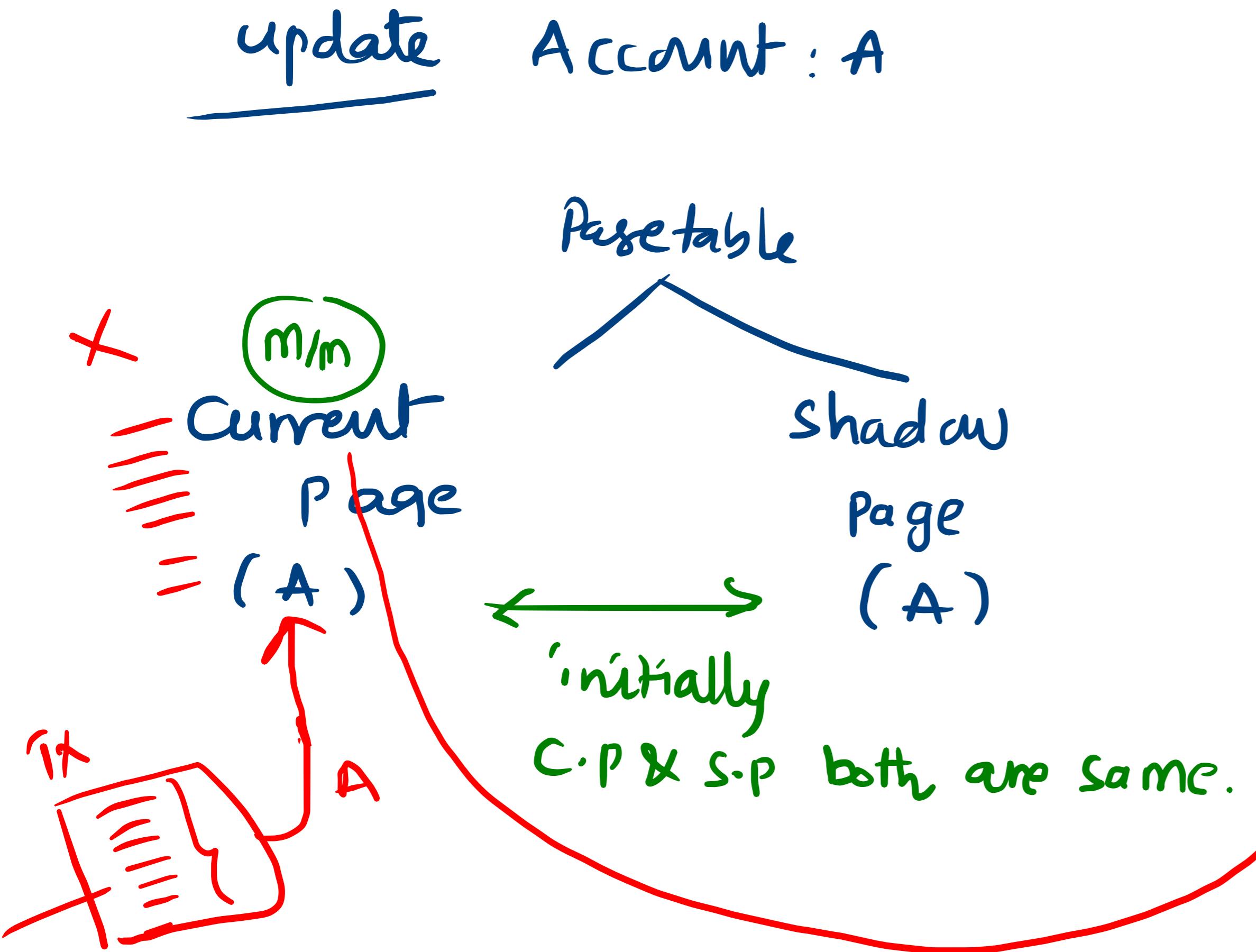


TX

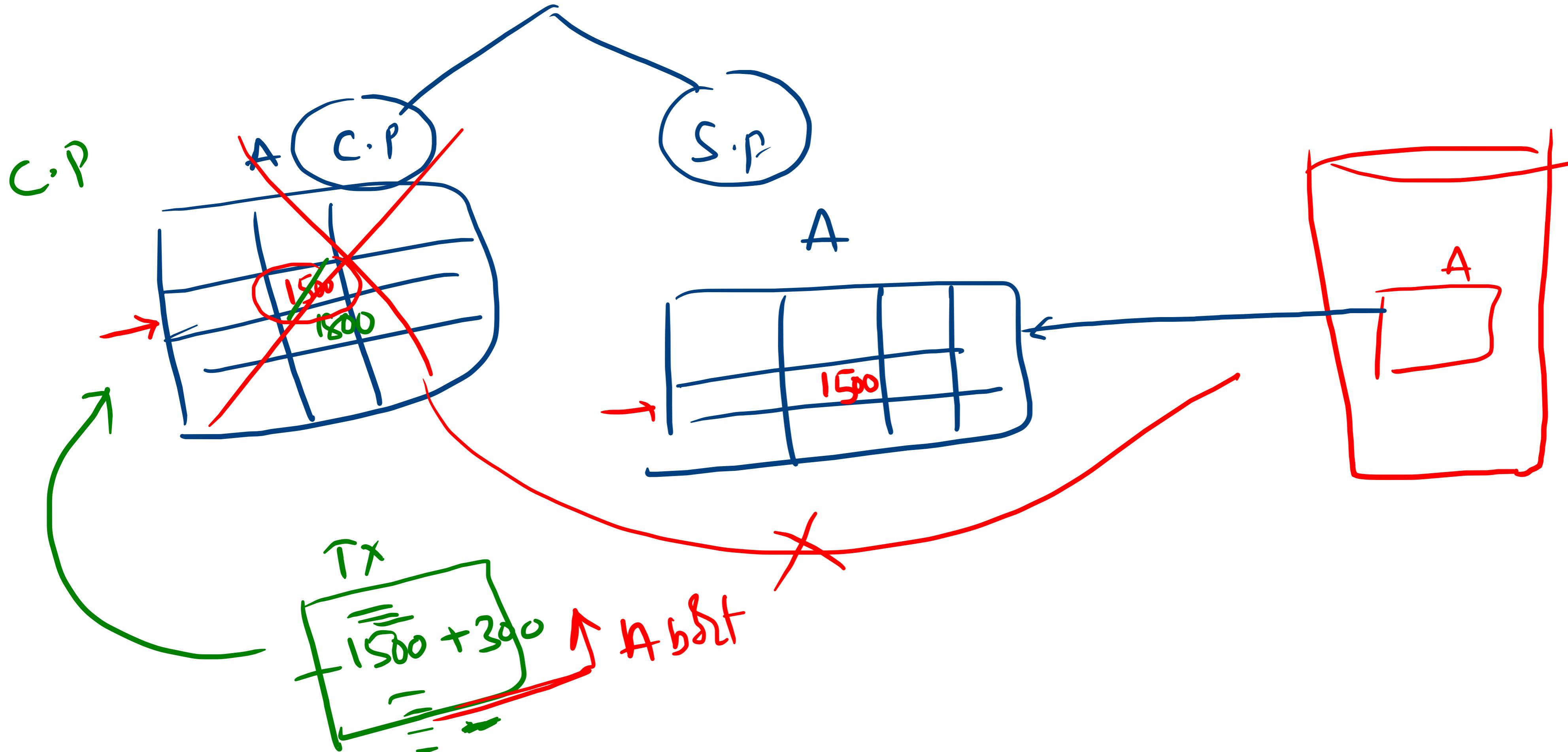
Immediate  
DB modification.



