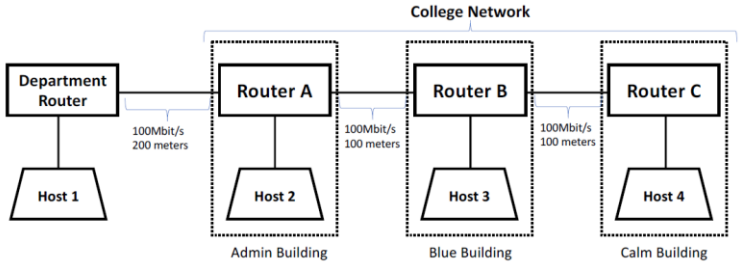
EAST WEST UNIVERSITY
Department of Computer Science and Engineering
B.Sc. in Computer Science and Engineering Program
Assignment - 1, Spring 2021 Semester

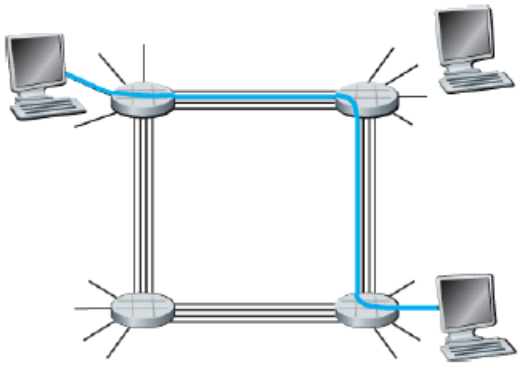
Course:	**CSE 405- Computer Networks, Section-4**
Instructor:	**Dr. Maheen Islam, Associate Professor, CSE Department**
Full Marks:	**120**
Submission Time:	**April 15, 2021**

Question-1 [10 Marks]
Suppose the Host 1 wants to send a large file to Host 4. At a very high level, show the encapsulation technique between the source and destination emphasizing how frames are transmitted.



Question-2: [10 Marks]
Consider the circuit-switched network in Figure below. There are 4 circuits on each link. Label the four switches S1, S2, S3, and S4, going in the clockwise direction.

a. What is the maximum number of simultaneous connections that can be in progress at any one time in this network?
b. Suppose that all connections are between switches S1 and S3. What is the maximum number of simultaneous connections that can be in progress?
c. Suppose we want to make three connections between switches S1 and S3, and another four connections between switches S2 and S4. Can we route these calls through the four links to accommodate all seven connections?



Question-3: [10 Marks]
Consider a packet of length L that begins at end system A and travels over three links to a destination end system. These three links are connected by two packet switches. Let d_i, s_i and Ri denote the length, propagation speed, and the transmission rate of link i, for i = 1, 2, 3 . The packet switch delays each packet

by d_{proc}. Assuming no queuing delays, in terms of d_i, s_i , R_i, (i = 1, 2, 3), and L, what is the total end-to-end delay for the packet?
Suppose now the packet is 1,500 bytes, the propagation speed on all three links is 2.5*10^8m/s, the transmission rates of all three links are 2 Mbps, the packet switch processing delay is 3 msec, the length of the first link is 5,000 km, the length of the second link is 4,000 km, and the length of the last link is 1,000 km. For these values, what is the end-to-end delay?

Question-4: [10 Marks]
Suppose users share a 2 Mbps link. Also suppose each user transmits continuously at 1 Mbps when transmitting, but each user transmits only 20 percent of the time.
a. When circuit switching is used, how many users can be supported?
b. For the remainder of this problem, suppose packet switching is used. Why will there be essentially no queuing delay before the link if two or fewer users transmit at the same time? Why will there be a queuing delay if three users transmit at the same time?

Question-5: [10 Marks]
Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates, R1 = 500Kbps, R2 = 2Mbps and R3 = 1Mbps.

a. Assuming no other traffic in the network, what is the throughput for the file transfer?
b. Suppose the file is 4 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?
c. Repeat (a) and (b), but now with *R* reduced to 100 kbps.

