

4 Concurrent and Distributed Systems (djg11)

- (a) A concurrency library provides a `signal` primitive for semaphores and a `notify` primitive for condition variables. Explain what they have in common and how they are different. Are they blocking primitives? Can they have no effect? [4 marks]
- (b) A transaction processing system uses non-strict isolation.
- (i) Without using an example, define the notion of serialisability of transactions. [2 marks]
- (ii) What is a conflict between two threads, and can conflicts be used to check for serialisability? [2 marks]
- (iii) What are the advantages and disadvantages of non-strict isolation? [2 marks]
- (iv) Can performance be enhanced when increment and decrement operations are considered as composite operations? Consider this in the context of conflict analysis techniques. [2 marks]
- (v) Give an example, not using increments or decrements, where simplistic conflict analysis may report a problem that in reality is not a problem. [2 marks]
- (c) Some code is replaced in an asynchronous, reliable message-passing language that uses `channel_id!value` and `?channel_id` to communicate between user-space threads. The whole system has now seized up. Sketch two possible code fragments that may have caused the seizure, one due to deadlock, and one not due to deadlock. [6 marks]