# Shadow Paging (DB Recovery)

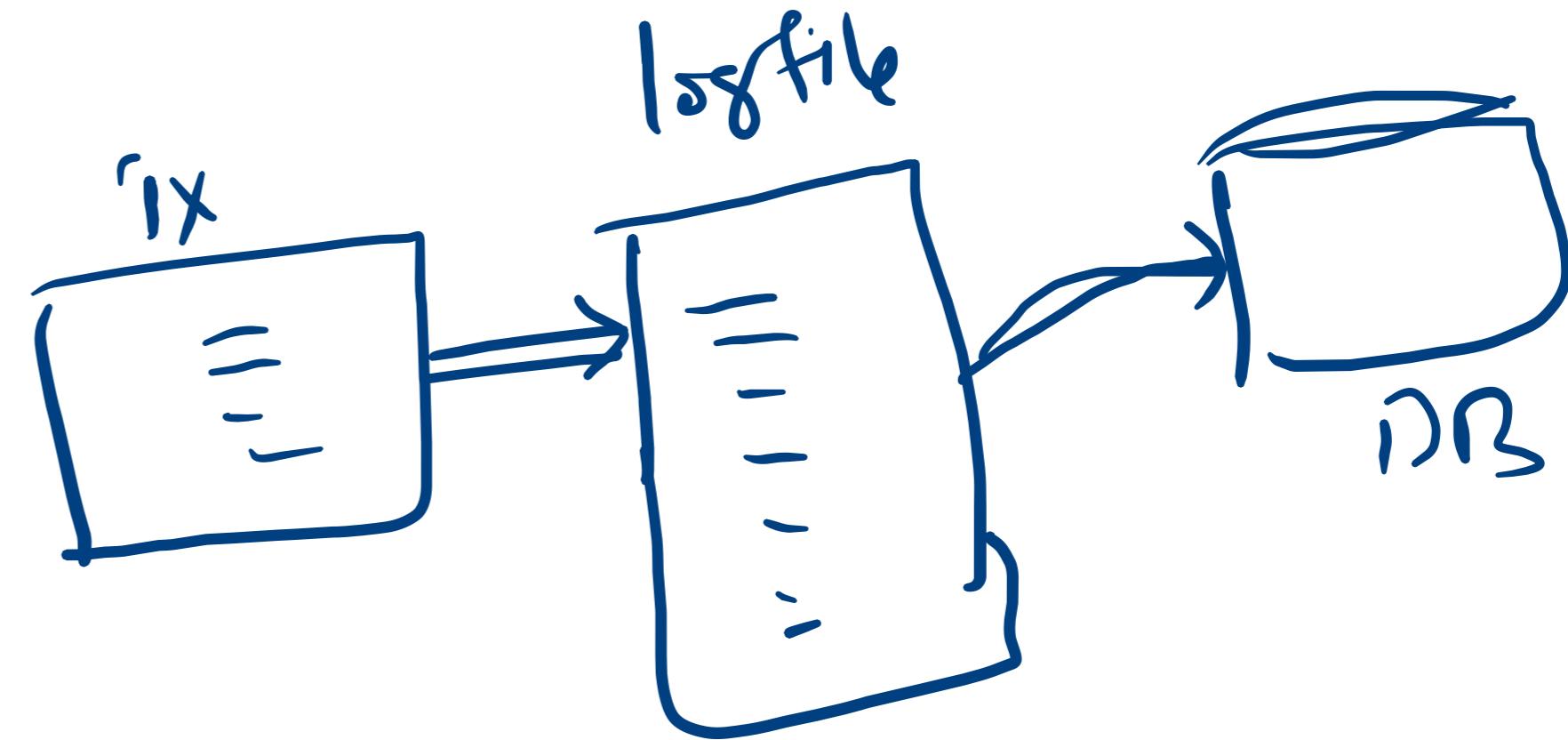
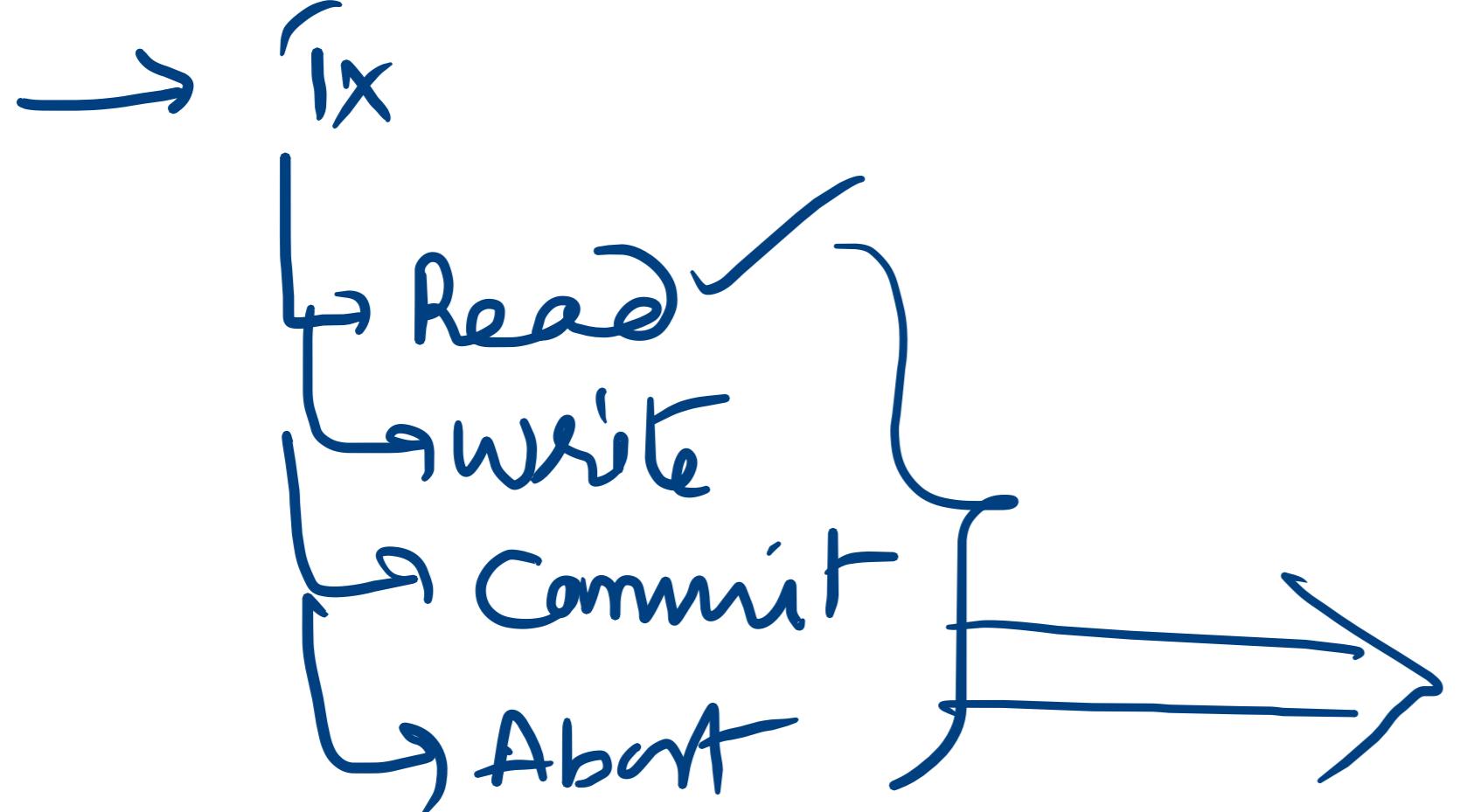


