University of Konstanz
Algorithmics
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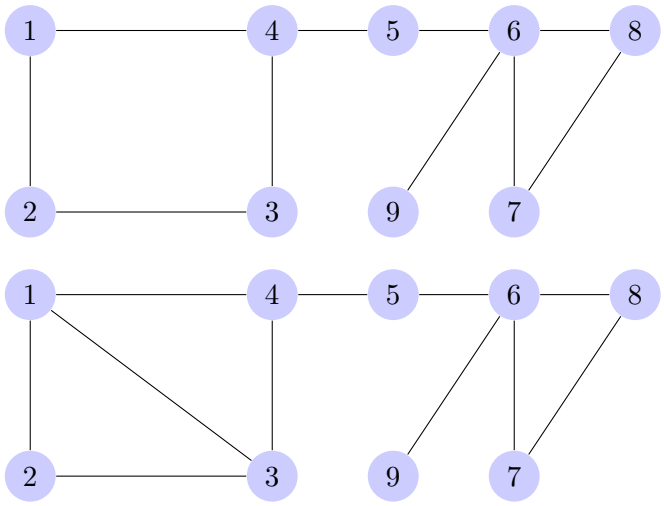
Network Analysis
Summer 2014

Assignment 10

Issue date: 26 June 2014 **Due date:** 03 July 2014, 11:00
It is explicitly recommended to solve exercises in groups of two.

Exercise 1: Clique number — 2+2 Points

Provide the clique numbers ω and the number of ω-cliques for the following two graphs.



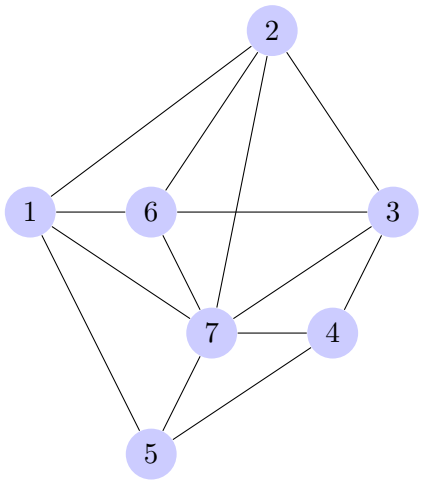
[please turn over]

Exercise 2: Maximal Clique Enumeration **1+2+3 Points**

(a) Modify the following example graph from the lecture by adding edge(s) to it such that the resulting graph has at least two identical maximal cliques at some level i of the binary tree.

(b) Construct the tree that lists all the maximal cliques of the modified graph.

(c) Show the lexicographically correct position for the clique(s) that get generated by more than one maximal cliques from the previous level in the tree.



Exercise 3: n-Cliques **3+3+4 Points**

Consider the adjacency matrix $A = A(G)$ associated with an undirected graph $G = (V, E), V = \{1, ..., n\}$. It is easily seen that an entry $a_{i,j}^{(2)}$ of the matrix $A^2 = A \cdot A$ is the number of length-2 walks between vertices i and j in G. Use this information to solve the following problems:

(a) Design a possibly fast algorithm for finding a 3-clique in an undirected graph $G = (V, E)$.

(b) Design a possibly fast algorithm for finding a 6-clique in an undirected graph $G = (V, E)$.

Hint: Reuse the algorithm designed for the first problem on an appropriate auxiliary graph.

(c) How can you generalize the algorithms to any fixed k for finding a k-clique in an undirected graph $G = (V, E)$?

Please submit your answers electronically to teaching assistant Habiba (habiba@uni-konstanz.de).