Venue _____

Student Number |__|__|__|__|__|__|__|__|

Family Name _____

First Name _____

School of Electrical Engineering, Computing and Mathematical Sciences

EXAMINATION

End of Semester 1, 2020

CNCO2000/CMPE2000

This is a TAKE HOME examination

Examination Duration 4 hours

End of Semester 1, 2020
CNCO2000/CMPE2000

Reading Time 10 minutes

Notes in the margins of exam paper may be written by Students during reading time

Total Marks 100

Supplied by the Student

Materials

One A4 sheet of handwritten and/or printed notes (both sides)

Calculator

A non-programmable calculator is permitted in this exam

Instructions to Students

Answer All questions

For Examiner Use Only

Q	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

Total _____

Question 1: (20 marks)

a. Consider the polynomial coding. The following information bits must be encoded with polynomial coding: 0111010110110. Let $g(x) = x^4 + x^2 + x + 1$. The leftmost position is the most significant bit.

i) What is the resulting codeword after the coding?

[10 marks]

ii) Please draw the corresponding shift-register circuit.

[4 marks]

b. Consider 16 information bits to be encoded with single-parity-check coding. What bit error patterns can be detected by this coding scheme?

[3 marks]

c. Explain how digital transmission system addresses the signal attenuation issue.

[3 marks]

Question 2: (13 marks)

a. If the bit sequence 01111110011001111101100111110010011111110 is to be bit de-framed and de-stuffed, what is the resulting bit sequence?

[2 marks]

b. If the byte sequence 7E 5E 7D 5D 7D 5E 2A 12 25 is to be byte stuffed and framed, what is the resulting byte sequence?

[2 marks]

c. Describe the operation of the *CSMA/CD* protocol.

[5 marks]

d. Six stations (S1-S6) are connected to an extended LAN through transparent bridges (B1 and B2), as shown Figure 1. Initially, the forwarding tables are empty. Suppose the following stations transmit frames: S1 transmits to S2, S3 transmits to S1, S2 transmits to S4, S5 transmits to S2, and S6 transmits to S5. Fill in the forwarding tables with appropriate entries after the frames have been completely transmitted.

[4 marks]

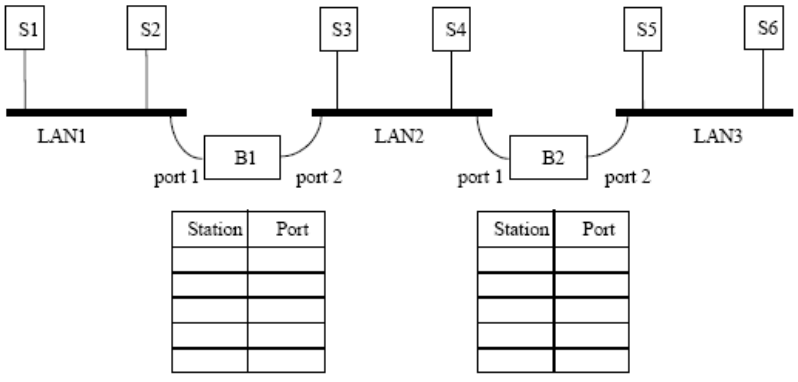

Figure 1

Question 3: (22 marks)

a. Consider the Ethernet. After the fifth collision, what is the probability that the value of K that a node chooses is 8? How many seconds of delay does the result K=8 correspond to on a 10Mbps Ethernet?

[3 marks]

b. Consider the Stop-and-Wait ARQ protocol. The user data frame is 2000 bits long where 100 bits are overhead for header and error check, etc. The ACK frame is also 100 bits long. The transmission rate is 1Mbps. The one-way propagation delay is 10ms. The probability that a data frame would be received without any errors is 0.2. We assume that all ACKs are received error-free. Assume the processing delay can be ignored. What is the effective data transmission rate of this protocol?

[7 marks]

c. Consider the Go-Back-N ARQ protocol with sender's window size N=5. The user data frame is 3000 bits long where 100 bits are overhead for header and error check, etc. The frame transmission rate is 2Mbps. Assume that the medium does not reorder the frames. The outstanding frames will be retransmitted when the sending window becomes empty. The probability that a data frame would be received without any errors is 0.3. We assume that all ACKs are received error-free. What is the effective data transmission rate of this protocol?

