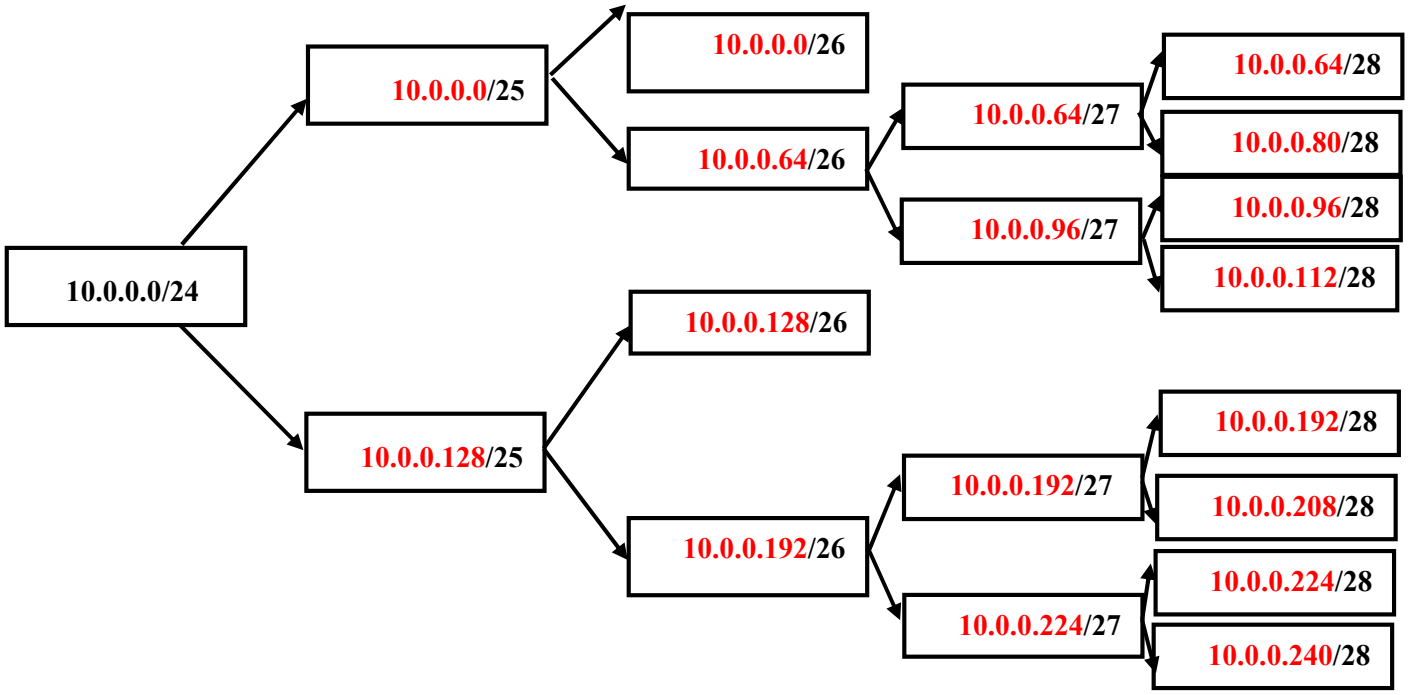
IP Addresses

Exercise 1

Fill in the following boxes with the values of the network addresses obtained by successive slicing.



Exercise 2

Complete the following table.

Network Address	*Mask*	*Broadcast*	*Smallest address*	*Largest address*
10.0.0.0/8	255.0.0.0	10.255.255.255	10.0.0.1	10.255.255.254
126.128.0.0/9	255.128.0.0	126.255.255.255	126.128.0.1	126.255.255.254
10.64.0.0/10	255.192.0.0	10.127.255.255	10.64.0.1	10.127.255.254
43.72.0.0/13	255.248.0.0	43.79.255.255	43.72.0.1	43.79.255.254
43.224.0.0/15	255.254.0.0	43.225.255.255	43.224.0.1	43.225.255.254
43.63.192.0/19	255.255.224.0	43.63.223.255	43.63.192.1	43.63.223.254
10.0.224.0/22	255.255.252.0	10.0.227.255	10.0.224.1	10.0.227.254
10.20.30.128/25	255.255.255.128	10.20.30.255	10.20.30.129	10.20.30.254
10.20.30.128/26	255.255.255.192	10.20.30.191	10.20.30.129	10.20.30.190
10.20.30.64/27	255.255.255.224	10.20.30.95	10.20.30.65	10.20.30.94
10.20.30.96/28	255.255.255.240	10.20.30.111	10.20.30.97	10.20.30.110
10.20.30.168/29	255.255.255.248	10.20.30.175	10.20.30.169	10.20.30.174
10.20.30.92/30	255.255.255.252	10.20.30.95	10.20.30.93	10.20.30.94

DATA TRANSFER IN A 4 LAYER ISO MODEL:

Let us consider a network whose operation is based on 4 layers whose characteristics are the following:

The W layer manipulates bits. It ensures the transmission and the reception of the bits in Manchester coding with a flow of 2 Mbits/s on a medium made up of two twisted pairs for a point-to-point connection.

