

2005 Paper 2 Question 9

Regular Languages and Finite Automata

- (a) Languages L_1, L_2 over alphabets Σ_1, Σ_2 are accepted by deterministic finite automata M_1, M_2 . Show how to construct a deterministic finite automaton M from M_1 and M_2 that accepts the intersection $L_1 \cap L_2$ of the two languages. What happens if M_1 and M_2 are non-deterministic? [10 marks]
- (b) A context-free grammar has a set of terminals $\{0, 1, -\}$, a set of non-terminals $\{N, P\}$, where N is the start symbol, and productions given by the following BNF.

$$N ::= 0 \mid P \mid -P$$

$$P ::= 1 \mid P0 \mid P1$$

- (i) Give a deterministic finite automaton that accepts the language generated by this context-free grammar. [4 marks]
- (ii) Give a regular expression that determines the same language. [1 mark]
- (iii) What is meant by *regular* context-free grammars and what is their connection with regular languages? Is the context-free grammar given above regular? [5 marks]