Assignment 6

Available Since: 28 May 2015   Due Date: 4 June 2015, 11:45 a.m.
You are permitted and encouraged to work in groups of two.

— NOTE: As June 4th is a holiday, please hand in handwritten solutions in the tutorial on
Wednesday 3rd or send a digital version by email! —

Exercise 1: Grid drawing

Find a straight line drawing of the following plane graph on a grid. Make sure your drawing
takes the minimum grid size.

Exercise 2: Orthogonal drawing

Find an orthogonal drawing of the following plane graph.

Exercise 3: Orthogonal drawing

Show that there is at least one edge having more than two bends in any planar orthogonal
layout of an octahedron. 

*Hint:* Consider the bends of edges incident to the outer face.
Exercise 4: Canonical ordering

Compute the canonical ordering for the following graph:

Exercise 5: Canonical ordering

Let $G = (V, E)$ be a triangulated plane graph of $n \geq 3$ vertices, and let $v_1, v_2$ and $v_n$ be the vertices on the outer face. Let $\pi = v_1, v_2, \ldots, v_n$ be an ordering of all vertices in $G$. For each integer $k, 3 \leq k \leq n$, we denote by $G_k$ the plane subgraph of $G$ induced by the $k$ vertices $v_1, v_2, \ldots, v_k$.

Prove that the following two definitions of a canonical ordering are equivalent to each other.

Definition 1 We call $\pi$ a canonical ordering if the following conditions hold for each index $k, 3 \leq k \leq n$:

- $G_k$ is 2-connected and internally triangulated
- $(v_1, v_2)$ is an outer edge of $G_k$
- if $k + 1 \leq n$, then vertex $v_{k+1}$ is located in the outer face of $G_k$, and all neighbours of $v_{k+1}$ in $G_k$ appear on the outer cycle (boundary of the outer face) of $G_k$ consecutively.

Definition 2 We call $\pi$ a canonical ordering if for each index $k, 3 \leq k < n$, there are $1 \leq i_1 < i_2 < k < j \leq n$ such that $\{v_{i_1}, v_k\}, \{v_{i_2}, v_k\}, \{v_k, v_j\} \in E$. 