Department : CSE

Program: B.Sc in Computer Science and Engineer

Course no : CSE 3211

Course Title: Data Communication

Examination: Semester-Final

Semester: Spring 2020

Student no: 170204105

Signature and Date:

8/6/2021

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Answer to the question no : 1 (a)

Layering in network : It is the concept of layering to simply to reduces the complexity of its working. The first computer network were designed with the hardware as the main concern and the software as an afterthought.

The necessity of having layering in a network are described bellow -

(1) (i) It breaks network communication in to smaller, more manageable parts.

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(ii) It standardizes network components of allow multiple vendor development and support.

(iii) It allows different types of ~~network~~ hardware and software to communicate with each other.

(iv) It prevents changes in one layer from affecting other layers.

(v) It devides network communication in to smaller parts to make learning it easier to understand.

(2)

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Adjacent layer: It refers to how the adjacent networking layer in the same computer interact to each other the higher-layer protocal uses the next lower-layer protocal to perform the service it needed.

We have seen a few example:

(i) Application layer protocal HTTP uses the transport layer. TCP to perform the error recovery service it needed.

3

(ii) Transport layer protocal UPP uses the interact layer protocal IP perform the IP address and routing, service if needed.

(3) Internet layer protocal IP uses the link layer protocal Ethernet to perform the host to host physical communication service if needed.

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Answer to the question no. 1 (B)

The key functions of the Data Link Layer are,

Framing: Divides the stream of bits received from network layer into manageable data units called frames.

Physical Addressing: Add a header to the frame to define the physical address of the source and the destination machine.

Flow Control: Impose a flow-control - control rate at which data is transmitted so as not to flood the receiver.

5

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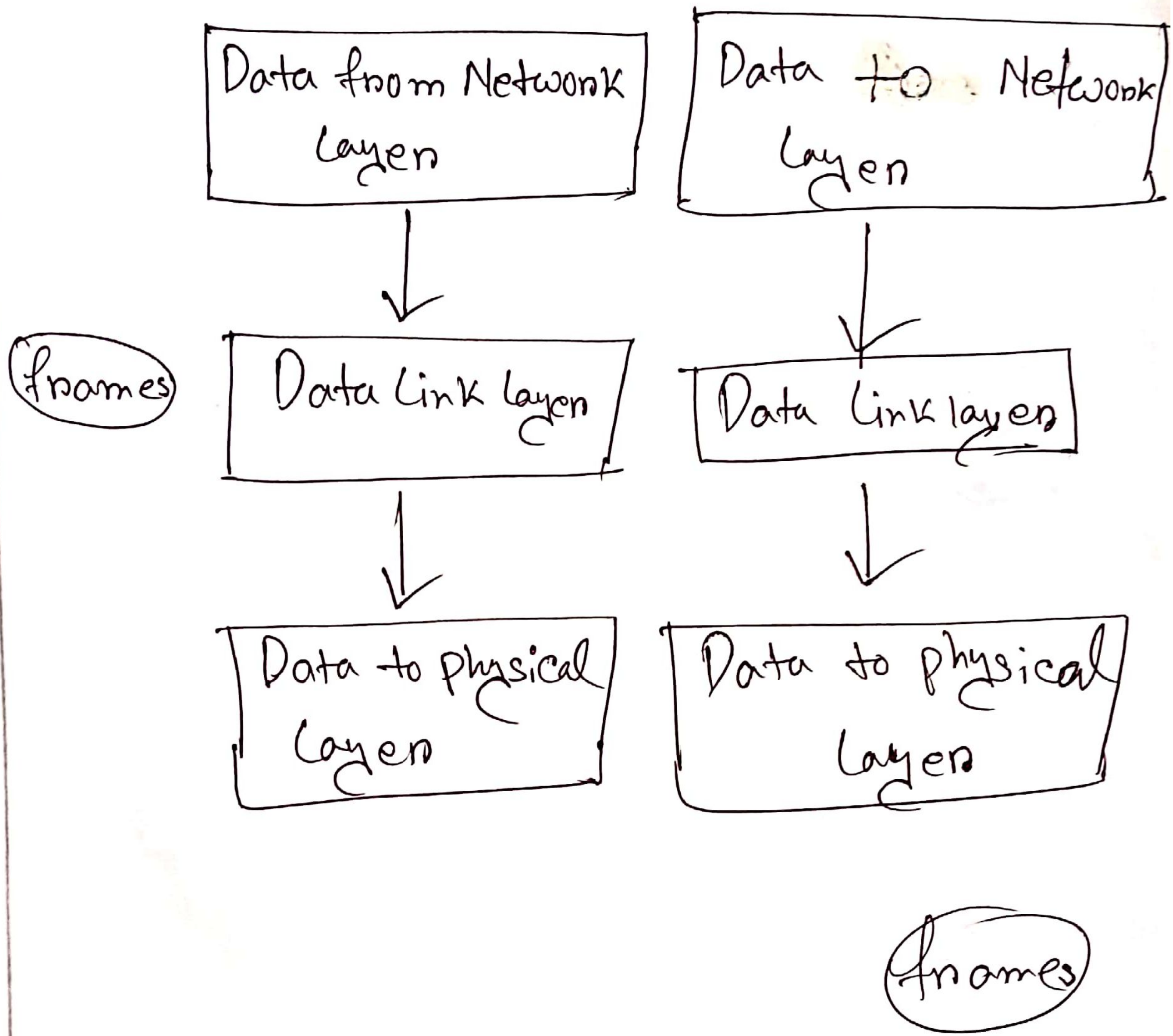
Ennon Contnal: Ennon Contnol is achieved by adding atnailen at the end of the frame. Duplication of frames ane also prevented by using the mechanism.

