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]