Mohamed Khider Biskra University
Computer science department

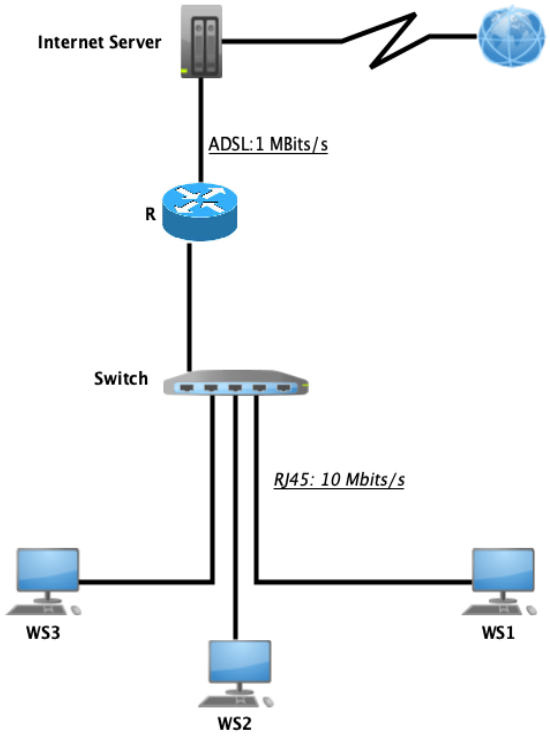
2^{nd} *Licence year* — Communication Networks
June 8^{th}, 2024 — 09:45-11:15 Amphi A,B

Resit Session Exam

Name: ..... **Group:**.....

Consider the network represented in the figure, where the switch connects three work stations WS1, WS2 and WS3 via an RJ45 network of 10 Mbits/s and connected to an internet server via a Router R using an ADSL connection of 1 Mbits/s. On the RJ45 network, the level 2 HDLC protocol on ABM mode defined by ISO is used in LLC sub-layer. Manchester coding is used on physical Layer.
On ADSL network, PSK modulation is used with 0° for 10, 90° for 00, 180° for 01 and 270° for 11.
We assume the following hypotheses :

- Size of the information field of the HDLC frame = 256 Bytes
- Address of WS1 is 1, WS2 is 2, WS3 is 3 and R is 4.
- Control, address and FCS fields size = 8 bits
- Station A sends 3 frames numbered from 0 to 7 (n=8) and puts itself on hold.
- The used generator polynomial is "01010001"
- The frame processing time at the station level is neglected.
- During the transfer, 3^{rd}, 10^{th} and 11^{th} frames are poorly received by R.



We want to transfer a 3 KBytes file from station WS1 to the Router R :

1. Calculate the number of frames composing this file. **0.5 pt**

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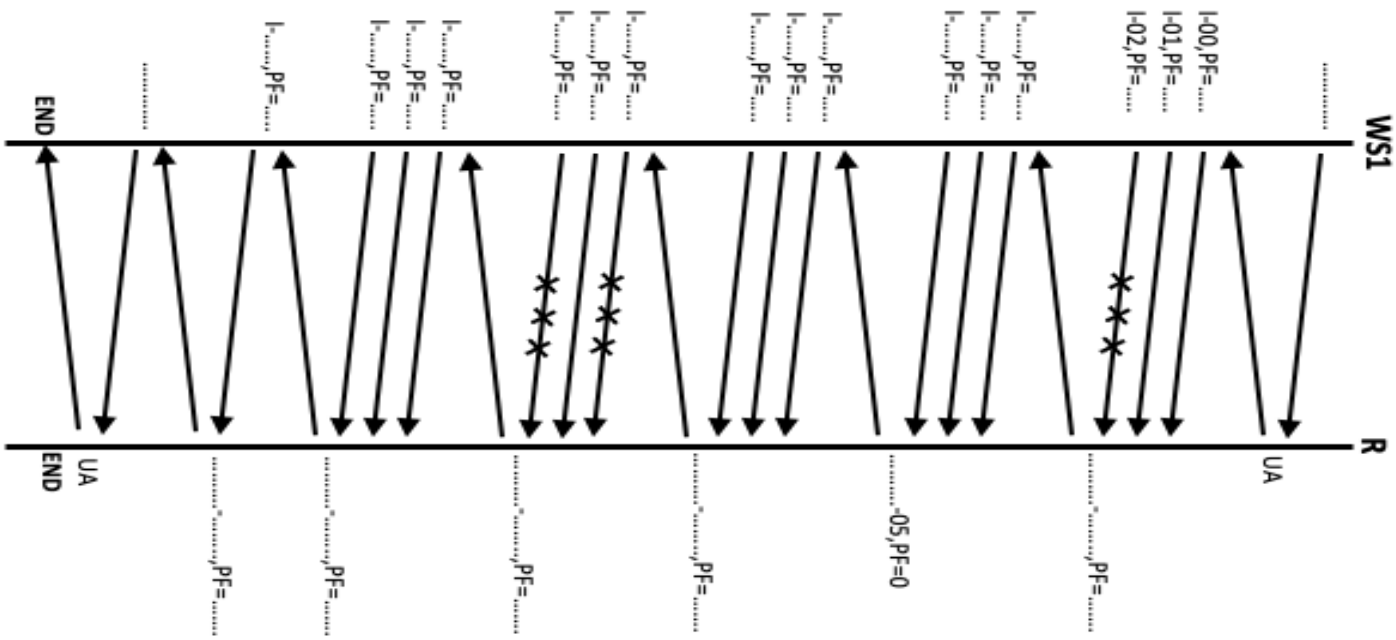
2. Complete the file transmission scenario on the folowing diagram : **4.5 pts**