Access Control: Protocols of this layen determine which of the devices has Contral oven the link at any given time, when two on mone devices ane Connected to the same link.

Synchronization: When data frames are sent on the link, both machines must be synchronized in onden to transfen to take place.

6


Data from Network layer
Data to Network layer
frames
Data Link layer
Data Link layer
Data to physical layer
Data to physical layer
frames

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Answer to the question no: 1(c)

Given that,

2 million bytes $= 2000 \times 8kb$

$= 16000 kb$

Time taken to download 56kbps channel

$= \frac{16000}{56}$

$= 285.7 s$

Time taken to download 1 mbps channel

$= \frac{16000}{1024}$

$= 15.6 s$

8

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Answer to the Question no: 2(a)

The Nyquist theorem, also known as the sampling theorem, is a principle that engineers follow in the digilization of analog signals. For analog-to-digital conversion (ADC) to result in a faithful reproduction of the signal, slices, called samples of the analog wave form must be taken frequently.

Any Analog signal consists of

9

components of various frequencies. The simplest case is the sine wave

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in which all signal energy is Concentrated at one frequency. In practice, analog signals usually have Comlex wave forms with Components at many frequencies. The higest frequency the bandwith of that signal.

Suppose the highest frequency Component, in hertz. for a given signal is fmax. According to the Nyquist Theorem, the sampling rate must be at least 2fmax, or twice

10

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the highest analog frequency component. If the sampling rate is less than 2fmax, some of the highest frequency acomponent in the analog input signal will not be correctly represented in the digitized output. When a such aigoal signal is converted back to analog ~~fron~~ form by a digital to analog convertor, false frequency. This undesireable condition is a form of distortion called ~~ala~~ aliasing.

11

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2-(b) (i)

```
             10100110110
       -------------------
10111 ) 10100 1111 0000
        10111
        -----
         00111
          00000
          -----
           01111
           00000
           -----
            11111
             10111
             -----
              10001
               10111
               -----
                01100
                 00000
                 -----
                  11000
                   10111
                   -----
                    11110
                     10110
                     -----
                      10010
                       10111
                       -----
                        01010
                         0000
                        -----
                         1010
```

q = 10100111110110

12

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(ii)

```
         10011
       ___________
10111 ) 101001100
        10111
        _____
         00111
         00000
         _____
          01111
          00000
          _____
           11110
           10111
           _____
            10010
            10111
            _____
             0101
```

