Design and Analysis of Algorithms (18 Fall)

Assignment 2

Due: Oct. 30, 2018

1. (20 points) Please write down the main steps of proving the NP-Completeness of a problem.

2. (30 points) Given a graph, a dominating set is a vertex set subset such that any vertex not in this set is adjacent to at least one vertex in this set. The dominating set problem is to check whether a given graph has a dominating set of size at most k.

   2.1 Prove that the dominating set problem is in NP.

   2.2 Prove that the dominating set problem is NP-hard.

   2.3 Design a polynomial-time algorithm for the dominating set problem in trees (graphs contain no cycles).

3. (20 points) Prove that: if we can check whether a graph has a Hamilton cycle in polynomial time then we can also find a Hamilton cycle in a graph in polynomial time.

4. (20 points) In the multiway cut problem, a undirected graph G=(V,E) and some special vertices in V (called terminals) are given. The problem asks whether we can delete at most k edges from the graph such that no pair of terminals are connected. Please give a 2-approximation algorithm for this problem.

5. (10 points) 谈谈本课程中你觉得最难的知识点是哪里，说一下主要难理解的地方和原因，如果感觉课程内容都容易理解则可以谈一谈你收获最大的地方或者一个你应用算法课程知识的地方。（用中文简单作答）