Tables  
||.  
os files  
||.  
Secondary  
memories (blocks)



## → Log Based Recovery

Tx. operations are stored in log file



Log records : operations

①

$[T_1, \text{start}]$

②

$[T_1, X, \underline{\text{old}}, \underline{\text{new}}]$

← write operations

③

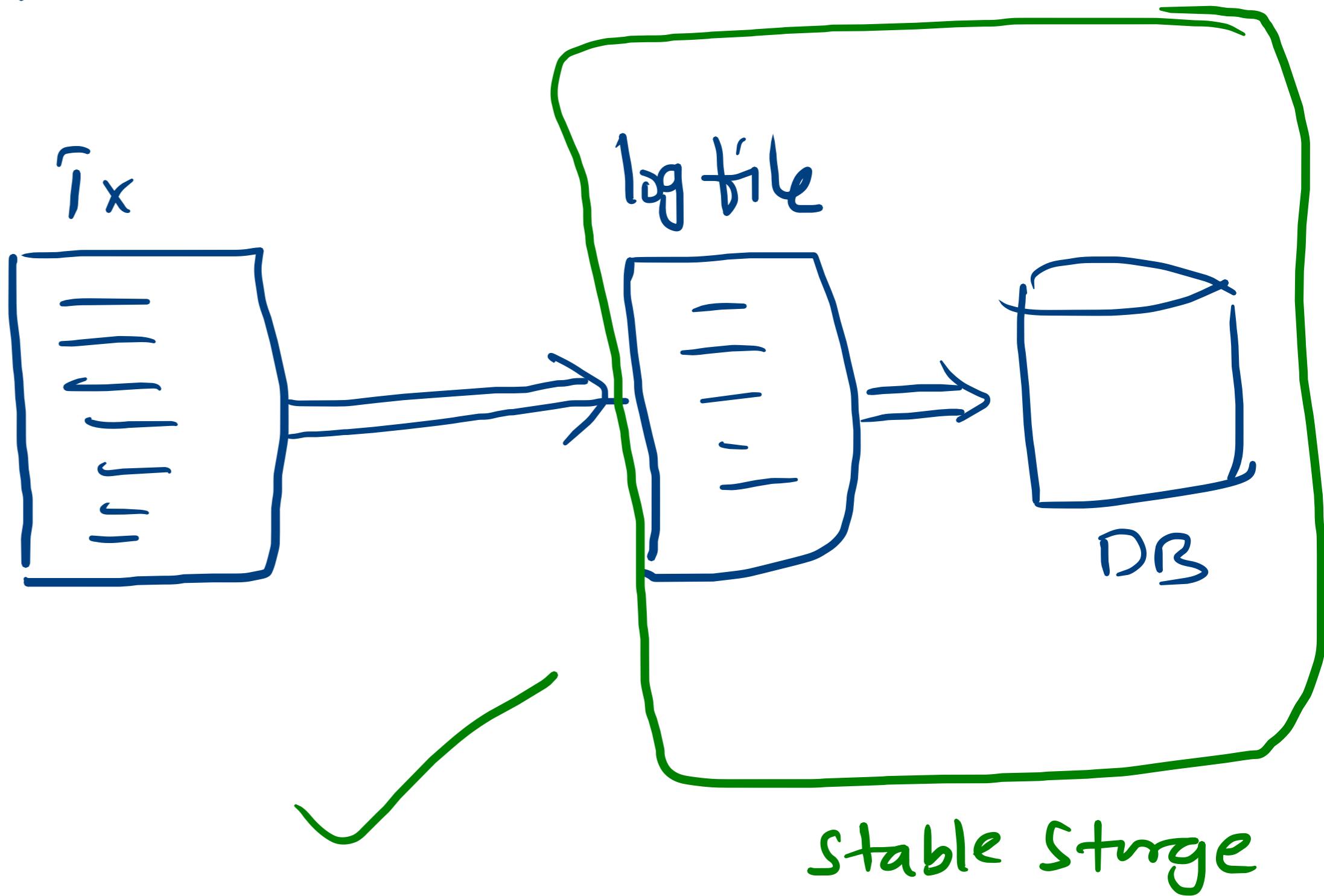
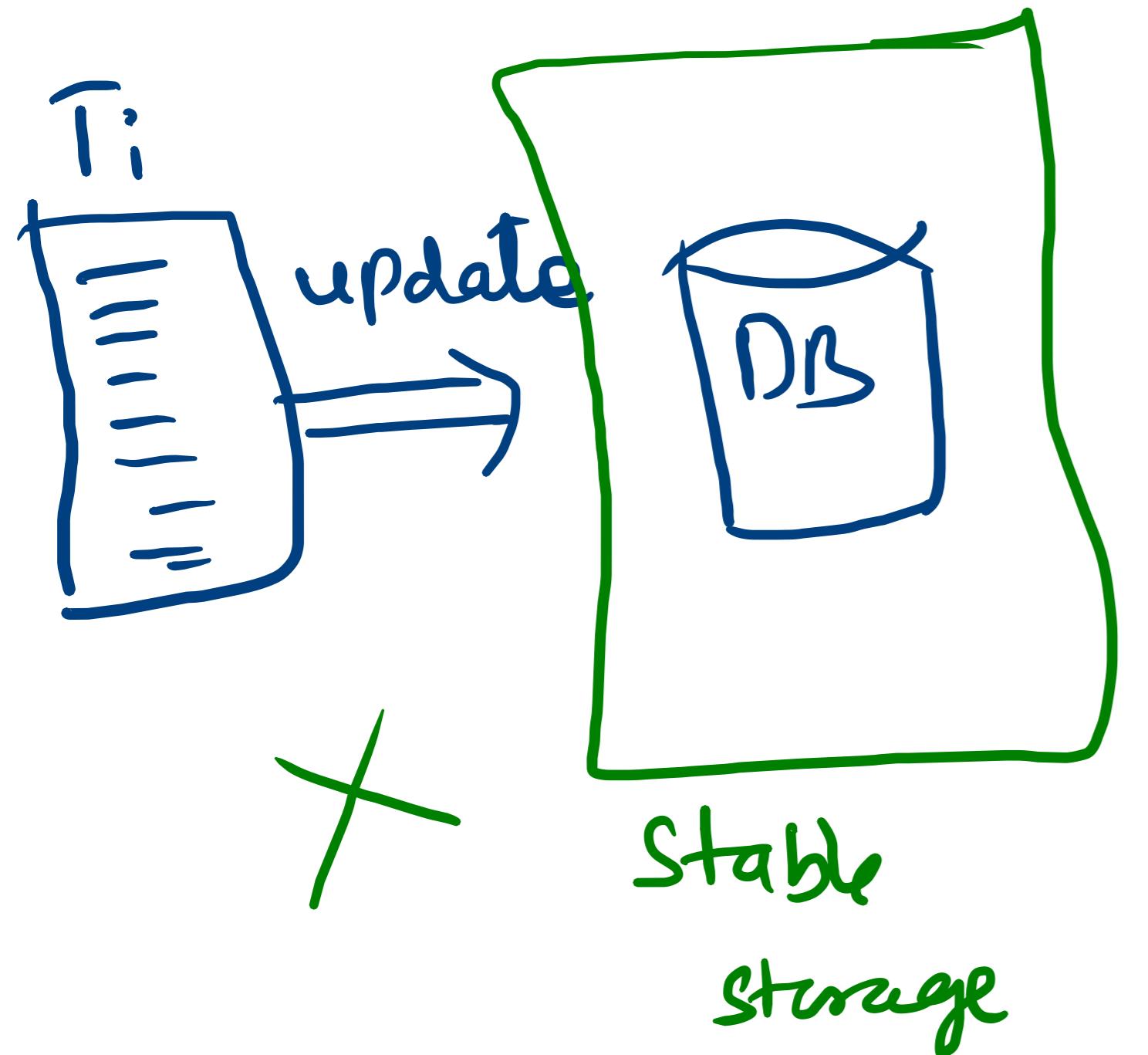
$[T_1, \text{Commit}]$

