

Q1.

(5 marks)

1. Define the concept of layer in communication architecture.

The sender and receiver has a layer using for dividing the task into a subset of tasks because take each layer a special task to do it and we have the techniques to interface between the layer for each layer we have interface from the top and bottom to making the data from/to the ether layer using the thtopot.

2. Define the concept of protocol

the protocol is a set of rules that connection between layer to interface between them (interactive).

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

- Physical layer : the layer responsible to (bit by bit) AND moving data
- Data link layer : the layer responsible to (stream by stream) AND moving data
- Network layer : the layer responsible to (packet by packet) moving data
- 4) Transport layer
- 5) Session layer
- 6) Presentation layer
- 7) Application 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 * log₂(1+SNR)~~
if we have a signal that have a noisy
in the physical 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.

$$\begin{aligned} \text{bit rate} &= 2 * \text{Bandwidth} * \log_2(SNR) \\ &= 21000 \text{ bps} \end{aligned}$$

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$$G(x) = x^5 + x^4 + x^2 + 1$$

~~$M(x) = 110101$~~

~~the M goes from $M(x) = 110101000110100000$~~

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

11010101100

110101 | 101000110100000000

110101 ↓

0111011

110101 ↓

0011101

0000000

0111010

110101 ↓

0011111

0000000

0111110

+ 110101 ↓

0010110

0000000

0101100

101100

110101 ↓

0110010

110101 ↓

0001110

0000000

011100

0000000

0111000

(11100)

(1)

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

Full M (M + sequence of bits)

1010001101011100

1010001101 | 011100

M S of b

(11100)

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

After division the full message (T) by the polynomial we generated (G(x))

if the remainder is equal to 0's then we don't have any error

otherwise

(1)

we have an error (G(x) is not 0)

Q4.

(5 marks)

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

* The transmission time is the time we need to move the data from the first node (Sender Physical layer) to the last node (receiver).

* The propagation time is the time to construct the data in Application layer to move to the node (Physical layer).

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.

$$= \frac{R \cdot L}{\text{Propagation Speed}}$$

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

B.

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

the concept is we add flag bit tell (marking) of the start and finish of data

2. Suppose the following bit string is received by the data link layer from the network layer: 0111011110111110111110. What is the resulting string after bit stuffing process?

the stuffing \rightarrow 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 0

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

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

7. Suppose the following bit string is received by the data link layer from the network layer:
0111011110111110111110. What is the resulting string after bit stuffing process?

- 01110111101111111111010

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

The used generator polynomial is given by $G(x) = X^5 + X^4 + X^3 + 1$.

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

- $M(x) = X^8 + X^7 + X^3 + X^2 + 1$

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

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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 = $M \text{ (bit)} / \text{rate (bit/sec)} = M/R$ seconds
- Propagation time: time for bits to propagate across