Solution to Algorithm Illuminated (Part 4)

Zeyuan Hu

October 11, 2024

Abstract

This document contains my own solution to [Rou20]. Mistakes are corrected using red.

Contents

1 Chapter 19

Problem 19.1.

b) and c)s

Problem 19.2.

- a) is false because by Clayley's formula, there are n^{n-2} different spanning trees for a complete graph with n vertices. Thus, the number of spanning tree of a graph is not polynomal in the number n of vertices and the number m of edges. Further, the MST problem is computationally tractable because there exists polynomial algorithms to solve the problem.
- b) is false because there are at most n^{n-2} possibilities for the total cost of a spanning tree of a graph
- c) is true.
- d) is false. Similar to a), the exponential number of travling salesman tours does not necessarily indicate that the TSP is computationally intractable.

Problem 19.3.

b)

Problem 19.4.

a). c) is false because if an input to an NP-hard problem is well-structured, the problem can be solved in polynomial time.

Problem 19.5.

e). b) is false because intuitively, A can be reduced to another problem C. If C is polynomial-time solvable, then A is polynomial-time solvable. a) is false because it could be the case that A is polynomial-time solvable because it is reduced to a polynomial-time solvable problem C, which is not B. As a result, the fact that A is polynomial-time solvable cannot be used to justify B is polynomial-time solvable.

References

[Rou20] Tim Roughgarden. *Algorithms Illuminated (Part 4): Algorithms for NP-Hard Problems*. Soundlikeyourself Publishing, LLC, 2020.