13

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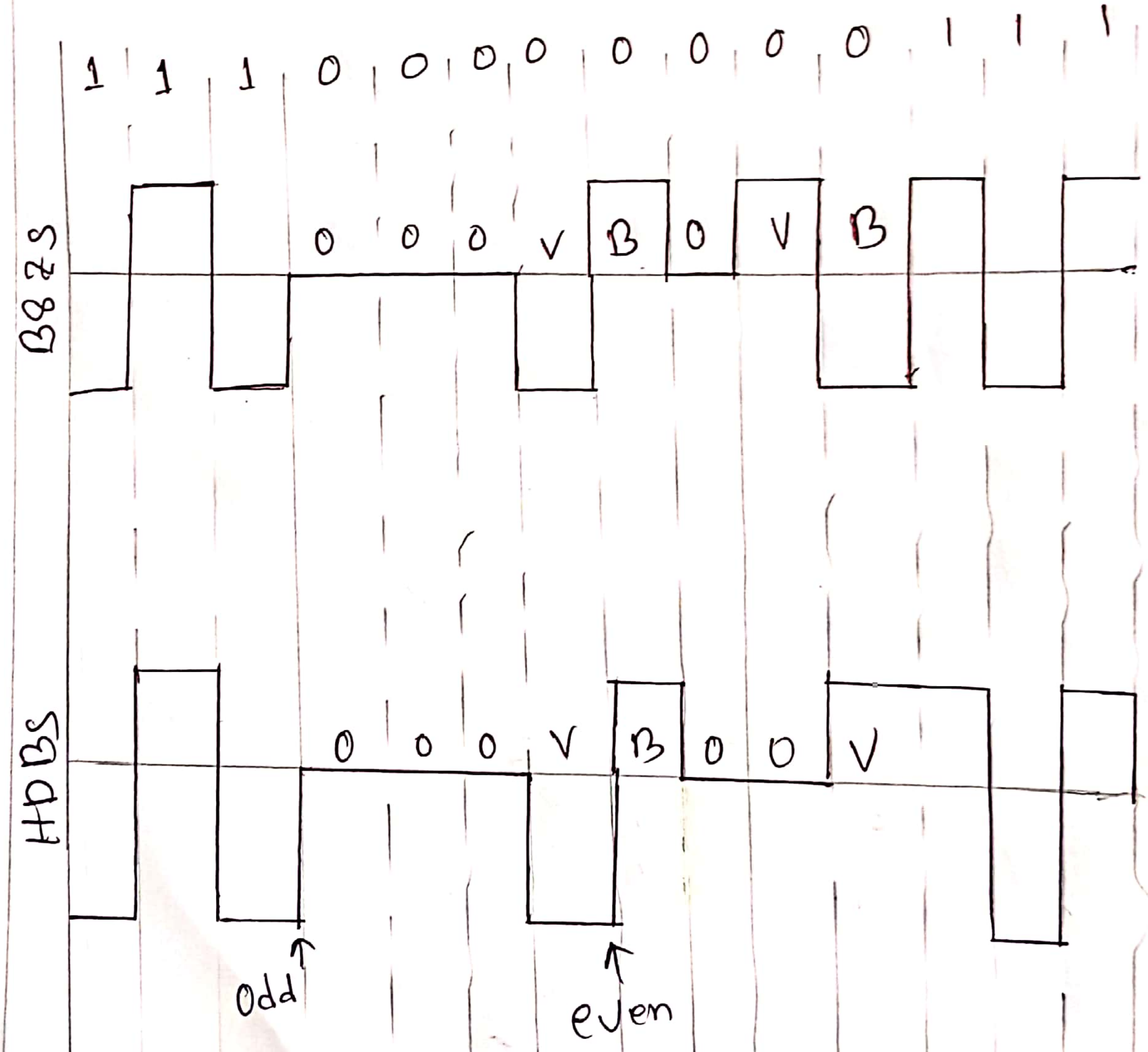
Answer to the question no: 2(c)

My id is 170204105

105 → odd

111 0000 0000 111



14

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Answer to the question no: 3(a)

We can QPSK instead of BPSK because QPSK has advantages of having double data rate compare to BPSK. This is due to support of two bit per carrier in QPSK compare to one bit per carrier in the case of BPSK.

