Uva Wellassa University, Sri Lanka
Faculty of Science and Technology
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CST 341-3/SCT 377-3/CST 241-3 Data Communications and Networking

Uva Wellassa University

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Instructions to Candidates: Answer only **Two** questions from **Part A**. Answer **All Three** questions from **Part B**.

Part A

Q1.

a. Briefly explain the OSI reference model and describe the interaction between layers in the OSI model. **(4 marks)**
b. Briefly explain the process of exchanging the information in between two devices by using the OSI model. **(5 marks)**
c. Briefly explain the responsibilities of each layer in the OSI model. **(5 marks)**
d. Refer the figure 01 on appendix A. Computer "A" sends a message to Computer "F" via LAN 1, LAN 2, LAN 3, R 1 and R2. Show the contents of the Packets and Frames at the Network layer and Data Link layer for each hop interface in the figure 01. **(6 marks)**

Q2.

a. List down the classes of transmission media. **(2 marks)**
b. Briefly describe the three types of Guided Medias with the connector types and applications. **(6 marks)**
c. Un-guided signals can travel from the source to the destination basically in three ways. Briefly explain them. **(5 marks)**
d. Wireless transmission can be broadly defined as three categories. Explain them with the applications and antenna types used in each category. **(7 marks)**

Q3.

a. A non-periodic composite signal has a Bandwidth of 400 kHz , with a middle frequency of 280 kHz and peak amplitude of 40 V. The two extreme frequencies have amplitude of 0. Draw the frequency domain of the signal. **(3 marks)**
b. What are the two different approaches used to transmit the digital data over a communication media? Briefly describe them. **(5 marks)**
c. Briefly explain the three types of transmission impairments. **(6 marks)**

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d. Calculate the followings.

i. Suppose a signal travels through a Transmission medium and its power is reduced to one fourth. Calculate the attenuation for this signal. **(2 marks)**

ii. The loss in cable usually defined in decibels per kilometer (dB/km). If the signal at the beginning of a cable with -0.2 dB/km has a power of 2 mW, what is the power of the signal at 10 km? **(2 marks)**

iii. We have a channel with a 2 MHz bandwidth. The SNR (Signal to Noise Ratio) for this channel is 59. What are the appropriate bit rate and signal levels? **(2 marks)**

Part B

Q4.

a. List three main multiplexing techniques and briefly explain them. **(5 marks)**

b. Ten channels each with a 200 kHz bandwidth are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a Guard band of 20 kHz between the channels to prevent interference? **(6 marks)**

c. We need to use synchronous TDM (Time Division Multiplexing) and combine 20 digital sources, each of 200 Kbps. Each output slot carries 1 bit from each digital source, but one extra bit is added to each frame for synchronization. Answer the following questions. **(5 marks)**

i. What is the size of an output frame in bits?

ii. What is the output frame rate?

iii. What is the duration of an output frame?

iv. What is the output data rate?

v. What is the efficiency of the system? (ratio of useful bits to the total bits)

d. We have 14 sources, each creating 500 8-bit characters per second. Since only some of these sources are active at any moment, we use statistical TDM to combine these sources using character interleaving. Each frame carries 6 slots at a time, but we need to add four bit addresses to each slot. Answer the followings. **(4 marks)**

i. What is the size of an output frames in bits?

ii. What is the output frame rate?

iii. What is the duration of an output frame?

iv. What is the output data rate?

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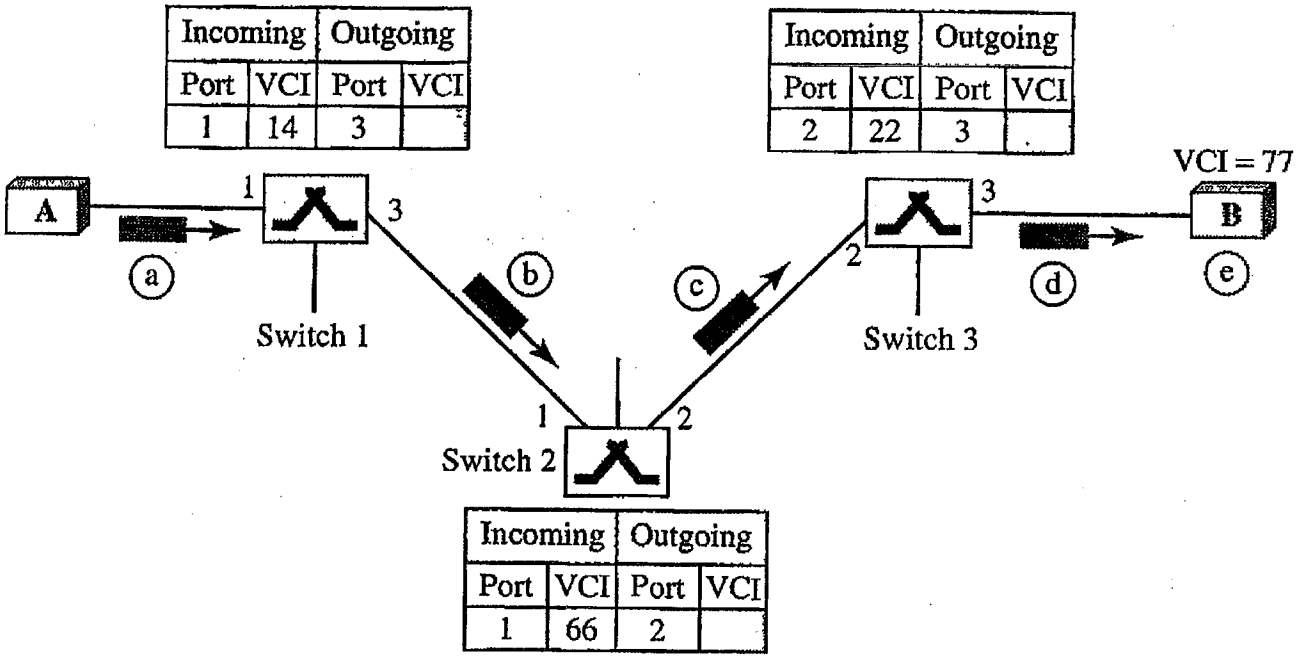
Q5.

