



American International University- Bangladesh (AIUB)
Faculty of Engineering

Course Name: Data Communication
Semester: Spring 2023-24
Total Marks: 30
Faculty Name: Nowshin Alam

Course Code: COE 3201
Term: Final
Submission Date:
Assignment: 01

Course Outcome Mapping with Questions

Item	COs	POIs	K	P	A	Marks	Obtained Marks
Q1	CO4	P.f.2.C6	K7	P1		10	
Q2	CO4	P.f.2.C6	K7	P7		10	
Q3	CO4	P.f.2.C6	K7	P3		10	
Total:						30	

Student Information:

Student Name: MD. SHOHANUR RAHMAN SHOHAN	Student ID: 22-46013-1
Section: E	Department: CSE

Marking Rubrics (to be filled by Faculty):

	Excellent [10-9]	Proficient [8-7]	Good [6-5]	Acceptable [4-3]	Unacceptable [2-1]	No Response [0]	Secured Marks
Problem #	Detailed unique response explaining the concept properly and answer is correct with all works clearly shown.	Response with no apparent errors and the answer is correct, but explanation is not adequate/unique.	Response shows understanding of the problem, but the final answer may not be correct	Partial problem is solved; response indicates part of the problem was not understood clearly.	Unable to clarify the understanding of the problem and method of the problem solving was not correct	No Response/(Copied/identical submissions will be graded as 0 for all parties concerned)	
1							
2							
3							
Comments						Total marks (30)	

INSTRUCTIONS:

Consider, your ID = AB-CDEFG-H. If the digits of your ID form 00 in any case, then use 10.

Note: Copied/identical submissions will be graded as 0 for all parties concerned.

QUESTION 1.

(a) A number of 4 data channels (digital), each transmitting at (A+D) Mbps, use a satellite channel of (A+D) MHz. Using FDM, design an appropriate configuration by choosing the right digital to analog modulation and properly labelling the system diagram. [5]

(a)

ID:

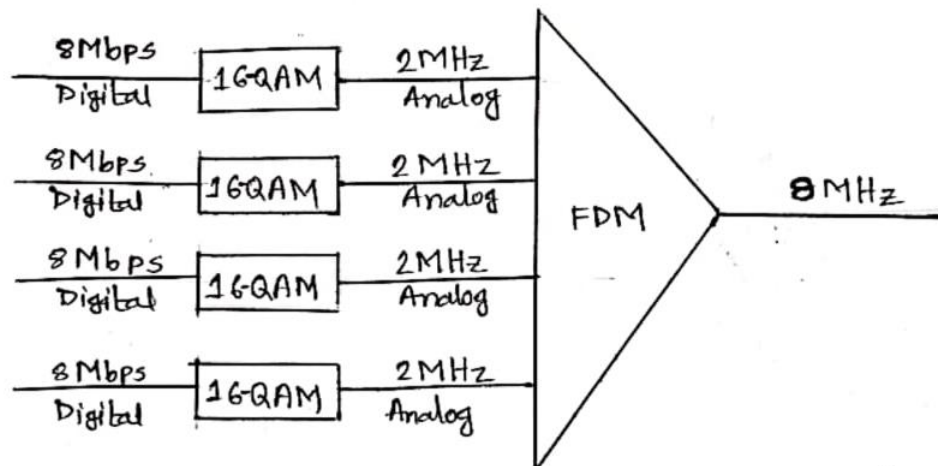
2	2	-	4	6	0	1	3	-	1
A	B	-	C	D	E	F	G	-	H

Number of Data Channel = 4

$$\begin{aligned}\text{Bandwidth} &= (A+D) \text{ MHz} \\ &= 2 + 6 = 8 \text{ MHz}\end{aligned}$$

$$\begin{aligned}\text{Bit rate} &= (A+D) \text{ Mbps} \\ &= 2 + 6 = 8 \text{ Mbps}\end{aligned}$$

Configuration:



(b) 4 voice channels each having a bandwidth of 30 kHz need to be multiplexed using the FDM technique into a link, which ranges from 300 to 450 kHz. Choose an appropriate guard band and draw the configuration of the system. [5]

(b)

Number of channel = 4

Channel Bandwidth, $B_{ch} = 30 \text{ kHz}$

Total Bandwidth, $B_T = 150 \text{ kHz}$ (450 - 300)

Number of guard Band = 4 - 1 = 3
We know,

$$B_T = \text{number of channel} \times B_{ch} + \text{number of guard band} \times B_g$$

