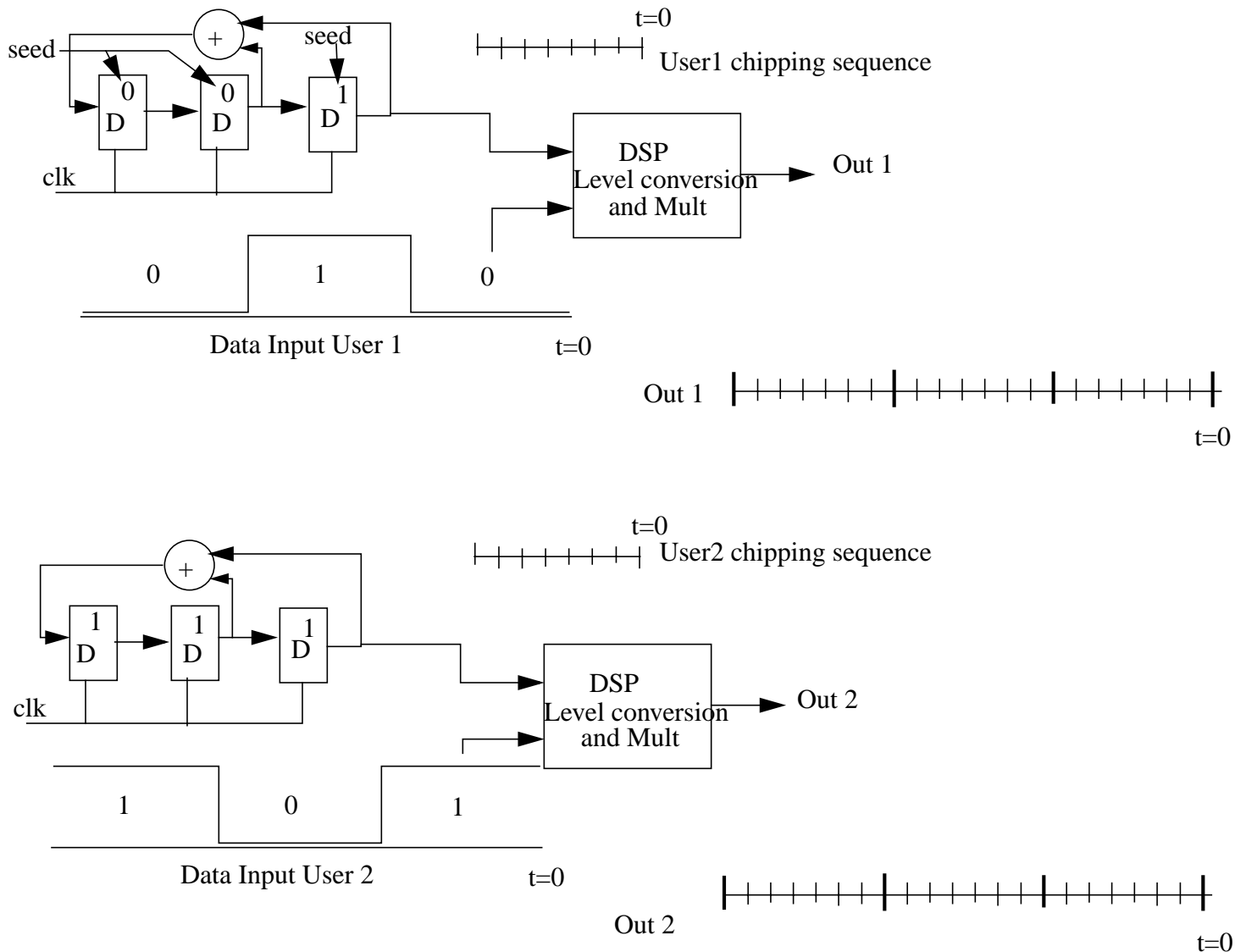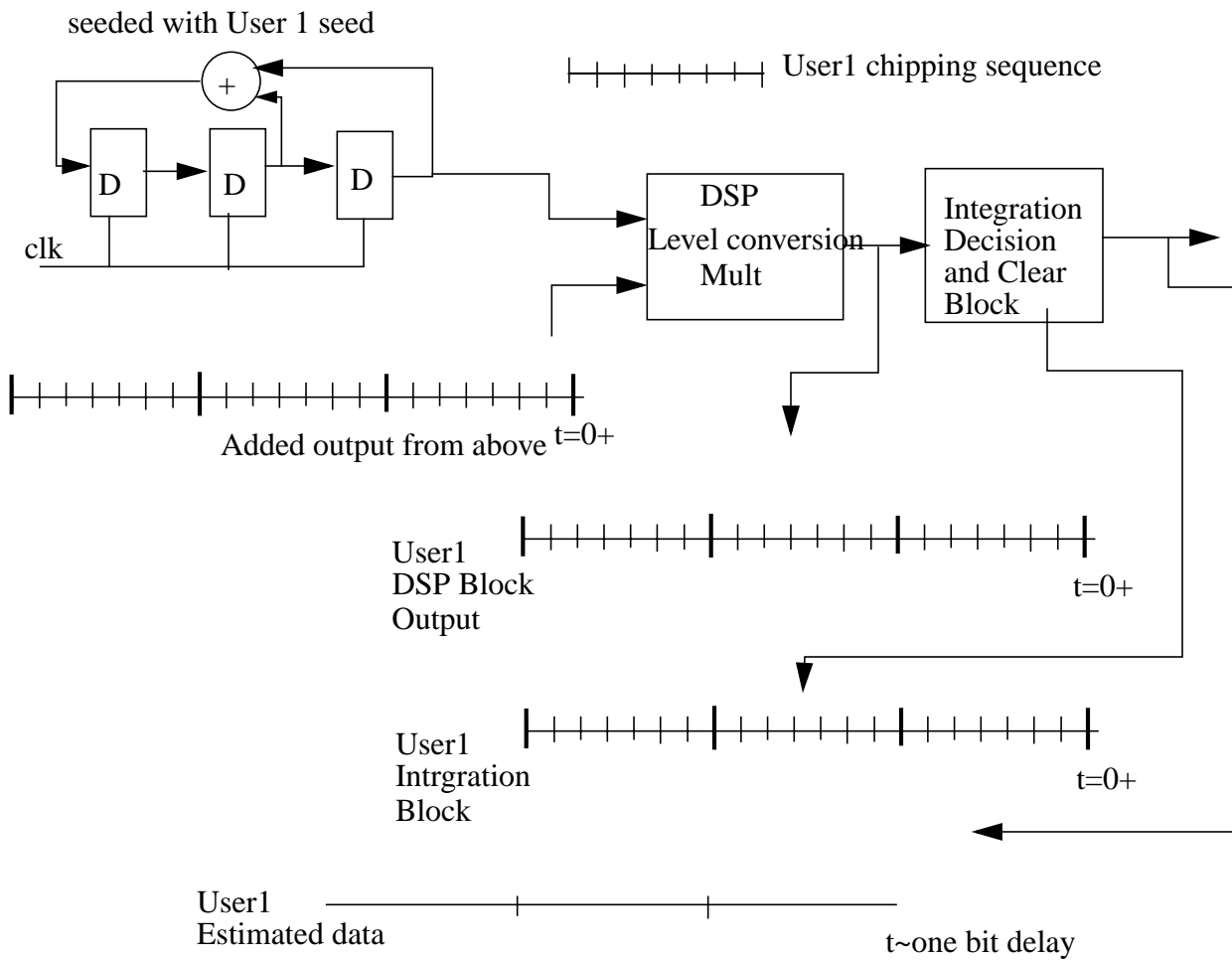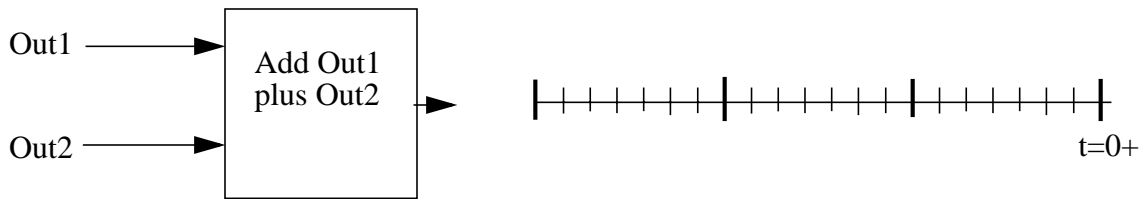**Question 1: CDMA Fill in the figures. Value (10)**

