Problem Set 1
Due: Thursday, November 6, 2003 at the beginning of section.
CSE/EE 461: Fall 2003
2 pages

1. Hamming Distance

What is the minimum Hamming distance for the 8 bit CRC (100000111) computed on an arbitrary 8-byte packet? (Assume the CRC check value is appended to the 8 bytes.)

2. Flood and learn

Suppose we modify the solution for Fishnet assignment 1 so that when forwarding a packet, each node sends it to the last neighbor that forwarded a packet from that source address, and broadcasts it to all neighbors if the node has never seen a packet from that source address. Other rules, such as discarding packets we’ve already seen and decrementing the TTL at each hop are kept the same.

a) Is it possible packets would loop? If so, give an example. If not, explain why not.

b) What happens when a node moves? Give a simple fix that allows the network to deliver packets to nodes that have moved.

3. Ping

Explain, by giving a procedure and equations, how a node can use the Fishnet ping protocol to determine the latency and bandwidth of each link along a multi-hop path to the destination. You may assume that the source knows the address of all the intermediate nodes along the path, that routing is symmetric, and that the rate and delay of each link are the same in both directions. (Hint: start with the base case of directly connected end nodes, and recurse.)

4. Sliding window and Ethernet

Suppose a node is sending a large file to another node on the same Ethernet segment using sliding window. Explain why nearly every packet send will result in a collision and backoff. How can the sending node avoid this problem?

5. Sliding window and wireless

Wireless signal strength decreases dramatically with distance (proportional to the distance cubed). A consequence is that nodes at the far range of a node’s radio signal incur a significantly higher packet loss rate than nearby nodes, since the bit error rate is inversely proportional to the signal strength.
Let’s assume we have a node, A, trying to send a large (e.g., 1MB) file to another node, B, separated by 100 feet. Using constants typical of 802.11 wireless networks, the nodes send fixed size packets at 2Mb/s and experience a 50% packet loss rate when separated by 100 feet. Suppose the packets have 100 byte payloads and 25 byte headers (so they are 1000 bits long).

a) Suppose the two nodes send packets directly to each other, using a sliding window protocol with selective acknowledgements. What end to end performance can we expect from this system? You may assume the nodes have a large amount of buffering available for the transfer.

b) Suppose we introduce an intermediate node, X, halfway between nodes A and B, and we use X to simply relay packets between A and B. (To keep things simple, suppose the loss rate from A-X and X-B is 10%) What bandwidth can we expect for the file transfer from A to B through X?

c) Suppose we first transfer the file to X (using sliding window), and then X transfers it to B (again using sliding window). What bandwidth can we expect between A and B in this case?