Department of Mathematics and Computer Science
University of Southern Denmark, Odense

April 1, 2005
LMF

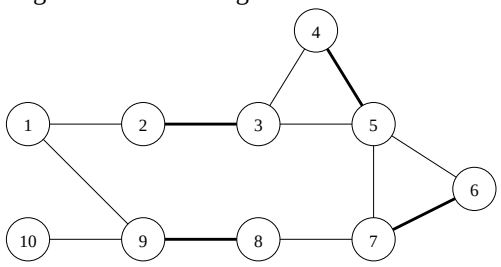
DM69 — Lecture 9

Lecture 9 — April 6

- The primal-dual algorithm applied to the assignment problem and the transportation problem: Section 3.12 in Bang-Jensen and Gutin.

Problems for April 8

1. Niels will give a 10-15 minutes presentation based on exam question 2 below.
2. Do one iteration of Edmonds' Blossom Algorithm with vertex 1 as the starting vertex. Thick edges are matched edges.



3. Let $G = (V, E)$ be a graph, let M be a matching in G, and let b be a blossom in G w.r.t. M. Show by an example that the following may fail to be true:
There is an augmenting path in G w.r.t. $M \Leftrightarrow$ there is one in G/b w.r.t. M/b.
Compare with Theorem 10.4.
4. Explain how Edmonds' Blossom Algorithm can be implemented to run in time $O(V^3)$. Hint: what takes time in the augment routine is the expansion of blossoms, or more specifically, finding the "entry and exit edges" of each blossom. Store some additional information when creating the blossom vertex to speed up a possible later expansion of the blossom.
5. Matrix rounding.

   Consider the following problem. You are given a $p \times q$ matrix with real numbers, and the row and column sums are calculated. Ex.:

3.1	6.8	7.3	17.2
9.6	2.4	0.7	12.7
3.6	1.2	6.5	11.3
16.3	10.4	14.5	

   Your task is to round the matrix elements and the row and column sums such that the rounded row and column sums are the sums of the rounded matrix elements.

Each element can be rounded either up or down. The example above could, e.g., be rounded like this:

4	7	7	18
10	2	1	13
3	1	7	11
17	10	15	

Explain how to solve this using network flows. What is the complexity of your algorithm?
Hint: Create a network with a vertex called s, a vertex called t, a vertex for each row and each column, an arc for each row and each column, and an arc for each matrix element.

Exam questions

We will start compiling a list of possible exam questions. For the material we have covered so far, the following are the possible main questions.

1. Shortest paths in weighted graphs
2. The maximum (s,t)-flow problem and the minimum (s,t)-flow problem
3. Polynomial algorithms for maximum flows
4. Minimum cost flows

Announcement

This year I am doing the "adjunktpædagogikum". Thus, my pedagogical supervisor, Søren Schmidt-Nielsen, will be attending the lectures on 6/4, 20/4, and 4/5 and my technical supervisor, Kim Skak Larsen, will attend the lecture on 27/4.