University of Toronto
Dept. of Electrical and Computer Engineering
ECE 460
Final Examination
Dec. 19th, 2001
Time 2 hours

Name_____

ID_____

Solve questions 1 through 8 in the space provided, if you need more space, use the back of the page

Question	Marks
1	/5
2	/6
3	/5
4	/5
5	/6
6	/6
7	/6
8	/6
Total	

Problem 1 (5 points)

a) The maximum throughput of slotted ALOHA _____ that of ALOHA
   1. Equal to
   2. Two times
   3. Three times
   4. Non of the above

b) Which of the following is true about the IPv4 address (choose only one)
   1. It's divided into exactly two classes
   2. It contains a fixed-length hosted
   3. It was established as a user friendly interface
   4. It is 32 bits long

c) . In TCP congestion control, the congestion threshold is reset _____ upon a timeout
   1. 1
   2. Half the previous congestion threshold
   3. Half the value of the congestion window just before the timeout
   4. 32K Bytes

d) TCP connection is
   1. A connection oriented
   2. Connectionless
   3. Both 1 and 2
   4. None of the above

e) IP protocol is
   1. A connection oriented protocol
   2. A connectionless protocol
   3. Both 1 and 2
   4. Non of the above

Problem 2 (6 points)

Why is all the complexity placed at the edges of the network in the TCP/IP architecture?

What is the purpose of the time to live TTL in the IP header?

What are the main advantages of IPv6 over IPv4 (mention only 2)

Problem 3 (5 points)

Suppose that we want to design a reliable data transfer protocol that only uses negative acknowledgments (NACKs). The sender operates in a selective repeat fashion and with an infinite window size (you may assume an infinitely large sequence space), and only retransmits a packet when it receives a NACK from the receiver. The channel may lose or corrupt messages, and the delays are variable and unknown.

a. Would the sequence numbers be necessary in this protocol? Why?
b. Would a timer be necessary or advisable in this protocol? Why? If so, would it be preferable to have the timer at the sender or receiver? Why?
c. Describe (in words or in pseudocode) the operation of a NACK-only receiver that would operate with this sender. If there are scenarios (no matter how unlikely) that your receiver would fail to operate reliably, identify these scenarios.
d. What would be one advantage of a NACK-based protocol?

Problem 4 (5 points)

Assume a TCP connection over a link with 1Gbps data rate and 10 msec. delay. Assume a segment size of 576 bytes. What is the window size needed to keep the pipe full all the time. How long will it take to reach that window size? Assume an initial threshold of 64Kbytes.

Problem 5 (6 points)

An FHSS system employs a total bandwidth of W= 400 Hz, and an individual channel bandwidth of 100 Hz. What is the minimum number of bits required to represent frequency hop?

An ATM network that works at 150 Mbps uses a token bucket scheme. A new token is put into the bucket every 5 μsec, and the bucket capacity is 50 tokens. What is the maximum sustainable data rate, and what is the maximum burst size in seconds. The ATM cell is 48 bytes of data + 5 bytes of header)

Problem 6 (6 points)

Suppose A sends two TCP segments back-to-back to B. The first segment has a sequence number 90; the second has a sequence number of 110.

a) How much data in the first segment

b) Suppose the first segment is lost, but the second segment arrives at B. In the ACK that B sends, what will be the ACK number?

c) Do we need to recalculate the checksum in the IP header at each intermediate node? Briefly explain

Problem 7 (6 points)

Assume that we want to transmit an audio signal with a bandwidth of 20KHz that is modulated using PCM with 8 bits per sample. The signal will be transmitted in a 20KHz band using a carrier frequency of 1GHz, how many bits per symbol we should use?

What if we use a carrier frequency of 2GHz?

Problem 8 (6 points)

Briefly explain the operation of the token bucket algorithm, what is it used for? What is the main difference between a leaky bucket and a token bucket algorithm?