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Theory of Network Communication

Fall 2002

Assignment 1

Problem 1 (1 point)**:**
Read the lecture notes. Why is the edge expansion a reasonable parameter to study the routing performance of networks? (Just give an explanation consisting of a few sentences here, maybe citing the theorems in the lecture nodes; no proofs are required.)

Problem 2 (3 points)**:**
Compute the flow number (2 points) and the edge expansion (1 point) for the n-node cycle with uniform edge capacities, where n is even. (Hint: use a system of shortest flow paths to solve the multicommodity flow problem underlying the flow number and use its perfect symmetry to argue about the congestion.)

Problem 3 (4 points)**:**
Consider the following multicommodity flow problem:

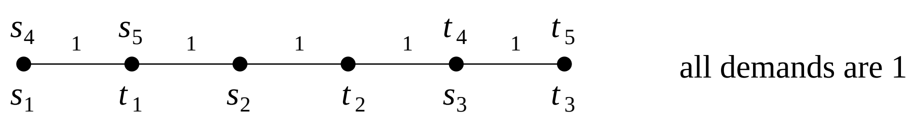

Figure 1: A multicommodity flow problem on a line.

Compute the min-cut ratio and concurrent max-flow on one side and the minimum multicut and maximum throughput on the other side. Also, give flows resp. cuts that achieve these results.