University of M'sila
Faculty of Mathematics and Computer Science
Department of Computer Science

Written Exam in "Computer Networks"

May 16th 2025 *08:30 – 10:30*

Last name: ……

First name: ……

Group: ……

Mark: ……

Instructions

- Use the provided sheets. Do not use your own paper.
- Do not use a red pen.
- Mobile phones, smart watches, **calculators**, and other electronic devices are **not allowed**.
- Turn off your mobile phones.
- No communication between candidates is allowed during the exam.
- Cheating or academic dishonesty will result in disciplinary action.

Exercises	1	2	3	4	5	**Total**
Maximum Points	4	4	3	4	5	20
Achieved Points						

Exercise 1 (Basic Concepts): Points: ..... of 4 pts

0.5 pt

1) Which OSI layer introduces physical addressing?

Data link layer

1 pt

2) What is the role of an "Access Point" in a LAN ?

It connects **wireless devices** to **wired networks**

1 pt

3) According to the OSI model, which networking layers are responsible for the following operations : …….(0.25 x 4)

Segmentation and reassembly : Transport layer

Clock Synchronization : Physical layer

Data Fragmentation : Network layer

Data Encryption/Decryption : Presentation layer

0.5 pt

4) Provide two application examples of using TCP protocol by the transport layer.

Website browsing

Email

1 pt

5) Why is framing necessary during data transmission?

Identifying start and end of a frame (Without framing, a receiver would see only streams of bits)

Exercise 2 : Points: ..... of 4 pts

0.5 pt

1) A station S is applying the "Flag bytes with byte stuffing" framing method to send the following stream of characters :

FLAG E X ESC A M

FLAG ESC FLAG E X **ESC** ESC A M **FLAG**

-0.25 pt for every error (adding or missing FLAG or ESC)

0.5 pt

2) A station R is receiving the following frame from another station S that applied "Starting and ending flag bytes, with bit stuffing" :

01111110 0000010 11111001 11110000 01111101 01111110

Question : Determine the original data before applying this framing method.

Delete red colored bits

01111110 0000010 11111001 11110000 01111101 01111110

0000010 1111101 1111000 0111111

Last name : First name :

2 pts

3) A sender wants to send a data frame 10010011 using CRC scheme for error control with polynomial generator : $X^3 + X^2$. Determine the codeword that will be transmitted.

$X^3 + X^2$ is represented in binary : 1100 (0.25 pt)

The order of the generator is 3 then we append 3 zeros (000) to the data frame : 10010011000 (0.25 pt)

```
10010011000 | 1100
1100        | 11100010
01010
 1100
 01100
  1100
  00001
   0000
   00011
    0000
    00110
     0000
     01100
      1100
      00000
       0000
       0000  <-- (1 pt)
```

The transmitted codeword is : 10010011000 (0.5 pt)

1 pt

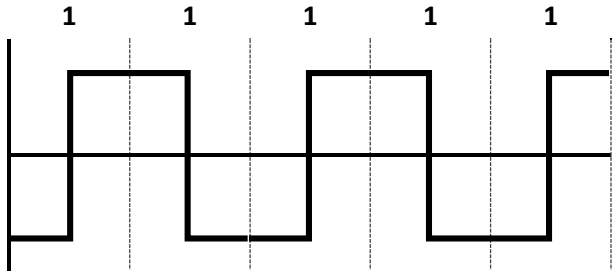
4) Consider a block coding scheme used for error control. What is the required hamming distance of this scheme in order to correct up to three transmission errors?