Implemantation of QPSK: The simplicity of BPSK enticed designers to use 2bits at a time in each signal element, there by decreasing the baud rate and eventually the required band width. The scheme is called quadrature PSK or QPSK because it uses two ~~st~~ separate BPSK modulations; one is in-phase

(15)

the other quadrature. The incoming bits are first passed through a serial-to-parallel conversion that sends one bit to one modulator and the next bit to the other modulator. If the during of each bit in the incoming signal is T, the duration of each bit B sent to the corresponding BPSK signal is 2T. This means that the bit to each BPSK signal has one-half the frequency of the original signal.

16

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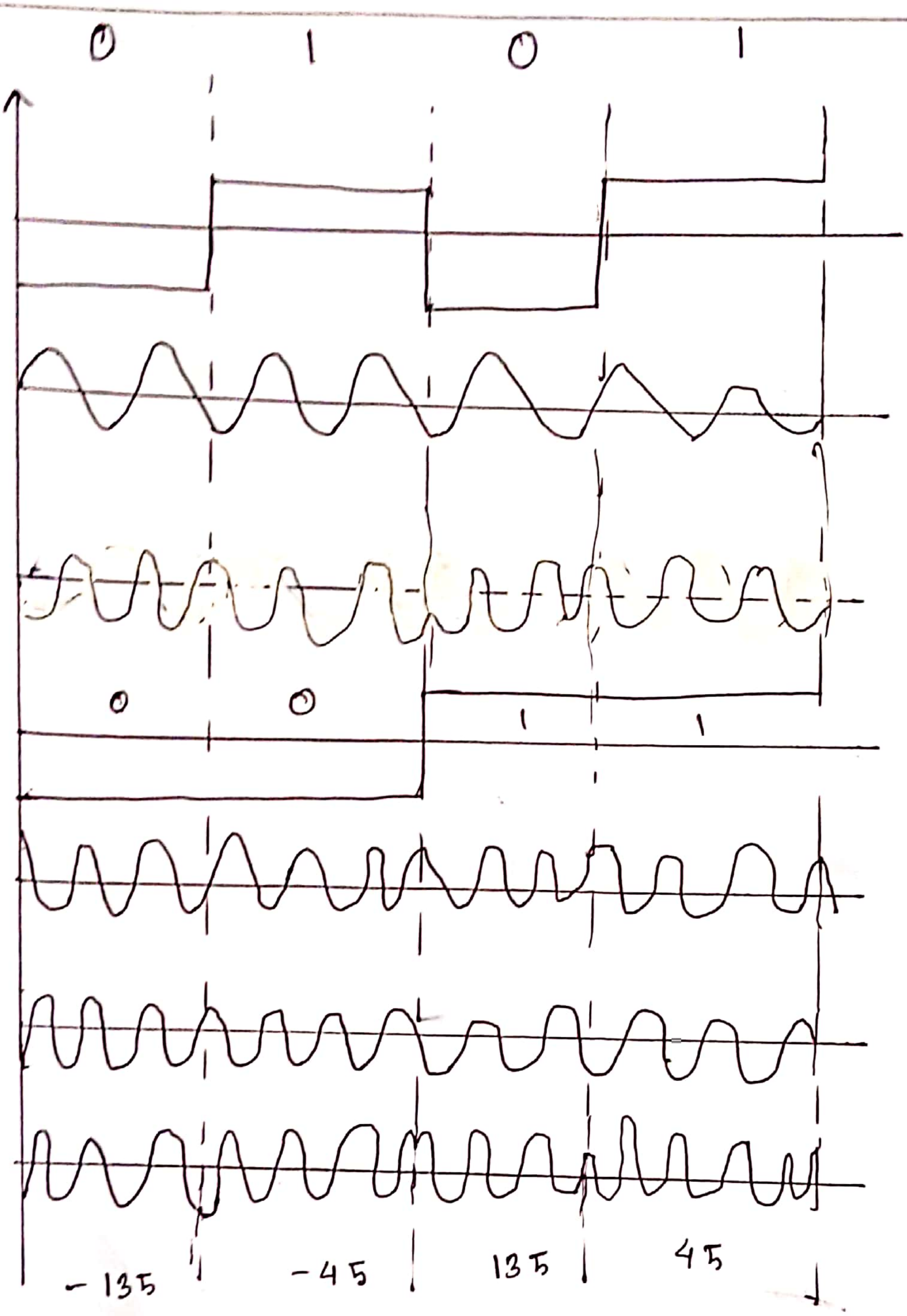

