Q1. (5 marks)

1. Define the concept of layer in communication architecture.

The Sender and resiver has a layer using for diveding the task into a sebset of tasks because take each layel a spcail task to do it. and we have the tacnices to interface between the layer for each layer we have interface from the top and bottom to moving the data from/to the eather layer using the thropof. 1

2. Define the concept of protocol

the protocal is a set of rouls that comenction betwan layer to inteface between them (interactive) 1

3. Name the seven layers defined in the ISO OSI Reference Model and state the functions of the lowest three layers. 3

1) Phaysical layer : the layer conteictive to (bit by bit) AND moving data
2) Data link layer : the layer conticitive to (stream by stream) AND moving data
3) Networkk layer : the layer conticictive to (Packt by Packt) moving data
4) Transport layer
5) Seissaion layer
6) Phesintion layer
7) Applection layer

Q2. (5 marks)

A.

1. Give the Shannon's Theorem that describes the data rate of a physical medium with respect to signal to noise ratio.

~~bit rate = 2 * Bandwidth * $\log_2$(1+SNR)~~

if we have a signal that have a noisy in the phayceal medium we this change the bit rate of this signal

2. Calculate the theoretical highest bit rate of a regular telephone line that has a bandwidth of 3000 hz. The signal-to-noise ratio is 3162.

SNR

bit rate = 2 * Bandwidth * $\log_2$(SNR)

= 21000 bps

B.

1. Explain the concept of bit stuffing in bit-oriented synchronous transmission.

the concept is we add flage bit tell (mean) of the start and finsh of data

2. Suppose the following bit string is received by the data link layer from the network layer: 01110111101111101111110. What is the resulting string after bit stuffing process?

the stuffing → after six 1's delete 0

0 1 1 1 0 1 1 1 1 0 1 1 1 1 1 0 1 1 1 1 1 1

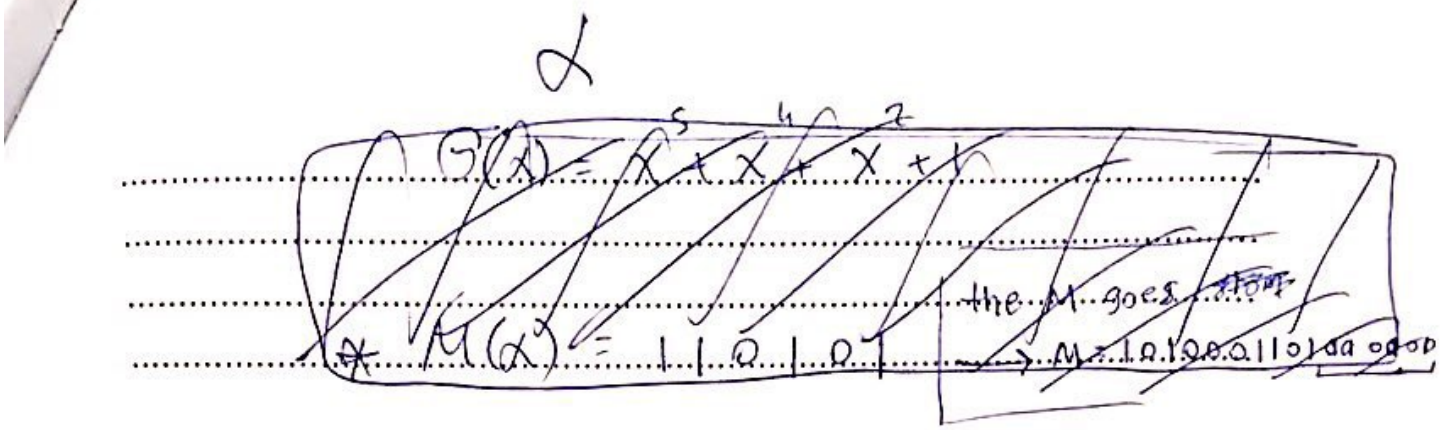
Q3. (5 marks)

A sender (S) wants to send a message M = 1010001101. It uses the CRC method to generate the Frame Check Sequence FCS.

