2006 Paper 2 Question 8

Regular Languages and Finite Automata

(*a*) Suppose that L_1 and L_2 are regular languages (over the same alphabet Σ) accepted by deterministic finite automata M_1 and M_2 respectively. Show that there is a *deterministic* finite automaton M such that for all strings u over Σ, M accepts u if and only if $u \notin L_1$ or $u \in L_2$. [8 marks]

(*b*) Show that if a deterministic finite automaton M over alphabet Σ accepts all strings of length less than the number of states in M, then it must accept all strings over Σ. [4 marks]

(*c*) What does it mean for two regular expressions over an alphabet Σ to be *equivalent*? Using parts (*a*) and (*b*), or otherwise, describe an algorithm for deciding equivalence of regular expressions. State carefully any standard results that you rely upon. [8 marks]