The Australian National University  
Research School of Computer Science  

Semester 1, 2018  
Tutorial 9  

Theory of Computation  
Due 10:00am, Monday, April 30, 2018

In general tutorial sessions are to discuss the problems you faced during solving these exercises. Solutions will in general not be presented but discussed during these sessions.

Exercise 1  
Showing NP-completeness
A $k$-clique in a graph $G = (V, E)$ is subset $C \subseteq V$ of size $k$ such that $(v_1, v_2) \in E$ for all $v_1, v_2 \in C$. The problem CLIQUE is: given a graph $G$ and a constant $k$, does $G$ have a $k$-clique?

a) How many edges does a $k$-clique have, as a function of $k$?

b) Prove that CLIQUE is NP-complete. (Hint: reduction from the node cover problem.)

Exercise 2  
co-NP
Define the set 
$$ co-NP := \{L \subseteq \Sigma^* \mid \Sigma^* \setminus L \in NP\}. $$

Show that $co-NP = NP$ if and only if there is an $NP$-complete language $L \in co-NP$.

Exercise 3  
P = NP?
Is the question whether $P = NP$ decidable?