Department of Computer Science and Engineering

University of Asia Pacific (UAP)

Program: B.Sc. in Computer Science and Engineering

Final Examination | **Spring 2020** | **3rd Year, 1st Semester**

Course Code: CSE 303 | **Course Title: Data Communication** | **Credits: 3.00**

Full Marks: 120* (Written) | **Duration: 2 Hours**

* Total Marks of Final Examination: 150 (Written: 120 + Viva: 30)

Instructions:

1. There are **Four (4)** Questions. Answer all of them. All questions are of equal value. Partial marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. **a)** Say, we have three rooms each having 3 PCs in a room, total of 9 PCs. Now draw a hybrid topology where you will use any one kind of topology to connect the three PCs in each room and another kind of topology (as a backbone topology) to connect the three rooms. [8]

b) What are the four levels of addresses in TCP/IP protocol? Write the significance of these four addresses and mention the corresponding layer name where they are dealt with. [4 x 3 = 12]

c) Suppose, we have a periodic composite signal shown in Fig: 1.1 which is a combination of three sine waves. The sine waves have the following properties. [10]

Sine wave No.	Amplitude (Unit)	Frequency (Hz)
1.	0.5	6
2.	1	3
3.	2	1

The signal in Fig 1.1 is drawn in time domain. Draw the signal in frequency domain.

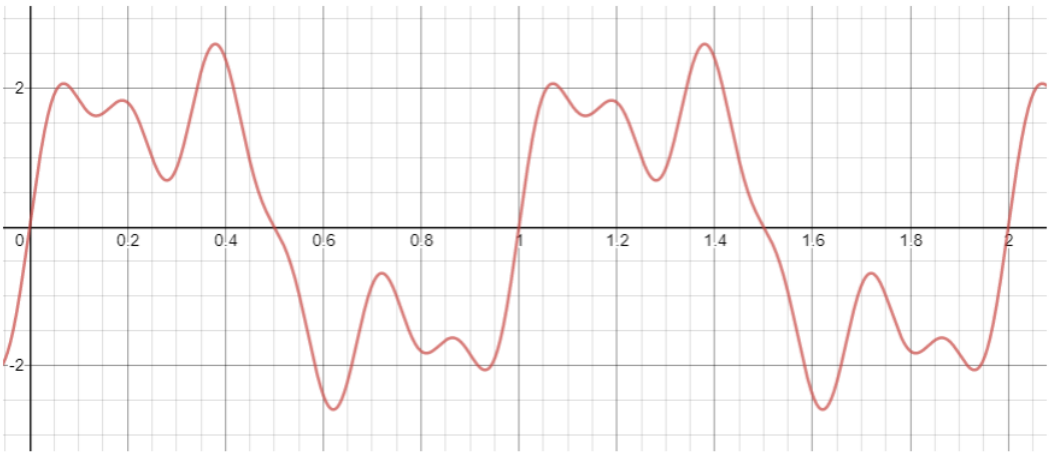

Fig: 1.1

2. **a)** Compare between Serial Communication and Parallel Communication. [5]

b) Explain how the Bipolar Scheme handles the following concerns – [2 x 5 = 10]

a) Self-synchronization

b) DC component

c) You have to send a data packet ***X*** of 12 bits to your friend using 4B/5B block coding. [15]

Here ***X*** is the least significant 12 bits of the binary representation of your student ID number.

If your student ID is 14101142, the binary representation will be

110101110010101010010110

Taking the right most 12 bits, we have ***X*** = **101010010110**

* Note: you can get the binary representation of your student ID easily by searching **"14101142 in binary"** in google search bar.

4B/5B mapping codes are given below:

Data Sequence	*Encoded Sequence*
0000	11110
0001	01001
0010	10100
0011	10101
0100	01010
0101	01011
0110	01110
0111	01111

Data Sequence	*Encoded Sequence*
1000	10010
1001	10011
1010	10110
1011	10111
1100	11010
1101	11011
1110	11100
1111	11101

What will be the encoded sequence of bits you will send to your friend?

3. Read the following description and answer question no. 3(a) and 3(b).

Suppose, you have to send a data packet ***X*** of 10 bits to your friend.

Here ***X*** is the least significant 10 bits of the binary representation of your student ID number.

If your student ID is 14101142, the binary representation will be

110101110010101010010110

Taking the right most 10 bits, we have ***X*** = **1010010110**

* Note: you can get the binary representation of your student ID easily by searching **"14101142 in binary"** in google search bar.

a) Say, you are using binary FSK for converting digital data ***X*** to a modulated analog signal. Now draw the modulated signal mentioning in your bit to frequency mapping. [10]

b) If you were using Quadrature PSK to convert your digital data ***X*** to the analog signal. Examine the shape of your modulated signal by mentioning the assumptions of bit to phase mapping. [10]
(You do not have to describe the entire method. Only the bit to phase mapping and the modulated signal)

c) Suppose in multilevel FSK, we need to send ***Y*** bits data at a time. Here, baud rate is 6 Mbaud. The carrier frequency is 50 MHz. Calculate the number of levels (different frequencies), the bit rate, and the bandwidth. [10]