3. Calculate transfer time of an information frame. **1.5 pts**

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4. Calculate transfer time of a supervision frame. **1 pt**

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5. Calculate transfer time of an unnumbered frame. **1 pt**

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6. Calculate the total transfer time of this file and deduce the effective throughput. **3 pts**

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7. Give the binary structure of the first supervision frame sent by R. **4.5 pts**

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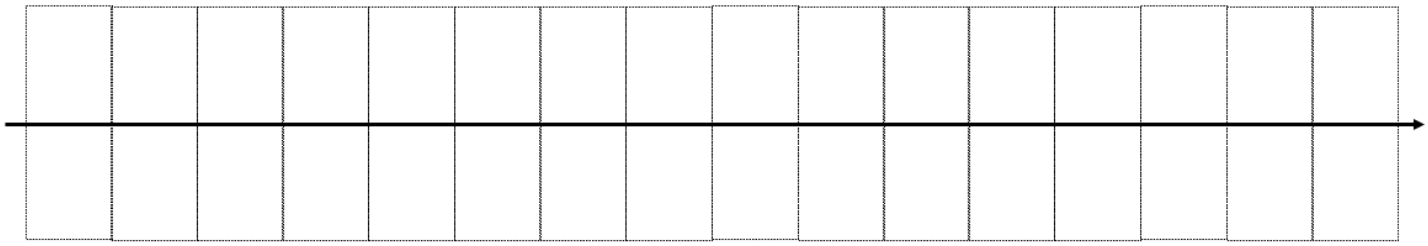
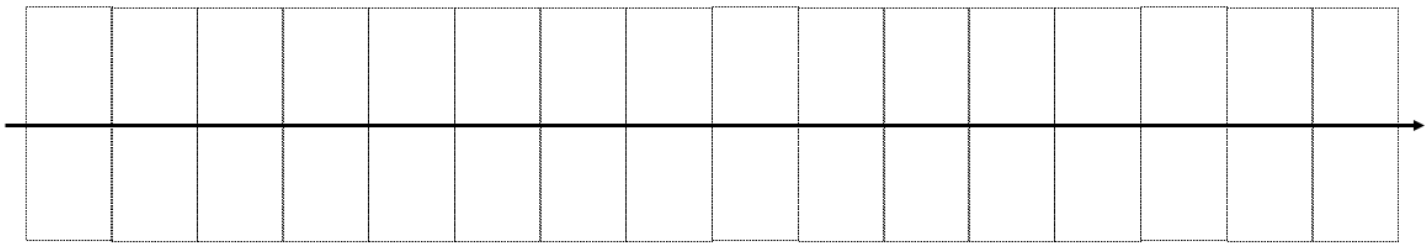
8. The hexadecimal string "1EC8" is sent from WS1 to R, draw, on the following diagram, the corresponding signal : **2pts**



9. The same hexadecimal string "1EC8" is sent from R to the internet server, draw, on the following diagram, the corresponding signal : **2 pts**



