# 2006 Paper 1 Question 5

**Foundations of Computer Science**

(*a*) This question concerns the data structure of queues.

(*i*) Describe the primitive queue operations. [3 marks]

(*ii*) Describe an efficient implementation of queues, presenting code fragments as appropriate (a complete program listing is not required). [3 marks]

(*iii*) Carefully discuss the efficiency of your implementation, using the concept of amortised time. [4 marks]

(*b*) Write an ML function to compute all permutations of its argument, a list. (You may assume that the elements of this list are distinct.) For example, given the argument $[1, 2, 3]$, the result should be a list consisting of the elements $[1, 2, 3]$, $[2, 1, 3]$, $[2, 3, 1]$, $[1, 3, 2]$, $[3, 1, 2]$ and $[3, 2, 1]$ in any order. For full credit, your code must be well structured and clearly explained. [10 marks]