UCSD CSE CS 123 — Computer Networks

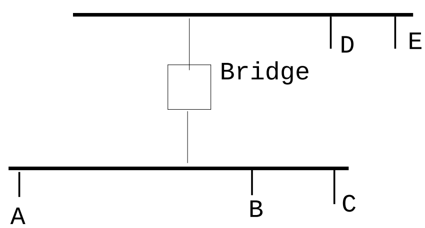
Homework Assignment 4

Due Thursday in a week

Directions: This homework has a very short fuse It's only to give you practice before the final. We will grade 1 and 2 and 3 is for practice only.

1. **IP Broadcast Storms, Bridges versus Routers :** (Adapted from Perlman's book) A *broadcast storm* is an event that causes a flurry of messages. One implementation that caused broadcast storms was the Berkeley UNIX endnode IP implementation. In this implementation, an endnode attempts to forward a packet that it mysteriously receives with a network layer (IP) address that is different from itself. This is what you would do if you found a neighbor's letter wrongly placed in your mailbox. However, this seemingly helpful policy can cause problems.

   Consider Figure 2 which shows 2 LANs connected by a bridge, with several IP endnodes on each LAN. There are no IP routers. All IP endnodes are configured with the same mask and so can tell that they have the same net number. Suppose IP endnode A is incorrectly configured and incorrectly thinks its data link address is all 1's. The data link address of all 1's is the broadcast address: any packet sent to such an address is received by all stations on a LAN (it is the ultimate multicast address!).

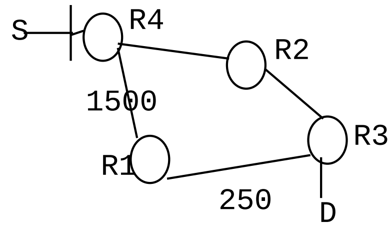


   - What happens when another IP endnode B decides to send a packet to IP endnode A.? Assume that B initially does not have A's data link address in its cache, and so must do the ARP protocol. Give the sequence of events.
   - Suppose bridge B is replaced by an IP router. (Of course, the masks at the nodes have to be changed so that there are now two masks, one for each LAN.) The problem does not disappear but it does get a little better. Explain.

2. **Modifying Routing to Avoid Fragmentation**: In order to avoid fragmentation, we may need to compute the minimum of the maximum packet sizes of all links on the best route to each destination D. For example in Figure 1, if the best route from S to D is through $R1$, the minimum of the maximum packet sizes is 250 bytes because the route uses the link from $R1$ to D.

   In distance vector routing, a router R computes its own distance, $Distance(D, R)$ to a destination D using the distances sent by its neighbors as follows: $Distance(D, R)$ = Minimum across all neighbors N of $Distance(D, N) + Distance(R, N)$. How would you modify this protocol to *also* compute the minimum max packet size on the shortest distance route to D?

3. **Link State Routing, just for practice**. Consider the topology shown in Figure 2. The numbers at every node describe the current sequence numbers at every node for the LSP from



node A. Notice that A's current sequence number is lower than the sequence number that other nodes have stored from A. This can happen if A has just crashed and restarted. Describe what happens if A starts by sending an LSP (from itself) to B and C. Assume that all messages take 1 unit of time to send. For every instant of time, describe what messages are sent and the stored sequence number at all nodes. Do this for all instants of time until they all have consistent values. How long does it take to stabilize?