

**Normal Session Exam**

Name: .....

Group:.....

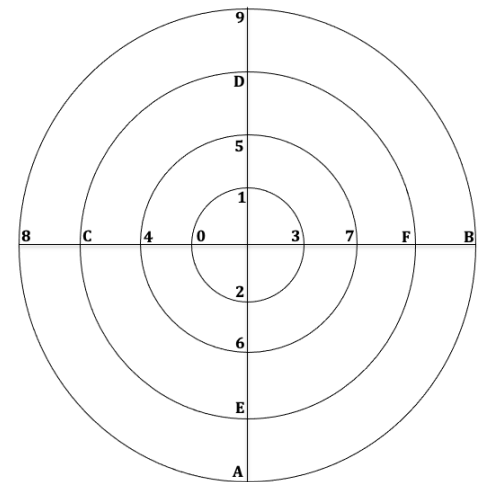
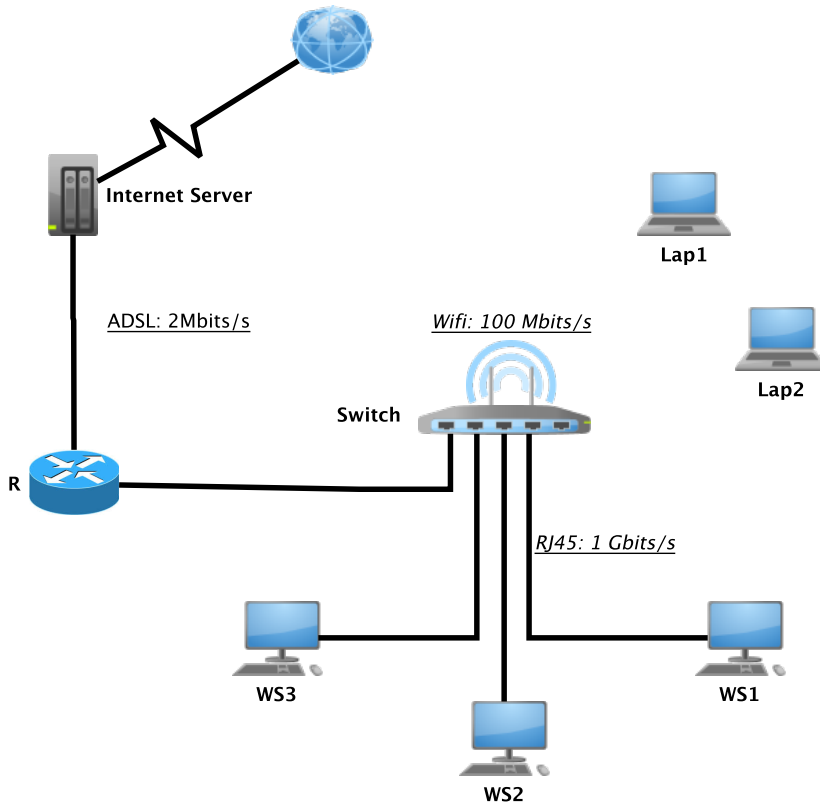
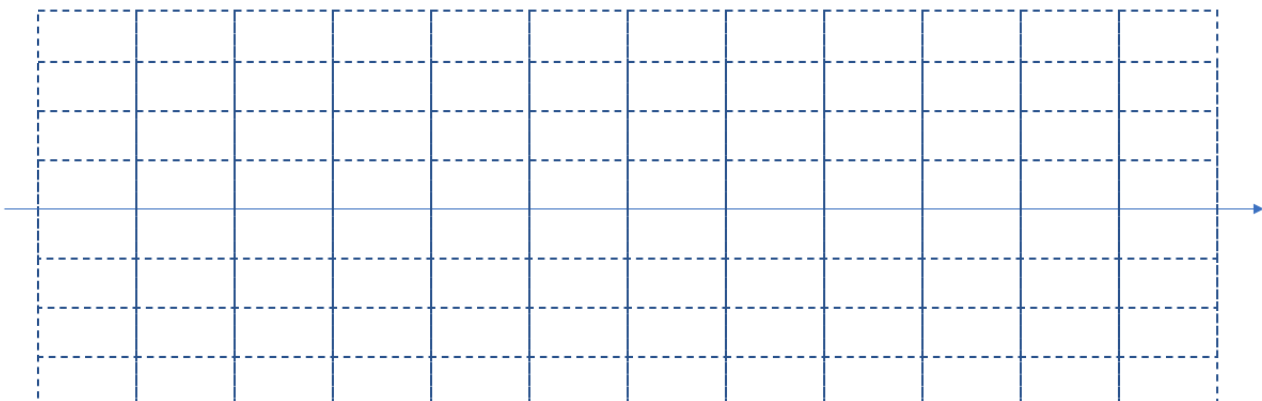


