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]