MATH 652: Optimization II

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Homework assignment 1 – due Thursday 1/28/2010

Problem 1 (l_∞ minimization). Assume you are given the following time series:

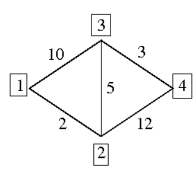
t_i	0	1	2	3
y_i	1.1	1.9	2.8	3.2

Consider the problem of fitting a line $y(t) = at + b$ through this data set. One way to do so is to ask for that set of parameters $x = \{a, b\}$ for which the maximal deviation $f(x) = \max_{i=1...4} |y_i - y(t_i)|$ is minimal. Note that the right hand side depends on x through the equation for $y(t)$.

Re-state this problem as a linear programming problem by introducing a (single) slack variable s. This way, you get a linear optimization problem in three variables: a, b, s.

While we will leave finding the solution of such problems for later, try to visualize the feasible set of this problem, i.e. the set of all points $\{a, b, s\}$ that satisfy the constraints of the re-formulated problem. **(6 points)**

Problem 2 (A network problem). Consider the following network problem (node numbers are given in boxes):



We want to consider the problem of finding the maximal data rate for sending data from node 1 to node 4. Bandwidths of all connections are shown along edges of the graph. Edges not shown have a zero bandwidth.

Consider the formulation for the network capacity problem given on slides 14–16 in the lecture notes. Write finding the maximal data rate as a linear optimization problem

$$\min_x c^T x \qquad \text{subject to} \quad Ax \geq b.$$

State explicitly what variables make up the vector x, and state the elements of the vectors b, c and the matrix A. (Hint: x will be a 6-dimensional vector.) Can you guess the solution of of this problem? **(6 points)**