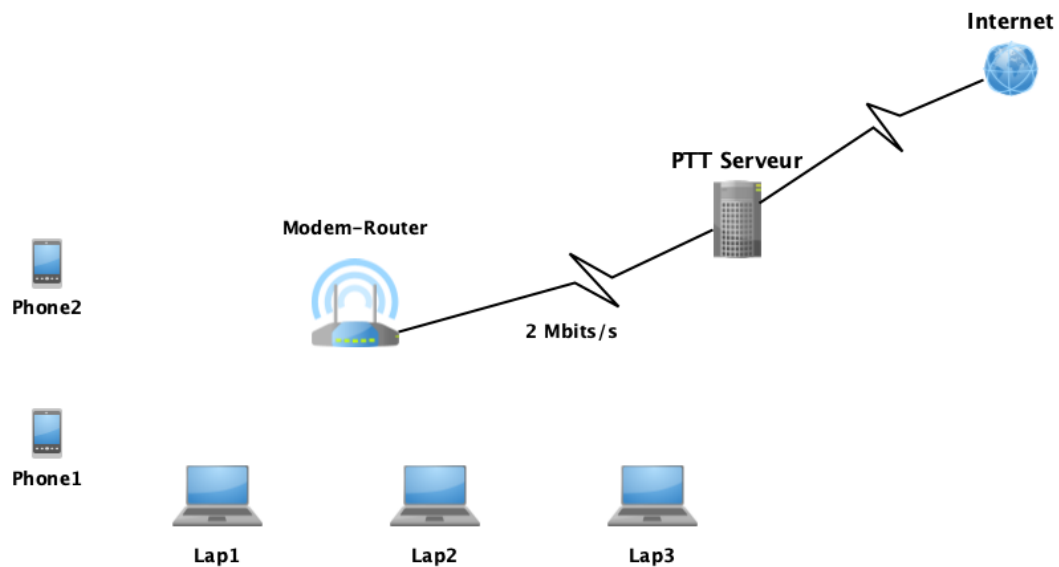


Normal Session Exam

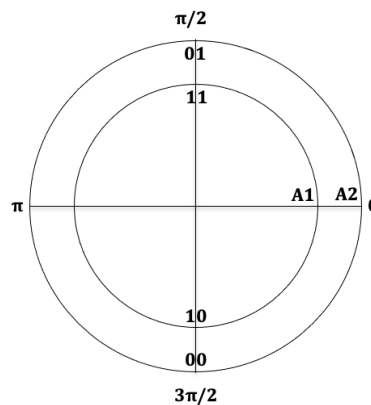
Consider the network represented in the following figure :



A Modem-Router connects three laptops and two telephones via a 100 Mbits/s wifi network. The Modem-Router is also linked to a PTT server by a 2 Mbit/s ADSL link.

Exercise 1 Physical layer (7 pts : 2 + 2.5 + 2.5)

1. We want to transfer a 250 MegaByte file from Lap1 to the PTT server. Calculate the required transfer time. Deduce the average throughput between lap2 and the PTT server. (We neglect the processing time at the nodes)
2. Lap2 wants to send the hexadecimal string "1ED9" to the Modem-Router. Knowing that the baseband coding used in the Wifi network is Miller's coding, Draw the shape of the transmitted signal.
3. The same hexadecimal string "1ED9" is sent from the Modem-Router to the PTT server. Knowing that the used modulation uses the below diagram, Draw the shape of the transmitted signal :



Exercise 2 Data Link layer (7.5 pts : 2.5 + 2.5 + 2.5)

The LLC sub-layer of the Wifi network uses the HDLC protocol seen in the course, with a generator polynomial $G(x) = x^8 + x^7 + x^5 + x^3 + x + 1$. Lap2 wants to send the hexadecimal string "1ED9" to the Modem-Router. Knowing that :

- The number of this frame = 0
 - The destination address (Modem-router) = 0
 - The modem router has nothing to send to Lap2,
 - The P/F bit =0,
1. Give the CRC code corresponding to this frame.
 2. Give the frame to send in hexadecimal.
 3. Give the frame put on the line in binary (after bit staffing)

Exercise 3 Network layer (5.5 pts : 0.5 + 1 + 1 + 1.5 + 1.5)

Executing the "ipconfig/all" command on Lap2 gave the following display :

```
Wireless LAN adapter Wi-Fi:
    Physical Address. . . . . : D0-DF-9A-72-D4-9B
    DHCP Enabled. . . . . : No
    IPv4 Address. . . . . : 168.243.87.131(Preferred)
    Subnet Mask . . . . . : 255.255.224.0
    Default Gateway . . . . . : 168.243.87.130
    DHCP Server . . . . . : 168.243.87.129
    DNS Servers . . . . . : 8.8.8.8
                           8.8.4.4
```

1. What class does the address of this subnet belong to?
2. Give the subnet address.
3. Give the broadcast address in this subnet.
4. How many machines can host this subnet,
5. How many more subnets can we add in this address.

