

Hands-on 1: Write Ahead Log System

Question 1: Wal-sys displays the current state of the database contents after you type `show_state`. What do you observe in on-disk DB contents? Why doesn't the database show studentC?

The content of on-disk DB is

```
Account: studentA Value: 1000
```

The studentC is created during action 3, while action 3 has been left uncommitted. The WAL will write data into DB after an action has been committed. So the studentC has not been written into the database.

Question 2: Which accounts should exist, and what values should they contain when the database recovers?

StudentA and StudentB should exist.

StudentA should contain 1100 while StudentB should contain 2000.

Question 3: Can you explain why the "DB" file does not contain a record for studentB and contains the balance for studentA before `credit_account` is issued?

The action 1 has been ended (by calling the instruction 'end 1') to install the results to the database, so the database contains the balance for studentA. And the `credit_account` on studentA is called in action 2, while action 2 has not been ended, so the changes have not been installed to the database. The database does not contain a record for studentB for the same reason (studentB is created in action 2.)

Question 4: What do you expect the state of "DB" to be after wal-sys recovers? Why?

The state of "DB" would be:

```
Account: studentB Value: 2000
Account: studentA Value: 1100
```

after wal-sys recovers, because the action 2 has been committed, but not ended, so the action 2 is the winner, which will be redone during recovery. So the studentB will be created and 100 credits will be added to the balance of studentA. While action 3 has not been committed, so the action 3 is a loser. And action 3 will not take effect.

Question 5: If you issue another wal-sys command to recover the database again, what would the "DB" file contain after the second recovery? Why?

The "DB" file contains

```
Account: studentB Value: 2000
Account: studentA Value: 1100
```

after the second recovery

In the last recovery, the action 2 has been recovered by redoing it. So action 2 has been ended, thus the results of action 2 being installed to the DB. But since the action 3 is a loser in the last recovery, it's undone and its content has not taken effect in the second recovery. (That will satisfy the all-or-nothing principal)

Question 6: During recovery, wal-sys reports the `action_ids` of those recoverable actions that are "Losers", "Winners", and "Done". What is the difference between these categories?

Losers refer to the actions which has not been committed yet at the moment the system crashes. During recovery, the system will undo the losers.

Winners refer to the actions which has been committed but not ended at the moment the system crashes. During recovery, the system will redo the winners.

Done refer to the actions which has been ended at the moment the system crashes. All the results of done actions will has been installed to the db. So during the recovery, the system will do nothing against done actions.