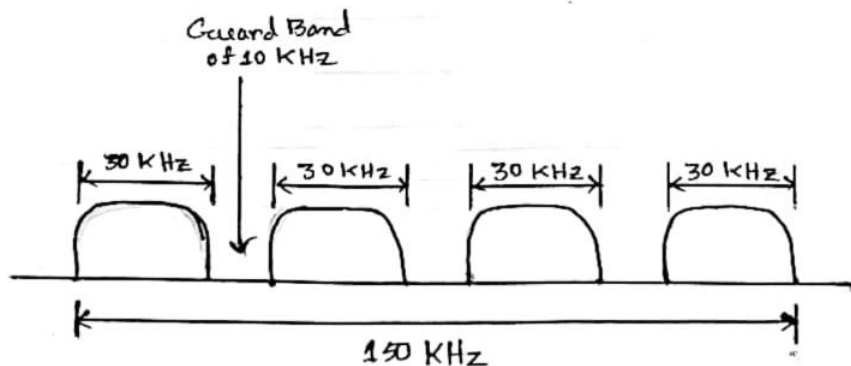
$$150 = 4 \times 30 + 3 \times B_g$$

$$B_g = \frac{150 - 120}{3}$$

$$= 10 \text{ kHz}$$

So, Appropriate Guard Band = 10 kHz

Configuration:



QUESTION 2.

(a) Using data rate management methods, perform synchronous TDM for six sources with the following data rates and draw the arrangement showing all the bit rates. [5]

- Source 1: $(A+C)$ Mbps
- Source 2: $(A+C - D/5)$ Mbps
- Source 3: $2(A+C)$ Mbps
- Source 4: $(A+C)$ Mbps
- Source 5: $(A+C)/2$ Mbps
- Source 6: $(A+C)/2$ Mbps

(a)

TD:

2	2	-	4	6	0	1	3	-	1
A	B	-	C	D	E	F	G	-	H

$$\text{Source 1: } (A+C) \text{ Mbps} = (2+4) = 6 \text{ Mbps}$$

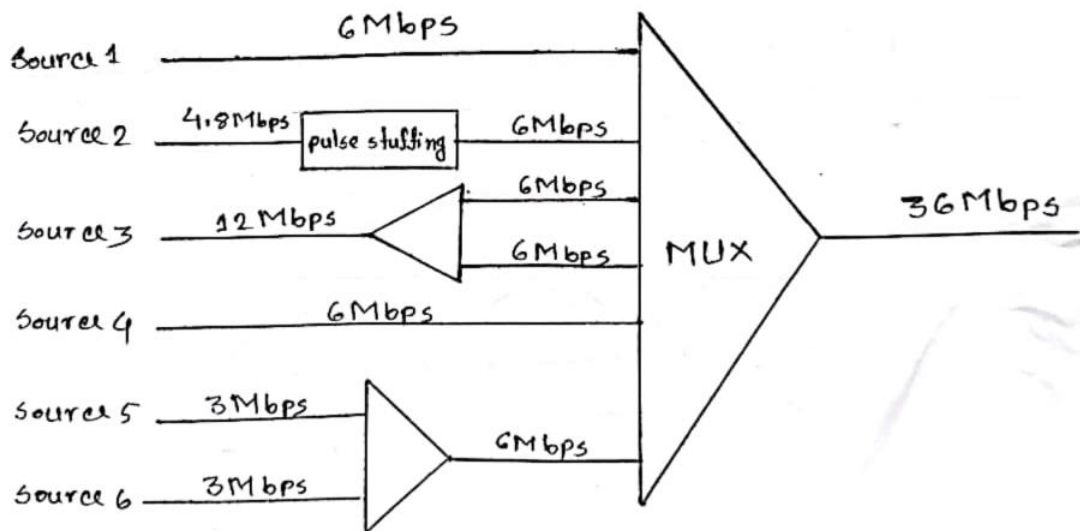
$$\text{Source 2: } (A+C - \frac{D}{5}) \text{ Mbps} = (2+4 - \frac{6}{5}) = 4.8 \text{ Mbps}$$

$$\text{Source 3: } 2(A+C) \text{ Mbps} = 2(2+4) = 12 \text{ Mbps}$$

$$\text{Source 4: } (A+C) \text{ Mbps} = (2+4) = 6 \text{ Mbps}$$

$$\text{Source 5: } (A+C)/2 \text{ Mbps} = (2+4)/2 = 3 \text{ Mbps}$$

$$\text{Source 6: } (A+C)/2 \text{ Mbps} = (2+4)/2 = 3 \text{ Mbps}$$



(b) Draw the input and output frames for a multiplexing configuration of three lines for both synchronous and statistical TDM. Assume the unit of data is 1 bit, and the inputs for each line are:

