

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION

SUMMER SEMESTER, 2015-2016

TIME: 1 Hour 30 Minutes

FULL MARKS: 75

CSE 4405: Data and Telecommunications

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **4 (four)** questions. Answer any **3 (three)** of them **including Question No. 1.**

Figures in the right margin indicate marks.

Question No. 1 is mandatory to answer.

1. a) A protocol is a set of rules that govern data communication. All the protocols have some key elements. Explain the key elements of a data communication protocol with proper examples of each. 5
- b) Consider the network depicted in Figure 1. Here, we have a sender, a receiver, and four routers. In this figure, capital letters specify the physical addresses of the devices and numbers specify the logical addresses of the devices. For example, the device marked as sender has a physical address A and logical address 10. 10

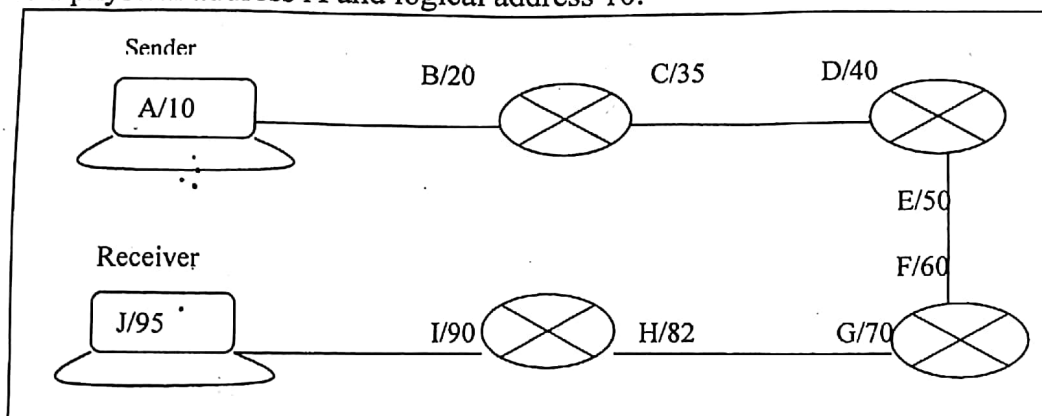


Figure 1: Network topology for Question 1.b)


Similarly, the router connected to the sender has physical address B and logical address 20 for the interface that is connected to the sender. Now, consider that process P_1 of the sending computer wants to send some data to process P_2 of the receiving computer. Port addresses of process P_1 and P_2 are P_x and P_y , respectively. Show the contents of the packets and frames for transport, network, and data link layers at the sender side of each hop.

- c) Suppose a computer sends a packet at the network layer to another computer somewhere in the Internet. The logical destination address of the packet is corrupted. What happens to the packet? How can the source computer be informed of the situation? 6
 - d) Mention the name of at least two protocols in different layers of TCP/IP protocol suite. 4
2. a) Compare line coding and block coding schemes. Briefly explain the concept of Bipolar with 8-Zero Substitution (B8ZS) scrambling technique. 2+5
 - b) Consider a bit stream: 01001110. Draw corresponding digital signal for the following line coding schemes: 10
 - i. NRZ-I
 - ii. Manchester
 - iii. Bipolar-AMI
 - iv. Differential Manchester

Mention the area of applications of the above line coding scheme (at least two schemes).

- c) Why do we use amplifier for analog transmission and repeater for digital transmission? Discuss briefly. 3
- d) What is the Nyquist sampling rate for each of the following signal? 5
- A low-pass signal with bandwidth of 300 KHz.
 - A band-pass signal with bandwidth of 300 KHz if the lowest frequency is 100 KHz.

3. a) Mention the field of application for Pulse Code Modulation (PCM)? Briefly explain different quantization step of PCM with appropriate figures and examples. 2+8
- b) What is the total delay for a frame of size 10 Million bits that is being sent on a link with 8 routers each having a queuing time 2.5 microseconds and a processing time of 1.5 microseconds? The length of the link is 12000 km. The speed of light inside the link is 2×10^8 m/s. The link has a bandwidth of 15 Mbps. 5
- c) How can you measure the performance of a network by using bandwidth-delay product? Based on the data of the following table pictorially depict the link utilization between a sender and a receiver for the two cases. 2+5



Metrics	Case-1	Case-2
Bandwidth	2 bps	5 bps
Delay	5 s	5 s

- d) What is frequency modulation? Briefly discuss the frequency modulation. 3
4. a) Briefly state the concept of self-synchronization in digital signal. Explain the effect of lack of synchronization. 2+3
- b) What is jitter? Discuss asynchronous, synchronous and isochronous mode of communication for serial transmission. 2+4
- c) Let us consider an example that relates the Nyquist and Shannon formulations for channel capacity. Suppose that the spectrum of a channel is between 3 MHz and 4 MHz and $SNR_{dB} = 24$ dB. What is channel capacity in this situation? How many signal levels are required? 6
- d) Draw the constellation diagram for the following cases. Find the peak amplitude value for each case and define the type of modulation (ASK, FSK, PSK, or QAM). The numbers in the parentheses define the values of I and Q respectively. 8
- Two points at (3, 0) and (2, 0).
 - Two points at (4, 0) and (-4, 0).
 - Four points at (3, 3), (-3, 3), (-3, -3), and (3, -3).
 - Two points at (0, 3) and (0, -3).