The X layer manages frames. The PDU of this layer consists of 3 parts:

- a 3-byte header: the header consists of a flag worth 01111110 followed by a byte defining the frame type (see below) and a byte indicating the total length of the frame in number of bytes,

- the SDU coming from the upper layer of variable length

- a CRC: the CRC is calculated with the generator polynomial V41 (it will be necessary to find the characteristics of this polynomial) and relates to the 3 header bytes + the SDU.

The coding of the type of frame is as follows:

0x0 frame containing user data (from the upper layer)

0x1 DE (request to send) control frame used when a station wants to know if the other station is ready to receive.

0x2 control frame PR (ready) to answer frame 1 if the station is ready.

0x3 control frame NPR (not ready) to answer frame 1 if the station is not ready.

0x4 ERR (error) control frame sent by the receiver if the previously received frame has a CRC error.

Layer X also manages the addition of transparency bits: in order to avoid any ambiguity in the data with the flag, the protocol systematically adds a 0 behind a sequence of five 1s in the data. At the reception, the reverse operation will of course be carried out.

The Y layer manages packets. This layer sets up an addressing to direct the packets towards the good recipient. The PDU consists of 2 parts:

- the 3-byte header: the 3 header bytes consist of 1 byte to indicate the address of the destination machine, 1 byte to indicate the address of the sending machine, and 1 byte containing the SAP number from which the SDU originates.

- the SDU coming from the upper layer. This SDU has a size of up to 128 bytes.

The Z layer breaks the messages into packets, if necessary. It is connected to the Y layer via an SAP identified by the number 0x0A. This layer manages the fragmentation of the SDUs of the upper layer so that the PDUs produced do not exceed 128 bytes.

The PDU consists of 2 parts:

- the 3-byte header: the header contains a 2-byte packet number and a 1-byte fragment number.

- the data coming from the upper layer.

From this description, is it possible to answer the following questions

Q1: Is it possible to transmit in full-duplex? Justify.

Yes because we are in baseband but with 2 twisted pairs: one for transmission, the other for reception

Q2: To which OSI layer does the medium correspond?

No layer. The medium is outside of the OSI model.

Q3: To which layers of the OSI model do the W, X, Y and Z layers correspond? Justify by giving one or two characteristics present in the description which indicates this correspondence.

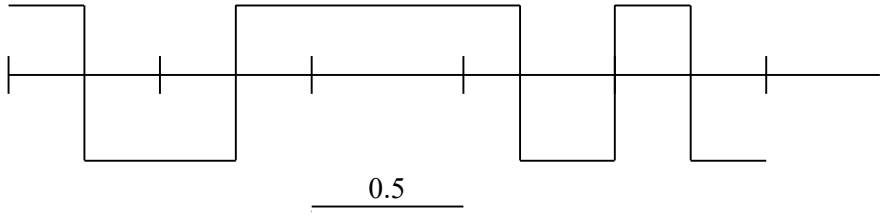
W: Physical layer because bits are considered and the coding is a baseband coding.

X: Link because frames are considered, delimitations with a flag

Y: Network because addressing and routing

Z: Transport because of segmentation

Q4: A machine receives the following signal:



Where is the error and which layer will notice it?

A transition is missing in the 3rd period. Layer 1 will detect it.

Q5: If a transmission error transforms the bit sequence 01110110 into 01111110, which layer of the receiver will notice the error? How will it be noticed?

The frame ends prematurely, the link layer will check the length and the CRC, both false.

Q6: What is flow control? Is such a mechanism implemented here? Justify it.

Flow control aims at avoiding that data are lost when the data throughput is too high to be correctly processed by the receiver. In this protocol are used the DE, PR and NPR control frames.

Q7: Why is there no need for addressing in the X layer?

Because the link layer mechanism is a point-to-point link between two devices only, so not needing an address.

Q8: Give the structure of an ERR control frame (which does not contain any data from the upper layer).

Flag	Type	Length	CRC (16 bits)
7E	04	05	XX XX

Q9: Give the general structure of a data frame by showing the headers of the W, X, Y and Z layers.

Flag	Type	Length	Address	Address	SAP	Packet	Fragment	Data	CRC
	=00		Dest	Source	=0x0A	Number	Number		
(1 byte)	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes	1 byte	x bytes	2 bytes

Q10: What are the minimum and maximum sizes of a frame?

The minimal size is 5 bytes (size of a control frame), whereas the maximum size is 136 (with a Z-PDU of 128 bytes (maximum possible).

Q11: What is the purpose of the SAP number contained in the header of the Y layer?

To forward the Y-PDUs to the right transport layer.

Q12: Find 2 frames in the following binary sequence. Transcribe them in hexadecimal by removing the transparency bits.

```
0 1 0 0 1 1 1 1 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 1 1 1 1 0 1 1 0 1 1 0 1 0 1 0 1 1 0 1 1 0 1 1 0 0 1 1 1 1 1 1

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

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

1 0
```

7E 01 05 FB 56

7E 00 0E FF 03 0A 07 EA 01 30 31 32 13 FE

Q13: Decode the maximum of information in these 2 frames (data, address, ...)

Q14: What checks does the X layer make to decide that a frame is valid?