ICS 167
Midterm, Closed Book and Notes, Time 1h
Attempt all questions. Use the additional sheets included with your exam to work out your solutions
February 5th, 2015
Prof. Magda El Zarki

Student Name:

Student ID:

Note: Answer all questions. Multiple Choice questions if answered wrong will be graded with a negative value, i.e., guessing the answer not a good idea! Use the worksheets in the back of the exam for extra workspace.

1. **Architecture**
   Which layer of the TCP/IP model processes requests from hosts to ensure a connection is made to the appropriate port? (select one) (*-0.25 Point, +1 Point*)
   a. Application
   b. Internet
   c. Transport xx
   d. None of these answers are correct.

2. **IP Addressing**
   Six hosts are connected to one hub. *(-6 Points - +6 Points*, NOTE negative points for listing a wrong combination)

   Host1 10.0.199.1/19
   Host2 10.0.208.5/16
   Host3 10.0.200.131/24
   Host4 10.0.204.7/20
   Host5 10.0.200.96/26
   Host6 10.0.200.106/28

   List all the pairs that can ping successfully to each other.

   Host1 and Host2
   Host1 and Host4
   Host5 and Host6

3. **Subnetting**
   You are given the following address space: 128.37.22.0/23, you are required to divide it to 4 subnets. One of the subnets has to accommodate 200 hosts and the 3 other subnets have to accommodate 59 hosts each.
   a. What are the 4 subnet network addresses and their corresponding prefixes? *(4 Points)*

128.37.22.0/24 -> 00010110.00000000
128.37.23.0/26 -> 00010111.00000000
128.37.23.64/26 -> 00010111.01000000
128.37.23.128/26 -> 00010111.10000000

   b. What is the broadcast address for each subnet? *(2 Points)*

Broadcast -> all host bits are set to "1"
128.37.22.255
127.37.23.63
128.37.23.127
128.37.23.191

4. IP Routing Tables

Consider the following routing table:

Network Destination	Next Hop
142.150.64.0/20	A
142.150.71.128/28	B
142.150.71.128/30	D
142.150.0.0/16	C

a. Assume that a router receives an IP datagram with destination 142.150.71.132. Determine the next hop of the IP datagram that is selected by the router? Explain you answer. *(5 Points)*

142.150.71.132 = **1000 1110.1001 0110.0100 0111.1000 0100**
142.150.64.0/20 = **1000 1110.1001 0110.0100** 0000.0000 0000
142.150.71.128/28 = **1000 1110.1001 0110.0100 0111.1000** 0000
142.150.71.128/30 = **1000 1110.1001 0110.0100 0111.1000 00**00
142.150.0.0/16 = **1000 1110.1001 0110.**0000 0000.0000 0000
The bold digits show the bits of the prefix that need to match the destination address. The first, second and fourth entry match. The second entry has the longest matching prefix, so the next hop is **B.**

b. Add a routing table entry to the table above which enforces that all IP datagrams with destination 142.150.71.132 have "A" as Next Hop. For all other IP destination addresses, the Next Hop should not change. *(3 Points)*

The routing table entry to be added is:

Network Destination	Next Hop
142.150.71.132/32	A

c. Add a routing table entry to the table above which enforces that all IP datagrams whose destination address does not match any of the entries in the table, are forwarded to next hop "C". (The network destination for this entry must be provided as a network prefix.) *(2 Points)*

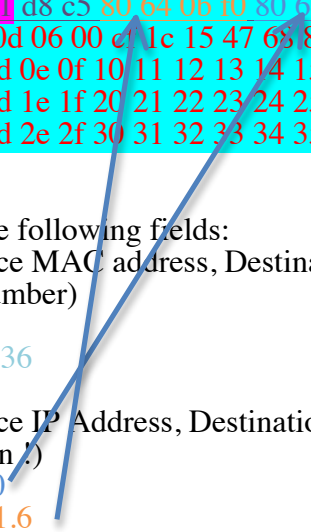
The routing table entry to be added is:

Network Destination	Next Hop
0.0.0.0	C

5. Encapsulation

Below *is* the traffic capture of an ICMP Echo Request packet in hexadecimal notation, The capture consists of an Ethernet II header, followed by an IP header, followed by an ICMP message. (Hint: Each digit corresponds to 4 bits.)

00 0a e4 37 f8 36 00 12 3f 61 d7 ac 08 00 45 00
00 54 4a 25 00 00 80 01 d8 c5 80 64 0b f0 80 64
0b 06*08 00 6d 02 44 0d 06 00 cf 1c 15 47 68 89
09 00 08 09 0a 0b 0c 0d 0e 0f 10 11 12 13 14 15
16 17 18 19 1a 1b 1c 1d 1e 1f 20 21 22 23 24 25
26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35
36 37



a. Provide the value of the following fields:

i. *(3 Points)* Source MAC address, Destination MAC address (as a hexadecimal number)

Source MAC: 00:12:3f:61:d7:ac
Destination MAC: 00:0a:e4:37:f8:36

ii. *(3 Points)* Source IP Address, Destination IP address (Use dotted decimal notation !)

Source IP address: 128.100.11.240
Destination IP address: 128.100.11.6

iii. *(3 Points)* Value of the protocol field in the IP header (as a decimal number)

1 (for ICMP)

iv. *(3 Points)* Total length of IP datagram (as a decimal number)

84

v. *(3 Points)* Header length of IP datagram (as a decimal number)

Note that the size of the IP header is the value of this field multiplied by 4 à IP header is 20 bytes long = 20 x8 = 160bits

vi. *(3 Points)* In the traffic capture above, mark the end of the IP header. Provide the number of bytes of the IP header (in bytes). Provide the number of bytes of the ICMP message following the IP header (in bytes).

The boundary is marked above with an * (ICMP payload is marked in red NOTE no ethernet frame CRC check here).

The IP header has a length of 20 bytes (see comment in (a5).

The length of the ICMP message is 64 bytes. (This can be obtained by counting, or by taking the total IP datagram length field (“84 bytes”) and subtracting the length of the IP header (“20 bytes”)