Line X: 1, 0, 1, No data, 1, 0

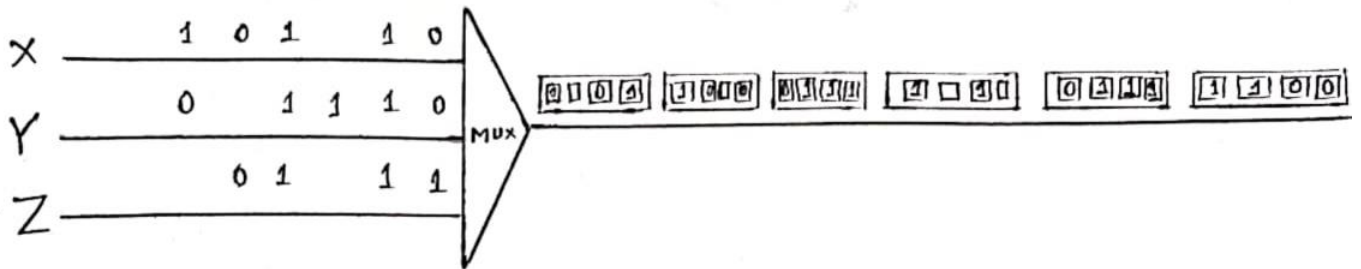
Line Y: 0, No data, 1, 1, 1, 0

Line Z: No data, 0, 1, No data, 1, 1

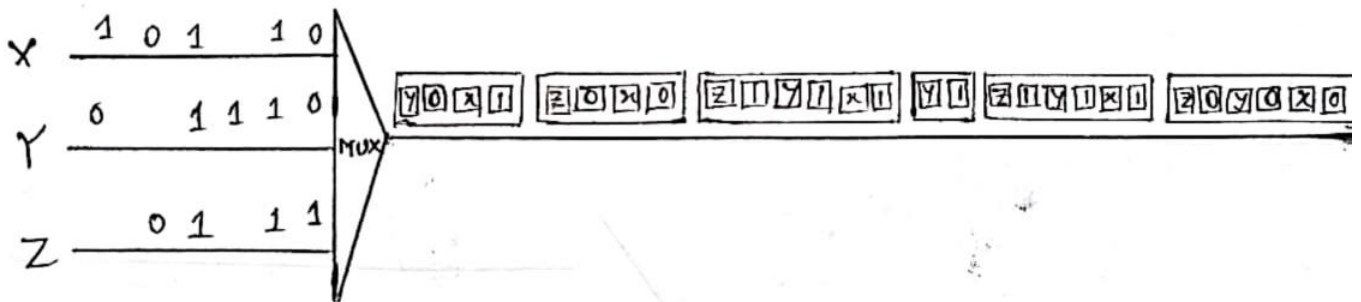
For the synchronous case, add 1 extra bit for synchronization on each frame, and for the statistical case, add addresses to show which line each interleaved unit is coming from. [5]

(b)

Synchronous Case:



Statistical Case:



QUESTION 3.

Four sources are creating **BDE** characters per second. If the interleaved unit during synchronous TDM is **(G+H)** bytes long and 1 synchronizing bit is added to each frame, **draw the configuration and the frame on the link** and find: [2+4×2]

- the data rate of each source,
- the duration of each frame,
- the number of bits in each frame,
- the data rate of the link.

ID:

2	2	-	4	6	0	1	3	-	1
A	B	-	C	D	E	F	G	-	H

(a)

$$\begin{aligned}\text{Data rate} &= BDE \times 8 \\ &= 260 \times 8 = 2080 \text{ bps}\end{aligned}$$

(b)

$$\begin{aligned}\text{Input bit duration} &= \frac{1}{\text{Input bitrate}} \\ &= \frac{1}{2080} \\ &= 0.480 \text{ ms}\end{aligned}$$

$$\begin{aligned}\text{Input bitrate} &= 2080 \text{ bps} \\ \text{unit size} &= (G+H) \text{ byte} \\ &= (4 \times 8) \text{ bit} \\ &= 32 \text{ bits}\end{aligned}$$

$$\begin{aligned}\text{Input time slot} &= \text{Input bit duration} \times \text{unit size} \\ &= 0.480 \times 32 \\ &= 15.36 \text{ ms}\end{aligned}$$

$$\begin{aligned}\text{Frame duration} &= \text{Input time slot} \\ &= 15.36 \text{ ms}\end{aligned}$$

$$\begin{aligned}\text{Frame rate} &= \frac{1}{\text{Frame duration}} \\ &= \frac{1}{15.36 \times 10^{-3}} = 65.10 \text{ fps}\end{aligned}$$

(c)

Number of bits in each frame

$$\begin{aligned} &= \text{unit size} \times \text{no. of line} + \text{synchronization bit} \\ &= 32 \times 4 + 1 \\ &= 129 \text{ bits} \end{aligned}$$

(d)

data rate of the link = Frame rate \times Frame size

$$\begin{aligned} &= 65.10 \times 129 \\ &= 8397.9 \text{ bps} \\ &\approx 8398 \text{ bps} \end{aligned}$$

Configuration

