Technische Universität München
Department of Computer Science
Chair for Efficient Algorithms
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WS 1999/2000
Problem Set 2
May 9, 2000

Efficient Algorithms and Data Structures II

Problem 1 (10 credits)

Let $G = (V, E)$ be a flow network, let f be a flow in G, and let p be an augmenting path in G_f. Define a function $f_p : V \times V \to \mathbb{R}$ by

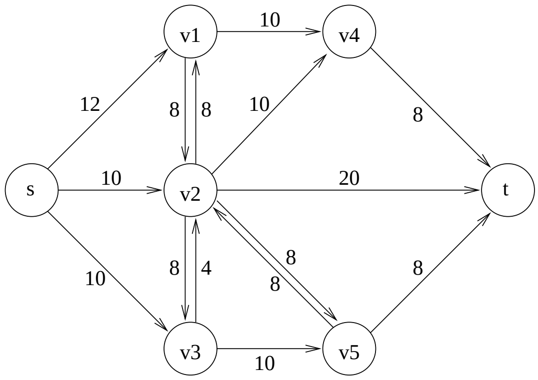
$$f_p(u,v) = \begin{cases} c_f(p) & \text{if } (u,v) \text{ is on } p, \\ -c_f(p) & \text{if } (v,u) \text{ is on } p, \\ 0 & \text{otherwise} \end{cases}$$

where $c_f(p) = \min\{c_f(u,v) : (u,v) \text{ is on } p\}$ and $c_f(u,v) = c(u,v) - f(u,v)$ is the residual capacity of edge (u,v).

Prove that f_p is a flow in G_f with value $|f_p| = c_f(p) > 0$.

Problem 2 (10 credits)

Use the Ford-Fulkerson algorithm to produce a maximum flow for the following network.



Problem 3 (10 credits)

Give an efficient algorithm to find the maximum flow in a given network whose underlying graph is undirected.

Problem 4 (10 credits)

Consider the following network where $c = 10^9$. Use it as an example to illustrate one of the shortcomings of the Ford-Fulkerson algorithm.