FIGURE 2 – ADSL diagram

FIGURE 1 – Network

**Exercise 1 Physical layer ( 8 pts : 3 + 1.5 + 1.5 + 2)**

- Knowing that a combined modulation ASK/PSK is used on the ADSL connection of the network of Figure 1 using 4 amplitudes  $A_1 < A_2 < A_3 < A_4$  and 4 phases according to the diagram figure 2, Draw the shape of the signal sent by router R to Internet server to transmit the following frame : **"7E 80 BC 02 2D 7E"** :



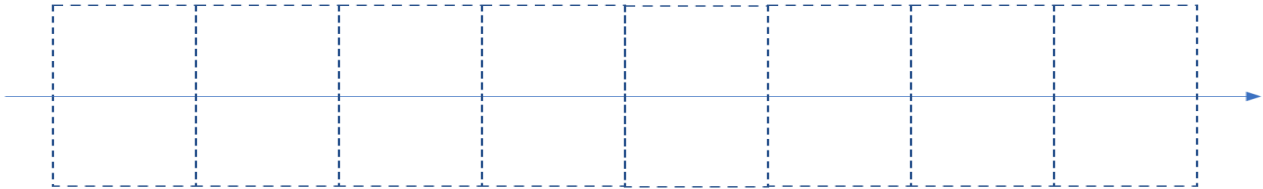
(a) Deduce the valence of the signal and calculate its modulation speed.

.....  
 .....

(b) Is the Gray coding respected on the diagram of figure 2? justify your answer.

.....  
 .....

2. Knowing that the RJ45 network uses a Miller code, draw the shape of the signal carrying the first byte of the previous frame received by router R.



**Exercise 2 Data Link layer (12 pts : 5 + 1.5 + 1.5 + 4)**

The LLC sub-layer of the RJ45 network uses the HDLC protocol seen in the course, with a generator polynomial  $G(x) = x^{16} + x^{11} + x^4 + 1$ . WS1 of address 00 sent a file to WS2 of address 01 :

1. Complete the following table representing the exchange between the two stations :

	1	2	3	4	5	6	7
WS1	SABM	I00,I01,I02	.....	I04,I05,I06	.....	wait	.....
WS2	.....	RR-03	REJ-04	RNR-07	.....	RR-07	RR-02

	8	9	10	11	12	13
WS1	.....	I03,I05,I06	.....	.....	.....	END
WS2	.....	REJ-05	RR-00	RR-03	UA	END

2. Give the number of frames composing the sent file.

.....  
 .....

3. Give P/F bits of the frames sent by WS2 .

	1	2	3	4	5	6	7	8	9	10	11	12
WS2												

4. Give the hexadecimal representation of the 9<sup>th</sup> frame sent by WS2.

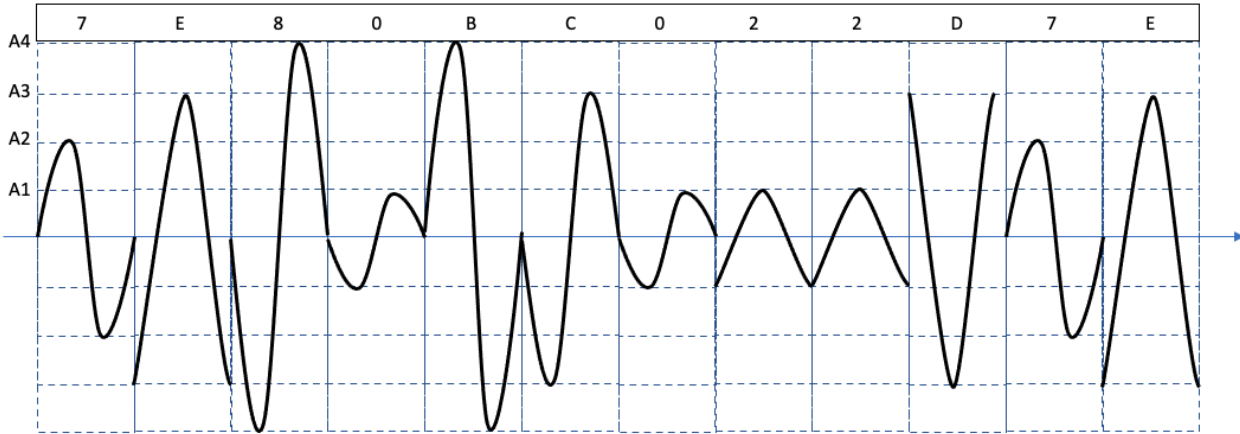
.....  
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Good Luck