④

$[T_1, \text{Abort}]$

## Write Ahead Log Strategy : (WAL)

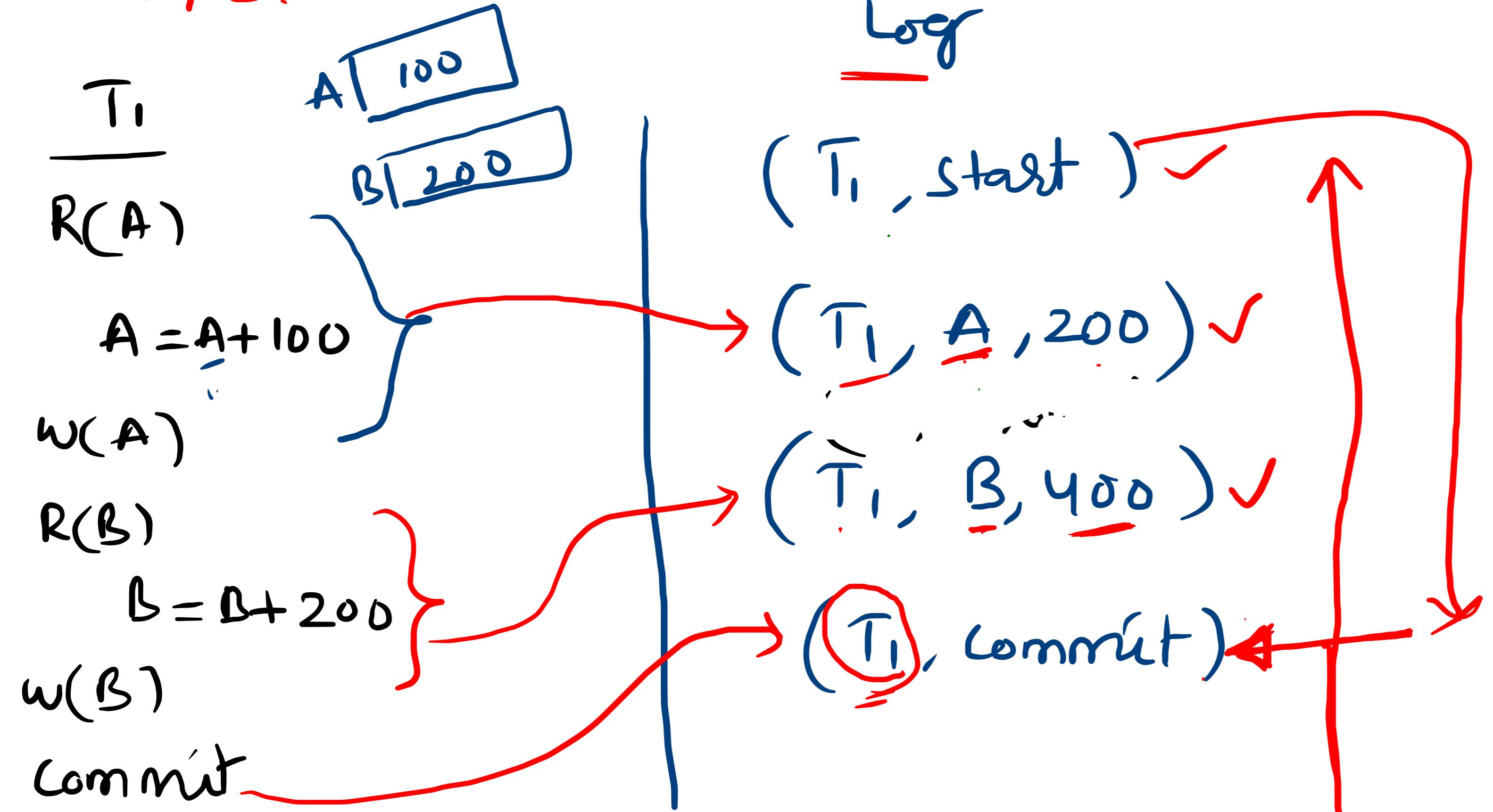
Log is written before any update is made to the database.



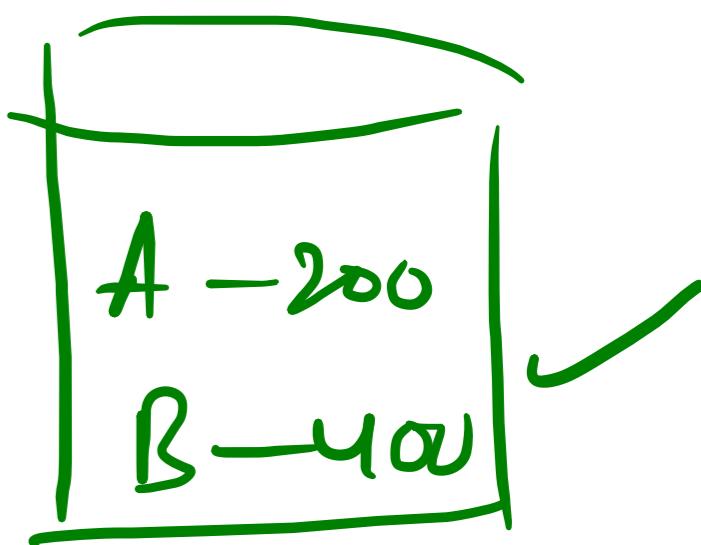
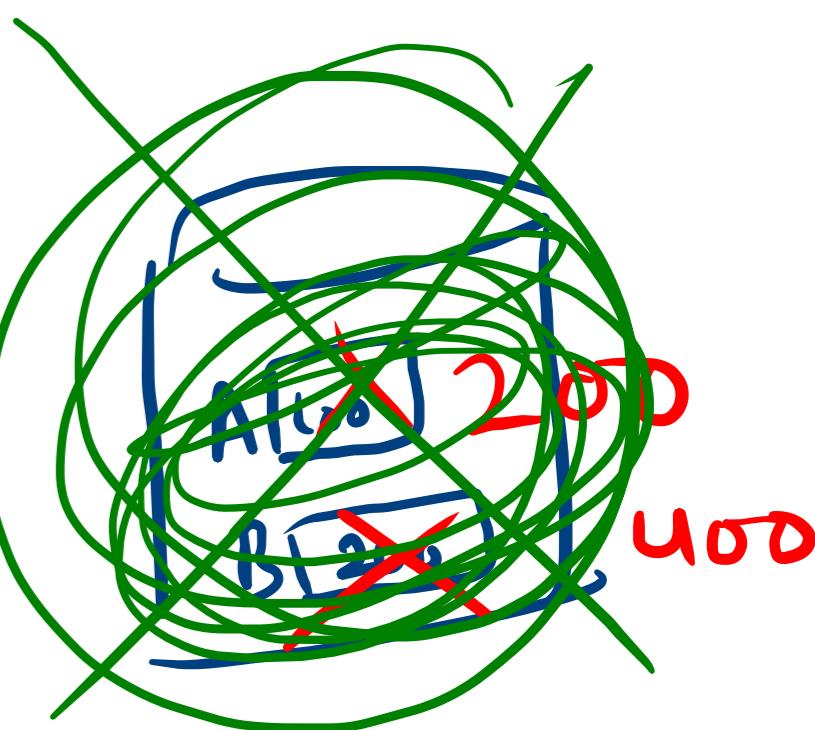
## ① Deferred Database Modification:

- Transaction operations do not immediately update the physical database.
- Only transaction log is updated
- Database is physically updated only after the transaction reaches commit point.
- Also Known as No-UNDO/REDO Alg.

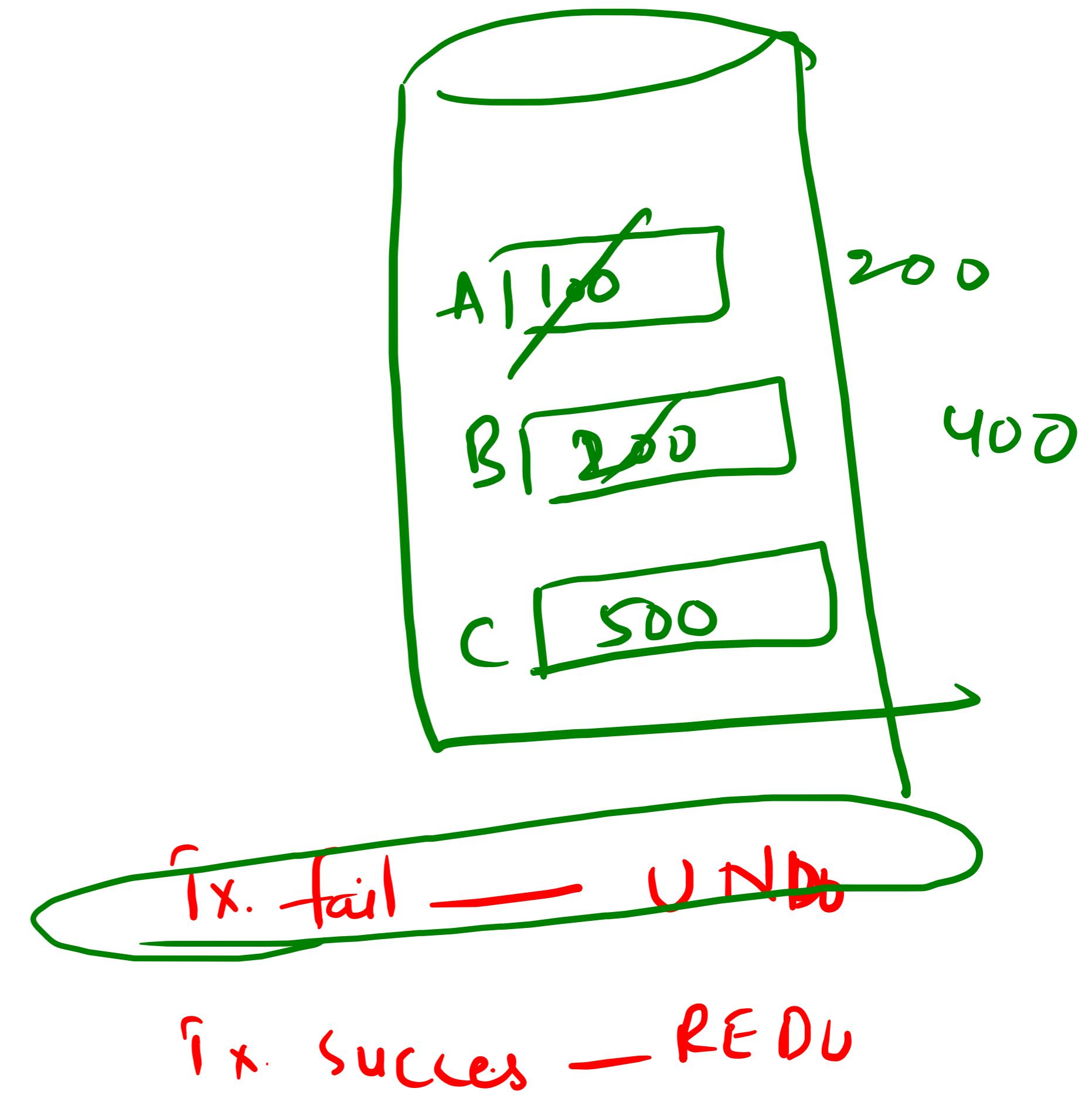
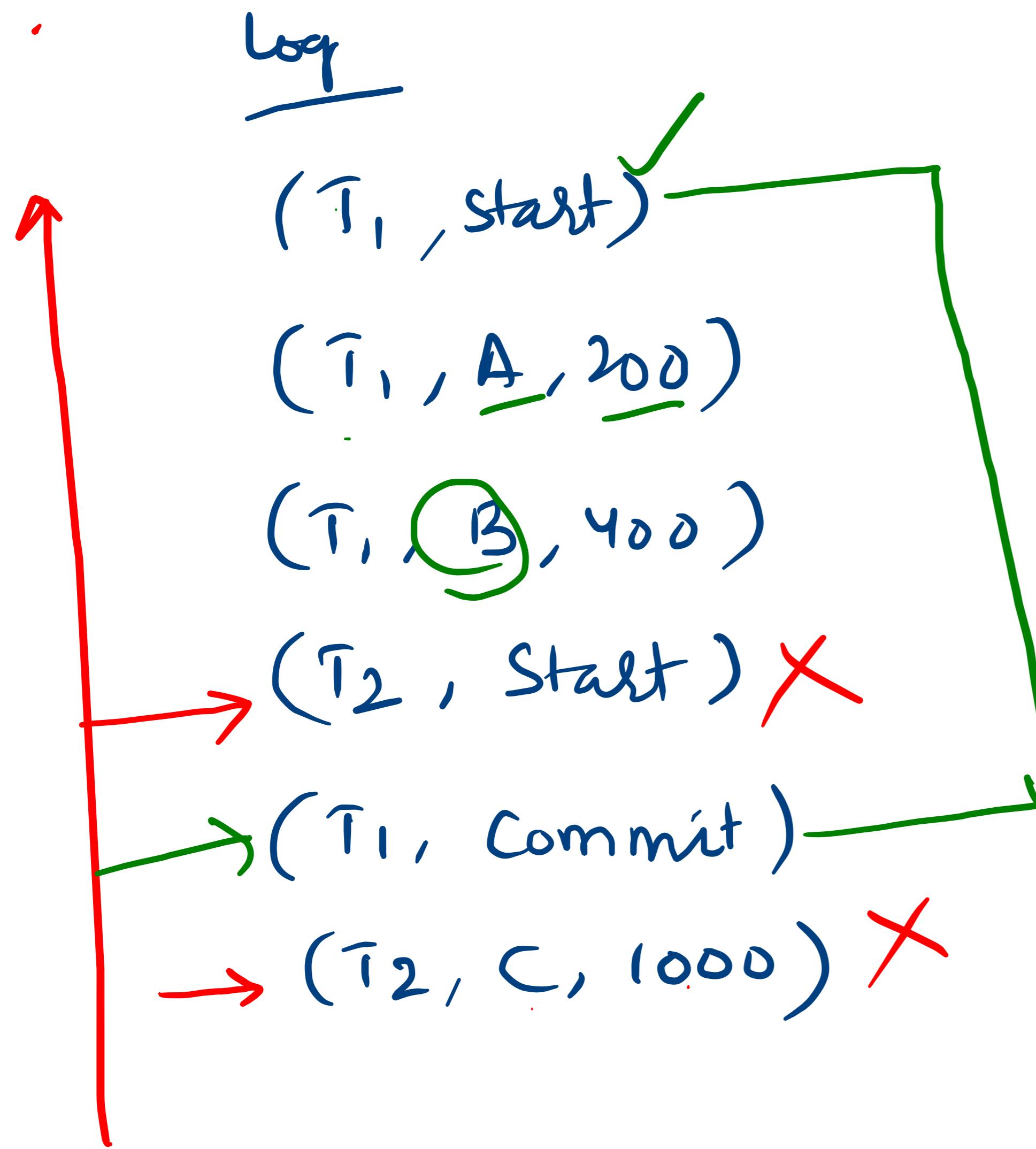
Example:



