B.Tech 3rd Semester End Term Examination- 2021

Name of Subject: Data Communication

Paper Code: UCS03B07

Full Marks: 50 **Time: 2 Hours**

[The figures in the margin indicate full marks for the questions]

Part – A (Ten MCQ Questions) 10x1=10

1. Which is more efficient?
a) Parity check b) Cyclic redundancy check c) Parity & Cyclic redundancy check d) None of the mentioned
2. Which are forward error correcting codes?
a) Block codes b) Convolutional codes c) Block & Convolutional codes d) None of the mentioned
3. An interconnected collection of piconet is called _____
a) scatternet b) micronet c) mininet d) multinet
4. Bluetooth is the wireless technology for _____
a) local area network b) personal area network c) metropolitan area network d) wide area network
5. Bits can be sent over guided and unguided media as analog signal by _____
a) digital modulation b) amplitude modulation c) frequency modulation d) phase modulation
6. In asynchronous serial communication the physical layer provides _____
a) start and stop signaling b) flow control c) both start & stop signalling and flow control d) only start signaling
7._____ Protocol is used for noiseless channel.
a) Stop and wait ARQ b) Go Back N ARQ c) Stop and Wait d) Selective Repeat ARQ
8. If there are n signal sources of same data rate, then the TDM link has _____ slots.
a) n b) n/2 c) n*2 d) 2^n
9. If link transmits 4000frames per second, and each slot has 8 bits, the transmission rate of circuit this TDM is _____
a) 32kbps b) 500bps c) 500kbps d) 32bps
10. Which type of demodulator is used in the frequency hopping technique?
a) Coherent b) Non coherent c) Coherent & Non coherent d) None of the mentioned

Part – B (Eight Questions)

8x5=40

11) Give one real life situation of Expose station problem and Hidden station problem and analyzed it? Explain with suitable diagram.

12) If the 7 bit Hamming codeword received by a 1011011.Assuming the even parity, state whether the received codeword is correct or wrong. If wrong locate the bit in error.

13) Generate the CRC code for the data word of 110010101.The divisor is 10101.

14) How does sky propagation differ from line-of-sight propagation?

15) A multiplexer combines four 100-kbps channels using a time slot of 2 bits. Show the output with four arbitrary inputs. What is the frame rate? What is the frame duration? What is the bit rate? What is the bit duration?

16) Write a short note on: Stop and wait Protocol.

17) Which of the three digital-to-analog conversion techniques (ASK, FSK, PSK) is the most susceptible to noise? Defend your answer.

18) Why Bandwidth-Delay Product is very important in Data communication explain with proper example.

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National Institute of Technology, Agartala

Name of Examination : End Sem Examination

Subject : Data Communication Subject Code : UCS03B07

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Enrollment no : 20UCS119 Section : A

Branch : Computer Science & Engineering Semester : 3rd Sem

Part - A

Q.1 (b) Cyclic Redundancy check.

Q.2. (c) Block & Convolutional Codes.

Q.3. (a) scattered.

Q.4. (b) personal area network.

Q.5. (a) Digital modulation.

Q.6. (c) Both start & stop signalling and flow control.

Q.7. (c) Stop and wait.

Q.8. (a) n

Q.9. (a) Transmission rate = Framerate x no. of bits in a slot.

TDM = 4000 x 8 = 32 Kbps (a)

Q.10. (b) Non-coherent.

Part - B

Q.12. Given, 1011011

1	0	1	1	0	1	1
D_7	D_6	D_5	P_4	D_3	P_2	P_1

$P_1 \longrightarrow D_3 D_5 D_7$

$P_2 \longrightarrow D_3 D_6 D_7$

$P_4 \longrightarrow D_5 D_6 D_7$

(1) $P_1 \longrightarrow D_3 D_5 D_7$

$1 \longrightarrow 0 \quad 1 \quad 1$

(2) $P_2 \longrightarrow D_3 \quad D_6 \quad D_7$

$1 \qquad 0 \quad 0 \quad 1$

(3) $P_4 \longrightarrow D_5 \quad D_6 \quad D_7$

$1 \longrightarrow 1 \quad 0 \quad 1$

Since, it is a even parity code, there is an error in the transmitted code

$P_4 \quad P_2 \quad P_1$

$\rightarrow 1 \quad 0 \quad 1$

$\rightarrow 2^0 + 2^2 = 5$

There is an error in the 5th bit.

