

2010 Paper 6 Question 2

Complexity Theory

- (a) Give precise definitions of the complexity classes **L** and **NL**. [3 marks each]
- (b) Explain why $\mathbf{NL} \subseteq \mathbf{P}$. [6 marks]
- (c) The problem **DIRECTED REACHABILITY** is known to be **NL**-complete under *logarithmic space reductions* and the problem **CVP** is known to be **P**-complete under logarithmic space reductions.

Given just this information what can you conclude about the truth of the following statements?

- (i) **DIRECTED REACHABILITY** is logarithmic-space reducible to **CVP**.
- (ii) **CVP** is logarithmic-space reducible to **DIRECTED REACHABILITY**.
- (iii) **DIRECTED REACHABILITY** is polynomial-time reducible to **CVP**.
- (iv) **CVP** is polynomial-time reducible to **DIRECTED REACHABILITY**.

[2 marks each]