

# Computational Complexity

## Exercise Session 6

**Exercise 1.** CLIQUE is the problem of deciding, given a graph  $G = (V, E)$  and a natural number  $k \in \mathbb{N}$ , whether there exists a set  $C \subseteq V$  such that  $|C| = k$  and for all  $c_1, c_2 \in C$  with  $c_1 \neq c_2$  it holds that  $\{c_1, c_2\} \in E$ .

For every  $\rho < 1$ , an algorithm  $A$  is called a  $\rho$ -approximation algorithm for MAX-CLIQUE if for every graph  $G = (V, E)$ , the algorithm outputs a clique  $C \subseteq V$  of  $G$  of size at least  $\rho \cdot \mu_G$ , where  $\mu_G$  is the maximum size of any clique of  $G$ .

Show that for each  $\rho < 1$ , if there exists a polynomial-time  $\rho$ -approximation algorithm for MAX-CLIQUE, then  $P = NP$ .