∴ Correct Codeword should be

= 1001011

D.15, Frame rate = input bit rate (convert it into bits) / time slot bits (s)

$= \frac{100000}{2} = 50000$ frames per second (Frame /s)

Frame duration $= \frac{1}{50000} = \frac{10}{5} \times 10^{-5} = 20 \times 10^{-6}$ s

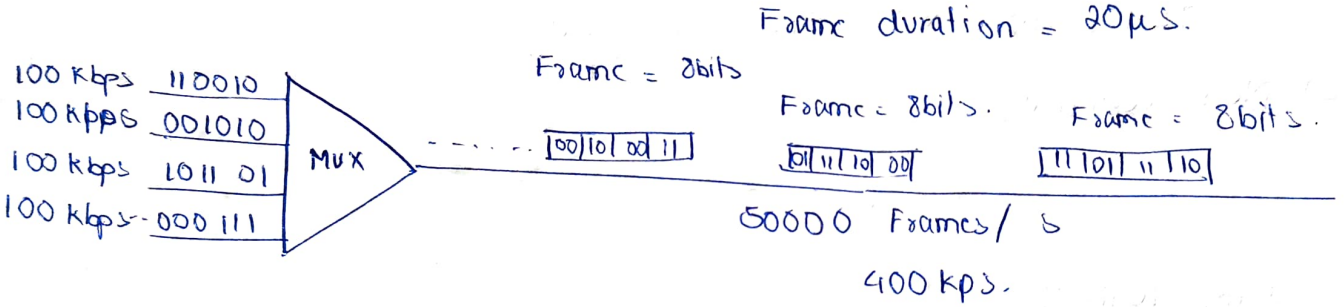
$= 20\mu s$.

Bit rate = No. of Frames per second (Frame rate)

× No. of bits in each Frame

$= 50000 \times 8 = 400,000 = 400$ Kbps.

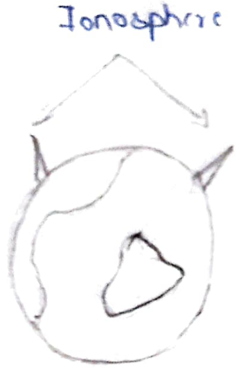
Bit duration $= \frac{1}{400000} = \frac{10}{4} \times 10^{-6}$ s $= 2.5\ \mu s$.



Q.14. In sky propagation, higher-frequency radio waves radiate upward into the ionosphere (the layer of atmosphere where particles exist as ions) where they are reflected back to earth. This type of transmission allows for greater distances with lower output power.

In line of sight propagation, very high frequency signals are transmitted in straight lines directly from antenna to antenna. Antennas must be directional, facing each other, and either tall enough or close enough together not to be affected by the curvature of the earth. Line-of-sight propagation is tricky because radio transmissions cannot be completely focused.

Diagram :



Sky propagation
(2-30 MHz)

Light-of-sight propagation
(Above 30 MHz)

Q.13. Data word : 110010101

Divisor : 10101

The number of data bits = m = 9

Dividend = Data word number of zeroes.

11001010100000

(110010101 — Data word; 00000 — 5 additional zeroes.)