Good Luck

Correction

1. Calculate the number of frames composing this file. **0.5 pt**
   Number of frames = $\frac{File\ size}{Frame\ size} = \frac{3\times1024\ KB}{256KB} = 12$ frames

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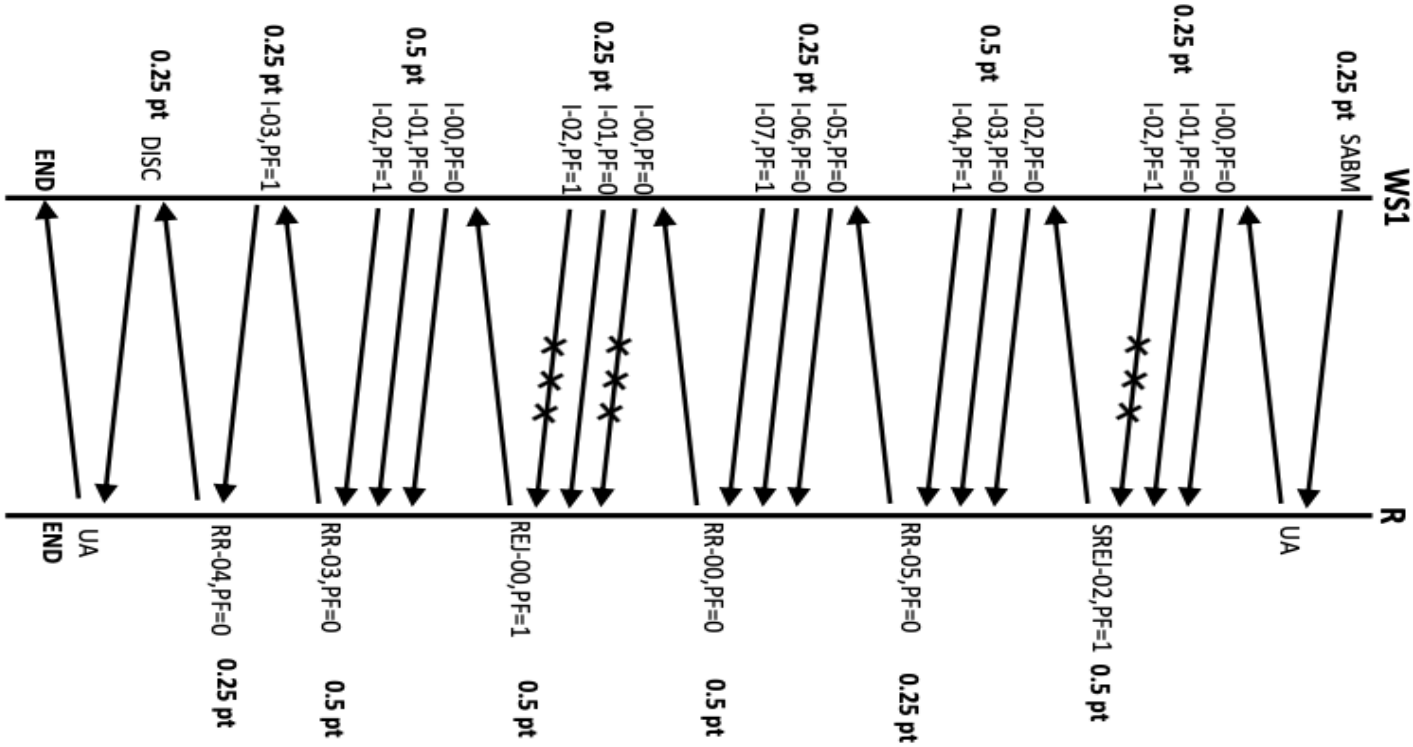
2. Complete the file transmission scenario on the folowing diagram : **4.5 pts**



3. Calculate transfer time of an information frame. **1.5 pts**
   - Information frame structure = Flag + Address + Control + Information + FCS + Flag
   - Information Frame size = 1 + 1 + 1 + 256 + 1 + 1 = 261 bytes ⇒ Transfer time = $\frac{(261\times8)}{(10\times1024\times1024)} = 199.12\times10^{-6}s$

