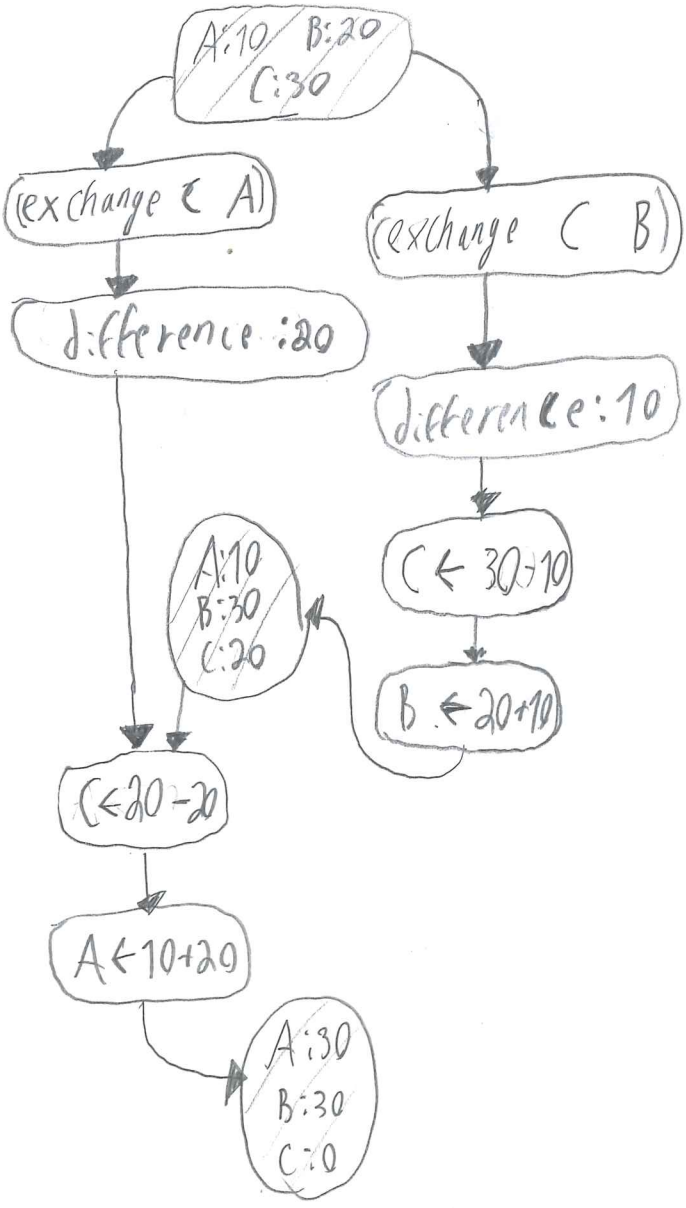
3.43 | (a) Q: Argue that if the processes are run sequentially, then after any number of concurrent exchanges, the account balances should be $10, $20, $30 in some order.

A: Assume we run the processes sequentially by using the serialized-exchange procedure. Then, each exchange protects, through serialization, the accounts from being interfered with part-way through an exchange. This means each serialized-exchange atomically swaps the contents of two accounts. Thus, the balances must remain the same amounts, in some order.

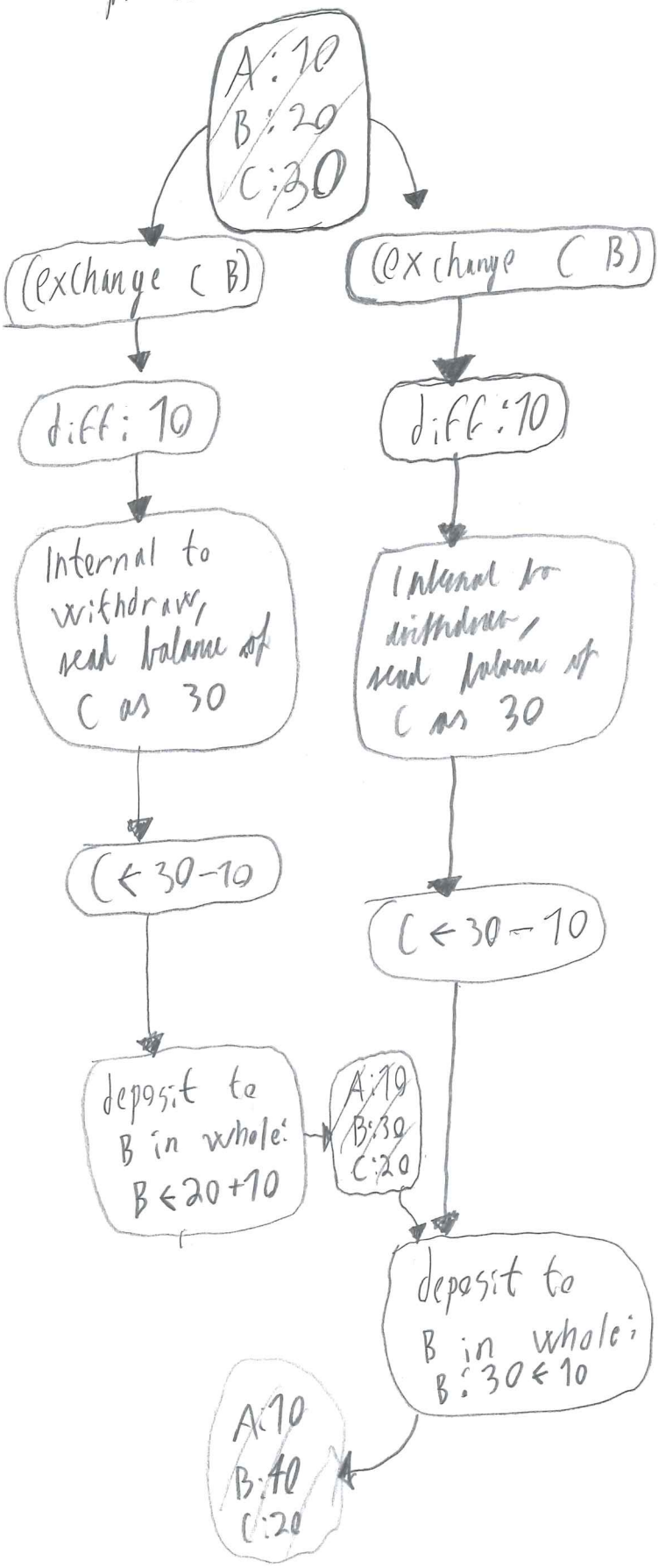
(b) Timing diagram for violation of condition in (a), using the first version of the account-exchange program:



We see that the account balances are no longer an ordering of ($10, $20, $30), but also that the sum of the balances is preserved. This is because the program operates on a closed system, withdrawing and depositing the same amount for any given exchange, thus preserving total amount in the system.

Eg: $a + x = z$
$a = z - x$.

(c) Total sum is not preserved if we remove the transaction serialization on individual accounts.



Total sum increased from $60 to $70.