1996 Paper 11 Question 8

Mathematics for Computation Theory

Let E be an event over S that is accepted by the deterministic finite automaton $M \equiv (Q, S, \iota, f, A)$, where $|\,Q\,| = N$. Suppose that $z \in E$ is a word such that $\ell(z) \geqslant N$: show that we may write $z = uvw$ where

(*i*) $\ell(uv) \leqslant N$

(*ii*) $\ell(v) \geqslant 1$

(*iii*) for all $n \geqslant 0$, $uv^n w \in E$ [12 marks]

State whether each of the following languages over $S = \{a, b\}$ is regular, giving your reasons.

(*a*) $L_1 = \{ww \mid w \in S^*\}$ [6 marks]

(*b*) $L_2 = \{wzw \mid w, z \in S^*\}$ [2 marks]

[Note: $|\,Q\,|$ indicates the number of elements in set Q, and $\ell(w)$ the number of characters in word w.]