$Tx \rightarrow \log \rightarrow DR$



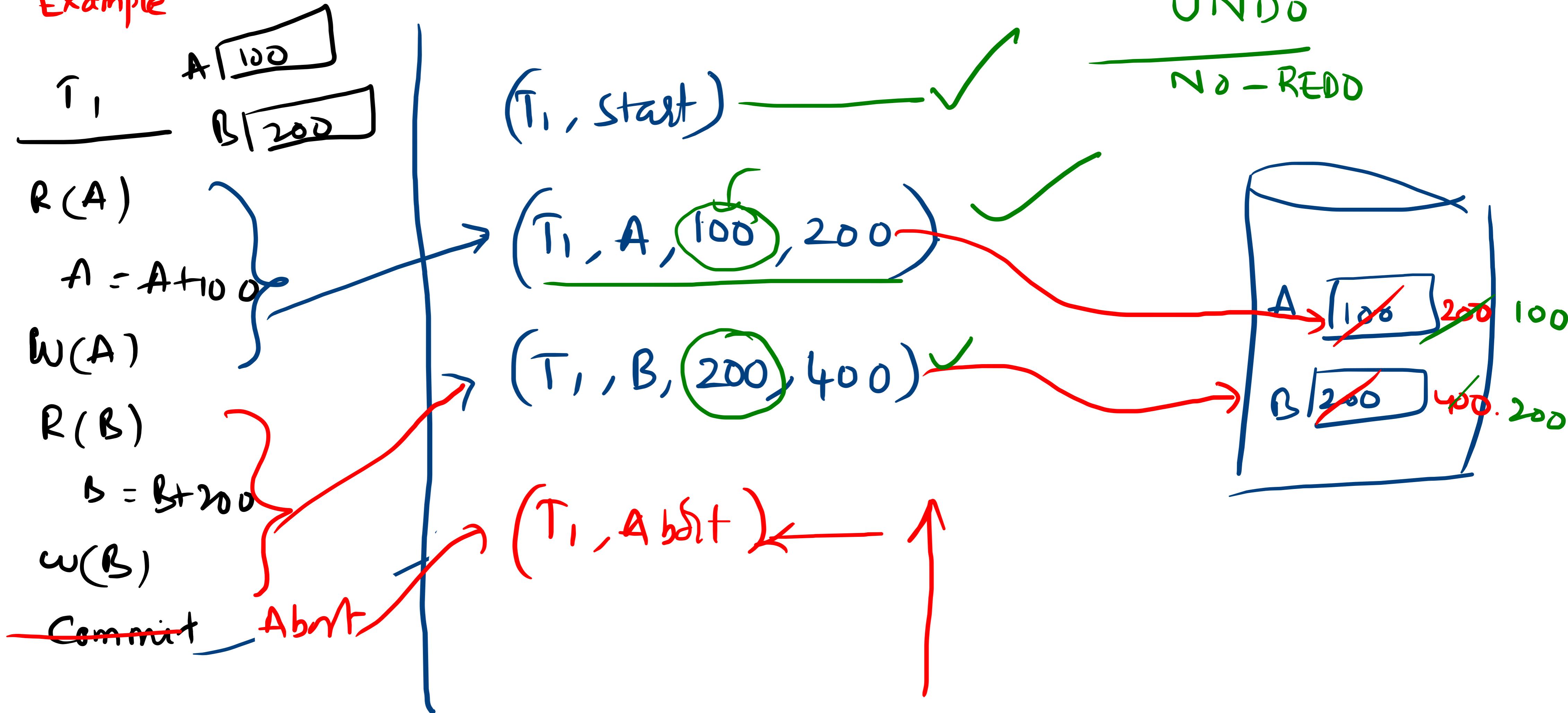
Eq:



