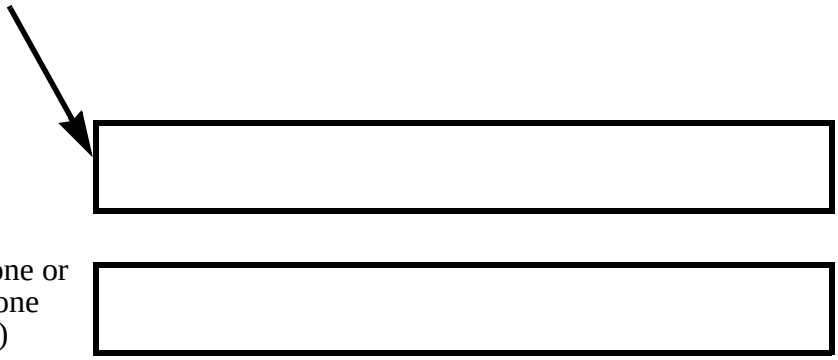
Check to be sure that there are 5 problems on 5 pages. You are encouraged to answer all 5 problems. Your grade will be based on the four best answers. You have 2 hours and 30 minutes. Note that some problems are more time-consuming than others. Use your time wisely. This is an open book and open note examine.

Show all your work. If a problem statement is unclear to you, state your assumptions. If you use additional sheets of paper, identify them and arrange them in sequence.

Write down your name here



work phone or home phone (optional)

Problem 1. Token Ring

Consider a 2Gbps token ring with 20 stations **equally separated**. Assume the signal propagation speed is 200m/μsec, 8000bits per frame, and every station has data to send.

a) 3pts. If the bit stream are delayed by the 1-bit delays, how far two bits will be separated in terms of meter?

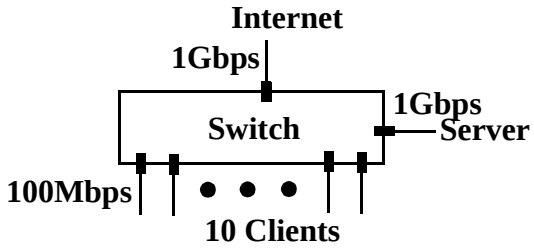
b) 3pts. What is the minimum length of the ring that can avoid the insertion of the artificial delay?

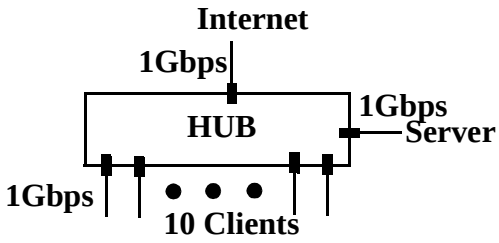
c) 3pts. Given a 10000-meter ring, how long will it takes for the first bit of the frame to return to the sender?

d) 8pts. Given a 10000-meter ring, what is the system throughput when it operates on single token mode?

e) 8pts. Given a 10000-meter hat is the system throughput when it operates on multiple token mode?

Problem 2. CSMA-CD and Ethernet Switch





Assume we have two network devices, each with 1Gbps connection to Internet, 1Gbps connection to a local server. The Ethernet switch connects to 10 client machines with 100Mbps Ethernet. The 1Gbps Ethernet HUB connects to 10 client machines with 1Gbps Ethernet interface. The switch has 3.2 Gbps capacity to switch frames between ports.

a) 6pts. Describe two cases where a client on the switch can not enjoy 100Mbps transmission speed.

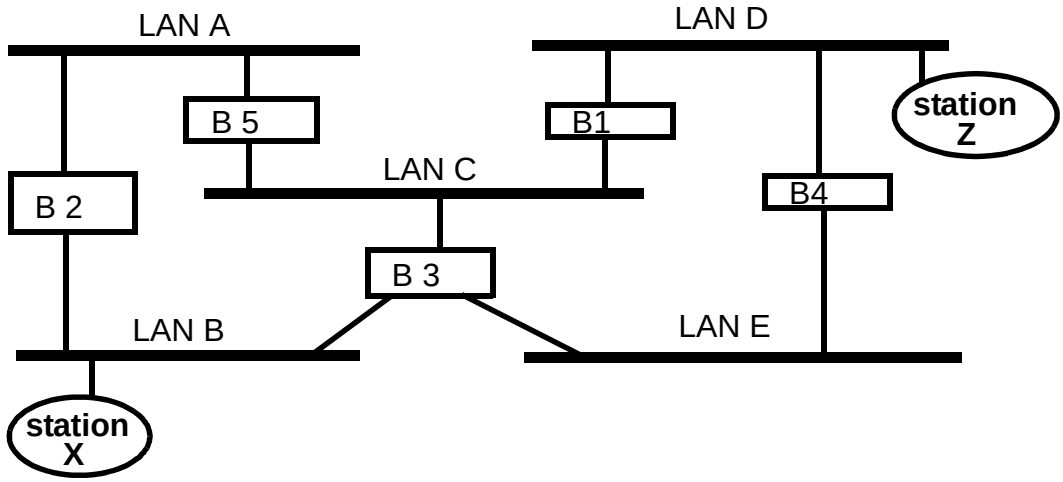
b) 6pts. Assume the server can deliver data with speed greater than 1Gbps, all switch connections are operated at full duplex mode, and all 10 clients have large files to download from the local server. Which one has better system throughput? Explain.

c) 6pts. Assume a High Definitive TV session (with one local user and a remote Internet user) requires 100Mbps upstream and 100Mbps downstream bandwidth. How many sessions can the switch support? How many can the hub support? Given an upper bound number.

d) 7pts. Is bigger frame more efficient in CSMA/CD? Explain it using the formula.

Problem 3. Routing with Bridges.

For the following network,



a) 15 pts. Assume the delay over any bridge port or LAN is the same one unit. Specify the spanning tree generated by the 802.1 spanning tree algorithm by marking the root bridge, the root port in each bridge and the designated bridge for each LAN. If there is a tie, use the bridge or LAN with the lower ID.

Assume no bridge learning (or station Z has been quiet for some time.) For a message sent by X to Z,

b) 5 pts. How many copies of the same message will be generated in this intranet?

c) 2 pts. How many copies of the same message will be observed by Bridge B3?

d) 3 pts. How many copies of the same message will B3 forward?

Problem 4. Wireless LAN and CDMA.

25 pts. Given the following chip sequences for mobile stations A, B, C, and D.

A: (-1 -1 -1 +1 +1 -1 +1 +1)
B: (-1 -1 +1 -1 +1 +1 +1 -1)
C: (-1 +1 -1 +1 +1 +1 -1 -1)
D: (-1 +1 -1 -1 -1 -1 -1 -1)

A CDMA basestation receives the following signal: (-1 +1 +1 -3 -1 +1 +1 -3). For each mobile station, describe whether it sends at all, and if it did send, what is the bit sent.

Ans:

Problem 5. CRC and ARQ

Assume that we use $g(x)=(x+1)(x^7+x^2+x+1)$ as generator polynomial.

a) 6 pts. If the information bits are 110001001, what is the codeword?

b) 7 pts. What is the error detecting capability of this g(x)?

c) 6 pts. Beside delivering or discarding the frame, what other actions will be taken by the receiver of a frame?

d) 6 pts. How the out of sequence frames are treated in selective repeat ARQ?