2003 Paper 11 Question 9

Mathematics for Computation Theory

Let L, L' be languages (events) over finite alphabets S, S'. Define the *concatenation* LL' of the languages L and L'. [2 marks]

What are the other regular operators on languages over finite alphabets? [You do not need to give a detailed definition.] Explain what is meant by a *regular language* L over a finite alphabet S. [3 marks]

What is meant by a *non-deterministic finite automaton* (NDFA) over a finite alphabet S? Given such an NDFA M, let ι be the initial state, and A be the set of accepting states. Define the *language L accepted by M* (equivalently, the *event E recognised by M*). [4 marks]

Show how to define a deterministic finite automaton (DFA) $\overline{M}$ that also accepts L. [3 marks]

Suppose that languages L, L' over alphabets S, S' are accepted by DFA M, M'. Construct an NDFA M_c that accepts their concatenation LL'. $(*)$

[4 marks]

Let L be a regular language over a finite alphabet S. Outline the proof that L is accepted by some DFA M. [You may assume results equivalent to $(*)$ for the other regular operators.] [4 marks]