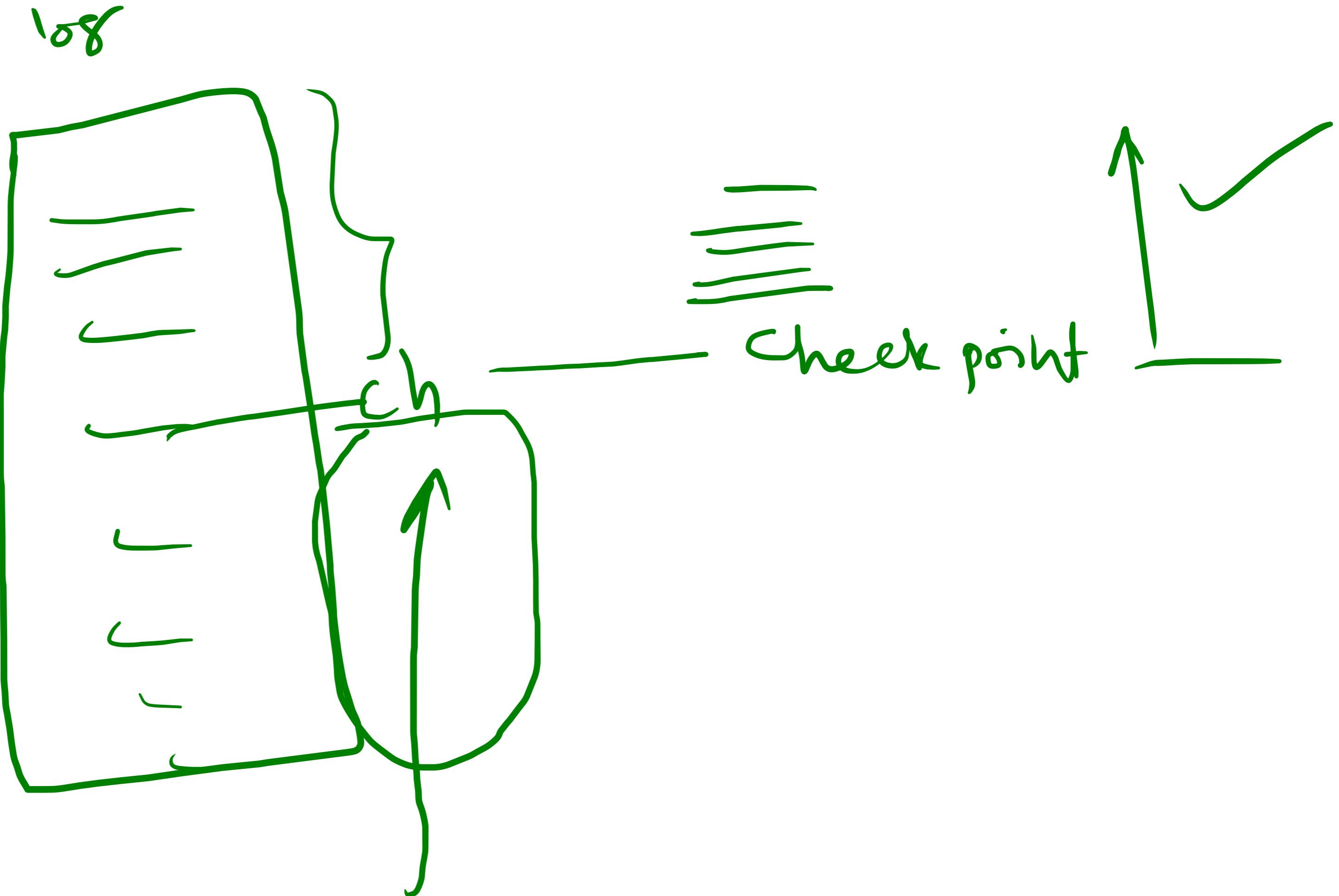
## ② Immediate Database Modification

- Database immediately updated by transaction operations during the execution of transaction before it reaches commit point.
  - In case of transaction abort UNDo operations needs to be done to restore the database to its consistent state.
- Also Called (UNDo/No - REDO) alg. ✓

## Example



Check point:



Ex :

