2008 Paper 4 Question 1

Concurrent Systems and Applications

(a) Describe the syntax of the `synchronized` keyword in Java and explain the effect on the runtime behaviour of a program. [5 marks]

(b) Compare and contrast the approaches of using a single mutex to guard access to an entire data structure and using individual mutexes on each unit of storage within the data structure. [5 marks]

(c) Consider a queue data structure, based on a linked list. The operations `pushTail` and `popHead` are to be provided and it should be possible to execute both concurrently whenever doing so would be safe (but not when it would be unsafe). Provide a Java implementation of the data structure and concurrency control mechanism, including the methods to push new items on the tail of the queue and to pop items from the head. [10 marks]