ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION   SUMMER SEMESTER, 2022-2023
DURATION: 1 HOUR 30 MINUTES   FULL MARKS: 75

CSE 4411: Data Communication and Networking

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **all 4 (four)** questions. Figures in the right margin indicate full marks of questions with corresponding COs and POs in parentheses.

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1. a) In Figure 1, the logical address of Device-A is 192.168.10.5 and physical address is 10. The logical address of Device-P is 20.21.22.5 and physical address is 95. Find out C, D, L, and Z when A is sending a packet to P and also when P is sending a packet to A.

   8
   (CO1)
   (PO1)
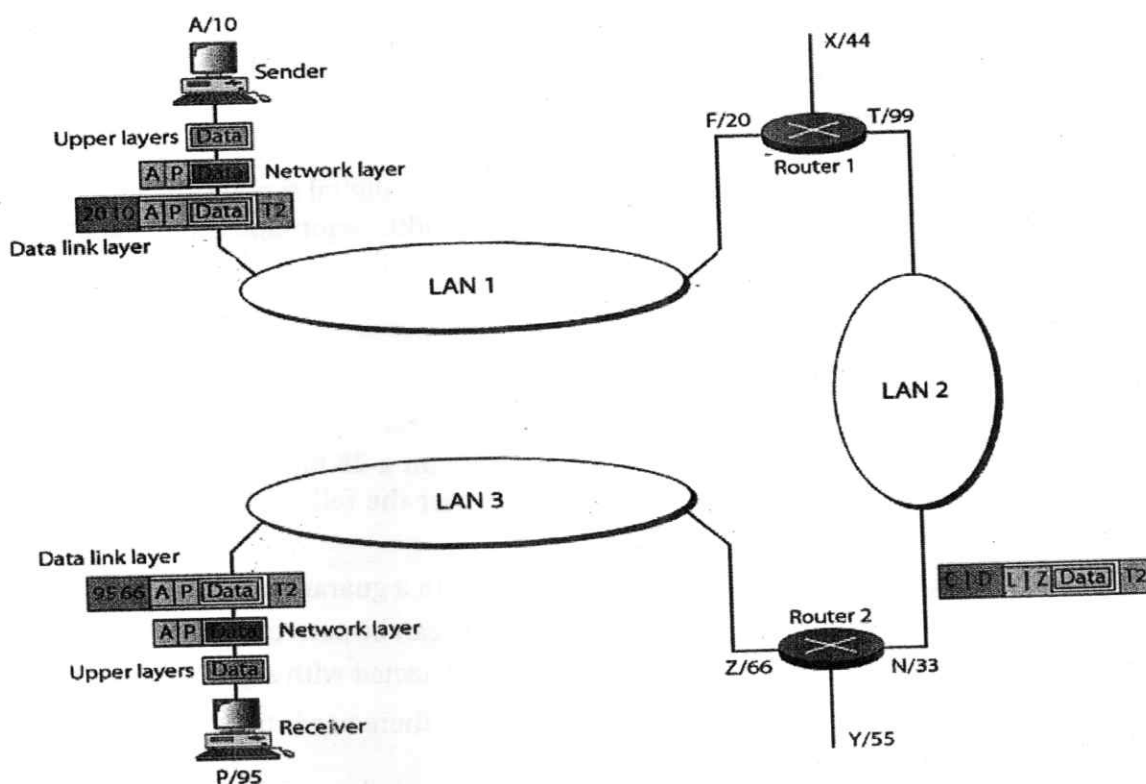
Figure 1: A diagram depicting communication between two devices for Question 1.a

   b) An ISP is granted a block of addresses starting with 160.25.0.0/16. The ISP wants to distribute these blocks to 320 customers as follows:

   - The first group has 64 customers; each needs 256 addresses
   - The second group has 128 customers; each needs 128 addresses
   - The third group has 128 customers; each needs 64 addresses

   Design the sub-blocks and show the address allocation and distribution by the ISP. You can ignore the network addresses and broadcast addresses. Also, find out how many addresses are still available after these allocations.

   7
   (CO1)
   (PO1)

   c) What is the motivation for configuring a Virtual LAN (VLAN)? Explain with a necessary diagram with respect to an organzation's network.

   10
   (CO1)
   (PO1)

2. a) Alison wants to send a signal of power 10 mW. Now, answer the following questions: 3 +
    i.   What will be his maximum data rate if the signal rate is 60 Kbaud and there are two   3 + 3 +
         levels?   5 + 4
                                                                                              (CO1)
    ii. If the number of levels has been increased to eight, what will be the new maximum data   (PO1)
         rate?
    iii. With the increase in levels as shown in 2.a)ii, what type(s) of problem can be observed?
    iv. Calculate the attenuation if the power has been observed to be one-third of the initial
         power. Calculate necessary amplification if 70% of the original signal strength is neces-
         sary for proper communication.
    v.   If a noise of 0.9 mW is introduced, then calculate the Shannon Capacity. (Assume suit-
         able bandwidth)

    b) Write down the advantages and disadvantages of optical fiber technology.   5
                                                                                   (CO1)
                                                                                   (PO1)

3. a) Explain the Pulse Code Modulation (PCM) technique for digitization. Include Block dia-   10
       grams to show different components of PCM encoder.   (CO1)
                                                            (PO1)

    b) Consider the bit stream: 0110001001. Draw corresponding digital signals for the follow-   3 × 3
       ing line coding schemes and also comment on the bandwidth requirement of each of the   (CO1)
       schemes: (PO1)
       i.   NRZ-I
       ii. Polar RZ
       iii. MLT-3

4. a) Assume that you are using two-dimensional parity code on a 28-bit data word, which is   6
       divided into rows of 7-bit. Analyze the scenario to answer the following questions along   (CO2)
       with suitable examples: (PO2)
       i.   What is the number of errors that can be corrected with a guarantee?
       ii. What is the maximum possible number of errors that can be corrected?
       iii. What is the maximum number of errors that can be detected with a guarantee?

    b) Design a Hamming Code where the dataword is 7 bits and there needs to be a correction of   5
       2 errors and a detection of 4 errors.   (CO3)
                                               (PO3)
    c) How can a linear block code be used to correct burst errors? Explain with an example.   6
                                                                                               (CO1)
                                                                                               (PO1)