## Correction

### Exercise 1 Physical layer ( 8 pts : 3 + 1.5 + 1.5 + 2)

1. Knowing that a combined modulation ASK/PSK is used on the ADSL connection of the network of Figure 1 using 4 amplitudes  $A1 < A2 < A3 < A4$  and 4 phases according to the diagram of figure 2.
  - (a) The shape of the signal sent by router R to Internet server to transmit the following frame : "7E80 BC 02 2D 7E" :



3pts

- (b) Deduce the valence of the signal and calculate its modulation speed.

The valence of the signal  $V = 4 \text{ phases} \times 4 \text{ amplitudes} = 16$

0.75 pt

The modulation speed = Throughput /  $\log_2(V) = \frac{2 \text{ Mbits/s}}{4} = 512 \text{ Kbauds}$

0.75 pt

- (c) Is the Gray coding respected on the diagram of figure 2? justify your answer.

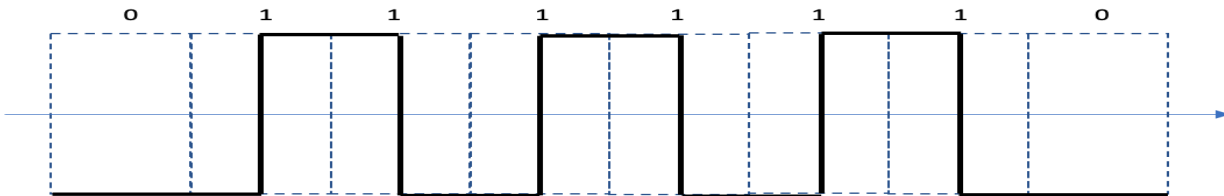
Yes

0.75 pt

Because between every two adjacent values there is only one different bit

0.75 pt

2. Knowing that the RJ45 network uses a Miller code, draw the shape of the signal carrying the first byte of the previous frame received by router R.



2pts

### Exercise 2 Data Link layer (12 pts : 5 + 1.5 + 1.5 + 4)

The LLC sub-layer of the RJ45 network uses the HDLC protocol seen in the course, with a generator polynomial  $G(x) = x^{16} + x^{11} + x^4 + 1$ . WS1 of address 00 sent a file to WS2 of address 01 :

1. Complete the following table representing the exchange between the two stations :

	1	2	3	4	5	6	7
WS1	SABM	I00, I01, I02	<b>I03, I04, I05</b>	I04, I05, I06	wait	wait	<b>I07, I00, I01</b>
WS2	<b>UA</b>	RR-03	REJ-04	RNR-07	not receiving	RR-07	RR-02

	8	9	10	11	12	13
WS1	<b>I02, I03, I04</b>	I03, I05, I06	<b>I05, I06, I07</b>	<b>I00, I01, I02</b>	<b>DISC</b>	END
WS2	<b>SREJ-03</b>	REJ-05	RR-00	RR-03	UA	END

5 pts

2. Give the number of frames composing the sent file.

The number of frames is **19**

1.5 pt

3. Give P/F bits of the frames sent by WS2 .

	1	2	3	4	5	6	7	8	9	10	11	12
WS1	0	0	1	0	0	0	0	1	1	0	0	0

1.5 pt

4. Give the hexadecimal representation of the 9<sup>th</sup> frame sent by WS2.

The Flag is 7E

0.5 pt

The address 00

0.5 pt

The control field = REJ-5 = 10101101 = AD

1 pt

FCS = Rest (00AD x  $x^{16}$  / G(x)) = Rest( $\frac{x^{23}+x^{21}+x^{19}+x^{18}+x^{16}}{x^{16}+x^{11}+x^4+1} = x^{14} + x^{11} + x^9 + x^5 + x^{13}$ )

FCS = 4A28 .....

1.5 pt

The 9<sup>th</sup> frame sent by WS2 = **7E 00 AD 4A 28 7E**

0.5 pt