

Midterm Examination

April 27

Be neat and concise. Show your work. Good luck!

Name: _____

Problem	Points	Score
1	15	
2	15	
3	15	
4	15	
5	15	
6	10	
7	15	
Total	100	

1. **Sockets API.** Give concise answers to the following:

- (a) What does it mean when a call to `recv()` returns a value of 0?

- (b) Which sockets API call initiates TCP's three-way handshake?

- (c) After issuing a `shutdown()` on a socket, is it possible to continue to send data?

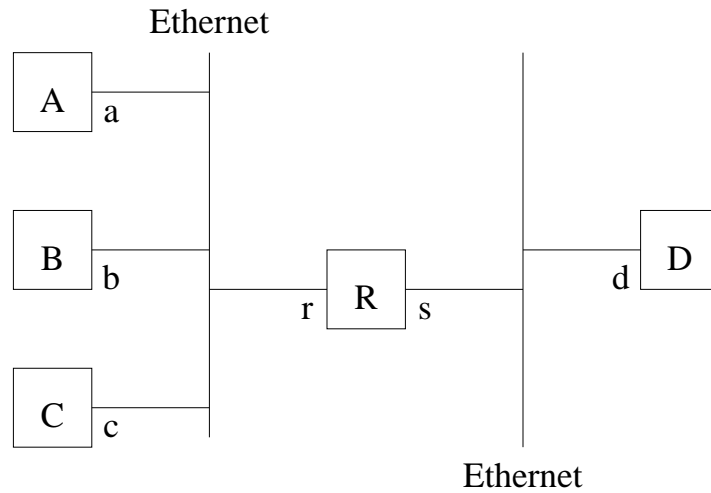
2. **Protocols.** Give concise answers to the following:

- (a) What is the most common first field in a protocol header, and why?

- (b) Give the definition of an “ephemeral port” and explain when it is used.

- (c) Why is the IP fragment offset field 13 bits long, when the IP total length field is 16 bits long?

3. **ARP.** Let n_i denote the IP address for interface n and n_p denote the physical address for interface n . Consider the following network, containing two Ethernet segments, one router (R) and four hosts (A, B, C, D). The interfaces are all labeled.



Assume all ARP tables are initially empty. Give the complete contents of the ARP table at host A after each of the following operations:

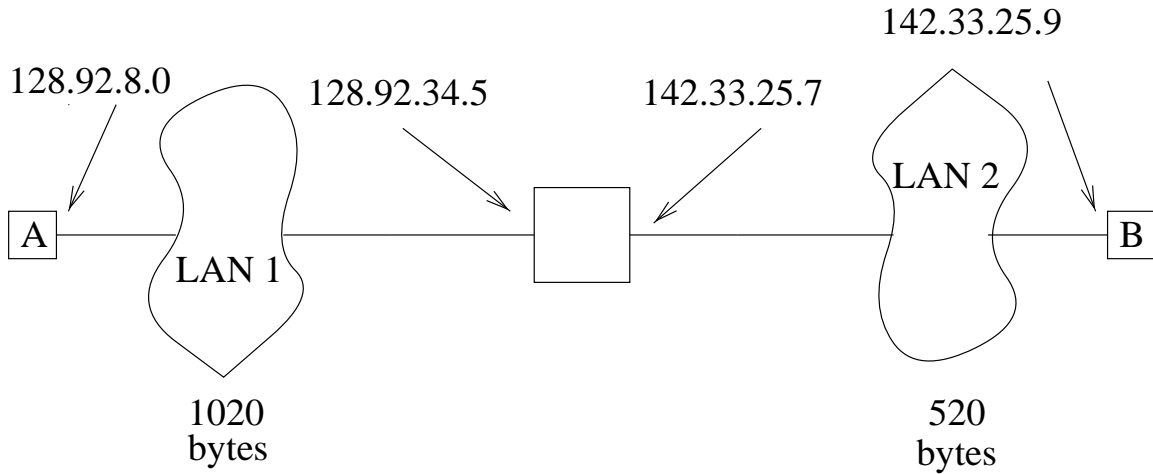
(a) A sends an IP packet to B.

(b) C sends an IP packet to B.

(c) A sends an IP packet to D.

(d) A long time later, D sends an IP packet to A.

4. **IP.** Suppose an IP packet with 1200 bytes of data and 20 bytes of header is generated at station A, destined for station B. The IP addresses of the interfaces are indicated in the diagram. The largest transmission unit of each local area network (LAN) is indicated in the diagram.



- (a) Give the source and destination IP addresses in the packet as it traverses LAN 2.
- (b) Give the number of fragments, the size of each fragment, and the value in the fragment offset field for the fragments traversing LAN 2. (Use as many rows of the table below as you need.)

Fragment number	Size (in bytes)	Offset
0		
1		
2		
3		
4		
5		

5. **Subnetting.** Suppose you are the network administrator for a campus that has been allocated the class B address 130.207.x.x. You currently have five Ethernet networks. The requirements for the number of interfaces per network are given below. Give a feasible subnetwork design, by giving a subnetwork address and mask for each of the five Ethernet networks.

Network	Interfaces	Subnetwork address	Subnetwork mask
A	128		
B	128		
C	192		
D	1024		
E	64		

6. **TCP RTT Estimate.** Assume the initial value of the RTT estimate is 10 ms, and the weight placed on each new sample is 0.1. Give the value of the RTT estimate after each of the following events:

(a) Send segment at time 0 and receive acknowledgement at time 5 ms.

(b) Send segment at time 10ms, timeout and resend at time 20 ms, and receive an acknowledgement at time 25 ms.

(c) Send segment at time 30 ms and receive acknowledgement at time 45 ms.

7. The following timing diagram depicts the TCP segments exchanged by two hosts, *A* and *B*. Each segment is labeled with a three-tuple: sequence number, ACK flag, acknowledgement number. The maximum segment size from *A* to *B* is 512 bytes; the maximum segment size from *B* to *A* is 1024 bytes. All segments sent are of maximum size. Fill in the missing parts of the labels in the diagram. (Note that two segments are lost in transit, as indicated by the X's in the diagram.)