The following 3 data bits (010) are to be sent using a CDMA spread spectrum method.
They are to be spread using an LFSR configured as shown. The LFSR for User1 is seeded with 001 and clocked to produce the spreading code.
A second user wants to send 101. He is using the same LFSR for spreading. The LFSR for User2 is seeded with 111.

The modulation scheme is ordinary multiplication, a data 1 represents a 1, while a data 0 represents a -1. The LFSR is clocked 7 times for every data bit. (Note: t=0, is drawn on the right.)

Out1 ⟶

Add Out1 plus Out2

Out2 ⟶

|+++++++|+++++++|++++++|
t=0+

seeded with User 1 seed

+

|++++++++| User1 chipping sequence

D → D → D

clk

DSP Level conversion Mult

Integration Decision and Clear Block

|+++++++|+++++++|++++++++|
Added output from above t=0+

User1 DSP Block Output

|+++++++|+++++++++|+++++++|
t=0+

User1 Intrgration Block

|+++++++|+++++++|+++++++|
t=0+

User1 Estimated data

|⎯⎯⎯⎯⎯+⎯⎯⎯⎯⎯+⎯⎯⎯⎯⎯|
t~one bit delay

Question 2: Flow control. Value (10)

Packets of size 10,000 bits are being sent across a 10.0 Mbps network. The distance between end machines is 1,000 km and the measured round trip time is approximately 100msec. Acknowledgement packets are 500 bits.

You are using a stop and wait protocol that requires an acknowledgement on a packet before another can be sent out. what is the approximate throughput between these two machines?

You decide to use a better protocol, a sliding window protocol. You start with a window of 4 (10,000 bit) packets. Draw a sequence diagram illustrating the packet transmissions. What is the approximate throughput?

What is the size of window required to sustain an effective throughput of 5 Mbps?

What is the throughput if the window were 500 (10,000 bit) packets in size?

Question 3: Ethernet. Value(10)

Consider two stations that are separated 100 meters apart. At time t=0, both attempt a transmission to the other . One with an IP packet of 1,500 Bytes the other an IP packet of 64Bytes. The medium is a shared cable and the data rate of the NIC cards is 10 Mbps. Is this half duplex of full duplex? Is this baseband signalling?
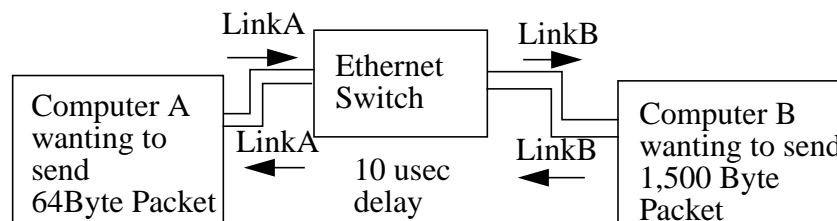
What is the earliest time that a collision can be detected, assuming the speed of signal propagation is $2*10^8$ m/sec?

If both stations enter their respective backoff mechanisms upon detecting a collision and the station wanting the send the 64Byte packet selects immediate retransmission while the other defers for one time slot what happens?
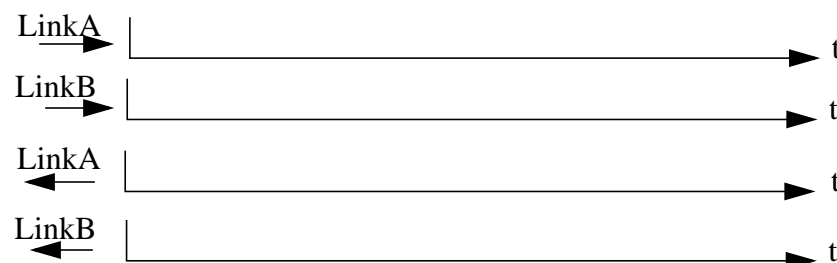
Station1 |_____→ t

Station2 |_____→ t
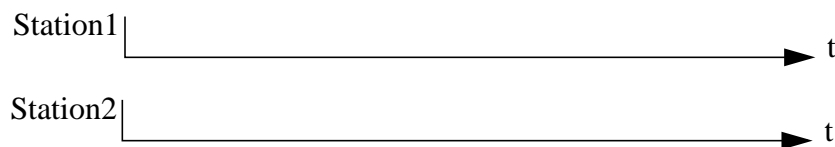
Given that 2 ethernet frames collided on their first attempt. What is the probability that the two machines on the ethernet segment will collide 3 times in a row? Provide and expression for n times in a row?