17

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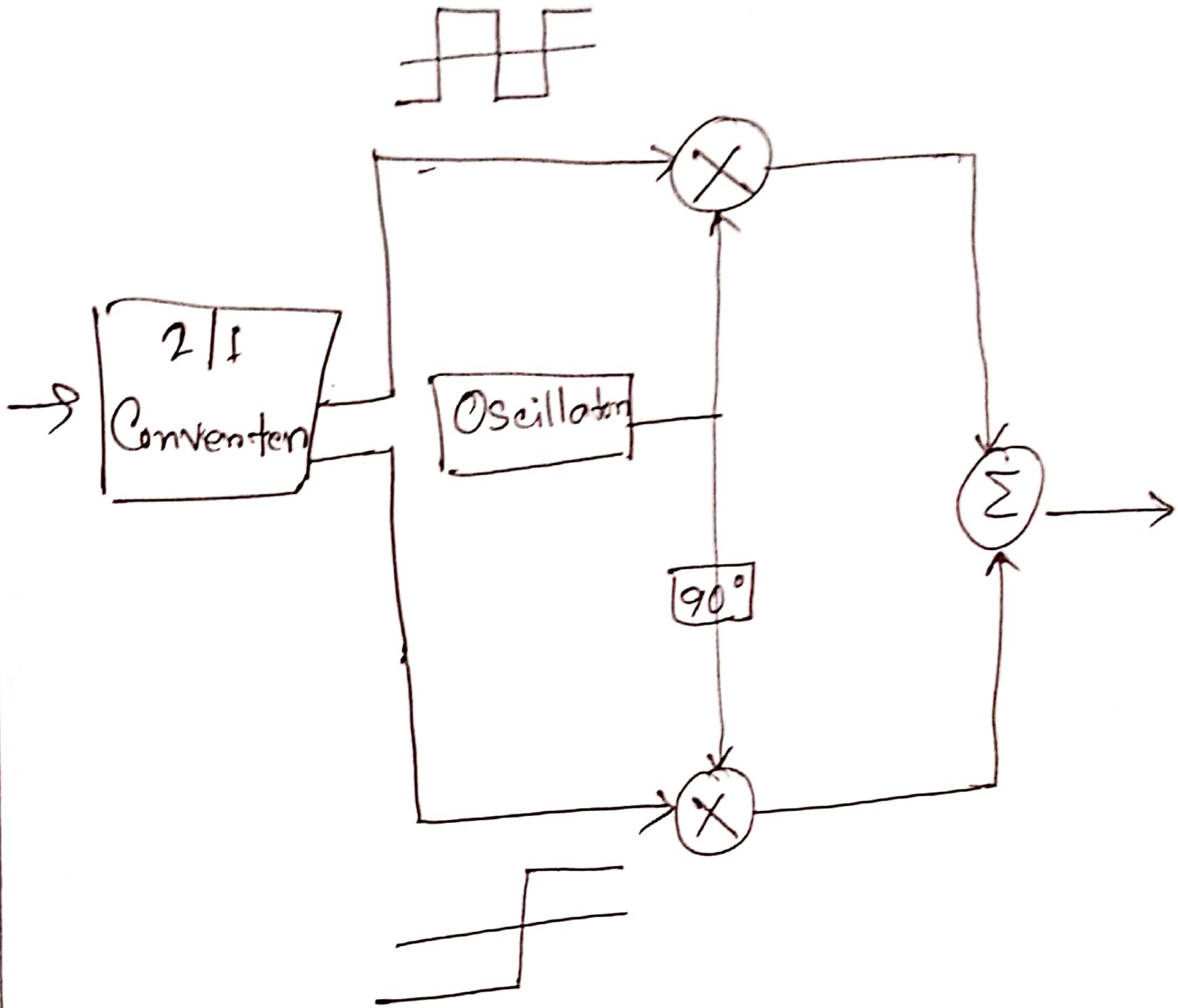

18

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Answer to the question no: 3(b)

Nyquist Theorm: Nyquist theorm state that a periodic signal must be sampled at more than twice the highest frequency component of the signal. In practice because of the finite time available a sample rate somewhat higher that this is necessary.

