

## Algorithmic Game Theory

Winter Term 2021/22

Tutorial Session - Week 3

### Exercise 1:

Consider the local search problem *Positive Not-All-Equal kSat* (Pos-NAE- $k$ SAT) which is defined the following way:

**Instances:** Propositional logic formula with  $n$  binary variables  $x_1, \dots, x_n$  that is described by  $m$  clauses  $c_1, \dots, c_m$ . Each clause  $c_i$  has a weight  $w_i$  and consists of exactly  $k$  literals, which are all positive (i.e., the formula does not contain any negated variable  $\bar{x}_i$ ).

**Feasible solutions:** Any variable assignment  $s \in \{0, 1\}^n$

**Objective function:** Sum of weights of clauses  $c_i$  in which not all literals are mapped to the same value.

**Neighbourhood:** Assignments  $s$  and  $s'$  are *neighbouring* if they differ in the assignment of a single variable.

Show that Pos-NAE- $k$ SAT is in PLS.

### Exercise 2:

Let  $p, p'$  be coarse correlated equilibria of a cost-minimization game  $\Gamma$ . Prove that any convex combination of the distributions  $p$  and  $p'$  yields also a coarse correlated equilibrium of  $\Gamma$  (i.e., any distribution  $q := \lambda p + (1 - \lambda)p'$  for some  $\lambda \in [0, 1]$ ).