CSE320: Midterm Assignment

Marks: 60

Deadline: 10/04/2021 (11:59PM)

1. 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 5.

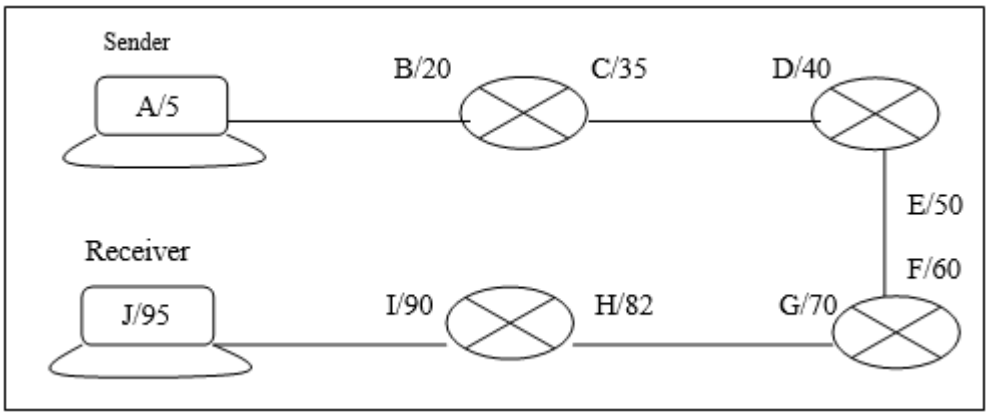


Figure 1: Network topology

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 segments, packets and frames for transport, network, and data link layers at the sender side of three hops with appropriate figures.

2. A. Imagine in an office building there are 3 floors and, on each floor, there are 7 employees working on their computers. Unfortunately, all the floors do not have a dedicated printer. There is only one shared printer on the second floor. Your task is to draw a hybrid topology (Bus and star) that will connect all the employee computers to the printer so that anyone can use it when needed.
   B. Briefly explain baseline wandering and lack of self-synchronization problem.
   C. Why do we need scrambling and block coding?
   D. Identify the line coding schemes based on the requirements and convert this data: 1011110010100 according to those schemes.

a. High bandwidth requirement but no DC component and self synchronization problem.
b. Good bandwidth utilization, no DC component problem but has a self synchronization problem.
c. Good bandwidth utilization, no baseline wandering, dc component and self synchronization problem.

3.

The following figure depicts a sampled analog signal for digital signal representation. By applying the concept of **Pulse Code Modulation** find the **4-bit** code words and finally draw the line coding by using **Bipolar-AMI** scheme. You have to solve the problem by using step by step formulation of normalized PAM values, normalized quantized value, normalized error and quantization code. Assume that the sampling amplitudes are between **-40V to +40V**.

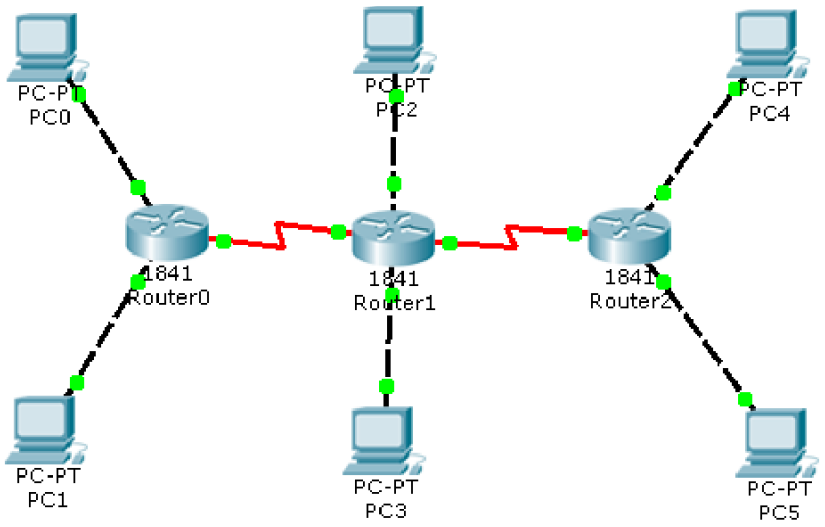
Time	**Analog Signal Value (V)**
0	23.7
1	-15.7
2	-29.6
3	20.5
4	33.5

4. A) List down the functionality of each layer of a OSI model.(Do not write book type documents. only list the responsible functions. For instance: Data link layer: 1. Framing, 2. Error control, 3…… etc.)

B) According to the given figure, assume that, PC0 wants to send a message to PC4. If the distance between the two points is 22,000 km, 3.2-kbyte message sends in 2.4 x 100000000 mls speed through cable and the transmission link has 1.5 Gbps Bandwidth. When the message arrives at Routers ,

a) Router0 already has 4 packets to process in the queue and each will need 2ms.
b) Router1 has no packets in the queue, but if it had then would require 3ms to process.
c) Router2 already has 5 packets to process in the queue and each will need 1ms.

Calculate the total time to send the message from PC0 to PC4.



5. BRAC University has in mind to establish a digital library. This library contains 30 millions of books with 400 white pages and black text for each. For each page, the text covers 7inch×7inch and it represents 250dpi×250dpi. Assume that one dot will be represented with one bit.
   a. What is the size in bytes of the storage disk required for this library?
   b. The library might be accessed concurrently by 2000 users and they request a new page per minute. Calculate the data rate if the channel has a bandwidth of 200MHz.

6. The following is a 1983 article published on the proceedings of the IEEE, volume 71. This is one of the first published documents related to OSI Layer. You can find the PDF version of this paper here. Now answer the following:
   a) "The OSI Reference Model has proven to be extremely useful in coordinating different groups working on the different parts of the problem." What problem is the author talking about and how was it solved?
   b) What are the elements of the OSI architecture?
   c) Three types of construction of N connections on top of N-1 connections and two forms of error control are recognized by the OSI model, what are these? Explain briefly.
   d) What was the approach adopted by SC16?
   e) "Layers have been chosen to break up the problem into reasonably sized smaller problems that can be considered relatively independently"- Explain briefly the seven layers.