Good Luck

Correction

Exercise 1 Physical layer (7 pts : 2 + 2.5 + 2.5)

1. We want to transfer a 250 MegaByte file from Lap1 to the PTT server. Calculate the required transfer time. Deduce the average throughput between lap2 and the PTT server. (We neglect the processing time at the nodes)

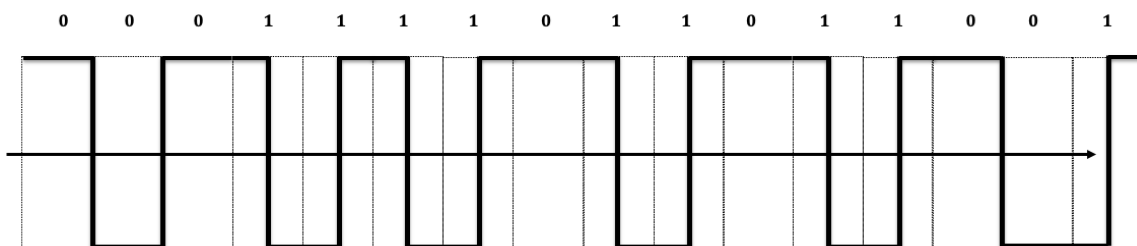
$$\text{Transfer Time} = T_{\text{wifi}} + T_{\text{adsl}}$$

$$T_{\text{wifi}} = \frac{250 \times 2^{20} \times 8}{100 \times 2^{20}} = 20s$$

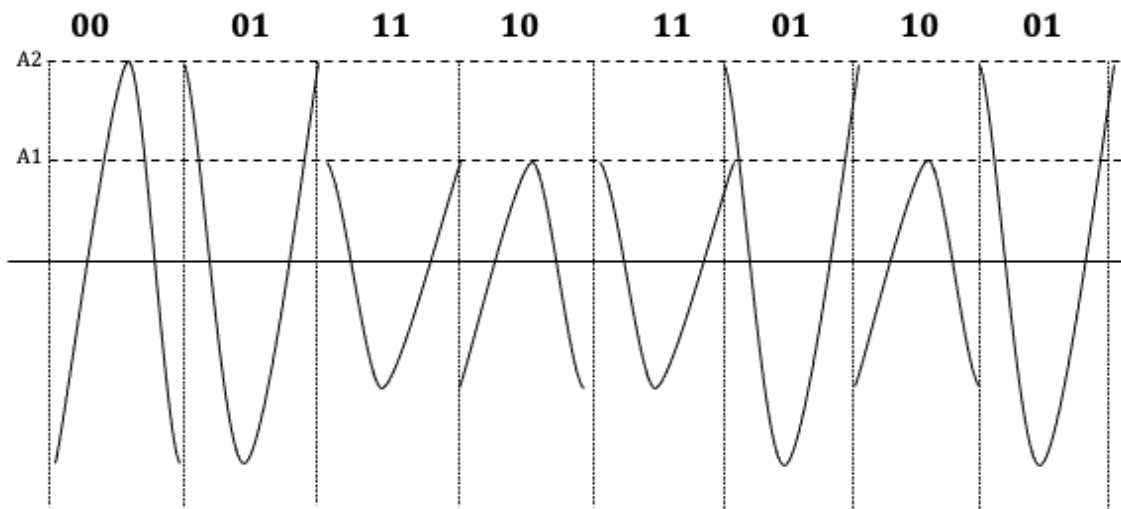
$$T_{\text{adsl}} = \frac{250 \times 2^{20} \times 8}{2 \times 2^{20}} = 1000s$$

$$\text{Transfer Time} = 1000 + 20 = 1020 \text{seconds}$$

2. Lap2 wants to send the hexadecimal string "1ED9" to the Modem-Router. Knowing that the baseband coding used in the Wifi network is miller's coding, Draw the shape of the transmitted signal.



3. The same hexadecimal string "1ED9" is sent from the Modem-Router to the PTT server. Knowing that the used modulation uses the below diagram, Draw the shape of the transmitted signal :



Exercise 2 Data Link layer (7.5 pts : 2.5 + 2.5 + 2.5)

The LLC sub-layer of the Wifi network uses the HDLC protocol seen in the course, with a generator polynomial $G(x) = x^8 + x + 1$. Lap2 wants to send the hexadecimal string "1ED9" to the Modem-Router. Knowing that :

- the number of this frame = 0
- the destination address (Modem-router) = 0
- The modem router has nothing to send to Lap2,
- The P/F bit = 0,

1. Give the CRC code corresponding to this frame.

- $M(x) = 00000000$ (address) 00000000 (controle) $0001\ 1110\ 1101\ 1001$ (data) $= x^{12} + x^{11} + x^{10} + x^9 + x^7 + x^6 + x^4 + x^3 + 1$
- $M(x) * x^8 = x^{20} + x^{19} + x^{18} + x^{17} + x^{15} + x^{14} + x^{12} + x^{11} + x^8$
- $R(x) = x^5 + x^4 + x^3$
- CRC = 0011 1000

2. Give the frame to send in hexadecimal.

00001ED938

3. Give the frame put on the line in binary (after bit staffing)

0111 1110 0000 0000 0000 0000 0001 1110 1101 1001 0011 1000 0111 1110

Exercise 3 Couche réseaux (5.5 pts : 0.5 + 1 + 1 + 1.5 + 1.5)

Executing the "ipconfig/all" command on Lap2 gave the following display :

```

Wireless LAN adapter Wi-Fi:
    Physical Address. . . . . : D0-DF-9A-72-D4-9B
    DHCP Enabled. . . . . : No
    IPv4 Address. . . . . : 168.243.87.131(Preferred)
    Subnet Mask . . . . . : 255.255.224.0
    Default Gateway . . . . . : 168.243.87.130
    DHCP Server . . . . . : 168.243.87.129
    DNS Servers . . . . . : 8.8.8.8
                           8.8.4.4

```

1. What class does the address of this subnet belong to?

B

2. Give the subnet address.

168.243.64.0

3. Give the broadcast address in this subnet. 168.243.95.255

4. How many machines can host this subnet, $2^{13} - 2$

5. How many more subnets can we add in this address.

$2^3 - 1$