2008 Paper 2 Question 8

Regular Languages and Finite Automata

(*a*) Explain what is a *context-free grammar* and the language it generates.
[4 marks]

(*b*) What does it mean for a context-free grammar to be regular? Given any deterministic finite automaton M, describe a regular context-free grammar that generates the language of strings accepted by M. [4 marks]

(*c*) Construct a non-deterministic finite automaton with ε-transitions whose language of accepted strings is equal to the language over the alphabet $\{a, b, c\}$ generated by the context-free grammar with non-terminals q_0 and q_1, whose start symbol is q_0 and whose productions are $q_0 \rightarrow abq_1$, $q_1 \rightarrow \varepsilon$, $q_1 \rightarrow q_0$ and $q_1 \rightarrow abc$. [4 marks]

(*d*) Is every language generated by a context-free grammar equal to the set of strings accepted by some non-deterministic finite automaton with ε-transitions? Justify your answer. (Any standard results about regular languages you use should be carefully stated, but need not be proved.)
[8 marks]

1