

Graph Drawing**Homework 4****FS10**URL: <http://www.ti.inf.ethz.ch/ew/courses/GD10/>**Exercise 1 (15 points)**

Prove that if a plane graph G has a regular labeling, it has a rectangular drawing.

Recall: A regular labeling of a plane graph G (that means a drawing of G is given) is a labeling of the angles in the drawing of G satisfying the following:

- (a) for each vertex v of G , the sum of the labels of all the angles of v is equal to 4,
- (b) the label of any inner angle is 1 or 2, and every inner face has exactly four angles of label 1, and
- (c) the label of any outer angle is 2 or 3, and the outer face has exactly four angles of label 3.

Exercise 2 (15 points)

Show that for every n , there is a graph on n vertices, whose rectangular drawing on a unit grid requires an area of $\Theta(n^2)$.

More formally, show that there is a family $\mathcal{G} = \{G_n \mid n \in \mathbb{N}\}$ of graphs with the following properties:

- for every n , $|V(G_n)| = n$ and G_n has a rectangular drawing,
- there are constants $c > 0$ and $n_0 \in \mathbb{N}$ such that for every $n \geq n_0$, every rectangular drawing of G_n on a unit grid covers an area $\geq cn^2$.

Remark: By an area of a drawing, we mean the area of the grid grid, onto which the graph is drawn.

Exercise 3 (15 points)

Prepare two rectangular cartograms of the states of Austria — one reflecting their area and the other reflecting their population. The bounding box of the cartogram should be a rectangle, where the sides correspond to the north, west, east and south.

You should make it realistically looking as much as possible, i.e. the incidences of the states to each other as well as to the boundary should be reasonably preserved.

For the information about the states, see <http://en.wikipedia.org/wiki/Austria#States>.

Exercise 4 (15 points)

Prepare a short presentation (no longer than 5 minutes) of the survey you did in Exercise 4 of the previous homework. In a later exercise session (on 31.5.2010), you will give the talk once

more and your performance will be graded. Some general guidelines for the presentations are on the next page.

General guidelines for presentations

This presentation has two goals. On the one hand, you should learn to put together an interesting presentation. This means that you must do some research: get an overview about the topic at hand; what is it all about, and why is it interesting (you have already done this in the last homework)? Then you should develop an idea of what to present. The second goal is that the audience learns something worthwhile, and you should seriously think about what you want this to be. It can be very painful to endure talks that have not been prepared with this goal in mind, and a bad grade is a foreseeable consequence.

Preparation, and the talk itself

Use electronic slides! It doesn't matter whether it is Powerpoint, Keynote, Slitex, Beamer, or still other systems. These days, the only serious alternative to electronic slides are pure blackboard talks, but giving good blackboard talks is something for the experts. Well-prepared slides guide you through your talk almost automatically. It is sometimes a good idea to change media and go to the blackboard once or twice during your talk to present a crucial concept or draw an important figure. This tells the audience that something special is going on now.

Hint: Please avoid using green colors on white background, as these are either invisible or hurting the eye on most beamers.

Show many pictures! Yes, drawing good pictures takes a lot of time, but it is an absolute must. It is very difficult for the audience to understand even simple definitions without an illustration. You have prepared this for days and (hopefully) know it by heart, but the other people hear it for the first time. Pictures add redundancy, so they allow the audience to cross-check whether their understanding of the previous formal definition was correct. Explaining pictures also slows down the presentation and gives people the time necessary to absorb the material.

Use large font, and show one thing at a time! Overfull slides in small font are a nightmare. A slide only helps if it corresponds to what the speaker is telling at the very moment. Slides that stay on for minutes while the speaker is simply droning on makes the audience lose attention. There may be technical slides (that explain an algorithm, say) which are necessarily somewhat denser, but these should be exceptions. Every slide should focus on just one issue.

The essential rule here is: keep it simple, but do the simple things well. There is only so much you can say in 4-5 minutes, so it makes sense to prefer simple over complicated material. The time will not allow you to explain the topic in complete breadth. You may pick the most interesting results or one interesting direction to present.

Understanding what you present is also the key to being more confident and less nervous. It is normal to be nervous, but this is hugely amplified if you don't have full understanding of your presentation.

Due date: 25.5.2010