[7 marks]

d. A router has the following (CIDR) entries in its routing table:

Address/mask	Next hop
129.47.104.0/21	Interface 0
129.47.112.0/21	Interface 1
190.34.116.0/22	Interface 2
129.47.96.0/19	Router 1
default	Router 2

For each of the following IP addresses, what does the router do if a packet with that destination address arrives?

i) 129.47.85.10
ii) 129.47.110.14
iii) 129.47.125.2
iv) 190.34.119.7
v) 190.34.106.7

[5 marks]

Question 4: (30 marks)

a. Compare the IPv6 header with IPv4 header. List four major differences.

[7 marks]

b. Explain briefly why two users behind the same NAT router can share the same external IP address at the same time.

[6 marks]

c. Consider the following network shown in Figure 2. With the indicated link costs, use Dijkstra's shortest path algorithm to compute the shortest path from C to all other network nodes.

[10 marks]

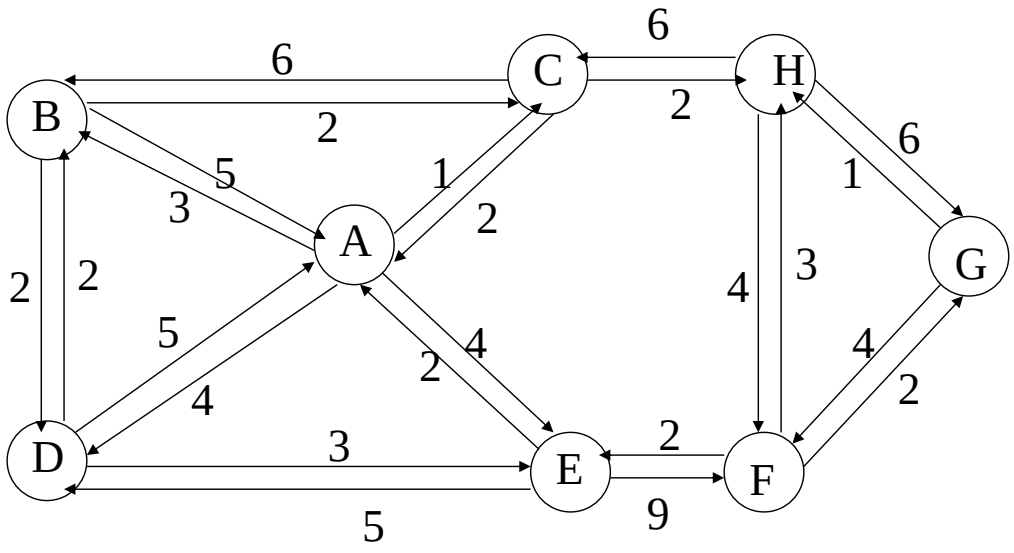

Figure 2

d. Consider distance vector routing. Delay is used as the measured metrics. A network consists of seven (7) nodes, Node A to Node G. Node C has three neighbouring nodes: B, D, and E. The following vectors have come to router C: from B: (6, 0, 5, 9, 8, 3, 3); from D: (7, 6, 1, 0, 8, 3, 4); from E: (3, 7, 3, 6, 0, 3, 4). The first element of the vector from node X represents the delay from node X to node A, while the second element represents the delay from node X to node B, and so on. The measured delays from node C to B, D and E, are 4, 6, and 3, respectively. What is C's new routing table? Give both the outgoing line to use and the expected delay.

[7 marks]

Question 5: (15 marks)

a. You want to send an email to your friend Bob, while only knowing his email address bob@company1.com.jp. Write down the steps involved in the process of sending an email including the name resolution process via the DNS Servers.

[5 marks]

b. Consider the three-way hand-shake procedure for setting up a TCP connection. Explain how it solves the duplicated connection request (CR) problem.

[5 marks]

c. Please explain how BitTorrent addresses the free riding problem?

[5 marks]

END OF EXAMINATION