

Due Oct 3,4,5

COURSE WEBSITE: "http://www.cs.umd.edu/gasarch/652/652.html"

1. (50 points) A graph $G = (V, E)$ has a *Vertex Cover* X of size k if there exists a set X of k vertices such that for every EDGE $(u, v) \in E$ either $u \in X$ or there exists $v \in X$ such that $(u, v) \in E$.

$$VC = \{(G, k) \mid G \text{ has a vertex cover of size } k\}.$$

Show that VC is NP-complete. You may assume the following problems are NP-complete: SAT (or variants such as 3-SAT), CLIQUE. (NOTE: there is a proof of this in the Algorithms book by Cormen, et. al, 'the big white book'- though the new edition is more green than white. There may also be proofs on the web someplace.)

2. (50 points) A graph $G = (V, E)$ has a *Hamiltonian Cycle* if it has a cycle of length $n = |V|$ which uses all n vertices of the graph.

$$HAM = \{G \mid G \text{ has a Hamiltonian Cycle}\}.$$

Show that HAM is NP-complete. You may assume the following problems are NP-complete: SAT (or variants such as 3-SAT), CLIQUE, VC. (NOTE: there is a proof of this in the Algorithms book by Cormen, et. al, 'the big white book'- though the new edition is more green than white. There may also be proofs on the web someplace.)

(NOTE- the graph and the cycle are undirected.)