ECE697AA Spring '08 – Exam I Prof. Wolf

Name:

ID Number:

	Maximum	Achieved
Question 1	9	
Question 2	10	
Question 3	14	
Question 4	11	
Question 5	6	
Total	50	

This exam is closed book, closed notes. One single page handwritten notes is allowed. No electronic devices (other than calculators) are allowed. Be concise, but show your work. Write legibly.

Time: 75 minutes.

Question 1 (9 points):

Answer the following general questions regarding computer.

a) Name the five layers of the Internet protocol stack and give an example of protocol for each layer (except for the lowest layer). Do not use abbreviations or acronyms. (4 points)

b) Switch tables can get large for large LANs since each station requires one entry. In order to reduce the number of entries, your colleague suggests using prefix aggregation for Ethernet MAC addresses similar to how it is used in CIDR for IP. What do you think of this suggestion? (2 points)

c) What are the three most common packet sizes in the Internet? Explain why this is the case. (3 points)

Question 2 (10 points):

Answer the following questions regarding transport protocols and their performance. Assume a network uses 100 Mbps links with a 1 ms one-way end-to-end delay between two nodes. Also assume that these nodes use a sliding window transport protocol with a maximum window size of 3 packets and a fixed packet size of 1300 bytes (50 bytes of headers and 1250 bytes of payload). Assume acknowledgement packets are 50 bytes in size. There is no connection setup.

a) What is the throughput of this protocol from the point of view of the end-system application (i.e., how much payload data can the protocol transfer per second)? Assume queuing and processing delays are zero, but consider transmission delays. Please report your results in bits per second, not bytes per second. (5 points)

b) What changes could be made to the transport protocol to increase the throughput? (2 points)

c) What window size would be necessary to achieve 80 Mbps of throughput from the point of view of the end-system application? (3 points)

Question 3 (14 points):

Answer the following questions regarding IP address allocation and routing tables.

a) Consider the network topology shown below. Assume you are given an address block of 128.119.86.128/25. Assign a suitable address to each network interface (enter IP address in white rectangular box). Allocate addresses such that they can be aggregated into prefixes. Note the network prefix in the while oval. (6 points)



b) Show the routing table for router R that matches your configuration in a). All hosts should be reachable. Assume that the Internet is configured to send all traffic destined for 128.119.86.128/25 to router R. The routing table should have an entry for each network prefix and the port (A-D) through which the packet should be forwarded. (4 points)

Prefix	Port

c) A colleague suggests a new IP protocol ("IPlight"), which uses a header that consist of only a version field and a (sufficiently long) destination address field. Discuss if IPlight would be an effective network protocol. If not, state which header fields you think need to be added and why. (4 points)

Question 4 (11 points):

Answer the following questions regarding CSMA/CD protocols.

a) Consider two stations that are 5 meters apart on a shared 10 meter long wire. The propagation speed of signals in this wire is 1 meter / microsecond (=1000km/s). Assume that station A starts transmitting a very long packet at time 0µs. Station B – after checking that the channel is clear – starts transmitting a very long packet at time 3µs. Determine the times of the events listed below the figure. Assume that in case of a collision a station stops transmitting instantaneously (no jam signal). You may solve the problem graphically or by calculation. (5 points)



Station A detects a collision at time t=_____

Station B detects a collision at time t=_____

Station A determines channel is clear (after collision) at time t=_____

Station B determines channel is clear (after collision) at time t=_____

Entire wire is free of any transmission (after collision) at time t=_____

b) Assume the network in a) and assume the transmission speed is 10Mbps. If collisions need to be detected reliably, what is the minimum packet size that can be permitted? (6 points)

Question 5 (6 points)

Answer the following questions regarding network measurement. Consider the Wireshark screenshot shown below that was obtained from a passive measurement experiment.