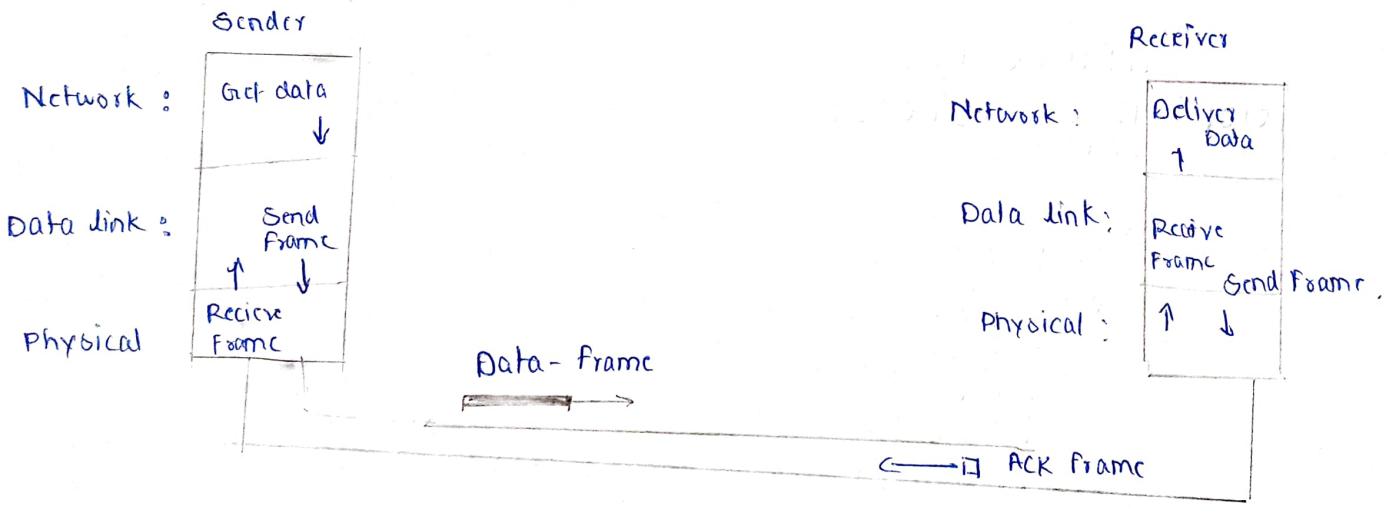
```
            11111001111
10101 ) 11001010100000
        10101
        ⊕⊕⊕⊕⊕
        011000
         10101
         011011
          10101
          011100
           10101
           11001 1
            10101
            11000
             10101
             11010
              10101
              11110
               10100
               10110
               10101
               00110   <— Remainder
```

In CRC, the required codeword is obtained by writing the data word followed by the remainder

```
1100 1010100 000
             110
```

Codeword = 1100101010011 0.

Q16. If data frames arrive at the reciever site faster than they can be processed, frames have to slow down. There must be feedback from reciever to the sender. For this purpose, we have Stop-and-wait Protocol because the sender sends one frame, stops unit it recieves confirmation from the receiver and then send the next data-frame. We still have unidirectional communication for data-frames, but Auxilary ACK frames travel from the other direction. we add flow control to our previous protocol "simple".



Event: Request from network layer

Repeat forever

Algorithm for sender

Event : Notification from physical layer

Repeat forever

Algorithm for receiver

Event : Notification from physical layer.

Q.18. Bandwidth - Delay product is the measurement of how many bits can fill up a network link. It is importance in data communication field as it gives the maximum amount of data that can be transmitted by the sender at a given time before waiting for acknowledgement and thus, it accounts for the maximum amount of ~~acknowledgement~~ acknowledged data. The bandwidth - Delay product is measured in bits & bytes.

We can understand with the use of an example.

Let the link capacity capacity of a channel be 512 Kbps & round trip delay time is 1000 ms.

Bandwidth - Delay product = 512×10^3 bps $\times$ 1000 $\times 10^{-3}$

= 512000 bits or 64000 bytes

= 62.5 Kb.

