Answers : Exam in NETWORKS 1 MODULE

Full Name :	Group :	Mark :

MCQ(7.5 points, -0.25 for the wrong answer): Choose the correct answer(s):

1- **What is the main difference between LAN (Local Area Network) and WAN (Wide Area Network)?**

☐ Data transmission speed
☐ Geographical area covered
☐ Maximum number of connected devices
☐ Connection technology used

2- **TCP/IP stands from :**

□ Transmission Control Protocol/Internet Protocol
□ Time Control Procedure/Internet Protocol
□ Total Control Process/Internet Protocol
□ Transmission Connection Procedure/Internet Procedure

3- **What is the primary function of the physical layer?**

□Error detection and correction
□Routing packets between networks
□Encoding and transmitting raw binary data
□Establishing sessions between applications

4- **What does CSMA/CD stand for in the context of Ethernet networks?**

□Carrier Sense Multiple Access/Collision Detection
□Collision Sensing/Medium Duplexing
□ Connection Service Multiple Address/Channel Deep
□Concurrent Service Management/Channel Distribution

5- **Which protocol operates at the data link layer and is responsible for MAC address resolution?**

□ ARP (Address Resolution Protocol)
□ DNS (Domain Name System)
□ ICMP (Internet Control Message Protocol)

6- **Which IEEE standard is affected to Ethernet technology ?**

□ IEEE 801 □ IEEE 802 □ IEEE 803 □ IEEE 804 □ IEEE 805

7- **At which OSI layer does a HUB operate?**

□ 1 □ 2 □ 3 □ 4 □ 7

8- **How many bits compose a MAC address?**

□ 32 □ 48 □ 64 □ 96 □ 128

9- **What is the transmission unit associated with the data link layer of the OSI model?**

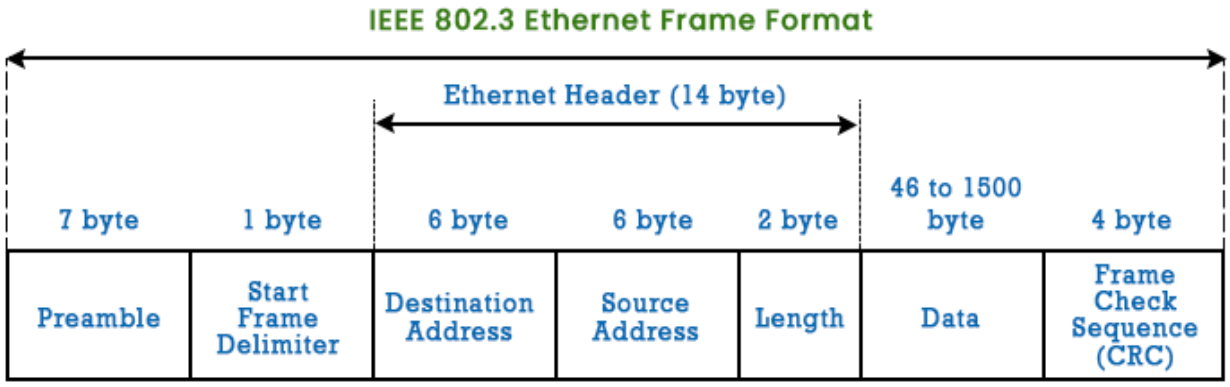
☐ Datagram ☐ Bit ☐ Frame ☐Packet ☐Segment

10- What is Hamming code used for in data communications?

□ Error correction □ Data compression □ Data encryption □ Data encoding

Exercise1 (3 points):

1- Give the format of an Ethernet frame **(1 point)**



2- Using the following frame, determine its destination address

10101010101010101010101010101010101010101010101010101011001122334455AABBCCDDEEFF08004500003C000040004011B861C0A80001C0A80002

Destination address is 001122334455 **(1 point)**

3- Is this frame destined for all the network devices? why or why not ?