Here, ***Y*** = (last digit of your student ID mod 4) +1

If your student ID is 1410114**0**, ***Y*** = (**0** mod 4) + 1 = 1

4. **a)** Suppose three friends Joey, Chandler and Ross are thinking about opening a Telephone company like the American company AT&T. They are planning to implement **FDM** for their multiplexing procedure. They know that each voice channel requires 4 KHz of bandwidth. They thought of combining **P** voice channels at the first stage to create a **Group**, then joining **Q** Groups together to form a **Super-group**. These **P** Groups are separated by guard bands of 50Hz each. In the third step, 12 Super-groups are combined to form a **Master-group**. In this stage, a total of 0.12MHz is used as guard band. Finally, 6 Master-groups are connected together to form a **Jumbo-group**. Now after multiplexing, find out the total bandwidth requirement for the telephone company. [15]

For the value of **P** and **Q** use your date of birth. Suppose, your date of birth is written in this format: ***P-Q-Y***. For example, my date of birth is 17-08-1992 (DD-MM-YYYY). So here, ***P***=17, ***Q***=8, ***Y***=1992.

b) The seven avengers Iron man, Captain America, Black widow, Hulk, Thor, Doctor Strange and Black Panther are on a mission to save the world. They are communicating using 7 channels. [6 + 6 + 3]

Channel 1 (Iron Man) : WHAT?
Channel 2 (Captain America): HELLO
Channel 3 (Black widow) : HEY!
Channel 4 (Hulk) : GRRR!
Channel 5 (Thor) : WELCOME
Channel 6 (Doctor Strange) : BYE

Channel 7 (Black Panther) : WAKANDA

Here you have to work with channel ***X*** , ***Y*** & ***Z*** where,
X = (last digit of your student ID mod 7) +1
Y = (second last digit of your student ID mod 7) +1
Z = (third last digit of your student ID mod 7) +1

(If you get same value for ***X***, ***Y*** or ***Z*** use that channel multiple times)

i) Create the contents of the output frames for a synchronous TDM multiplexer that combines these sources ***X***, ***Y*** & ***Z*** sending the characters having the unit size of one character. Remember to use synchronization bit for each of the frame.
ii) In statistical TDM, construct the contents of the output frames for the channels ***X***, ***Y*** & ***Z***. Remember to add the source addresses (channel no.) in each frame.
iii) Analyze the significance of the source addresses in statistical TDM.

Or,

4. **a)** Suppose three friends Barney, Ted and Marshall are thinking about opening a Telephone company that uses **TDM** for their multiplexing procedure. The Digital Signal (DS-0) lines in TDM needs 64 kbps individually. There will be total ***P*** DS-0 lines in the first stage. In the second stage DS-1, they are planning to add ***Q*** lines each having ***P*** number of DS-0 lines with a total of 8kbps overhead. Again, in third stage DS-2, there will be 96 DS-1 lines with a total of 168kbps overhead. Now after multiplexing, find out the total bandwidth requirement for the telephone company. [12]

For the value of ***P*** and ***Q*** use your date of birth. Suppose, your date of birth is written in this format: ***P-Q-Y***. For example, my date of birth is 17-08-1992 (DD-MM-YYYY). So here, ***P***=17, ***Q***=8, ***Y***=1992.

b) Total ***Z*** channels, from which ***X*** channels with a bit rate of 200 kbps and ***Y*** channels with a bit rate of 150 kbps, are to be multiplexed using multiple slot TDM. A unit size is 1 bit. [10]

Here***, Z= X+Y***
X= Last digit of your student ID +1
Y= Second Last digit of your student ID+2

Answer the following questions:
a. What is the size of a frame in bits?
b. What is the frame rate?
c. What is the duration of a frame?
d. What is the data rate of the link?
e. What is the duration of a bit in the link?

c) The Fig 4.1 shows a demultiplexer of a TDM. If the frame size is 16 bits long (no synchronous / frame bits), what is the bit stream in each output? The bits arrive at the demultiplexer as shown by the arrow. [8]

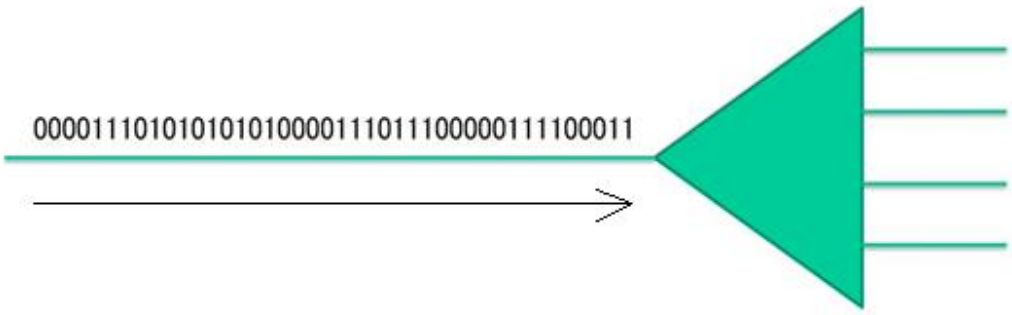

Fig: 4.1