University of Washington   March 18, 2020
Department of Computer Science and Engineering
CSE 417, Winter 2020

Homework 10, Problem 2

Problem 2 (10 points):
Suppose that you have an $O(n^3)$ time algorithm for the Hamiltonian Circuit Problem. Prove that
$P = NP$.

Answer:

It has been proven that Hamiltonian Circuit Problem is an NP complete problem (Kleinberg page
475 8.17).
And suppose Hamiltonian Circuit Problem can be solved by an $O(n^3)$ time algorithm, that means
Hamiltonian Circuit Problem can be solved in polynomial time, and therefore Hamiltonian Circuit Problem $\leq_P$
any other problem in P. And since Hamiltonian Circuit Problem is an NP complete problem,
any other NP complete problem $\leq_P$ Hamiltonian Circuit Problem. Because Transitivity of Reduc-
tions,then any other NP complete problem $\leq_P$ any other problem in P. According to Kleinberg
page 466 8.12, Suppose X is an NP-complete problem. Then X is solvable in polynomial time if
and only if P = NP. And any NP-complete problem is solvable in polynomial time means any other
NP complete problem is solvable in polynomial time, which suggests that P = NP.