BU CLA CS 530: Analysis of Algorithms

Spring 1999

Problem Set 10

Due Thursday April 1, by 5:00 pm, in my mailbox in the main office of the CS department. Late submissions not accepted.

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1. Exercise 36.2-8, page 929, in [CLR].

2. Show that VERTEX-COVER (page 949 in [CLR]) remains NP-complete even if all vertices in the input graph are restricted to have even degrees. *Hint*: The sum of the degrees of the vertices in an undirected graph is always an even number.

3. In [CLR], page 950, it is shown that VERTEX-COVER is NP-hard by the reduction CLIQUE $\leq_P$ VERTEX-COVER. Prove the converse reduction, namely VERTEX-COVER $\leq_P$ CLIQUE. *Hint*: Let the proof on page 950 inspire you.

4. (a) Exercise 36.2-6, page 929, in [CLR]. *Hint*: This is easy. See the argument on page 926 showing that HAM-CYCLE is polynomial-time verifiable.

   (b) Exercise 36.5-5, page 961, in [CLR].

   (c) Define the following decision problem HAM-PATH$'$: Given an undirected graph G, determine whether or not G has a hamiltonian path. HAM-PATH$'$ is different from HAM-PATH in Exercise 36.2-6 (part (a) above); the latter specifies two distinct vertices as part of an input instance. Show that HAM-PATH$'$ is NP-complete. *Hint*: HAM-CYCLE $\leq_{\mathrm{P}}$ HAM-PATH$'$. Split an arbitrary vertex $v \in V$ into v' and v'' so that there are no edges between v' and v'' and $\ldots$.

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