

**ECE 461– Internetworking
Fall 2010**

Quiz 1

Instructions (read carefully):

- The time for this quiz is 50 minutes.
- This is a closed book and closed notes in-class exam.
- Non-programmable calculators are permitted
- The only aid permitted are the two aid sheets included in this quiz.
- Write your answers on the pages provided, using front and back if needed. Use extra sheets if needed.
- Do not give aid or receive aid from other students.
- Show all steps of your solutions.
- Make sure your answers are legible. If we cannot read an answer, we will not grade it.

	Max Points	
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
Total	60	

**STAPLE EXTRA SHEETS WITH YOUR SOLUTIONS TO THIS SHEET
BEFORE TURNING IN !**

Name: _____

Email: _____

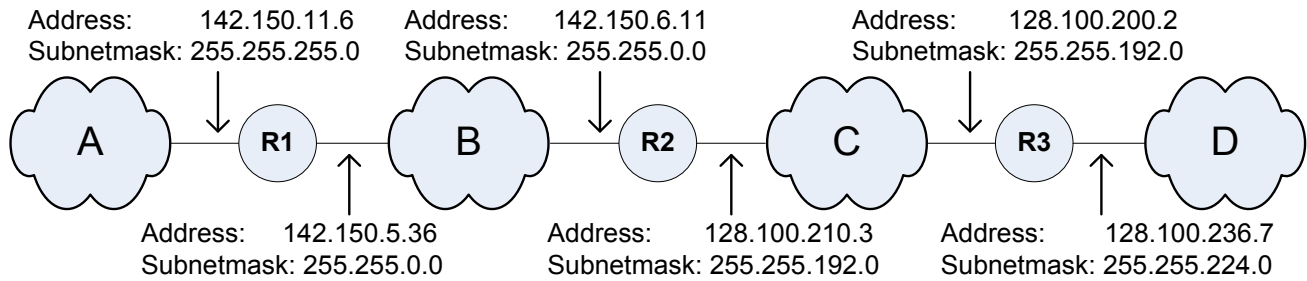
Problem 1. (10 points)

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

```
00e0 f923 a820 00a0 2471 e444 0800 4500 002c 9d08 4000 8006
8bff 808f 8990 808f 4715 065b 0050 0009 465b 0000 0000 6002
2000 598e 0000 0204 05b4
```

- a. (2 points) Indicate the beginning and end of the IP header.
- b. (2 points) Provide the value of the Source IP Address and the Destination IP address (Use dotted decimal notation !)
- c. (2 points) How can you tell that the Ethernet header is followed by an IP header? How can you tell that the IP header is followed by a TCP header? Indicate the relevant information in the captured data.
- d. (2 points) How can you tell from the captured data that the IP datagram has not been fragmented? Indicate the relevant information in the captured data.
- e. (2 points) How can you tell that there is no payload following the TCP header? Since there is no payload in the above packet, what is the purpose of this packet?

Problem 2. Consider the following figure with four IP subnetworks (A, B, C, D) and three routers (R1, R2, R3). The IP configuration of the router interfaces is indicated.



a. (5 points) Consider the following hosts and their IP addresses:

Host	IP address
H1	142.150.7.23
H2	128.100.197.4
H3	128.100.240.22

For each host, determine the subnetworks, if any, that the host can be placed on. For each feasible placement, provide the name of the subnetwork (A,B,C, D) and the required subnetmask.

b. (3 points) Fill up the remaining routing table entries at router R2 (One entry is given.)

Network with Prefix	Next hop
142.150.11.0 /24	142.150.5.36

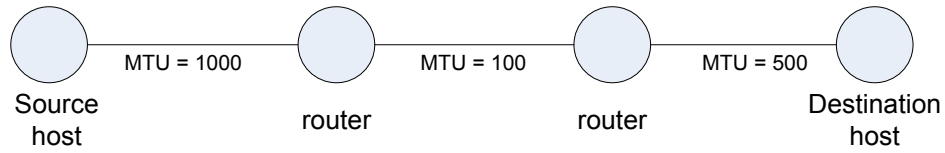
c. (2 points) Could two hosts have the same IP address but different subnetmasks? Explain your answer.

Problem 3. (10 Points)

- a. (2 points) Explain why the use of CIDR (Classless Interdomain routing) in the Internet helps to reduce the size of routing tables.
- b. (2 points) Using CIDR leads to a hierarchical allocation of IP addresses. What is a disadvantage of allocating IP addresses in a hierarchical fashion? Explain.
- c. (2 points) Express the entire Class B address space using the CIDR notation for IP addresses.
- d. (4 points) In the following routing table, indicate the entries that result in a match for destination address “128.9.200.20”? On which interface will an IP datagram with this destination address be transmitted? Explain.

Network with Prefix	Interface
128.0.0.0/8	3
128.9.0.0/16	5
128.9.192.0/20	2
128.9.192.0/22	4
128.9.192.0/24	7
128.9.200.0/24	8
128.9.200.0/28	10
128.9.200.16/28	1
128.9.200.16/30	9
128.9.192.8/30	6

Problem 4. (10 points) The “Path MTU” is the smallest MTU of each hop between the source and the destination. In the example below, the path MTU is given by 100 bytes.



- a. (4 Points) Explain how a source host that has knowledge of the Path MTU can improve the performance of IP datagram transmissions to a destination host.
- b. (6 Points) Describe how a source host can take advantage of the ICMP protocol to determine the Path MTU to a destination host.

Problem 5. (10 points) IP Fragmentation

Consider an IP datagram with the following characteristics:

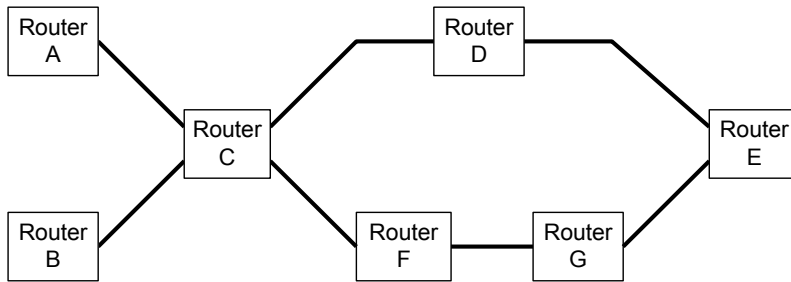
Length of IP header:	20 bytes
Total length of IP datagram:	1000 bytes
DF flag:	0
MF flag:	0
Fragment offset:	0

Suppose this datagram must be transmitted on a network where the MTU is only 512 bytes.

- (a) (2 points) Explain why this IP datagram must be fragmented. How many fragments will be created?
- (b) (6 points) After the fragmentation is performed, provide the value of the following fields for each of the fragments:
- Total length (in bytes)
 - Value of DF flag
 - Value of MF flag
 - Value of Fragment offset (as a decimal number)
- (c) (2 points) What does a router do, if the value of the DF flag of an IP datagram is set to one?

Problem 6. (10 points)

In the network topology below with seven routers, the objective is that traffic from A to E, traverses the path A-C-D-E and traffic from B to E should traverse the path B-C-F-G-E.



- a. (5 points) Describe a key problem in achieving this objective in an IP network.

- b. (5 points) Propose a method to overcome the problem.