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Theory of Network Communication

Fall 2002

Assignment 3

Problem 8 (3 points)**:**
Consider the d-dimensional hypercube. Suppose that we use the bit adjustment strategy presented in the lecture to get from any source to any destination (i.e. every source-destination pair only has a single path). Construct a permutation routing problem for this case that causes $\Omega(\sqrt{2^d})$ paths to cross a single node. (Hint: compute for a given node, how many nodes can reach it in i hops and how many nodes can be reached from it in $d-i$ hops when using the bit adjustment strategy.)

Problem 9 (4 points)**:**
Give a path system for the (2-ary) d-dimensional DeBruijn graph that has one path for every source-destination pair, and use it to construct together with Valiant's trick a path system that has a congestion and dilation of $O(d)$ for every BMFP. (Hint: look at how we did the construction and proof for the hypercube in the lecture.)

Problem 10 (1 point)**:**
Suggest a recursive oblivious routing strategy for the hypercube that follows the idea of the recursive routing strategy presented for the mesh in the lecture.