

Exercise sheet 9

COMP6741: Parameterized and Exact Computation

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Exercise 1. A *domatic k -partition* of a graph $G = (V, E)$ is a partition (D_1, \dots, D_k) of V into k dominating sets of G .

(sol+tw)-DOMATIC PARTITION

Input: graph G , integer k
Parameter: $k + \text{tw}(G)$
Question: Does G have a domatic k -partition.

- Show that (sol+tw)-DOMATIC PARTITION is FPT using Courcelle's theorem

Exercise 2. Show that the incidence treewidth of a CNF formula F is at most the dual treewidth of F plus 1.

Exercise 3. Show that CSP is W[1]-hard for parameter incidence treewidth and Boolean domain ($D = \{0, 1\}$).

Exercise 4. Design an $O^*(2^t)$ time DP algorithm for tw-INDEPENDENT SET.

tw-INDEPENDENT SET

Input: Graph G , integer k , and a tree decomposition of G of width t
Parameter: t
Question: Does G have an independent set of size k ?

Exercise 5. Design an $O^*(9^t)$ time DP algorithm for tw-DOMINATING SET. Can you even achieve an $O^*(4^t)$ time DP algorithm?

tw-DOMINATING SET

Input: Graph G , integer k , and a tree decomposition of G of width at most t
Parameter: t
Question: Does G have a dominating set of size k ?