The Nyquist Theorem also known as the sampling theorem. It is a principle that sampling theorem. It is a principal that engineers follow in the digitization of analog signals.

(19)

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(i) For FSK: $S = 1/n \times N$

$n = \log_2 2 = 1$

$\therefore S = 1/n \times N = 1/1 \times 2000 = 2000$ baud

(ii) For ASK:

$n = \log_2 2 = 1$

$\therefore S = 1/1 \times 4000 = 4000$ baud

(iii) For QPSK

$n = \log_2 4 = 2$

$\therefore S = 1/2 \times 6000 = 3000$ baud

(iv) For 64-QAM

$n = \log_2 64 = 6$

$\therefore S = 1/6 \times 36000 = 6000$ baud

20

We, can say that 64-QAM has the highest baud rate while FSK has the lowest baud rate.

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Answer to the question no: 3(C)(I)

Yes we can say if a signal is periodic or non periodic by just looking its frequncy domain plot. For periodic frequency domain plot the graph will be a stright ling corresponding to the frequency. On the other hand non-~~preod~~ periodic signal will no be a straight line.

21

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Answer to the Question no: 3 (c)(II)

The cause of impairment →

(i) Attenuation

(ii) Distortion

(iii) Noise

~~Attenuataion: Attent~~

Attenuation: Attenuation means of energy when a signal simple or composite travels through medium it loss some of it energy in overcoming the resistance of the medium.

Distortion: Distortion means that the signal changes it form or ~~spho~~ shape. Distortion can occur

22

in a composite signal made of different frequencies.

Noise: Noise is another cause of impairment several type of noice such as thermal noise, induced noise, crosswalk, and impluse noice may corrupt the signal.

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Answer to the question no: 4(a)

The traditional checksum uses a small number of bits (16) to detect errors in a message of any size.
At least three types of error cannot be detected by the current checksum calculation. First, if two data items are swapped during transmission, the sum and the checksum values will not change. Second, if the value of one data item is increased and the value of another one is decreased the same amount, the sum and the checksum

Can not ~~be~~ detect these changes. third, if one or more data items is changed in such a way that the change is a multiple of 216-1, the sum or the checksum can not detect the changes".

However, the tendency in the Internet, Particularly in designing new protocols, ~~so, it~~ is to replace the checksum with a CRC.

25

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Answer to the question no: 4(b)

TDM is a digital multiplexing technique for combining several low-rate channels into one high-rate one.

TDM ~~d~~ is a digital process that allows several connections to share the high ~~d~~ bandwidth of a line Instead of sharing a portion of the bandwidth as in FDM, time is shared. Each connection occupies a portion of time in the link.

26

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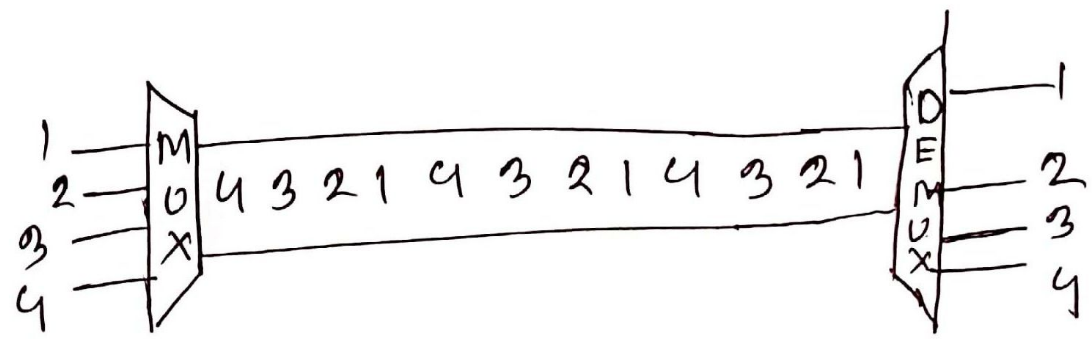

In synchronous TDM, each input connection has an allotment in the output even if it is not ~~sp~~ sending data. In synchronous TDM, the data flow of each input connection is divided into units, where each input occupies one input time slot.