📶 t1.pcap - Wireshark							
<u>File Edit View G</u> o	<u>C</u> apture <u>A</u> nalyze <u>S</u> tatistics <u>H</u>	elp					
E E E E E E E E E E E E E E E E E E E							
Eilter: (ip.addr eq 192.168	.2.219 and ip.addr eq 64.233.169.10	4) and (tcp.port ϵ ▼ Expression	n <u>C</u> lear <u>A</u> p	ply			
No Time	Source	Destination	Protocol	Info			
25 7.850468	192.168.2.219	64.233.169.104	тср	activesync > http [SYN] Seq=0 Win=16384 Len=0 MSS=14			
28 7.908010 29 7.908059	64.233.169.104 192.168.2.219	192.168.2.219 64.233.169.104	TCP TCP	<pre>http > activesync [SYN, ACK] Seq=0 Ack=1 Win=5720 Le activesync > http [ACK] Seq=1 Ack=1 Win=17160 Len=0</pre>			
30 7.909466	192.168.2.219	64.233.169.104	HTTP	GET / HTTP/1.1			
32 7.934220	64.233.169.104	192.168.2.219	TCP	[TCP segment of a reassembled PDU]			
33 7.934353	64.233.169.104	192.168.2.219	HTTP	HTTP/1.1 200 OK (text/html)			
90 13.736443	192.168.2.219	64.233.169.104	НТТР	GET / HTTP/1.1			
91 13.756406	64.233.169.104 64.233.169.104	192.168.2.219	ТСР НТТР	[TCP segment of a reassembled PDU]			
93 13.756832	192.168.2.219	64.233.169.104	TCP	activesync > http [ACK] Seq=1018 Ack=5123 Win=17160			
94 13.807798	192.168.2.219	64.233.169.104	HTTP	GET /intl/en_ALL/images/logo.gif HTTP/1.1			
97 13.829215	64.233.169.104	192.168.2.219	TCP	[TCP segment of a reassembled PDU]			
98 13.829261	192.168.2.219	64.233.169.104	TCP	activesync > http [ACK] Seq=1685 Ack=7890 Win=17160			
<		III III		4			
⊕ Frame 30 (541 b	ytes on wire, 541 bytes	captured)					
🗄 Ethernet II, Sr	c: IntelCor_23:35:24 (0	0:15:00:23:35:24), Ds1	:: 3com_c6	:e3:3c (00:01:02:c6:e3:3c)			
Internet Protoc	ol, Src: 192.168.2.219	(192.168.2.219), Dst:	64.233.16	9.104 (64.233.169.104)			
Header length	· 20 bytes						
Differentiate	d Services Field: 0x00	(DSCP 0x00: Default; #	CN: 0x00)				
Total Length:	527						
Identificatio	n: 0x003d (61)						
In Flags: 0x04 (Enagment offs	Don't Fragment)						
Time to live:	128						
Protocol: TCP	(0x06)						
Header checks	⊞ Header checksum: 0x4ad7 [correct]						
Source: 192.168.2.219 (192.168.2.219)							
DESTINATION: 04.233.109.104 (04.233.109.104) Transmission Control Protocol Ster Port: artivesvnc (1034) Dst Port: http://doi.org/10.1016/10.1017							
Source port:	activesync (1034)	,					
Destination p	ort: http (80)						
Sequence number: 1 (relative sequence number)							
[Next sequence number: 488 (relative sequence number)]							
Header length: 20 bytes							
☑ Flags: 0x18 (PSH, ACK)							
window size: 17160							
B Checksum: 0x18c2 [correct]							
■ Hyper cext Trans ■ GET / HTTP/1.	1\r\n						
Host: www.goo	gle.com\r\n						
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-U5; rv:1.8.0.4) Gecko/20060508 Firefox/1.5.0.4\r\n							
Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,image/png,*/*;q=0.5\r\n							
Accept-Language: eIn-US, eII; q=0. 3 \r \n Accept-Language: deflate): Accept-Language: Accept-Language							
Accept-charset: ISO-889-1,utf-8(q=0.7,*;q=0.7)r\n							
Keep-Alive: 300/r/n							
Connection: keep-alive\r\n							
Cookie: PREF=ID=46T3ec99b92c94d8:TM=1156182628:LM=1189037521:S=9SANegcdAJnhhdvs\r\n							
0000 00 01 02 c6	e3 3c 00 15 00 23 35 3	24 08 00 45 00	< #5\$.	.E.			
0020 02 06 80 40 a0 50 07 cc 94 4a d7 6a at 27 f 50 la hP							
0030 43 08 18 c2	00 00 47 45 54 20 2f	20 48 54 54 50 C	.GET/H				
0050 67 6f 6f 67	6c 65 20 62 6f 6d 0d 1	1.1. 1. 55 72 65 72 googl	o c om H				
File: "C:\Users\wolf\Docur	rine: C:\users\wom\uocuments\reacning\courses\ELEBY/AA\documents\t1.pcap: ov KB 00 Packets: 124 Uisplayed: 32 Marked: 0						

- a) Do these packets belong to the same (bi-directional) connection? (2 point)
- b) What is the IP address and DNS name of the server? (2 point)
- c) What is the round-trip time for this connection (based on TCP handshake)? (2 points)