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4. Calculate transfer time of a supervision frame. **1 pts**
   - Supervision frame structure = Flag + Address + Control + FCS + Flag
   - Supervision Frame size = 1 + 1 + 1 + 1 + 1 = 5 bytes ⇒ Transfer time = $\frac{(5\times8)}{(10\times1024\times1024)} = 3.81\times10^{-6}s$

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5. Calculate transfer time of an unnumbered frame. **1 pts**
   - Unnumbered frame structure = Flag + Address + Control + FCS + Flag
   - Unnumbered Frame size = 1 + 1 + 1 + 1 + 1 = 5 bytes ⇒ Transfer time = $\frac{(5\times8)}{(10\times1024\times1024)} = 3.81\times10^{-6}s$

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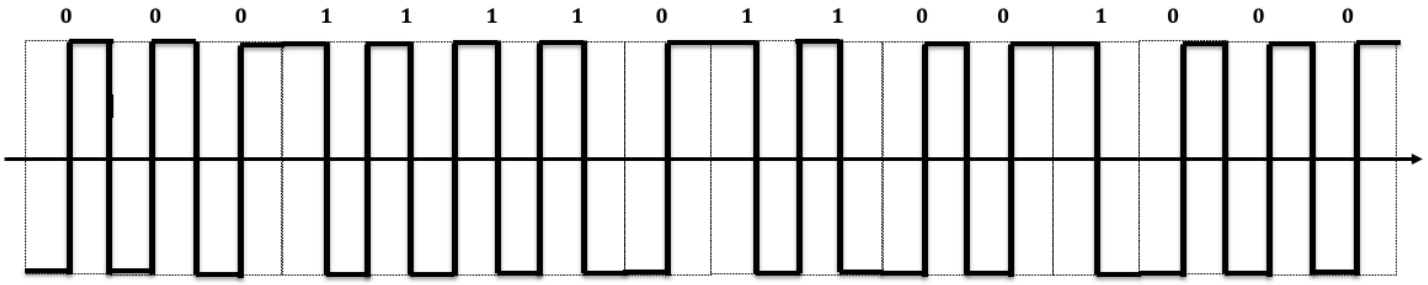
6. Calculate the total transfer time of this file and deduce the effective throughput. **3 pts**
   - Number of sent I Frames = 16 ⇒ size = 16 x 261 = 4176
   - Number of sent S Frames = 06 ⇒size = 06 x 5 = 30 bytes
   - Number of sent U Frames = 04 ⇒size = 04 x 5 = 20 bytes
   - Total sent data = 4176 + 30 + 20 = 4226 ⇒ Transfer time = $\frac{(4226\times8)}{(10\times1024\times1024)} = 3.22\times10^{-3}s$

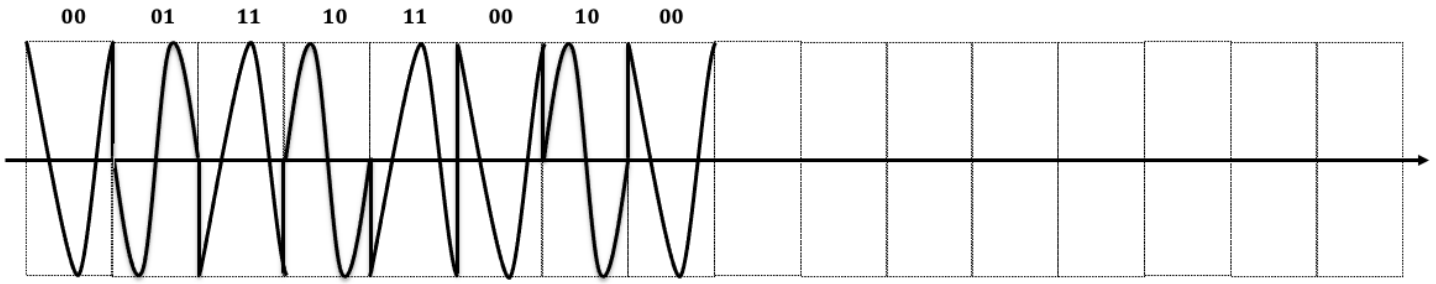
7. Give the binary structure of the first supervision frame sent by R. **4.5 pts**
   - First S frame : SREJ-02,PF=1 ⇒ Control field = 10111010, WS1 address = 00000001
   - M(x) = 0000000110111010 = $M(x) = x^8 + x^7 + x^5 + x^4 + x^3 + x$
   - Generator polynomial is "01010001" = $G(x) = x^6 + x^4 + 1$, r=6