A unit can be 1 bit, one character, or one block of data. Each input unit

27

and occupies one output time slot is n times shorter than the duration of an input time slot. If an input time slot is Ts, the output time slot is T/ns. where n is the number of connections. In other words, a unit in the output connection has a shorter duration; it travels faster. The following figure shows an example of synchronous TDM where n is 3

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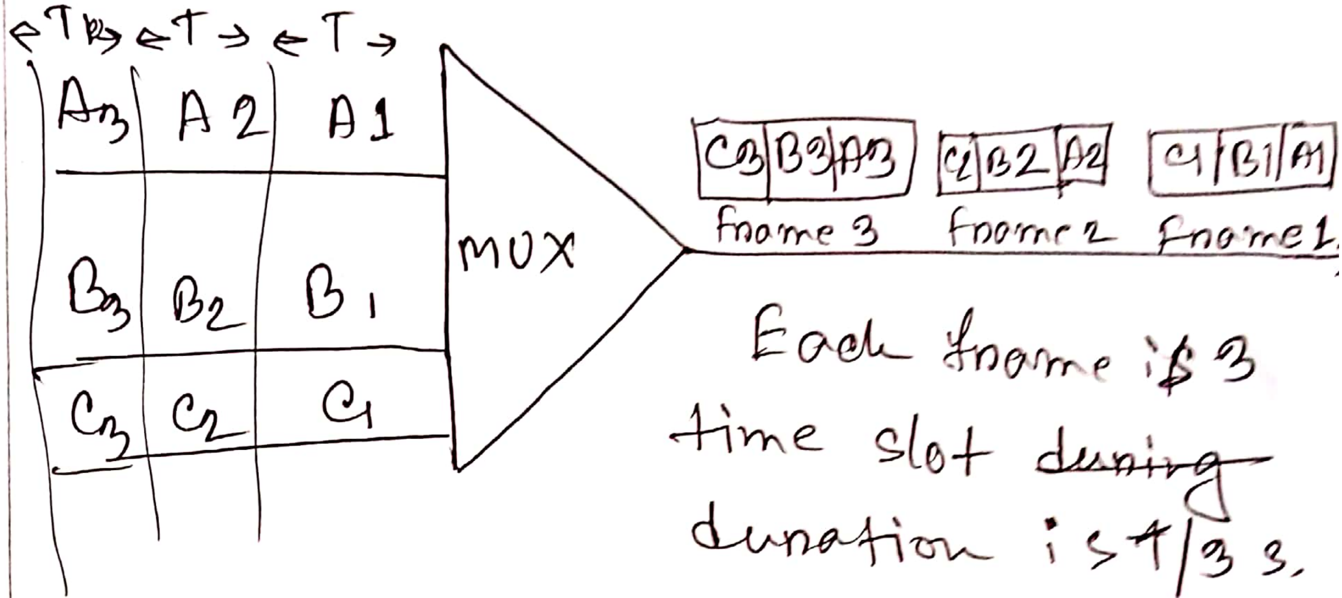

Each frame is 3 time slot ~~during~~ duration is 4/3 s.

In synchronous TDM, a round of data units from each input connection is collected into a frame. If we have connections, a frame is divide into n times slots and one slot is allocated for each unit, one for each input line. It the duration

2(a)

of each slot is T/n and the duration of each frame is T.

Time slots are grouped into frames. A frame consists of one complete cycle of time slots, with one slot dedicated to each sending device. In a system with n input lines, each frame has n slots with each slot allocated to carry data from a specific input line

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Answer to the question no: 4.(c)

Each ~~bandwidth~~ = (849 - 824)
= 25

= (894 - 869)
= 25

If we divide 25 MHz by 30 kHz, we get 833.33. In reality the band is divided into 832 channels. of these, 42 channels are used for control, which means only 790 channels are used for control, which means only 790 channels are availabe for cellular phone users.

Ans: 790 channels

Answer to the question no-7 (a)

(I)

The relationship between the size of the data word and the size of the codeword is : $n = k + r$

Where,

n = Size of the codeword

k = Size of the data word

r = Size of the remainder

(II)

The remainder is always one bit smaller than the divisor.

