CSE320 – Home Assignment 1

BRAC UNIVERSITY | SPRING 2025

Deadline: 13th-March-25 (Thursday) 11:59 PM | (*No Late Submission Accepted)*

Total Mark: 15 (10 questions* 1.5 marks each)

1. Write the functionalities of the 4 layers in the TCP/IP model. Include their protocols, PDUs, special tasks, etc.

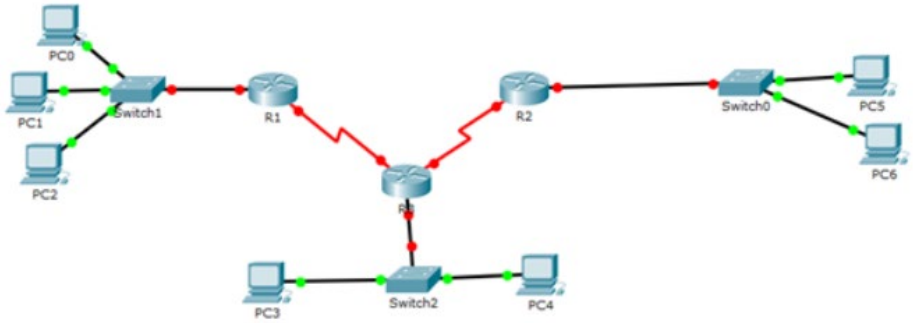
2. Suppose a computer sends a frame to another computer on a bus topology LAN. The physical destination address of the frame is corrupted during the transmission. What happens to the frame? How can the sender be informed about the situation?

3. Imagine the following scenario:
   You are playing a video game with a friend, and you both have reached a crucial level where you need to work together to defeat a powerful boss. You decide to save the game at regular intervals to ensure that neither of you loses progress. If one of you loses, you can quickly return to the last saved point and continue playing from there.
   Can you identify which layer of the OSI Model resembles such a procedure? What is the purpose of this mechanism? Briefly explain with any relevant example

4. Match the following to one or more layers of the **OSI Model**:
   a. Communicates directly with the user's application program
   b. Error correction and retransmission
   c. Mechanical, electrical, and functional interface

5. A communication channel operates in a noisy environment where the average signal power is 1533 W and the average noise power is 3 W. The channel has a bandwidth of 1 MHz.
   a. Calculate the theoretical maximum capacity of the channel.
   b. If the system operates at a bit rate that is 75% of the maximum capacity, determine the number of signal levels required to achieve this bit rate.

6. In the diagram below, R1, R2 and R3 are three routers. How many local area networks (LANs) do you think the topology has and why? If PC1 wants to send data to PC5, what is the 1st hop that the data has to go from source PC1?



7. Match the following to one or more layers of the **TCP/IP protocol** suite:

a. route determination
b. connection to transmission media
c. providing services for the end user
d. creating user datagrams
e. responsibility for handling frames between adjacent nodes
f. Converting the data from Bangla to Chinese

8. A nonperiodic composite signal contains frequencies from 10 to 30 KHz. The peak amplitude is 10 V for the lowest and the highest signals and is 30 V for the 20-KHz signal. Draw the frequency spectrum, assuming that the amplitudes change gradually from the minimum to the maximum.

9. Consider a communication channel that requires to send 108 GB within 8 hours. The link operates on signals with frequency range from 800 KHz to 13 MHz. If the link is perfect, i.e., no noise is introduced in the link,
   a. Determine the number of voltage levels needed to fulfill the requirement.
   b. In practice, there is no noise free channel. Suppose, the strength of the noise power is 30mW which is 20 times weaker than the signal power. What will be the channel capacity considering the noise?
10. Suppose, a transmission line is 10 km long. Along this line, any signal deteriorates at an average rate of 3 W/km throughout the transmission. To prevent the signal from degrading too much, a 15x (15 times) amplifier is placed at 6 km distance from source. The signal strength at source is 20W. Calculate attenuation in each part of the transmission medium and find the total attenuation.
    [Hint. There are three segments in the overall transmission medium]