

**ECE3076b Final Exam**  
**Dec. 10, 2008 8:00 - 10:40 a.m.**

**RULES.**

- i This quiz is **not** open book. Three original sheets of hand-written notes may be used. Calculators are ok.
- ii Answer all questions and **show all work** to receive full credit. Use back of sheets only if necessary.
- iii Please do not ask the proctors any questions during the exam about exam questions. Part of the test is understanding the question, as written, without supplemental information. If you feel additional data is needed to solve the problem, make (and state) an assumption and then work the problem.
- iv. This is a time-limited test. If you find you are taking more than 15 minutes on a particular problem, move on and come back to that problem after finishing the others. Each answer counts 1.6 points.
- v. There should be no headphones, and no active wireless devices of any sort. Cell phones should be turned off and in a book bag on the floor, or not brought into the room. Computers must be off and out of sight.
- v. The Georgia Tech Honor Code applies (see last page).

**Question 1 – TCP with no Congestion** A 100 Mbps network connection has a 40 ms round trip time (RTT). A server begins sending maximum-size (MSS=1500 byte) packets (after the initial SYN-ACK is acknowledged). The client ACK's every packet, and has a Receiver-Window which holds 64 Kbytes.

What is the transmission time for a single packet (1500 bytes)? 120 us

How many duplicate ack-numbers trigger the Fast Recovery mode? 3

When are the two times (after what events) when the Slow Start mode begins? Startup,  
 and Time Out

What is the transmission time for a 100 MByte file, if there are no packet losses (and the connection has reached equilibrium)?  $Window\ Limit = 64\ kByte/0.04s = 1.6\ MByte/s$  62.5 s

What is the transmission time for a 100 MByte file, if the average CongWin is 32 kByte? 125 s  
*Twice as long*

**Question 2 - Network and Socket "addresses"**

Name the three remote "addresses" needed to send a TCP segment to www.cnn.com, starting with the transport layer, network layer, and the link/physical layer. Show (a) what the "address" is commonly called, and (b) which host or network equipment is being addressed. Last list how (c) each "address" is found (by protocol name, or is it a standard value),.

	(a) "Address" is Called?	(b) Whose address is it?	(c) How is the value found?
Transport Layer	<b>Port Number</b>	<b>Software Socket</b>	<b>Requested by program</b>
Network Layer	<b>IP Address</b>	<b>www.cnn.com</b>	<b>DNS Lookup</b>
Link/Physical Layer	<b>MAC Address</b>	<b>Local (gateway) router</b>	<b>ARP</b>

**Question 3 – IP Datagrams**

a. When is the ID number used? For fragments

b. What field in the IP header changes when a datagram is forwarded by a simple router? TTL

c. What other field always changes when an outbound IP datagram is forwarded by a NAT router? Source IP address

d. What other field may or may not change, depending on the NAT implementation? Source port number

**Question 4 – Name that Protocol** (OSPF, RIP, BGP, SSL, PGP, IP, ARP, DHCP, UDP, TCP, HTTP)

Broadcasts information only about delays on links connected to itself.     **RIP**    

Sends network neighbors information about its hop-count values to all nodes in network.     **OSPF**    

Uses UDP port 67 and 68 to negotiate a lease for a network IP and configuration information.     **DHCP**    

Allows packets to be split into a series of smaller packets.     **IP**    

Provides security for Web transactions.     **SSL**    

**Question 5 – Cell Phone Modulation and Multiple**

What multiple access technique was used with the first cell phones (AMPS):     **Multiple Frequencies**    

What multiple access technique was used with the first digital cell phones     Time Slots - **TDMA**    

What multiple access technique was used with the later digital cell phones     Chip Codes - **CDMA**    

Which technique is always used, alone or with one of the other two?     **Multiple Frequencies**    

**Question 6 – Authentication**

What is the primary property of a hash (output is \_\_\_)?     **fixed length**    

What are two more properties of a cryptographic hash used for digital signatures?     **can not be reversed**    ,  
and     **can not find another message with the same hash**    

Who can decrypt a message encrypted with Bob's public key?     **Bob**    

Who can decrypt a message encrypted with Bob's private key?     **Everyone**    

A KDC "ticket" issued to Alice provides a \_\_\_ (so that she can communicate with Bob)?     **Session Key**    

**Question 7 – Security**

What are the five services provided by information security?     **Privacy**      
    **Integrity**      
    **Authentication**      
    **Access**      
*(not listed in textbook)*     **Authorization**    

What attack is a "Nonce" used to prevent.     **Replay attack**    

What attacked is prevented by a signed certificate?     **Masquerade** (False Identity)

**Question 8 – Ethernet and IEEE 802.11 (WiFi)** Which things are the same or different

Which things are in both the two protocols, or WiFi only, or Ethernet only? (answers "Both", "WiFi", or "Ethernet").

6-byte MAC addresses, first few bytes assigned to the vendor, unique. \_\_\_\_\_ Both \_\_\_\_\_

Carrier Sense Multiple Access (CSMA) \_\_\_\_\_ Both \_\_\_\_\_

Collision Detection \_\_\_\_\_ Ethernet \_\_\_\_\_

Collision Avoidance \_\_\_\_\_ WiFi \_\_\_\_\_

Resends frames that are not acknowledged \_\_\_\_\_ WiFi \_\_\_\_\_

**Question 9 – IP Digital Addresses**

. You are assigned a block of IP addresses for your company: **209.162.128.0/21**. Divide this block into two equal sized subnets. How many hosts can be on each subnet?

$2^{(32-22)} - 2 = \underline{\underline{1022}}$

Show the parameters of the two subnets below. *Third bytes are 10000000 and 10000100 (128 and 132)*

Sub-net ID	Net Mask	Broadcast Address	Lowest Address for a host
<b>209.162.128.0/22</b>	255.255.252.0	<b>209.162.131.255</b>	<b>209.162.128.1</b>
<b>209.162.132.0/22</b>	255.255.252.0	<b>209.162.135.255</b>	<b>209.162.132.1</b>

**Question 10 – IP Addresses**

What two techniques have prevented the IANA from running out of IPv4 addresses to issue to new networks?

\_\_\_\_\_ *Network Address Translation - NAT* \_\_\_\_\_

\_\_\_\_\_ *Classless Internet Domain Routing - CIDR* \_\_\_\_\_

How many bits are in an IPv4 address, and an IPv6 address? IPv4 32, IPv6 128

Fill in the values of the fragmentation flag (MF) and the Offset, before and after a 1500 byte datagram is fragmented:

Type of Fragment	MF	Offset
Not Fragmented (1500 bytes)	<b>1</b>	<b>0</b>
First Fragment, new length = 20 + 640 bytes	<b>1</b>	<b>0</b>
Middle Fragment	<b>1</b>	<b>640</b>
Last Fragment	<b>0</b>	<b>1280</b>

**Honor Code** - I affirm that I have obeyed the rules of the Georgia Tech Honor Code\*.

Signature \_\_\_\_\_

\*Basically, I did not cheat, and I reported any observed cheating. A grade will not be recorded if there is no signature.