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Winter term 2018/2019

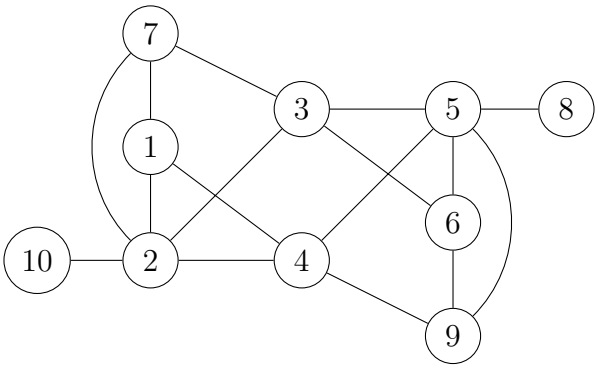
# Concepts and Algorithms of Optimization – Series 3

www.math.uni-magdeburg.de/institute/imo/teaching/wise18/cao/

November 2, 2018

## Exercise 1

Consider the following undirected graph $G = (V, E)$.




(a) Determine all nodes $v \in V$, for which the degree $\delta(v)$ is odd.

(b) Determine two subgraphs $G' = (V', E')$ and $G'' = (V'', E'')$ induced by the node sets $V' = \{1, 2, 3, 4, 7\}$ and $V'' = \{2, 5, 6, 8, 9, 10\}$, respectively.

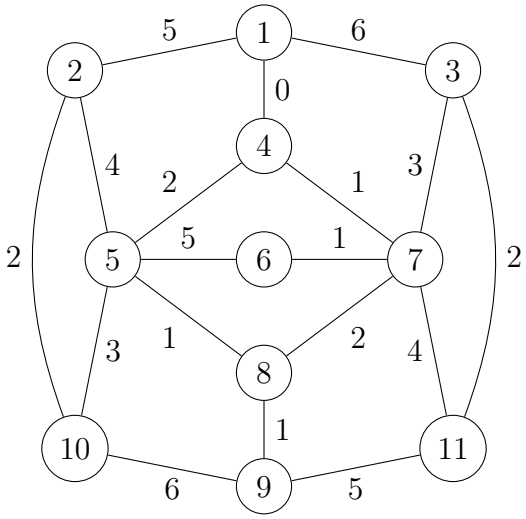
(c) State whether the given subgraphs $G'$ and $G''$ have the following properties:

- The subgraph is spanning.
- The subgraph is connected.
- The subgraph is cyclic.
- The subgraph has exactly one component.

(d) Determine a spanning subgraph $G^F$ of $G$, which is a forest but no tree. Give the necessary changes in $G^F$, so that it becomes a tree.

## Exercise 2

Consider the following graph $G = (V, E)$ with given edge costs $c_e$ for all $e \in E$.




(a) Determine a spanning tree $T$ in $G$ with minimal costs $c(T)$.

(b) Give a general description of the algorithm applied in (a).

(c) Determine all cliques $C_i$ in $G$ with $|C_i| \geq 3$.

(d) Find a stable set $S^*$ in $G$ with maximal weight $w(S^*)$ regarding the node weights $w_v = 1$ for all $v \in V$.

(Hint: This corresponds to finding a stable set with maximal cardinality in $G$.)