Suppose now the machines are connected as follows.

LinkA   LinkB

Computer A wanting to send 64Byte Packet — LinkA — Ethernet Switch 10 usec delay — LinkB — Computer B wanting to send 1,500 Byte Packet

Consider the same scenario where both want to transmit at t=0. What happens? When are the transmissions completed?

LinkA |_____→ t

LinkB |_____→ t

LinkA |_____→ t

LinkB |_____→ t

Wireless case: (802.11) Assume a collision on a wireless 802.11 network is detected (inferred), one station (User1) defers for 10 slots, while the other (User2)defers for 5 slots. Both want to send messages lasting 15 slot times. Sketch the activity on the channel. (label as appropriate)

User 1

User 2

Collision
Detected (Inferred)

5 slot times
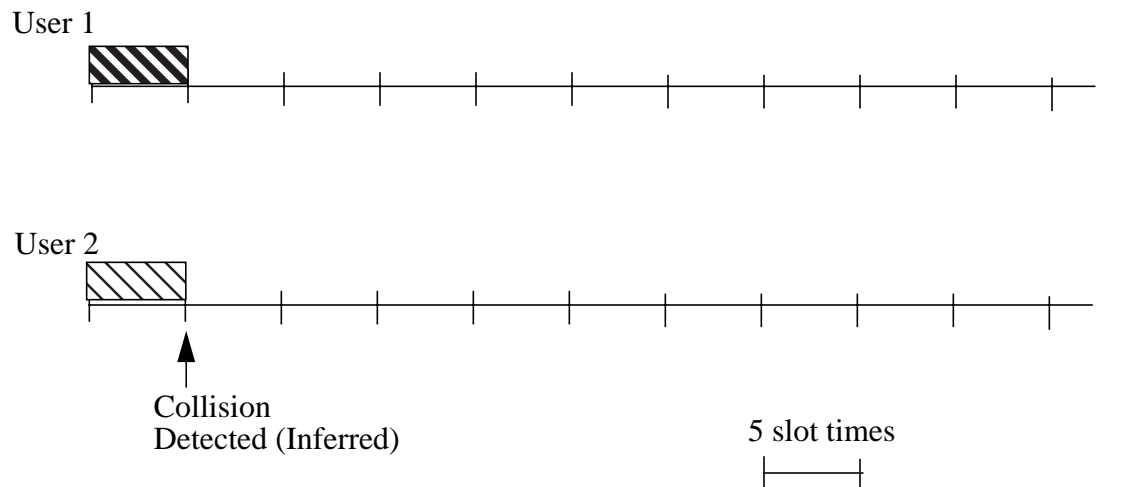
In ethernet, if a station senses that the medium is free it will attempt a transmission immediately. In wireless 802.11, if a station senses the medium is free why does the station select a slot from a small window (8 slots) before attempting its transmission?

