National University of Computer and Emerging Sciences, Lahore Campus

Computer Networks (Code: CS3001)

Assignment 1 [Section BCS 5A] Fall 2024

Due Date: Sep 5, 2024

Time: At the start of class **Marks: 85**

Please note the following:

1. No exceptions to the above date and time will be allowed. Inability to submit the assignment by the required time will result in zero marks.
2. To ensure self-completion of assignments and discourage plagiarism, the instructor or the relevant TA may randomly contact you and ask for an explanation of your answers. Where plagiarism and/or cheating is evident, you will be referred to the departmental disciplinary committee. In extreme cases of plagiarism, an F may be awarded immediately with further referral to the university disciplinary committee.
3. All solutions must be **handwritten.**
4. **Assignment Solution Submission:** Each student will submit the hard copy of the handwritten assignment's solution to the Instructor / TA directly in case classes are conducted **on the campus (The current scenario)**. Otherwise, in the case of **online classes (exceptional scenario)**, handwritten assignments will be scanned into one PDF document and submitted online via **Google Classroom**. The file or folder name should contain your roll number and assignment number, i.e. **(##L-####_A#)**. If you are making multiple submissions, write "Updated" at the end, i.e. (##L-####_A#_Updated).

Part I: Answer the following short questions: (3 x 10 = 30 Marks) [CLO 1]

Q1: Describe how Internet Service Providers (ISPs) connect to the Internet.
Q2: Discuss the concept of packet switching and its significance in data transmission over the Internet.
Q3: What is a peer-to-peer (P2P) network, and how does it differ from the client-server model?
Q4: Differentiate between end systems and edge routers.
Q5: What are the advantages and disadvantages of packet switching over circuit switching? What advantages do TDM provide over FDM in a circuit-switched network?
Q6: Discuss the concept of "network throughput" and its importance in network performance.
Q7: Describe the different types of physical media used in networking (e.g., twisted-pair copper wire, coaxial cable, fiber optics, and wireless).
Q8: Explain the concept of bandwidth and how it affects data transmission.
Q9: How does the Internet backbone differ from regional and local ISPs?
Q10: Explain the hierarchical structure of the Internet and the role of Internet Service Providers (ISPs).

Part II: Review Question from the book (5 x 5 = 25 Marks) [CLO 1]

Use the following text for completion of this part of the assignment:
Computer Networking - A Top-Down Approach 8th Edition by Kurose & Ross.
Chapter 1 Exercise Questions

R3, R8, R11, R20, R24

Part III: Solve the following by showing the necessary working: (10 x 3 = 30 Marks) [CLO 1]

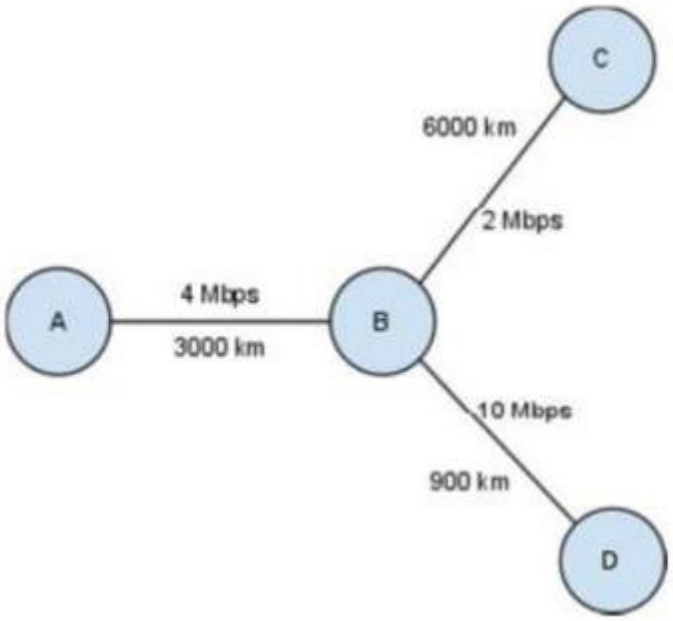
Q1: Consider a packet of length 1000 bytes, which starts at source end system and travels over 10 links to destination end system. Nine packet switches connect these ten links. The transmission rate of all ten links is 2 Mbps. Suppose that propagation speed on all 10 links is 2 x 10^8 m/s. and each packet switch incurs a processing delay of 5 msec (assume zero processing delay at end systems). Moreover, suppose that the distance is the same i.e., 1000 km between all links (i.e., distance from source end system to packet switch 1, from packet switch 1 to packet switch 2, …, and from packet switch 9 to destination end system is the same). Moreover, consider that no queuing delay exists, then what is the end-to-end delay for these values? (3+3+2+2=10 Marks)

Q2: Solve the following questions: (5+5 = 10 Marks)

A. Assume that you are downloading an MP3 file of 24 million bits (assume 1 million = 10^6 bits) from a server with one router between client host and server host. The transmission rate of of the link from router to server i.e., Rs is 8 Mbps while transmission rate of your access link i.e., Rc is 6 Mbps. What will be the throughput? What is the required time to transfer the file considering that all delays except transmission delay are negligible? (2+3 = 5 Marks)

B. Ten digital sources (channels) are multiplexed using TDM. If each input channel sends 5 kbps (assume 1 k = 10^3) and each output slot carries 8 bits from each digital source. Then for this link, find the (i) frame size in bits, (ii) frame rate, and (iii) bit duration? (2+2+1 = 5 Marks)

Q3: Assume data travels through the links at the speed of light (i.e. 3 x 10^5m/s). (10 Marks)



A. What is the transmission delay if A sends 700-byte packet to B?

B. What is the propagation delay between B and C?