Complexity Theory

(a) Give definitions for the complexity classes $\text{SPACE}(f)$ (for any function $f$); $\text{L}$ and $\text{NL}$. [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 $\text{NL}$. [7 marks]

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