2001 Paper 6 Question 12

Complexity Theory

(a) Show that any language that can be accepted by a nondeterministic machine in *time* $f(n)$ can also be decided by a deterministic machine in *space* $O(f(n))$. [4 marks]

(b) Show that any language that can be accepted by a nondeterministic machine in *space* $f(n)$ can also be decided by a deterministic machine in *time* $O(c^{(f(n)+\log n)})$, for some constant c. [6 marks]

(c) Explain what the above results tell us about the inclusion relationships among the complexity classes:

NL, co-NL, P, NP, PSPACE and NPSPACE

[4 marks]

(d) It has been proved that the graph reachability problem is in co-NL. What further inclusions can you derive among the above complexity classes using this fact? Explain your answer. [6 marks]