

Graphs & Algorithms II**Exercise Set 1****HS09**URL: <http://www.ti.inf.ethz.ch/ew/courses/GA09/>

In every exercise session we provide you with an exercise sheet. Some of the exercises are to be discussed and solved outside the class. This counts as a part of the extra hour of independent work (A).

Others - usually one or two per week - you solve in written form and return the solutions at the beginning of the subsequent exercise session. Your solutions will be thoroughly commented and graded, but they do not count towards your final grade. The motivation to work on the homework stems from your interest in the topic (and possibly also the desire to succeed on the exam :-)).

The exercise sessions is devoted to the presentation and discussion of solutions.

Exercise 1

Let G be a simple, planar graph with $n(G) \geq 3$ which does not contain a triangle. Show that $e(G) \leq 2n(G) - 4$

Exercise 2

Show that a graph is outerplanar if and only if it does not contain a subdivision of K_4 or $K_{2,3}$.

Exercise 3

Let $f(n)$ be the maximum number of edges in a simple graph on n vertices that does not contain a $K_{3,3}$ subdivision.

a) For $(n - 2) \bmod 3 \equiv 0$, construct a graph with $3n - 5$ edges that does not contain a $K_{3,3}$ subdivision.

b) Prove that $f(n) = 3n - 5$ for $(n - 2) \bmod 3 \equiv 0$ and $f(n) = 3n - 6$, for any other $n \geq 2$.

Hint: Use induction and Homework 1.

Homework 1

Prove that every 3-connected graph on at least six vertices that contains a subdivision of K_5 also contains a subdivision of $K_{3,3}$.

Homework due: 24.9.2009, 11:00AM.