No, it is not destined to all the devices because it is of type Unicast, so only one device (having the mac address 001122334455) will receive this frame **(1 point)**

Exercise 2 (6 points):

1- A transmission channel has a data rate of **10 Mbit/s** and a length of **3000 km**. The propagation speed of the signal in the medium is **2×10^8 m/s**.
   1.1. Calculate the propagation delay over this link.
   1.2. Given a data packet of **512 bytes**, determine the total time required for the packet to be fully received at the other end of the link.
   1.3. Using the **CSMA/CD** protocol, calculate the minimum frame length required to avoid collisions on this link.
2- Consider the network topology provided (diagram attached or described by the instructor):
   2.1. Define a collision domain.
   2.2. Define a broadcast domain.
   2.3. Based on the given topology, determine the number of collision domains and broadcast domains in the network.

Solution : Given

1/

- Data rate R=10 Mbit/s=10×106 bits/s
- Channel length d=3000 km=3×10^6 , d = 3000 km
- Propagation speed v=2×108 m/s
- Packet size = 512 bytes = 512×8=4096 bits

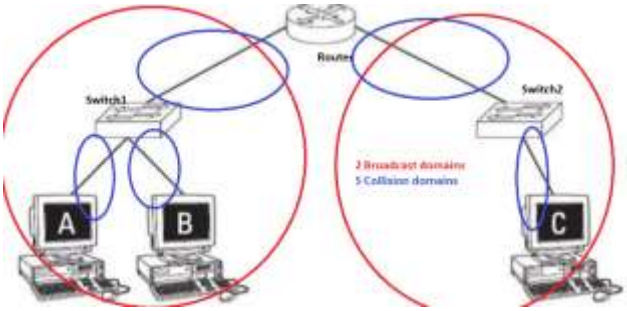
1.1. Propagation delay:
Propagation delay=d/v=3×10^6 / 2×10^8=0.015 seconds=15 ms (0.5 points)
1.2. Total time to receive a 512-byte packet:
The total time = transmission time + propagation delay. (0.5 points)

- **Transmission time** =packet size / data rate=4096/10^7=0.0004096 s= 0.4096ms (0.5 points)
- **Total time** = 0.4096 ms + 15 ms = **15.4096 ms** (0.5 points)

1.3. Minimum frame length using CSMA/CD:
To avoid collisions, the **transmission time** of the frame must be **at least twice the propagation delay**, because the signal must reach the far end and a collision must have time to propagate back.
Minimum frame transmission time (RTD)=2×Propagation delay=2×15 ms=30 ms (0.5 points)

Minimum frame length=Rate×RTD=$10^7\times0.03$=300000 bits=37500 bytes. (0.5 points)

2/
2.1 A collision domain is a network segment where data packets can "collide" with one another when being sent over a shared medium (applies to hubs, not switches). (1 point)
2.2 A broadcast domain is a logical area where any broadcast sent by a device is received by all other devices. (1 point)
2.3 Number of domains: 2 Broadcast domains and 5collision domains (1 point)



Exercise 3 (3.5 points):

Given information: **1 1 1 0 1 1** and the generator polynomial: g(X) = X^2 + X

1- Calculate the CRC code (give all steps)

- Information in form of polynomic : info(X) (0.5 point)
  - Multiply the polynomial info(X) by $\mathbf{X^2}$ (2 is the degree of the generator polynomial) : this corresponds to 11101100 (0.5 point)
  - Divide X^2.info(X) by G(x) , obtain the Quotient **Q(X)** et the rest **R(X) (method)**
  - The **CRC** corresponds to the rest of division (R(X)) **CRC Code = 10** (1 point)

2- What is the final transmitted information (including the CRC code)

1 1 1 0 1 110 (0.5 point)

3- The following block (data + CRC) is received: **1 1 0 0 1 111**

a. Using the same generator polynomial, check whether any error is detected in the received message.

The remainder of division: **1 1 0 0 1 111 ÷ 110 is 001**(1 point)

GOOD LUCK