

Networks - B1.

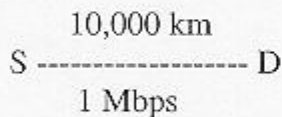
1. (25 pts) DNS – Domain Name System
 1. (2pts) What is the primary service provided by DNS?
 2. (5pts) What is the difference between an Authoritative Server and a Non-Authoritative Server?
 3. (5pts) Distinguish between an iterative and a recursive DNS server, as well as between an iterative and a recursive DNS query (include an example to help clarify your answer.)
 4. (5pts) Explain how caching is used in DNS to improve performance. In your answer, describe the implications (both negative and positive) of using a caching lifetime that is relatively
 - a. too short
 - b. too long
 5. (8pts) The majority of DNS queries are transported using UDP, while DNS zone transfers are transported using TCP.
 - a. Explain why the designers of DNS did not choose to use TCP for all queries.
 - b. What additional work must be performed by DNS to compensate for using UDP's unreliable service?

Networks - B2.**2. (25 pts) IP Addressing**

The original scheme for IP addressing defined 3 classes of networks: A, B, and C. (For this question, ignore Class D multicast and Class E reserved addresses.) As the Internet grew exponentially, it became apparent in the early 1990s that this scheme was insufficient for the growing number of machines wanting to connect. Discuss 3 developments that have effectively increased the original scheme's address space.

Networks – B3.**3. (25 pts) Delay-Bandwidth and Reliable Data Transfer Protocols**

- (a) (2 pts) In networking, what is the “delay-bandwidth product”?
- (b) (5 pts) The delay-bandwidth product plays a significant role in the operation of the Ethernet protocol. Please explain.
- (c) (10 pts) Suppose you are designing a sliding window (i.e. “pipelining”) reliable data transfer link layer protocol for a 1-Mbps point-to-point link between source S to destination D that are 10,000km apart (as shown below.) Assume each link layer data PDU (i.e., frame) is 1,000 bytes of which 40 bytes are header. Assume each link layer acknowledgment PDU is just the 40 byte header. To achieve the maximum possible throughput, what is the minimum number of bits your protocol would need for the sequence number in the following two cases? Assume signal propagation speed is $2 * 10^8$ m/s. (For full credit, you must show all work.)



1) Go-Back-N with Receive Window Size = 1

2) Selective Repeat with Send Window Size = Receive Window Size

- (d) (8 pts) Source S decides to transfer a 1,000,000 byte file over the link described in part (c), this time using a Stop-and-Wait ARQ reliable data transfer protocol. Assume the transmission line exhibits a uniformly distributed random bit error behavior with a bit error rate of 10^{-6} . What is the expected number of link layer PDUs (transmissions plus retransmissions) S will need to transmit to communicate the file to D? (For this question, your answer may be left in terms of the questions' parameters.)

You may use the following approximation: $(1-p)^n \approx 1 - np$ for $p \ll 1$

Networks - B4.

4. (25 pts) Network Layer and Fragmentation/Reassembly

- (a) (6 pts) Explain the major differences between virtual circuit vs. datagram networks.
- (b) (6 pts) Give at least 3 important advantages each one has over the other.
- (c) (5 pts) How does the design of a transport layer reliable data transfer protocol differ when built on top of a virtual circuit vs datagram network?
- (d) (8 pts) TCP provides a reliable data transfer service on top of IP's datagram network. Both TCP and IP provide fragmentation/reassembly service. Argue whether it is better to perform fragmentation/reassembly in the TCP layer, or in the IP layer, or it does not matter.