

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

在DB中只能看到studentA 1000

```
文件(E) 编辑(E) 格式(O) 查看(V) 帮助(H)
studentA 1000
```

因为crash时，创建studentC的action 3还没有end。在action 3 end之后，studentC 3000才会被写入DB。

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

DB恢复时，应该包含studentB 2000，studentA 1100。

因为crash时，action 2已经commit，DB恢复时会redo action 2的操作；而action 3没有commit，action 3的操作会被undo。所以DB恢复后应该是action 1和action 2正常完成的状态，即创建student A 1000，student B 2000，再给studentA 增加100。

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

因为在crash时，action 2并没有end，所以action 2的操作还没有写入DB，即创建studentB 2000和给studentA增加100的操作都还没写入DB，DB中的数据不包含student B的记录，且student A的余额为1000。

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

期望的DB状态如图：

```
-----
On-disk DB contents:
Account: studentB Value: 2000
Account: studentA Value: 1100
-----
```

在crash时，action 1 已end，action 2已完成commit操作，而action 3还没commit，所以在DB恢复时，应该redo action 2，undo action 3，即DB应该为action 1和action 2正常完成的状态：创建student A 1000，student B 2000，再给studentA增加100。结果为 studentB 2000，studentA 1100。

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?

第二次恢复后DB仍然只包含studentB 2000, studentA 1100。

```
-----  
On-disk DB contents:  
Account: studentB Value: 2000  
Account: studentA Value: 1100  
-----
```

因为DB恢复时是根据log进行redo和undo的，所以再次恢复DB时状态仍与上次一致。

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

```
Winners: id: 2  Losers: id: 3  Done: id: 1
```

Winners: 在crash时已经commit但尚未end的操作；在恢复时这些操作会被redo。

Losers: 在crash时已经开始但尚未commit的操作；在恢复时这些操作会被undo。

Done: 在crash时已经end的操作。