

16.2

Purpose:

- to reduce the time and the log needed for potential recovery
- to better reuse the stable storage storing logs. If not, more stable storage may be needed

Frequency:

- the frequency should be determined by the actual conditions, like the requirement on recovery and the frequency of potential crash
- checkpoints slow down the performance exactly, so when no failure occurs, excessively frequent checkpoints will seriously slow down the performance
- the more frequent checkpoints are, the less time it takes to recover from a system crash
- checkpoints do not affect the recovery from disk crash

16.10

- Recovery of interactive transactions is more difficult because the result of such transactions may be irreversible. An example is that a customer is trying to retrieve some cash from a ATM. Once the money is taken by the customer, it is hard to get the money back, which explains the difficulty of 'aborting' such transaction.
- A simple way to deal with this is to make all the operations done at the end of the transaction meanwhile guaranteeing the atomicity. In this way, if a transaction is aborted, all the operations can be undone.

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Redo pass:

1. Undo list: $\{T_0, T_1\}$
2. $C = 600$
3. T_1 is removed from the undo list
4. T_2 is added to the undo list
5. $A = 400$
6. $B = 2000$

Undo pass:

1. Undo list: $\{T_0, T_2\}$
2. $A = 500$ and append $\langle T_2, A, 500 \rangle$
3. append $\langle T_2, abort \rangle$
4. $B = 2000$ and append $\langle T_0, B, 2000 \rangle$
5. append $\langle T_0, abort \rangle$

Final result: $A = 500, B = 2000, C = 600$

Logs added:

$\langle T_2, A, 500 \rangle$

$\langle T_2 \text{ abort} \rangle$

$\langle T_0, B, 2000 \rangle$

$\langle T_0 \text{ abort} \rangle$

16.22

a.

No, because it means that the page has been flushed and thus clean before the checkpoint. However, if this page is updated after the checkpoint, then we need to apply redo records to it.

b.

The RecLSN is the LSN at the end of the log when the page became dirty, that is, the LSN of the first log that made this page dirty. Those log records updating the page whose LSNs are less than the RecLSN will not be redone during the redo phase, which is unnecessary. This is because the page is clean before the log record of RecLSN, which means the log records before the log record of RecLSN have been done and saved. If not, the RecLSN will be smaller.