PES University

(Established under Karnataka Act no. 16 of 2013)
100ft Ring Road, BSK 3rd Stage, Hosakerehalli, Bengaluru - 560085

Department of Computer Science & Engineering

Course Title: Computer Networks Course Code: UE20CS253
Course Anchor: Mr. Vadiraja A

Assignment-1

Marks: 2 | **Date**: 1st Jan'22 | **Mode**: Online/Individual/Hand-written
Time: 6PM to 8PM | **Duration**: 2 Hours

Solve the following questions by hand and submit it through the channel (edmodo/google drive etc.) specified by your respective faculty member.

1. A cable is able to transfer 5 packets each of 500 bits length in 0.4 seconds into the link connecting one router to another. What is the transmission delay?

2. There are two ways you can send 10TB of data from Bengaluru to Chennai. You have a dedicated link for this very purpose transmitting at 100Mbps and a special courier option with delivery in one day. Which would you prefer to use?

3. The time taken by a packet to travel across a link is 1000 times the time taken for the packet to be inserted in the link. Assuming no queuing and processing delay, what is the transmission delay of the link if it connects an end to end distance of 2km in the network in a total of 3 microseconds ?

4. 100 Terabytes of data is to be transferred between two hosts, Host A in Bengaluru and Host B in Chennai, separated by a distance of 350 km. The transmission speed at Host A is 1 Gbps and the propagation speed of the dedicated link is 2×10^8 *m/s*. Which one of these is better:

    a. To transfer the data over the link or
    b. To drive to Chennai to deliver the data and drive back to Bengaluru, if a one-way trip takes 7 hours

    Which component is dominant in the total time taken for the data transmission? Assume negligible processing and queuing delays.

5. An ISP offers internet connections with transmission speeds of 10 Mbps. To attract customers, it promises less than 5 ms of end-to-end delay while playing online games, if the other players are also their customers and are no more than 10,000 km away. Assume an idle network with propagation speed of 2.5 × 108 m/s and no processing and queuing delays. If the average amount of data generated per second is 100 KiloBytes, find out if the ISP can deliver on their promise.

6. Suppose a circuit-switched network has a one-time setup delay of 500 ms and a transmission speed of 100 Mbps, with no additional queuing delay. Also, suppose a packet switched network has a queuing delay of 10 ms per packet and transmission speed of 10 Mbps. After transmission of how many packets, each of size 16 Kilobytes, does the circuit-switched network seem like a better choice for data transmission in terms of end-to-end delay? Assume transmission is happening between hosts separated by the same distance and the propagation speed of the links is also the same in both the networks.

7. Alice and Bob are connected to each other via a router. The bandwidth of each link between the router and Bob is 20Mbps. If the network allows for the actual transmission of data at 20Mbps, then what is the time taken for a packet of size 1000 bits to enter the network?

8. Consider the scenario shown above, with four different servers connected to four different clients over four three-hop paths. The four pairs share a common middle hop with a transmission capacity of R = 200 Mbps. The four links from the servers to the shared link have a transmission capacity of RS = 70 Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of RC = 90 Mbps.

   a. Assuming that the servers are sending at the maximum rate possible, what is the link utilization for the shared link (R)? What is the maximum achievable end-end throughput (in Mbps) for each of four client-to-server pairs, assuming that the middle link is fairly shared (divides its transmission rate equally)?
   b. Assuming that the servers are sending at the maximum rate possible, what is the link utilization for the shared link (R)?