- $M(x)x^r = x^{16} + x^{15} + x^{13} + x^{12} + x^{11} + x^9$; $\frac{M(x)x^r}{G(x)} = x^{10} + x^9 + x^8 + x^5 + x^4 + x^3 + x$; $R(x) = x^4 + x^3 + x = 00011010$
- $\Rightarrow$ **Frame = 01111110 00000001 10111010 00011010 01111110**

8. The hexadecimal string "1EC8" is sent from WS1 to R, draw, on the following diagram, the corresponding signal : **2pts**



9. The same hexadecimal string "1EC8" is sent from R to the internet server, draw, on the following diagram, the corresponding signal : **2 pts**



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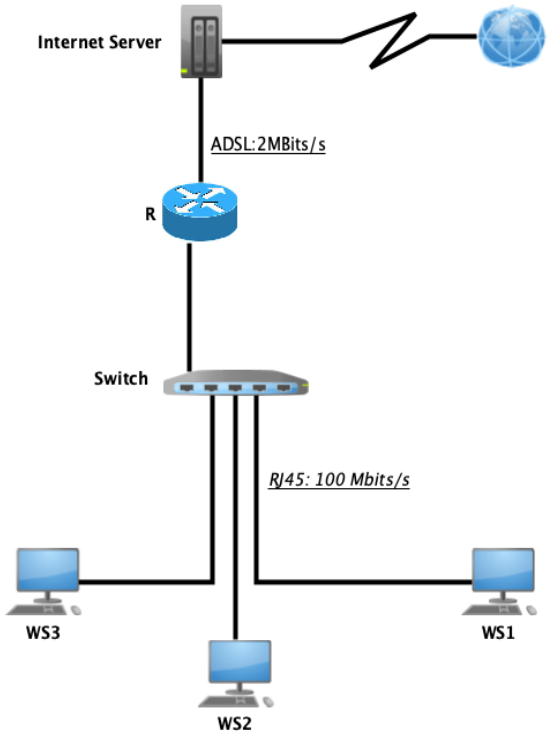
June 8^{th}, 2024 — 09:45-11:15 Amphi A,B,1

Resit Session Exam

Name: ..... **Group:**.....

Consider the network represented in the figure, where the switch connects three work stations WS1, WS2 and WS3 via an RJ45 network of 100 Mbits/s and connected to an internet server via a Router R using an ADSL connection of 2 Mbits/s. On the RJ45 network, the level 2 HDLC protocol on ABM mode defined by ISO is used in LLC sub-layer. Differential Manchester coding is used on physical Layer.
On ADSL network, PSK modulation is used with 0° for 11, 90° for 10, 180° for 00 and 270° for 01.
We assume the following hypotheses :

- Size of the information field of the HDLC frame = 256 Bytes
- Address of WS1 is 1, WS2 is 2, WS3 is 3 and R is 4.
- Control, address and FCS fields size = 8 bits
- Station A sends 3 frames numbered from 0 to 7 (n=8) and puts itself on hold.
- The used generator polynomial is "10000011"
- The frame processing time at the station level is neglected.
- During the transfer, 3^{rd}, 10^{th} and 11^{th} frames are poorly received by R.



We want to transfer a 3 KBytes file from station WS1 to the Router R :

