Assignment 2

Exact and Parameterized Algorithms, 2021

Every question carries 10 marks

1. Give an iterated compression algorithm for 3-Hitting Set problem.
   (Hint : Can we reduce the disjoint version of the problem to another problem solved in the class?)

2. Given a graph $G(V, E)$, the Matching Deletion problem is to delete k vertices from V such that the resultant graph is a matching i.e a 1-regular graph. For example, if G is a path of 5 vertices, if we delete the third vertex from one end, we get a 1-regular graph. Give a $O^*(c^k)$ randomised algorithm to solve the Matching Deletion problem.
   (Hint : Bound the average degree of the graph (you might need some preprocessing). Note that the average degree of the graph needed is 1. Lower bound the number of edges to be deleted as a constant fraction of the number of edges present. This lets any random vertex chosen to be in the solution with a constant probability. For full credits, give an algorithm where $c = 6$)

3. Give an exact dynamic programming algorithm to solve the Feedback Arc Set problem.
   (Hint : Solving the Feedback Arc Set *problem is same as finding a topological sorting of the graph)*