Assignment 9

Issue date: 21 Dec 2016   **Due date:** 11 Jan 2017

Exercise 1.

Show that the following statements are true for sets $A, B \subseteq \{0,1\}^*$ such that $A, B \in \mathrm{NP}$:

(a) $A \cap B \in \mathrm{NP}$ (i.e., NP is closed under intersection)

(b) $A \cup B \in \mathrm{NP}$ (i.e., NP is closed under union)

(c) $A \cdot B \in \mathrm{NP}$ (i.e., NP is closed under concatenation)

(d) $A^* \in \mathrm{NP}$ (i.e., NP is closed under iteration)

Exercise 2.

Find lowest possible complexity classes in the polynomial hierarchy for following problems:

(a) $\{\, H \mid H$ is a propositional formula such that there is no shorter logically equivalent propositional formula $H' \,\}$

(b) $\{\, H \mid H$ is a satisfiable propositional formula such that the lexicographically smallest satisfying assignment has an even number of 1's $\}$

(c) $\{\, G \mid G$ is an undirected graph having an even chromatic number $\}$

Exercise 3.

Which complexity classes coincide with P^{E}, $\mathrm{LIN}^{\mathrm{P}}$, and $\mathrm{P}^{\mathrm{NP} \cap \mathrm{coNP}}$?

Merry Christmas and a Happy New Year!