1. Calculate the number of frames composing this file. **0.5 pt**

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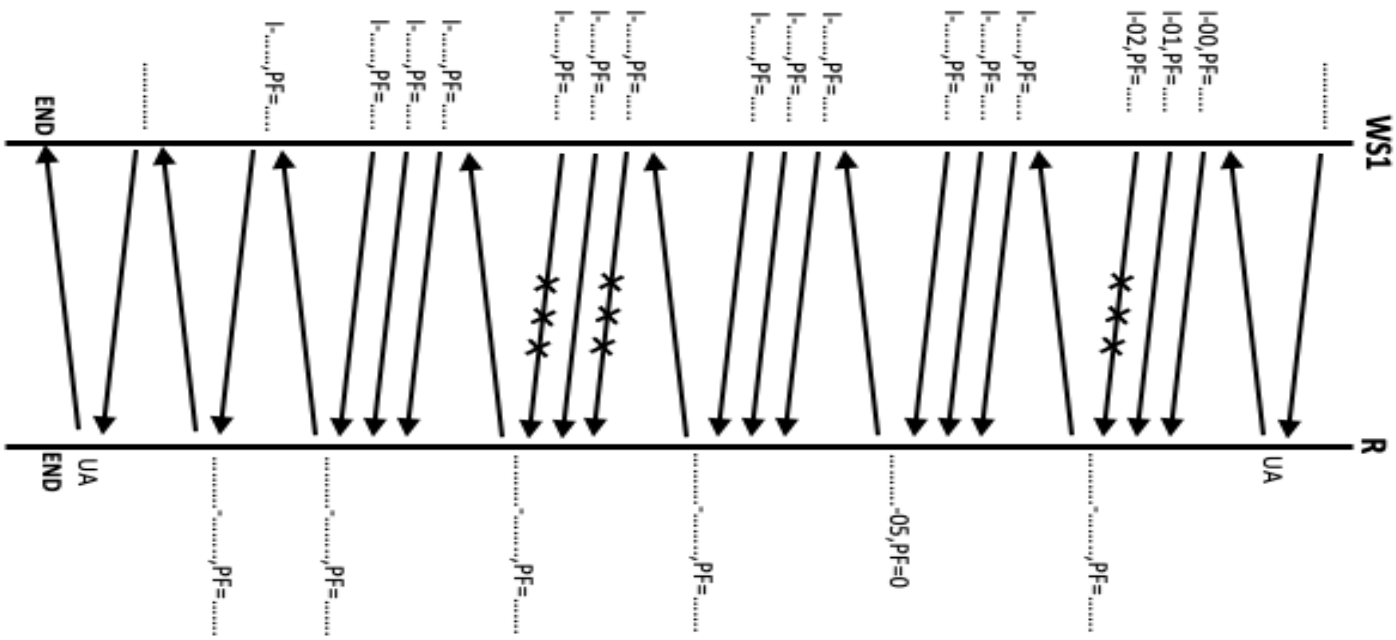
2. Complete the file transmission scenario on the folowing diagram : **4.5 pts**



3. Calculate transfer time of an information frame. **1.5 pts**

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4. Calculate transfer time of a supervision frame. **1 pt**

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5. Calculate transfer time of an unnumbered frame. **1 pt**

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6. Calculate the total transfer time of this file and deduce the effective throughput. **3 pts**

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7. Give the binary structure of the first supervision frame sent by R. **4.5 pts**

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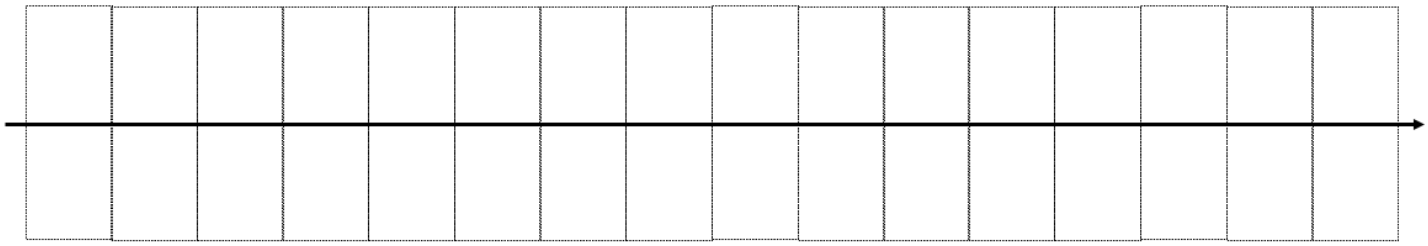
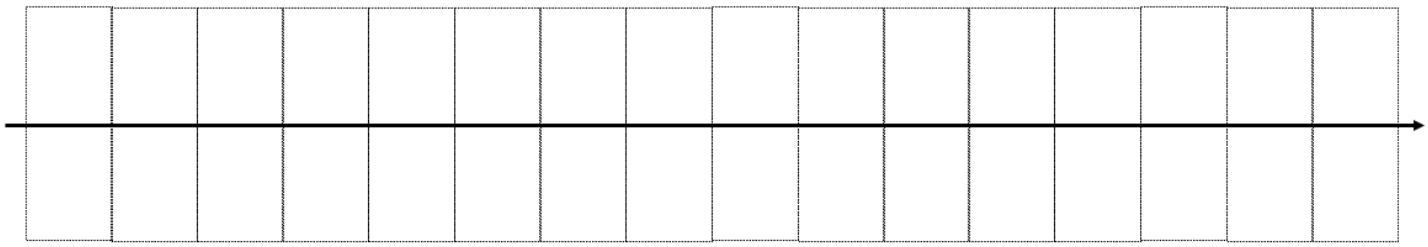
8. The hexadecimal string "A02C" is sent from WS1 to R, draw, on the following diagram, the corresponding signal : **2pts**