a. List three traditional switching methods. Briefly describe them. **(5 marks)**

b. Consider the following virtual circuit network in Figure 02. Explain how data transfer from source-A to destination-B. Update the routing table according to the setup acknowledgement phase. **(7 marks)**

Figure 02:



c. Design a three stage 200X200 switch (N=200) with k= 3 and n = 20, where N- number of input lines, k-number of crossbars in middle stage, n- number of input lines in one group. Clearly mention the steps for your design. **(5 marks)**

d. Consider the Banyan switch shown in figure 03. Write down the binary numbers for the following traversals. **(3 marks)**

i. From Input port 1 to output port 6

ii. From Input port 2 to output port 0

iii. From Input port 6 to output port 6

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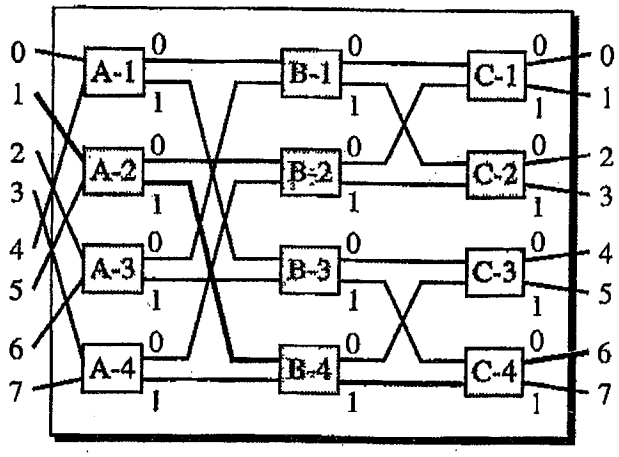
Figure 03:



Q6.

a. Explain the two main methods of error corrections. **(2 marks)**

b. What is the Hamming Distance for each of the following code-words? **(2 marks)**

   a. d(10000,00000)
   b. d(10101,10000)
   c. d(11111,11111)
   d. d(1001,100)

c. Prove that the code represented by the Table 01 is not a linear code. **(2 marks)**

Table 01:

Dataword	Codeword
00	00000
01	01011
10	10111
11	11111

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d. Refer the Table 02 for the following two parts.

i. Show that the Hamming code C(4,7) of Table 02 can detect two-bit errors but not necessarily three-bit error by testing the code in the following cases.
The character "O" in the burst error means no error; the character "E" means an error.
(If you have any assumptions clearly mention them) **(7 marks)**

a. Dataword : 0100 Codeword: OEEOOOO
b. Dataword : 0111 Codeword: EOOOOOE
c. Dataword : 1111 Codeword: EOEOOOE
d. Dataword : 0000 Codeword: EEOEOOO

ii. Show that the Hamming code C(4,7) of Table 02 can correct one-bit errors but not more by testing the codes in the following cases .
The character "O" in the burst error means no error; the character "E" means an error.
(If you have any assumptions clearly mention them) **(7 marks)**

a. Dataword : 0100 Codeword: EOOOOOO
b. Dataword : 0111 Codeword: OEOOOOO
c. Dataword : 1111 Codeword: EOOOOOE
d. Dataword : 0000 Codeword: EEOOOOE

Table 02:

Dataword	Codeword
0000	0000000
0001	0001101
0010	0010111
0011	0011010
0100	0100011
0101	0101110
0110	0110100
0111	0111001

Dataword	Codeword
1000	1000110
1001	1001011
1010	1010001
1011	1011100
1100	1100101
1101	1101000
1110	1110010
1111	1111111

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Appendix A: Figure 01