Dr. Christian Scheideler
Johns Hopkins University Baltimore, Oct. 8 2003

Theory of Network Communication

Fall 2003

Assignment 5

Problem 11 (4 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 12 (6 points)**:**
Consider the problem of routing two packets from every node (x, y) (with $x, y \in \{0, \ldots, n-1\}$) in a two-dimensional $n \times n$-mesh: one with destination $(n-x-1, y)$, and one with destination $(n-x-1, n-y-1)$. Use the synchronization method for the mesh in the previous assignment to divide the time into rounds. In each round, each node can send one packet along each of its outgoing edges. Use the simple $x-y$ routing strategy presented in the lecture to select paths for the packets. Write a C++ program in the Spheres environment that simulates routing the packets to their destinations for $n = 10$. (Use any strategy of queueing packets in nodes that cannot be moved on immediately in a round.) Print out the C++ program and the number of rounds it needs to deliver all packets. (The number of rounds may depend on your particular queueing strategy, but that's fine.)