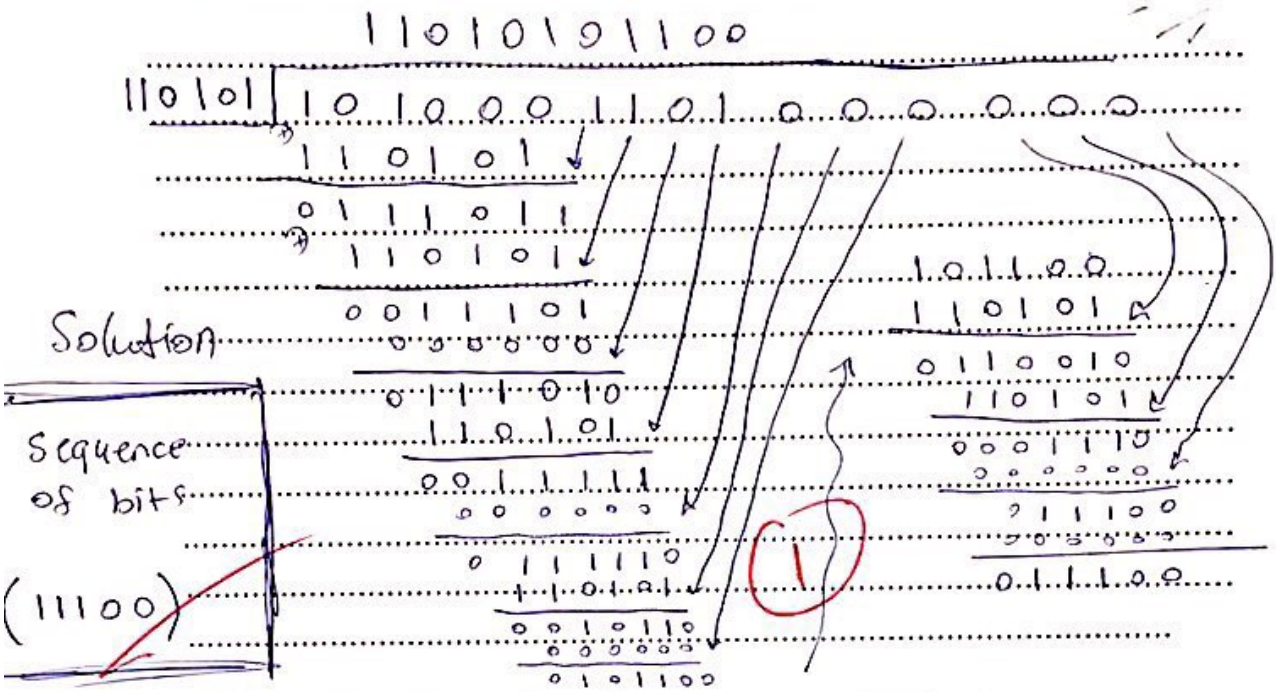
The used generator polynomial is given by $G(x) = x^5 + x^4 + x^2 + 1$.

1. Give the polynomial M(x) that represent the message M

$M(x) = x^9 + x^7 + x^3 + x^2 + 1$ (1)

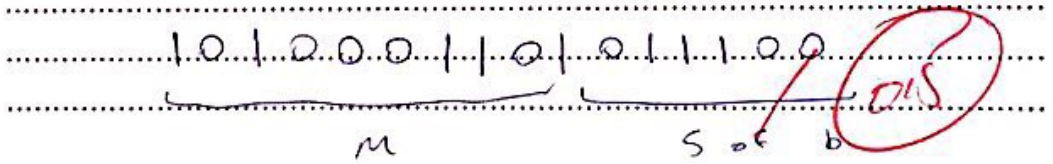


2. Determine the sequence of bits (5 bits) that allows detecting errors.



3. Represent the binary whole message (T) send by the sender (S).

full m (m + sequence of bit)



4. How does the receiver check whether the message T was transmitted without any errors

After division the full message (T) by the polynomir we generated (G(x))
if the remander is equle to 0's
then we don't have any error
othwise
we have an ethor (Getting

Q4. (5 marks)

1. Briefly explain the difference between transmission time and propagation time.

* The transmission time is the time we need to the data move from the first Medie (Sender Phaycal layel) to the last Medie (resived). 0.5

* The Propagation time is the time to constrict the data in Applection sender to move to the Medie (Phaycal layer) 0.5

2. Assume that two hosts, A and B are connected by a single link with rate R bps (bits per second). A and B are separated by m meters and the propagation speed along the link connecting them is s meters/second. Host A is sending a packet of L bits to host B. Ignoring processing and queuing time, obtain an expression for the end-to-end delay.

$$= \frac{R * L}{\text{Propastion speed}}$$

3. We consider the sliding window protocol Figure 2. Does this figure indicate that Go-Back-N is being used or Selective Repeat is being used?

we use Selective Repeat 1

7. **Suppose the following bit string is received by the data link layer from the network layer: 01110111101111101111110. What is the resulting string after bit stuffing process?**

- 01110111101111101111010

01111101ρ

8. **A sender (S) wants to send a message M = 1010001101. It uses the CRC method to generate the frame check sequence FCS.**

The used generator polynomial is given by G(x) = $X^5 + X^4 + X^2 + 1$.

1. **Give the polynomial M(x) that represent the message M.**
   - $M(x) = X^9 + X^7 + X^3 + X^2 + 1$
2. **Determine the sequence of bits (5 bits) that allows detecting errors.**
   -
3. **Represent the binary whole message (T) send by the sender (S).**
4. **How does the receiver check whether the message T was transmitted without any errors?**

9. **Briefly explain the difference between transmission time and propagation time.**

- **Transmission time:** time to put M-bit message "on the wire".
- **Transmission time** = M (bit) / rate (bit/sec) = M/R seconds
- **Propagation time:** time for bits to propagate across