32

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(III)

The degree of generator polynomial is one less than the size of the divisor

(IV)

The degree of the generator polynomial is the same as the size of the remainder.

33

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Answer to the Question no: 7 (b)

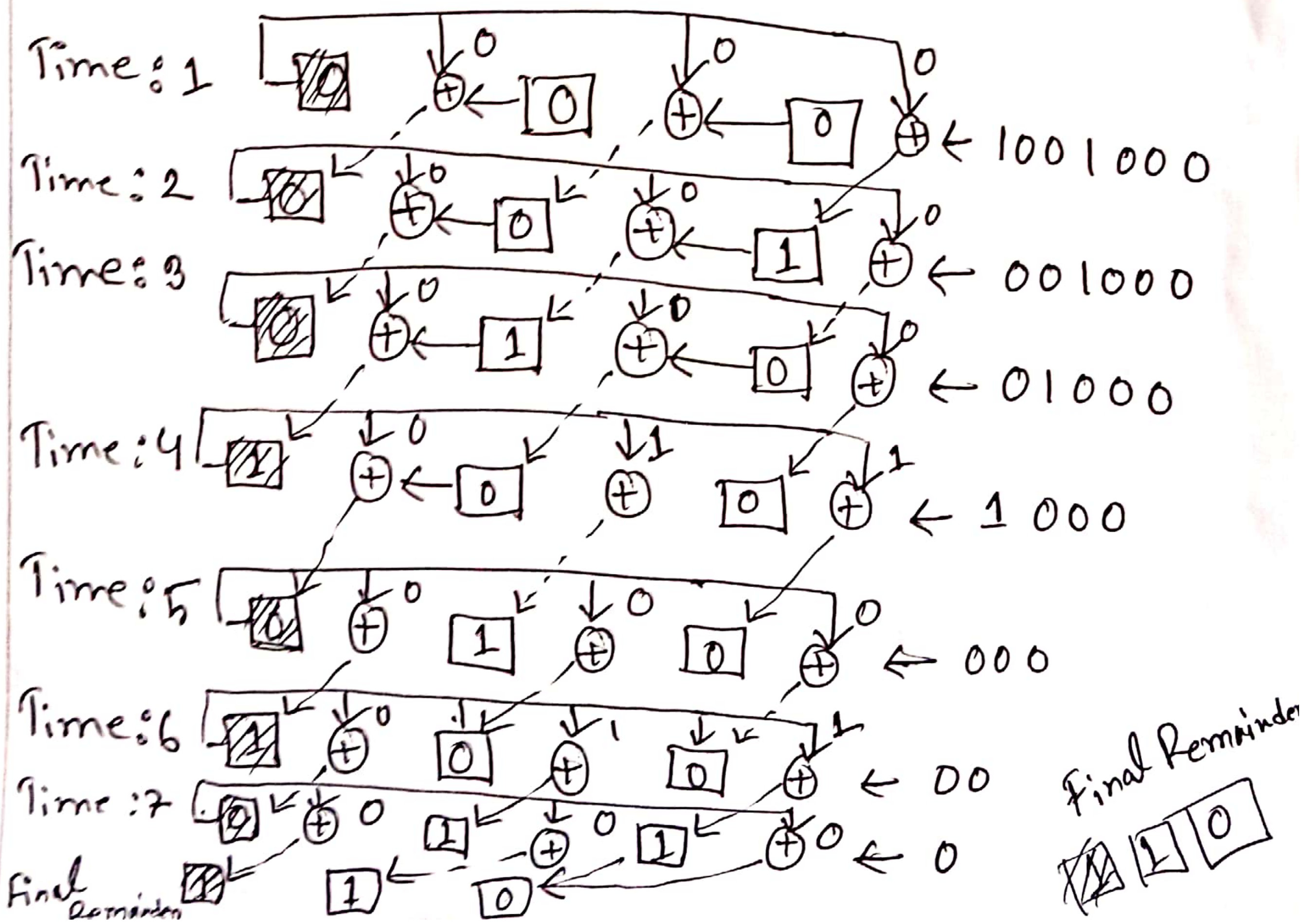
My ID is : 170204105

The second last digit of my Id is 0 which is even.

So,

The augmented dataword = 1001000

Simulation



34

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