

CS350 – Lab 12
Due Date: May 7

Purpose: The question of whether P is equal to NP is the most famous open problem in computer science. If the answer is yes then many problems that are now difficult to solve will become tractable and this would be a really big deal! One way to do this is to show that any one of the known NP -complete problems, or the hardest problems in the class NP , are solvable in P . The tool for showing a problem is NP -complete is the polynomial time reduction. The purpose of this lab is to practice polynomial time reductions and explore the significance of this open problem.

Knowledge: This lab will help you become familiar with the following content knowledge:

- How to perform a polynomial time reduction.
- Explore the significance of NP -complete problems.

Task: Follow the steps in this lab carefully to complete the assignments.

Assignment 1:

Complete exercise 13.7 on p291 of your text.

Criteria for Success: You show how to take an instance of the stranded salesperson decision problem and convert it to an instance of the traveling salesperson decision problem in such a way that the solution to TSPD will give you a solution to SSPD. The instance of each problem is a weighted undirected graph and a threshold value L and answers "yes" if there is a path of length at most L . You need to take the graph G and threshold L for the SSPD problem and convert it to a G' and L' for the TSPD problem.

You need to show that a) a positive instance of SSPD gives a positive instance of TSPD, b) a negative instance of SSPD gives a negative instance of TSPD (show the contrapositive), and c) the transformation can be done in polynomial time.

Assignment 2:

Complete 13.15 on p292 of your text.

Criteria for Success: You show how to take an instance of the RedDHC problem and turn it into an instance of DHC. As in assignment1 you need to show a) a positive instance of RedDHC gives a positive instance of DHC, b) a negative instance of RedDHC gives a negative instance of DHC (show the contrapositive), and c) the transformation can be done in polynomial time.

Assignment 3:

Complete 14.5 on p311 of your text.

Criteria for Success: You explain what class CRACKRSA is in and how we know.

Assignment 4:

Complete 14.7 on p312 of your text.

Criteria for Success: You describe and cite an NP-complete problem that is substantially different from those we have seen.

Written answers may be submitted in Canvas or on paper for grading.