COMP-362: Honours Algorithm Design

Assignment 5: NP-Completeness

Winter Term 2004

Prove that the following problems are NP-complete:

1. Given a set S, a collection of subsets of S denoted by C and a positive integer K, is there a set $S' \subseteq S$ with $|S'| \leq K$ such that S' contains at least one element from each subset in C?

2. Given two graphs $G = (V, E)$ and $H = (V', E')$ does G contain a subgraph G' isomorphic to H? In other words, is there a set $V'' \subseteq V$ with $|V'| = |V''|$ and a mapping $f : V' \to V''$ which is onto such that $(u, v) \in E'$ if and only if $(f(u), f(v)) \in E$ for any $u, v \in V'$?

3. Given a *directed* graph $G = (V, E)$ and a positive integer K is there a set $V' \subseteq V$ with $|V'| = K$ such that V' contains at least one vertex from every (directed) cycle of G?

Due date: 8th of April, 2004.