Distance = 2 * d + 1 = 2 * 3 +1 = 7

Exercise 3 : Points: ..... of 3 pts

1 pt

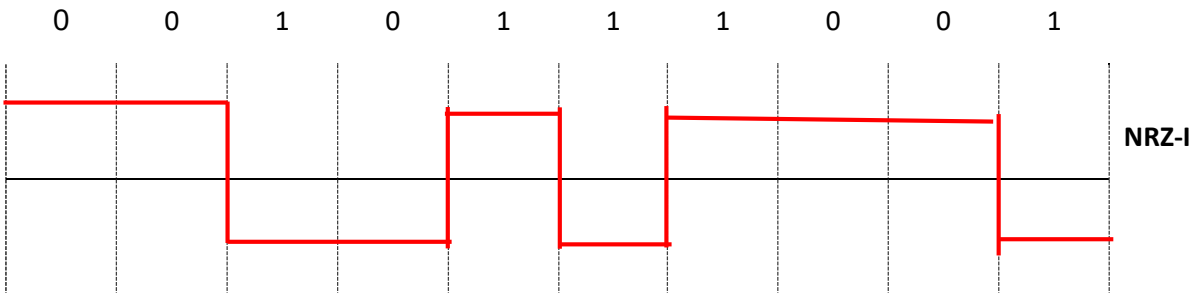
1) Determine the line encoding scheme used to provide the following signal curve



Differential Manchester

2 pts

2) Assuming that the last signal level has been positive, draw the signal curve of the following bit sequence with NRZ-I : 0010111001



In NRZ-I, bit 1 = transition from high to low or low to high, bit 1 = No transition (stay in the same level)

If the signal curve is inverted (starts from negative level) …….(1 pt)

Exercise 4 : Points: ..... of 4 pts

2 pts

1) Given a LAN with the following address : **192.168.1.0 /26**

Among the following IP addresses, determine which ones are invalid IPs (cannot be assigned to any host of this LAN) and explain why (if invalid).

IP address	Valid / Invalid	Why ?
192.168.1.4	Valid	Belongs to the IP addresses interval (0.25 pt)
192.168.1.100	Invalid	Out of IP addresses interval (0.5 pt)
192.168.1.255	Invalid	Out of IP addresses interval (0.5 pt)
192.168.1.63	Invalid	This is the broadcast address (0.5 pt)
192.168.1.0	Invalid	This is the subnet address (0.25 pt)

If the explanation is wrong then the answer is also considered wrong (the answer is not considered).

2 pts

2) Consider two stations A and B belonging to the same LAN. Among the following scenarios, determine the output of a ping from station A to station B.

Scenario 1 : A : 10.0.0.255 B : 10.255.255.0

Ping output (Succes / Fail): Success (0.25 pt)

Explanation : Both stations belong to the same network (0.75 pt)

Scenario 2 : A : 192.168.0.1/24 B : 192.168.1.1/24

Ping output (Succes / Fail): Fail (0.25 pt)

Explanation : The two stations belong to the different networks (0.75 pt)

Last name : First name :

Exercise 5 : Points: ..... of 5 pts

Given the network of the faculty company with IP block : 192.168.1.0 /24

1 pt

1) Determine the range of IP addresses (first host address, last host address)

First host : 192.168.1.1 (0.5 pt)

Last host : 192.168.1.255 (0.5 pt)

2) Split this network into subnets of equal sizes, each subnet should have 62 hosts.

Questions:

0.5 pt

a) Which method should be used to achieve this splitting ? (Explain why)

FLSM because all subnets have the same size (0.5 pt = 0.25 + 0.25)

1 pt

b) How many subnets will be created ? (Explain)

Number of bits for Host part : $2^n - 2 \geq 62$ $THEN$ $n = 6$ bits (0.25 pt)

Number of bits for subnet ID (borrowed bits) : k = 8 – 6 = 2 bits (0.25 pt)

Number of subnets $= 2^k = 2^2 = 4$ (0.5 pt)

2.5 pts

c) Using the method stated in question (a), determine the following information for each subnet:

Subnet Mask, Subnet Address, First Host Address, Last Host Address, Broadcast Address

	Mask	Subnet Adr	Fist host	Last host	Broadcast Adr
Subnet 1	255.255.255.192	192.168.1.**0**	192.168.1.1	192.168.1.62	192.168.1.63
Subnet 2	255.255.255.192	192.168.1.**64**	192.168.1.65	192.168.1.126	192.168.1.127
Subnet 3	255.255.255.192	192.168.1.**128**	192.168.1.129	192.168.1.190	192.168.1.191
Subnet 4	255.255.255.192	192.168.1.**192**	192.168.1.193	192.168.1.254	192.168.1.255

(- 0.5 pt) for each error