9. The same hexadecimal string "A02C" is sent from R to the internet server, draw, on the following diagram, the corresponding signal : **2 pts**



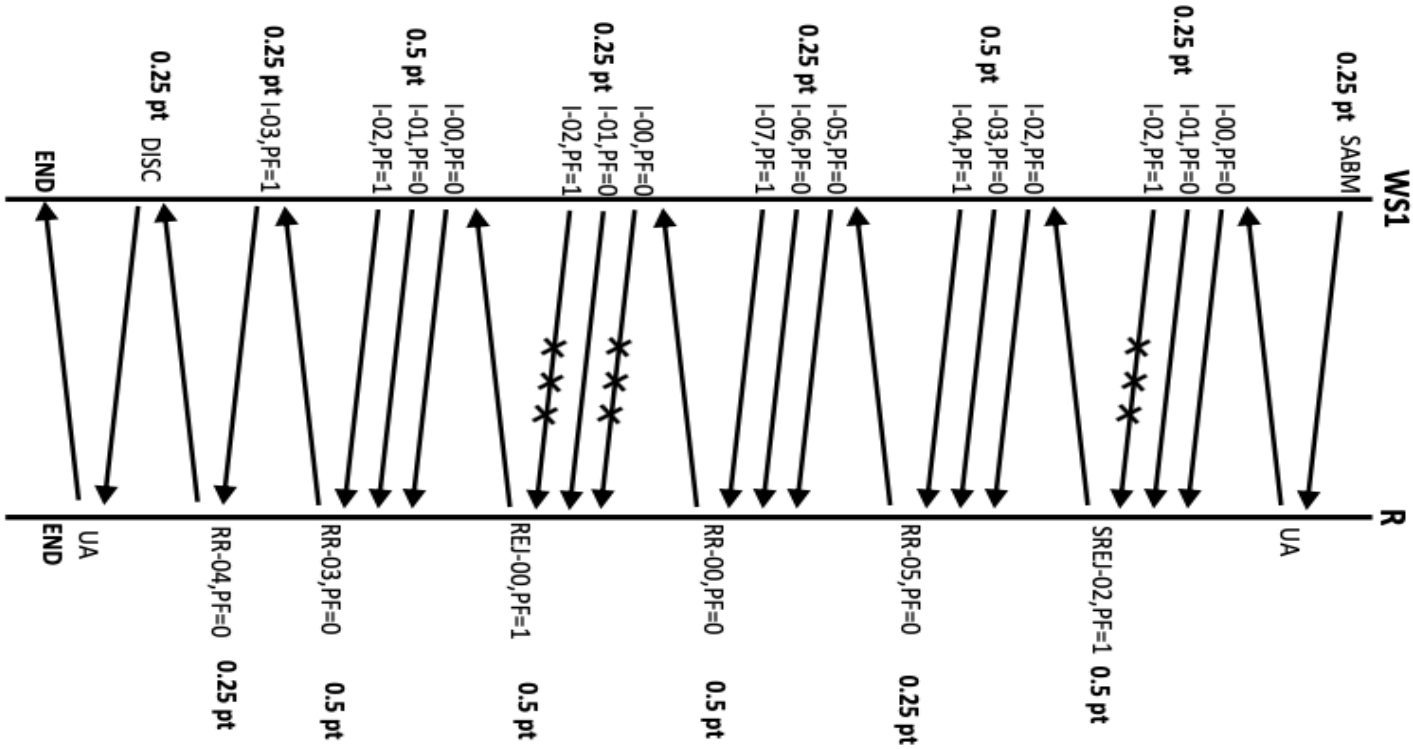
Good Luck

Correction

1. Calculate the number of frames composing this file. **0.5 pt**
   Number of frames = $\frac{File\ size}{Frame\ size} = \frac{3\times1024\ KB}{256KB} = 12$ frames

   .....