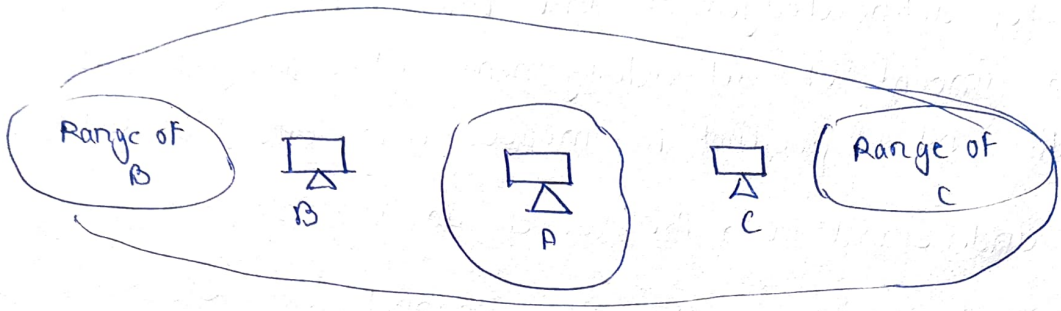
Q.17. • ASK is the most susceptible to noise. It affects the amplitude.

- FSK - Frequency of carrier signal is varied to represent binary 1 and 0. The advantage of FSK over ASK is that it is less susceptible to errors than ASK. The receiver looks for specific frequency changes over a number of intervals. So voltage(noise) spikes can be ignored

- PSK - phase of carrier signal is varied to represent binary 1 and 0. The advantage of PSK is that is less susceptible to errors than ASK while it requires / occupies the same bandwidth as ASK. PSK is for efficient use of bandwidth (higher data-rate) as compared to FSK.

Q.11. Real-life situation of Expose station problem and hidden station problem.

Hidden Station Problem:

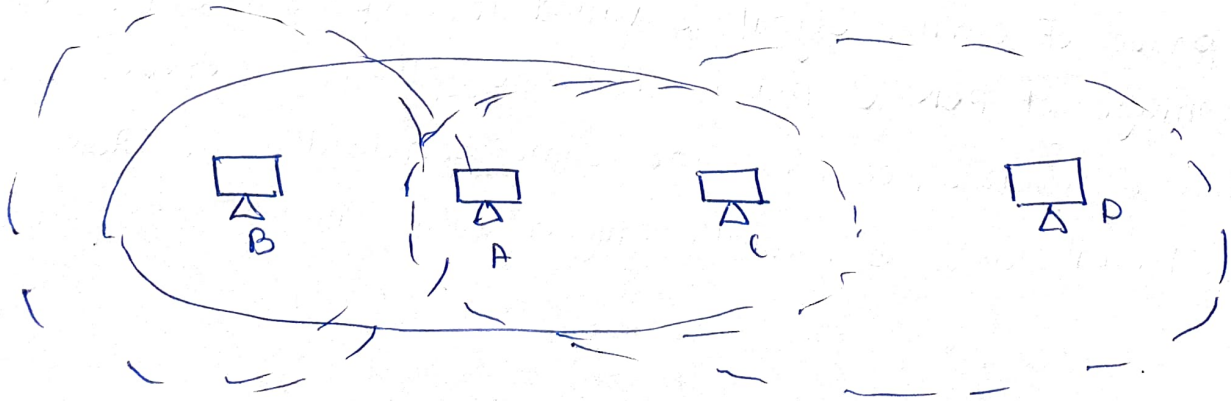


B and C are hidden from each other with respect to A.

In hidden station, problem, station B has a transmission range shown by the left oval (sphere in space). Every station in this range can hear any signal transmitted by station B. Every station located in range of station C can hear signal transmitted by C and soon.

We can say that stations B and C are hidden from each other with respect to A. The hidden stations reduces the capacity of network because of the probability of collision.

Exposed station Problem:



∴ Station C is exposed to transmission from B and A.

In this problem, a station refrains from using a channel when it is, infact available.
Since station C is exposed to transmission from A, it hears what A is sending, and thus refrains from sending. In other words, C is too conservative and wastes the capacity of the channel.

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