1. In our previous configuration (star topology using a switch), we use cables with a propagation speed S = 100,000 km/s. The data emission rate is 10 Mbps, and the minimum frame length is 64 bytes.

a. What is the emission time of a 64 bytes frame

- Emission time = Frame_length/emission_rate

b. Compute D, the max diameter (distance between the two most distant machines sharing the same cable) of the network in order to CSMA/CD technique works properly.

- Propagation time = Diameter / S
  The condition for CSMA/CD to work properly : Te >= 2Tp (any machine in the network needs to detect an incoming signal while sending to detect the collision) ð ((Frame_length/emission_rate) / 2) * S >= Diameter

c. For a higher emission rate requirement, an Ethernet network type with of 100Mbit/s has been studied. What is would be the maximum diameter possible in this case?
Rule of three to compute the new diameter based on the rate
10 -> D
100->? 10*D
d. What solution could have been proposed so that CSMA/CD works while preserving the diameter of the network.
If we maintain the same diameter and increase the emission rate we need then to adjust the minimum frame length
2. A player client transfers a 15Kbits message to the server for each update. With a frame length of 1000 bits, 80 bits of headers and each frame is acknowledged with an 88 bits acknowledgment frame before being able to transfer the next frame.
Assuming that the switch processes a frame in 1ms and has the same emission rate as the other machines 100Mbit/s, the emission rate = reception rate all cables length is the diameter computed above, what are :
a. The propagation time between a station and the switch (Pt)

- Pt = Diameter/S

b. The emission time of a frame from a client to the server (Et)

- Et = Frame_length/emission_rate

c. Assuming that a machine takes the same time to receive a frame as to send it (emission time), compute the transfer time of a frame (with ack) Tt

- Et_ack = 80/emission_rate
  Tt = Et*4 + Pt*2 + 2*1ms + Et_ack*4 + Pt*2

d. Total transfer time (Ttotal) of the application message

- How many frame for a message of 15Kbits Nb_frames = message_length / (frame_length - 80)
  Ttotal = Tt * Nb_frames

e. The actual (useful) transfer rate (Ur)

- We send 1000 – 80 bits (data without headers) in Tt => the usful rate Ur = 1000 – 80 / Tt

Using the given frame format, decode the following Ethernet frame (these frames are given without the preamble, SFD and FCS).

- Determine the values of all the fields present and theirs meaning.

Destination Mac address **Source Mac addres** **Protocol type : IP** **Other bytes are Data : layer 3 packet**

FF FF FF FF FF FF 08 00 20 02 45 9E 08 00 00 01 08 00 06 04 00 01 08 00 20 02 45 9E 81 68 FE 06
00 00 00 00 00 00 81 68 FE 05 08 00 20 02 45 9E 08 00 20 07 0B 94 08 06 00 01 08 00 06 04 00
02 08 00 20 07 0B 94 81 68 FE 05 08 00 20 02 45 9E 81 68 FE 06

- Who sent the frame ? why ?
  The server sends the message because it is a broadcast address