Question-6 [10 Marks]
Ideally, a multiple access protocol for a broadcast channel of rate *R* bits per second should have the following desirable characteristics:
1. When only one node has data to send, that node has a throughput of *R* bps.
2. When *M* nodes have data to send, each of these nodes has a throughput of *R*/*M* bps. This need not necessarily imply that each of the *M* nodes always has an instantaneous rate of *R*/*M*, but rather that each node should have an average transmission rate of *R*/*M* over some suitably defined interval of time.
3. The protocol is decentralized; that is, there is no master node that represents a single point of failure for the network.
4. The protocol is simple, so that it is inexpensive to implement.

a. Discuss which of these characteristics does token passing have.
b. Discuss which of these characteristics does CSMA/CD have.

Question-7 [10 Marks]

a. Assume, in the CSMA/CD protocol, the adapter waits k * 512-bit times after a collision, where *K* is drawn randomly. For k=100, how long does the adapter wait until trying to access the idle channel for a 10 Mbps broadcast channel?
b. Consider a broadcast channel with *N* nodes and a transmission rate of *R* bps. Suppose the broadcast channel uses polling (with an additional polling node) for multiple access. Suppose the amount of time from when a node completes transmission until the subsequent node is permitted to transmit (that is, the polling delay) is d_{poll}. Suppose that within a polling round, a given node can transmit at most *Q* bits. What is the maximum throughput of the broadcast channel?

Question-8 [10 Marks]
Let us consider the operation of a learning switch in the context of a network in which 8 nodes labeled A through H are star connected into an Ethernet switch. Suppose that

(i) B sends a frame to H,
(ii) H replies with a frame to B,

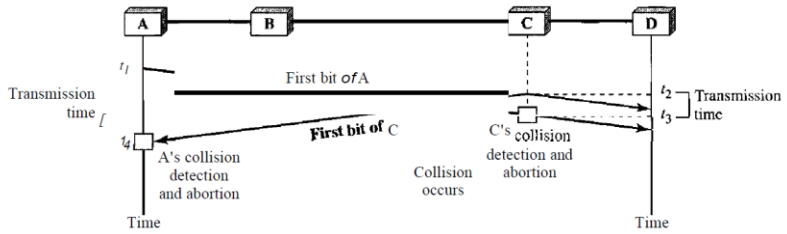
(iii) A sends a frame to B,
(iv) B replies with a frame to A.
(v) D sends a frame to C
(vi) C replies with a frame to D.

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

Question-9 [10 Marks]

In the Figure below, the data rate is 10 Mbps, the distance between station A and C is 2000 m, and the propagation speed is 2 x 10^8 *m/s.* Station A starts sending a long frame at time *t1* =0; station C starts sending a long frame at time *t2* =3 microsecond. The size of the frame is long enough to guarantee the detection of collision by both stations. Find:

a. The time when station C hears the collision *(t3)'*
b. The time when station A hears the collision *(t4)'*
c. The number of bits station A has sent before detecting the collision.
d. The number of bits station C has sent before detecting the collision.



Question-10 [10 Marks]

Briefly describe the waiting convention of Binary Exponential Backoff (BEB)algorithm. Illustrate how and when two hosts A and B get into collision consecutively if sets to pick elements for the hosts are set = {0,1,2,3} and set = {0,1,2,3,4,5,6,7} respectively

Question-11 [10 Marks]

Suppose the information content of a packet is the bit pattern 111001100011101 and an even parity scheme is being used. What would the value of the field containing the parity bits be for the case of a two-dimensional parity scheme? Your answer should be such that a minimum length checksum field is used.

Question-12 [10 Marks]

In a communication system CRC is being used to detect error. Consider the 5-bit generator, G=10011, and suppose that D has the value 1010101010. What is the value of R?