Homework Assignment 1: 100 points
Due date: Sept. 30, 2024 (Monday)
Question 1: From the network structure perspective, what are the key components in Internet? (5 points)

Question 2: Please specify three typical types of access networks. (5 points)

Question 3: Regarding the hierarchical structure of Internet, please provide your solutions to the following two questions. (10 points)
(a) In Internet, what is the difference between Tier-I ISP and Tier-II ISP.
(b) How do two different Tier-I ISPs exchange data?

Question 4: Regarding the circuit switching and packet switching, please provide your solutions to the following two questions. (30 points)
(a) What are the key differences between the circuit switching and packet switching? (10 points)
(b) What are the advantages and disadvantages of the circuit switching? (10 points)
(c) What are the advantages and disadvantages of the packet switching? (10 points)

Question 5: We consider the following scenario in Figure 1. There is an access link with bandwidth of 1Mbit per second (i.e., 1Mbps) to serve several hosts (i.e., end-system) in a local area network. Each host requires a bandwidth of 100kbps for sending its data when its active, and each host's active probability is 0.2. Please provide your solutions for the following two questions (20 points)
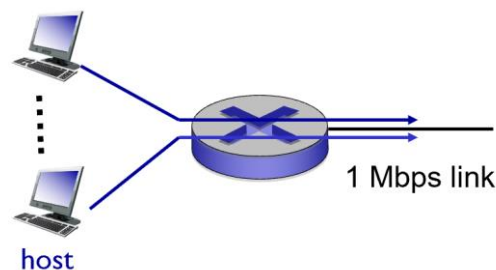

Figure 1

(a) Suppose that circuit switching is adopted, how many hosts can be admitted by this access link? (5 points)

(b) Suppose that packet switching is adopted and that there are 25 hosts admitted by this access link. In this case, what is the probability that an admitted host cannot obtain its required bandwidth (i.e., 100kbps) when it is active? (10 points)

(c) Compared to the solution in (b), if there are 40 hosts are admitted, how will the above probability change (i.e., increase, decrease or keep the same)? Please give your explanation. (5 points)

(d) Compared to the solution in (b), if each host's active probability becomes 0.1, how will the above probability change? Please give your explanation. (5 points)

(e) Based on the solution in (d), if each host's active probability becomes 0.1, will the benefit of from the statistical multiplexing gain be more significant or not? Please give your explanation. (5 points)

Question 6: Suppose that we consider the store-forward-delay in packet switching. As shown in Figure 2, a source host send three packets to a destination host via one router. The size of each packet is L bits, and the bandwidth of each link is R bps. The source host sends the three packets in sequence. Assume that only the transmission delay in considered in this scenario. What is the overall latency for the destination host to receive ALL THE THREE packets? (20 points)
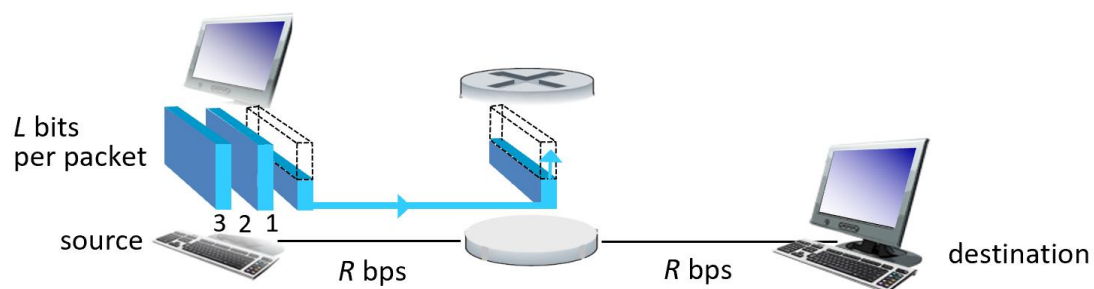

Figure 2