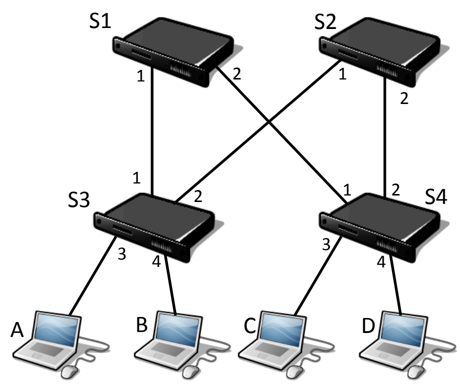
Homework 2

Due: 16 October, 4pm

Question 1 - Spanning Tree

Consider the following figure of a switched Ethernet network with two redundant core switches. Since it is switched, each individual wire is a separate physical LAN with only 2 nodes connected (on either end of the wire). The switches are numbered S1-S4, hosts named A-D, and ports on the switches numbered for each switch. In the following, refer to a port as either A-D (for the hosts), or Sn.m (e.g. S1.1) for the switches.



a. We discussed the Spanning Tree Protocol (STP) in class. Why is it needed in this topology? Give an example of something bad that can happen without it.

b. If the priority of the switches in the STP is their numeric id, what is the final state of the protocol? Give the final state by listing the state of each port (from one the three possible states - root, preferred, or disabled).

c. What is the final state after switch S1 is removed? (You can pretent the ports on other switches that used to connect to S1 don't exist.)

d. In this new state (from c.), assuming that the switches are all learning switches, and that their tables are empty initially, list all transmissions in the network when A sends a frame to D, and when D replies to A. (Assume A and D know eachother's MAC addresses, and list messages based on their source and destination ports, e.g., A→S3.3, S3.1→S2.1, etc.)

Question 2 - Mystery Routing

Your friend wanted to optimize his home network and made it barely functional. Since you are taking 168, they asked you to go see if you can make it better. The network has four components: two computers, an Ethernet switch, and an IP router. The two nodes and the router are connected to the switch directly. (In reality, modern home routers are both switches and routers, but conceptually you can think of the two as separate components.)

They have the following configuration:

Node	IP Address	Netmask	Gateway
Laptop	192.168.1.6	255.255.255.224	192.168.1.1
Desktop	192.168.1.36	255.255.255.0	192.168.1.1
Router	192.168.1.1	255.255.255.0	not relevant

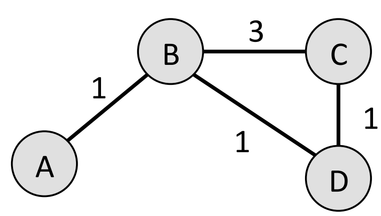
a. The laptop is accessing the Internet just fine, but connections between the laptop and the desktop have been slower since he played with the configurations. You suspect that the router may be faulty, so you disconnect it, while leaving the switch and the two nodes connected. You notice that you can send UDP datagrams from the desktop to the laptop, *but not the other way around!* Why is that?

b. In an attempt to diagnose the problem, you reconnect the router, and you can send UDP datagrams in both directions now. Puzzled, you run traceroute from the laptop to the desktop. What is the result? What is the result of traceroute from the desktop to the laptop? Explain any differences.

c. You finally figure it out and fix the problem. What is the right way to fix the network?

Question 3 - Routing Algorithms

Consider the network in the figure below, where numbers represent the costs of a link.



a. (Link State) Write down the sequence of costs and next hops for each destination n from node A, i.e., $[n, C(A,n), \text{next}(n)]$, computed by each stage of running Dijkstra's algorithm on this graph. (Consider each stage to be the state of the table for each new node added to the set M. No need to write entries for which the cost is ∞.)

b. (Distance Vector) Assume the network has reached a stable state with a distance vector algorithm, and consider the routes **to A** from the rest of the network. Now assume node A's link to B goes down. Write down a sequence of events that will cause count-to-infinity to happen.

c. List at least two advantages of path vector over distance vector protocols.