

2002 Paper 6 Question 4

Concurrent Systems and Applications

A system is to support abortable transactions that operate on a data structure held only in main memory.

- (a) Define and distinguish the properties of *isolation* and *strict isolation*. [2 marks]
- (b) Describe *strict two-phase locking* (S-2PL) and how it enforces strict isolation. [4 marks]
- (c) What impact would changing from S-2PL to ordinary 2PL have (i) during a transaction's execution, (ii) when a transaction attempts to commit and (iii) when a transaction aborts? [6 marks]
- (d) You discover that the system does not perform as well as intended using S-2PL (measured in terms of the mean number of transactions that commit each second). Suggest why this may be in the following situations and describe an enhancement or alternative mechanism for concurrency control for each:
 - (i) The workload generates frequent contention for locks. The commit rate sometimes drops to (and then remains at) zero. [2 marks]
 - (ii) Some transactions update several objects, then perform private computation for a long period of time before making one final update. [2 marks]
 - (iii) Contention is extremely rare. [4 marks]