Exercise sheet 1b

COMP6741: Parameterized and Exact Computation

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19T3

Exercise 1. An *independent set* of a graph $G = (V, E)$ is a subset of vertices $S \subseteq V$ such that no two vertices of S are adjacent in G. Consider the Independent Set and the Maximum Independent Set problems.

Independent Set	
Input:	Graph G, integer k
Question:	Does G have an independent set of size at least k?

Maximum Independent Set	
Input:	Graph G
Output:	A largest independent set of G

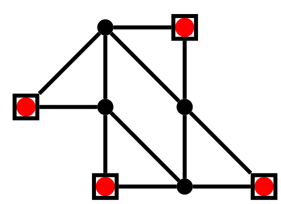

Figure 1: An independent set of size 4 in a graph

1. Given a $O(1.2^n)$-time algorithm for Maximum Independent Set, design an algorithm for Independent Set with running time $O(1.2^n \cdot \text{poly}(n))$.
2. Given a $O(1.2^n)$-time algorithm for Independent Set, design an algorithm for Maximum Independent Set with running time $O(1.2^n \cdot \text{poly}(n))$.

Exercise 2. Discussion topic.

Are Nondeterministic Turing Machines realistic computation models?

- Is this a good representation of how our computing devices work?
- What is different?

What about Deterministic Turing Machines?

Exercise 3. Design a Deterministic Turing Machine $(Q, \Gamma, \Sigma = \{0, 1\}, q_0, A, \delta)$ that accepts palindromes. A *palindrome* is a word that is equal to its reverse; e.g., 011010110.

Exercise 4. A *vertex cover* in a graph $G = (V, E)$ is a subset of vertices $S \subseteq V$ such that every edge of G has an endpoint in S.

Vertex Cover	
Input:	Graph G, integer k
Question:	Does G have a vertex cover of size k?

- Prove that Vertex Cover is NP-complete.