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# Algorithmic Game Theory

Winter Term 2020/21

Exercise Set 3

**Exercise 1:** (3+3+4 Points)

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 $\overline{x}_i$).

**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.

(a) Show: Pos-NAE-$k$SAT is in PLS.

(b) Show: Pos-NAE-2SAT $\leq_{PLS}$ MaxCut

(b) Show: Pos-NAE-3SAT $\leq_{PLS}$ Pos-NAE-2SAT

**Exercise 2:** (3 Points)

Show that the set of correlated equilibria of a cost-minimization game $\Gamma$ is convex, i.e. for two correlated equilibria $p$, $p'$ and $\lambda \in [0,1]$, also $\lambda p + (1-\lambda)p'$ is a correlated equilibrium.

**Exercise 3:** (3 Points)

Show that every correlated equilibrium is also a coarse correlated equilibrium.