8 Concurrent and Distributed Systems (SMH)

(a) In the context of concurrent systems, what is a transaction? [1 mark]

(b) Describe the ACID properties of transactions. [4 marks]

(c) Compare and contrast strict and non-strict isolation. [2 marks]

(d) For each of the following, describe how it can be used to provide isolation and/or strict isolation:

(i) 2-Phase Locking (2PL) [3 marks]

(ii) Time-Stamp Ordering (TSO) [3 marks]

(iii) Optimistic Concurrency Control (OCC) [3 marks]

(e) A researcher suggests an isolation scheme that works as follows:

(i) Every object $o$ has an associated version number, $V(o)$.

(ii) When executing, a transaction reads a copy of any object it wishes to access, and remembers the version number.

(iii) If the transaction wishes to modify an object, it modifies the copy rather than the original.

(iv) When complete, the transaction checks the versions of all objects it has modified; if any are different, it aborts; otherwise it writes back the new versions of all objects, incrementing their version numbers, and commits.

Assuming that step (iv) occurs atomically, does this scheme ensure serializability? Justify your answer. [4 marks]