Question 4: Getting a Packet through the Internet. Value(10)
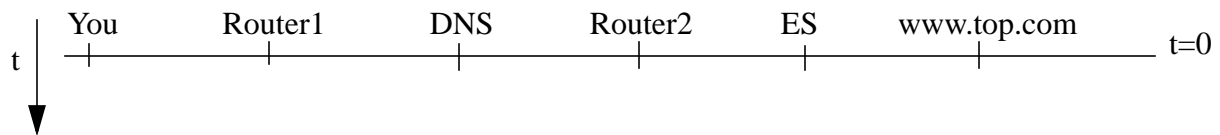
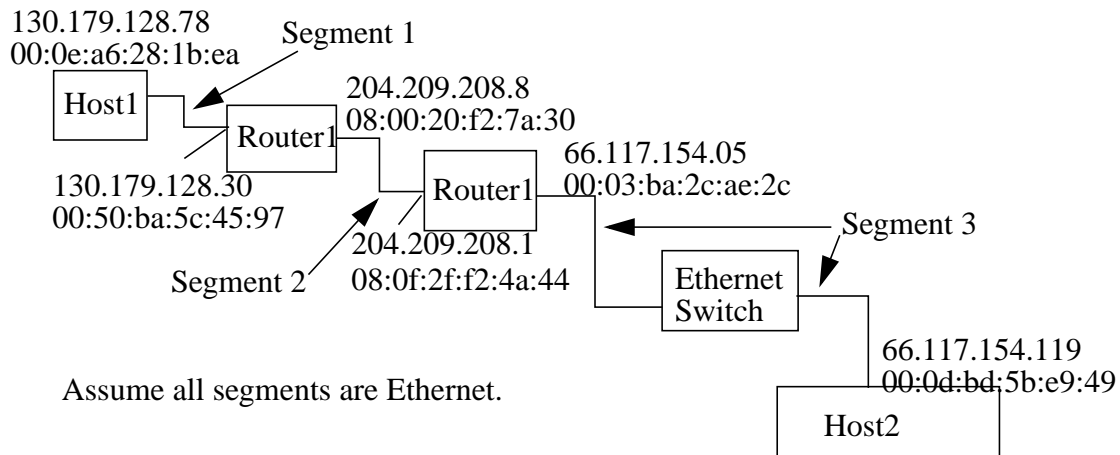Consider the following network.
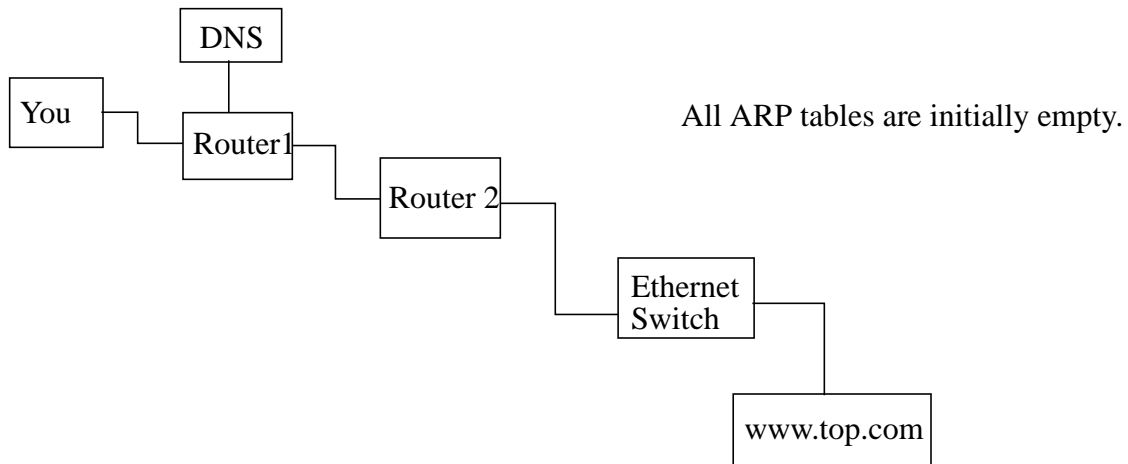
You want to ping www.top.com.

Your machine is configured with the IP address of the default router and DNS server.

The DNS server can resolve all requests.

Sketch the packet sequence diagram for pinging www.top.com. Include the protocol on all edges.

Consider the following:

130.179.128.78
00:0e:a6:28:1b:ea

Segment 1

204.209.208.8
08:00:20:f2:7a:30

66.117.154.05
00:03:ba:2c:ae:2c

Host1

Router1

130.179.128.30
00:50:ba:5c:45:97

Router1

Segment 3

204.209.208.1
08:0f:2f:f2:4a:44

Segment 2

Ethernet
Switch

66.117.154.119
00:0d:bd:5b:e9:49

Assume all segments are Ethernet.

Host2

An IP packet is making its way from Host1 to Host2. For each segment/network of the route fill in the IP addresses associated with the IP packet and the MAC addresses associated with the Ethernet Frame containing the IP packet.

Segment 1

Mac Source	Mac Destination	IP Source	IP Destination

Segment 2

Mac Source	Mac Destination	IP Source	IP Destination

Segment 3

Mac Source	Mac Destination	IP Source	IP Destination

Question 5: Short Snappers Value(10)

1. Is Internet TCP/IP packet switched or circuit switched?

2. What is meant by half duplex?

3. What does frequency division multiplexing mean?

4. How does full duplex work with frequency division multiplexing.

5. What does frequency shift keying mean?

6. How are bit errors detected at the ethernet (phy/mac) layer?

7. If a radio signal's power is attenuated by 40 dB. How much weaker is the signal at the receiver that the transmitter assuming that the transmitter were transmitting at a power of 0.5 Watts?

8. For a CDMA system, if a spreading code or chip sequence is 1010111000, what is the spreading gain?

9. How many bytes are in a Ethernet MAC address?

10. What is a baseband signal?