(handwritten top right) IP = postal code.
MAC = NRIC no.

1. **[KR, Chapter 6, R6]** In CSMA/CD, after the fifth collision, what is the probability that a node chooses $K = 4$? The result $K = 4$ corresponds to a delay of how many microseconds on a 10 Mbps Ethernet?

(handwritten) $P = \dfrac{1}{1+2+\cdots+2^5-1}$

(handwritten) NIC wait for $4 \times \dfrac{512}{10\times10^6} = 204.8\,\mu s.$ (See lecture notes).

2. **[Modified from KR, Chapter 6, P26]** Let's consider the operation of a learning switch in the context of a network in which 4 nodes, labeled A through D, are star connected into an Ethernet switch (refer to the diagram on Lecture 9 notes page 37/38).

Suppose that the following events happened in sequence,

   i. B sends a frame to D *(handwritten)* → know B, broadcast D.

   ii. D replies with a frame to B *(handwritten)* → know D

   iii. D sends a frame to A *(handwritten)* → broadcast A

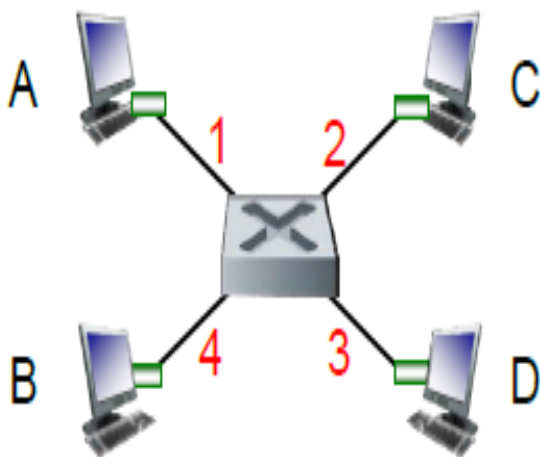*(handwritten diagram of star topology with A, B, C, D connected to central switch)*

The switch table is initially empty. Show the state of the switch table after each of the above events (ignore TTL field). For each event, identify the link(s) on which the transmitted frame will be forwarded, and briefly justify your answers.

Event	Switch table after event	Link(s) a frame is forwarded to
B sends a frame to D	B	A, C, D
D replies with a frame to B	B, D	B
D sends a frame to A	B, D	A, C, B · (broadcast).

(handwritten) (B might be a mistake).

3. Suppose nodes A, B and R are star connected into a switch S. A, B and R are aware of the IP addresses of each other.

Diagram: Computers A (top-left), C (top-right), B (bottom-left), D (bottom-right) connected to a central switch via ports labeled 1, 2, 4, 3.

a) Consider sending an IP datagram from Host A to Host B. Suppose all of the ARP tables and switch table are up to date. Enumerate all the steps the host and switch take to move the packet from A to B. $A \to S \to B$.

(handwritten bracket) ARP Query - for mac address.

b) Repeat the problem in a), assuming that ==ARP table in the sending host is empty==, but all other tables are up to date. $A \to S \overset{\to B}{\underset{\to R}{}} \to S \to A$

(handwritten note) Switch learn the mac

c) Repeat the problem in a), assuming that ==all tables in all nodes== are empty. $A \to S \overset{\to B}{\underset{\to R}{}}$ $B \to S \to A$

d) Suppose A sends an IP datagram to a host in another subnet. ==All of the ARP tables== and ==switch table are up to date==. Enumerate all ==the steps== the host, switch and router take to move the packet to another subnet.

$A \to S \to R \to \cdots$

(handwritten note) ※ change mac address to public NIC mac address.

4. Wireshark: Ethernet

Do the following:

1. Make sure your browser's cache is empty. To do this, Clear Recent History.
2. Start up the Wireshark packet sniffer.
3. Enter the following URL into your browser http://gaia.cs.umass.edu/wireshark-labs/HTTP-ethereal-lab-file3.html.
4. Stop Wireshark packet capture.

Answer the following questions:

1. Based on the contents of the Ethernet frame containing the HTTP GET message:

   a. What is the 48-bit Ethernet address of your computer?

$84:a9:38:96:9a:70$

28:ac:9e:73:72:00

Router of subnet.

b. What is the 48-bit destination address in the Ethernet frame? Is this the Ethernet address of gaia.cs.umass.edu? What device has this as its Ethernet address?

2. Based on the contents of the Ethernet frame containing the first byte of the HTTP response message:

28:ac:9e:73:72:00

a. What is the value of the Ethernet source address? Is this the address of your computer, or of gaia.cs.umass.edu. What device has this as its Ethernet address?   Router of subnet. / Gateway.

b. What is the destination address in the Ethernet frame? Is this the Ethernet address of your computer?   84:a9:38:9b:9a:70.

Yes.