

تمرین شماره یک درس شبکه های کامپیوتری
دانشکده مهندسی کامپیوتر- دانشگاه صنعتی شریف
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1. Explain each following concepts:
 - Protocol
 - Protocol stack
 - Queuing delay
 - Layers in protocols
2. **Packet-switching versus circuit-switching.** Suppose users share a 10 Mbps link. Also suppose each user requires 500 kbps when transmitting, but each user transmits only 10 percent of the time.
 - a) When circuit switching is used, how many users can be supported? Explain.
 - b) For the remainder of this problem, suppose packet switching is used. Why will there be essentially no queuing delay before the link if 20 or fewer users transmit at the same time? Why will there be a queuing delay, at least occasionally, if more than 20 users transmit at the same time?
 - c) Suppose there are 30 users. Find the probability that at any given time, 25 users are transmitting simultaneously. You can give your answer in the form of an expression to be evaluated, but you must explain how you arrived at this formula?
 - d) With 30 users, what is the fraction of time during which the queue grows. Again, you can provide your answer in term of a formula, but must explain how you arrived at this answer.
3. Calculate the total time required to transfer a 1.5-MB file in the following cases, assuming an RTT of 80 ms, a packet size of 1 KB.
 - a) The bandwidth is 10 Mbps, and data packets can be sent continuously.
 - b) The bandwidth is 10 Mbps, but after we finish sending each data packet we must wait one RTT before sending the next.

- c) The link allows infinitely fast transmit, but limits bandwidth such that only 20 packets can be sent per RTT.
4. Hosts A and B are each connected to a switch S via 10-Mbps links as in following Figure. The propagation delay on each link is $20 \mu\text{s}$. S is a store-and-forward device; it begins retransmitting a received packet $35 \mu\text{s}$ after it has finished receiving it. Calculate the total time required to transmit 10,000 bits from A to B.



5. Suppose a host has a 1-MB file that is to be sent to another host. The file takes 1 second of CPU time to compress 50%, or 2 seconds to compress 60%.
- Calculate the bandwidth at which each compression option takes the same total compression + transmission time.
 - Explain why latency does not affect your answer