

## 2008 Paper 6 Question 12

### Complexity Theory

(a) Give definitions for the complexity classes  $\text{SPACE}(f)$  (for any function  $f$ );  $\mathbf{L}$  and  $\mathbf{NL}$ . [6 marks]

(b) Consider the following decision problem:

**Reachability:** Given a graph  $G = (V, E)$  and two distinguished vertices  $s, t \in V$ , does  $G$  contain a path from  $s$  to  $t$ ?

(i) Explain why **Reachability** is in the complexity class  $\mathbf{NL}$ . [7 marks]

(ii) Show that if **Reachability** were in the class  $\mathbf{L}$ , we would have  $\mathbf{L} = \mathbf{NL}$ . [7 marks]