2. Complete the file transmission scenario on the folowing diagram : **4.5 pts**



3. Calculate transfer time of an information frame. **1.5 pts**
   - Information frame structure = Flag + Address + Control + Information + FCS + Flag
   - Information Frame size = 1 + 1 + 1 + 256 + 1 + 1 = 261 bytes ⇒ Transfer time = $\frac{(261\times8)}{(100\times1024\times1024)} = 19.91\times10^{-6}s$

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4. Calculate transfer time of a supervision frame. **1 pts**
   - Supervision frame structure = Flag + Address + Control + FCS + Flag
   - Supervision Frame size = 1 + 1 + 1 + 1 + 1 = 5 bytes ⇒ Transfer time = $\frac{(5\times8)}{(100\times1024\times1024)} = 0.38\times10^{-6}s$

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5. Calculate transfer time of an unnumbered frame. **1 pts**
   - Unnumbered frame structure = Flag + Address + Control + FCS + Flag
   - Unnumbered Frame size = 1 + 1 + 1 + 1 + 1 = 5 bytes ⇒ Transfer time = $\frac{(5\times8)}{(100\times1024\times1024)} = 0.38\times10^{-6}s$

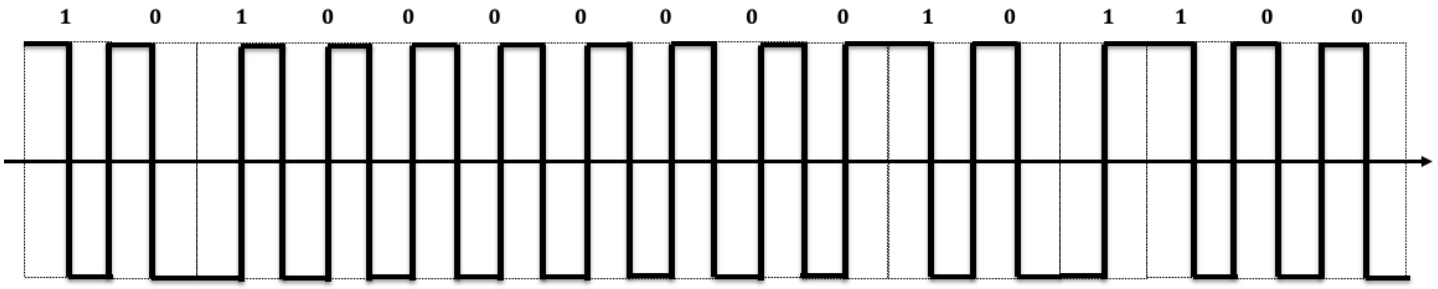
   .....

6. Calculate the total transfer time of this file and deduce the effective throughput. **3 pts**
   - Number of sent I Frames = 16 ⇒ size = 16 x 261 = 4176
   - Number of sent S Frames = 06 ⇒size = 06 x 5 = 30 bytes
   - Number of sent U Frames = 04 ⇒size = 04 x 5 = 20 bytes
   - Total sent data = 4176 + 30 + 20 = 4226 ⇒ Transfer time = $\frac{(4226\times8)}{(100\times1024\times1024)} = 0.32\times10^{-3}s$

7. Give the binary structure of the first supervision frame sent by R. **4.5 pts**
   - First S frame : SREJ-02,PF=1 ⇒ Control field = 10111010, WS1 address = 00000001
   - M(x) = 0000000110111010 = $M(x) = x^8 + x^7 + x^5 + x^4 + x^3 + x$

- Generator polynomial is "10000011" $= G(x) = x^8 + x + 1$, r=8
- $M(x)x^r = x^{16}+x^{15}+x^{13}+x^{12}+x^{11}+x^9$; $\frac{M(x)x^r}{G(x)} = x^8+x^7+x^5+x^4+x^3$; $R(x) = x^7+x^6+x^3 = 11001000$
- $\Rightarrow$ **Frame = 01111110 00000001 10111010 11001000 01111110**

8. The hexadecimal string "A02C" is sent from WS1 to R, draw, on the following diagram, the corresponding signal : **2pts**



9. The same hexadecimal string "A02C" is sent from R to the internet server, draw, on the following diagram, the corresponding signal : **2 pts**