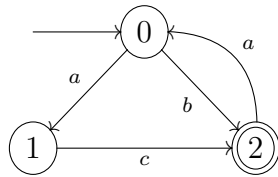


8 Regular Languages and Finite Automata (AMP)

(a) (i) Given any non-deterministic finite automaton  $M$ , describe how to construct a regular expression  $r$  whose language of matching strings  $L(r)$  is equal to the language  $L(M)$  accepted by  $M$ . [5 marks]

(ii) Give a regular expression  $r$  with  $L(r) = L(M)$  when  $M$  is the following non-deterministic finite automaton.



[3 marks]

(b) State the Pumping Lemma and explain how it is used to prove that languages are not regular. [4 marks]

(c) Are the following languages regular? Justify your answer in each case.

(i)  $L_1 = \{a^k b^m c^n \mid (k = m \text{ or } m = n) \text{ and } k + m + n \geq 2\}$

(ii)  $L_2 = \{a^k b^m c^n \mid (k = m \text{ or } m = n) \text{ and } k + m + n \leq 2\}$

(iii)  $L_3 = \{a^k b^m c^n \mid k + m + n \geq 2\}$  [8 marks]