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CS 485 - Computer Networks
Final Examination

This test is open notes/book. **Observe the Emory College Honor Code while taking this test.**

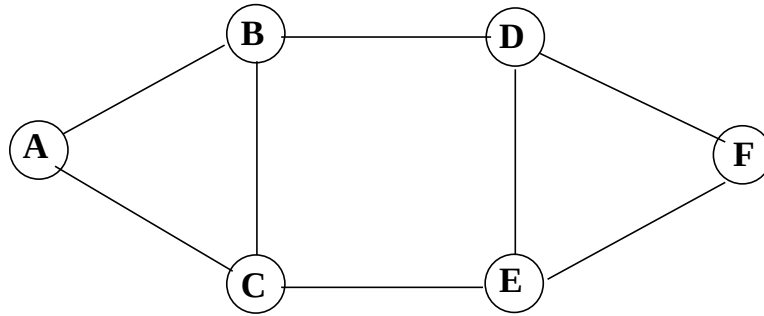
Question 1 (20 points)

Give clear and concise answers to the following questions.

1. What protocol is used to determine the physical address for an IP host ?
2. Which type of multicast routing protocol can achieve minimum delay from source to all multicast destinations ?
3. Give 2 problems in computer network that are solve with tunnelling.
4. What protocol is used by an IP host to obtain its IP address at boot time ?
5. What is "Advertised Window Size" ? (Define this term)
6. What type of addresses is used by a bridge to perform the forwarding function ?
7. What type of addresses is used by a router to perform the forwarding function ?
8. Name three services provided by TCP.
9. State the relationship between the sender window size, the receiver window size and the number of sequence numbers to must be satisfied for the sliding window method to perform correctly.
10. What is the most common cause of packet loss in today's computer network ?

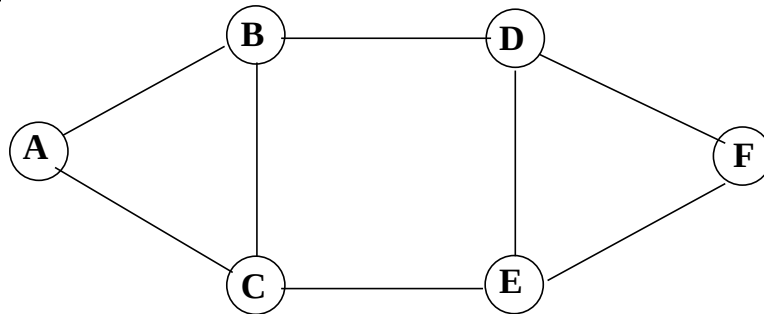
Question 2 (15 points)

Consider the following network:

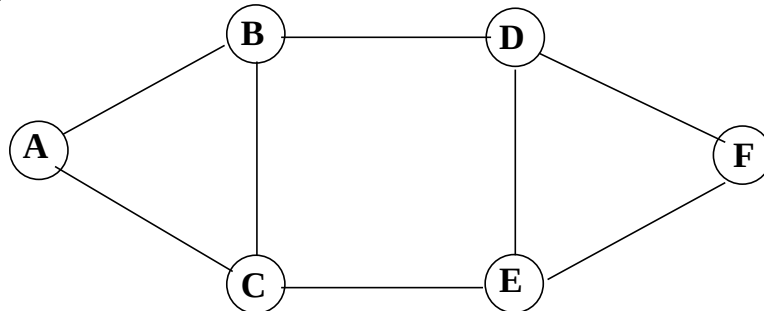


- What is the smallest TTL (Time To Live) value that node A can use to flood the network ? (3 pts)
- What is the smallest TTL (Time To Live) value that node D can use to flood the network ? (3 pts)
- Suppose D floods the network using a TTL value 3. Show all the messages that will be transmitted in each round in the following figures: (9 pts)

Round 1:

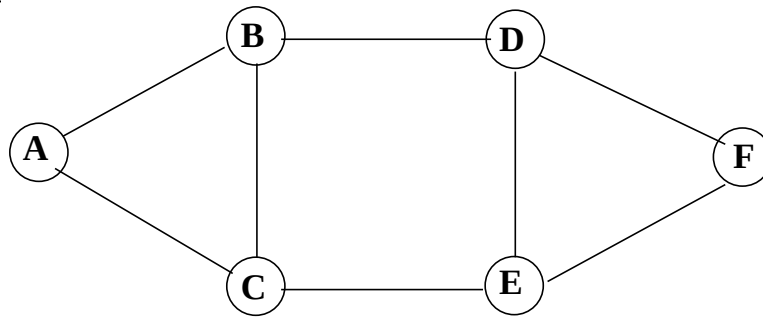


Round 2:



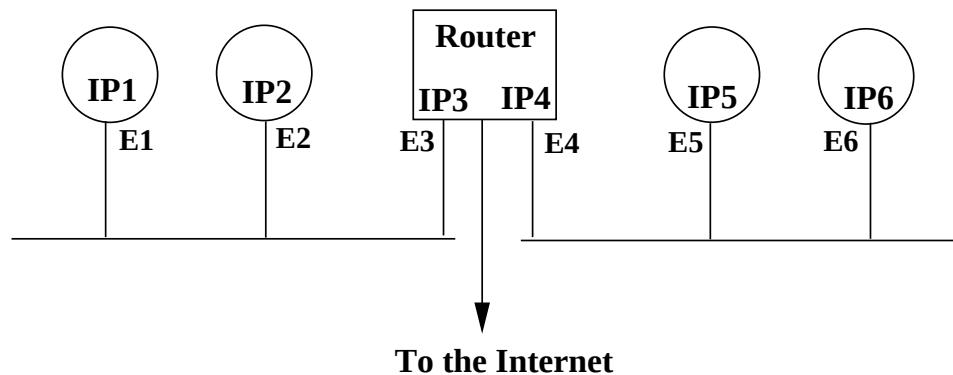
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Round 3:



Question 3 (20 points)

Consider the following network with 2 LAN segments. There are 4 IP hosts with the IP addresses IP1, IP2, IP5 and IP6. The Physical network (Ethernet, FDDI, wireless) addresses of each IP host is given in the figure (E1, E2, E5 and E6 respectively). The router is multi-homed and it is assigned with two IP addresses. The IP addresses IP1, IP2 and IP3 belong to one IP network and the IP addresses IP4, IP5 and IP6 belong to another IP network. All IP hosts (IP1, IP2, IP5 and IP6) in the figure use the router as their default router.



- Suppose host IP1 wants to send an IP packet to host IP5.

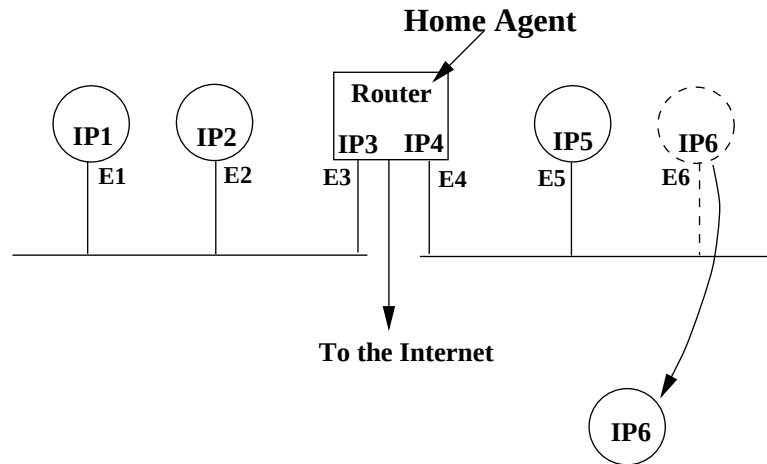
What is the destination **Ethernet** address of the Ethernet frame sent by IP1 ? (5 pts)

- The ARP cache of host IP2 is empty and host IP2 wants to send an IP message to host IP5.

What is the **IP** address in IP2's ARP request ? (5 pts)

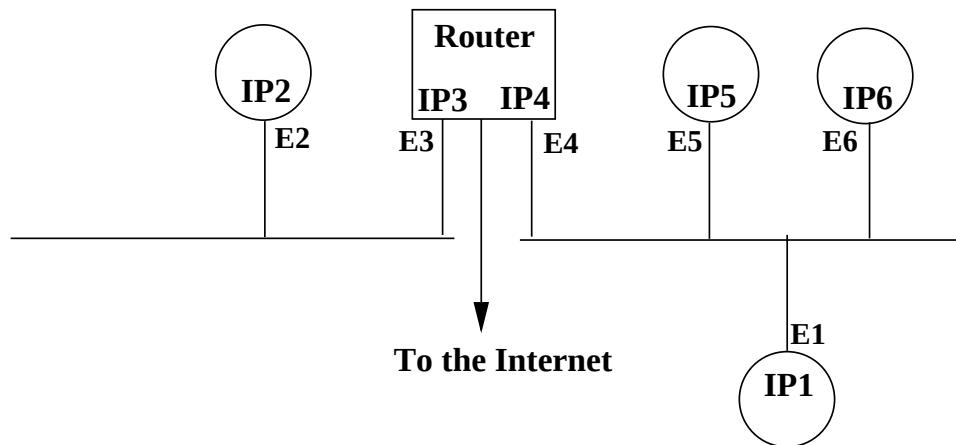
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- Suppose host IP6 is a mobile host and has moved away to another network. Host IP6 is using the router in the figure as home agent.



If host IP5 sends an ARP request for IP6, what is the value of the Ethernet address in the ARP reply message ? (5 pts)

- Suppose the network shown in the figure was in the same room and we **inadvertently** connected the network cable of the host IP1 to the **other network**, like this:



The IP addresses are unchanged.

Can the host IP1 receive messages from host IP5 ? Explain your answer to get full credit. (5 pts)

Question 4 (10 points)

Consider a network that runs the Distance Vector routing protocol. A router A has two neighbors D and E, and the following is the current content of A's routing table:

Destination	Via D	Via E
A	—	—
B	6	7
C	4	9
D	3	8
E	6	5

- What is the content of A's routing table: (4 pts)

Destination	Next
A	—
B	
C	
D	
E	

Router A then receives the following distance vector message from router D:

From	To	Distance
D	A	4
D	B	6
D	C	5
D	E	4

- Show router A's distance table after incorporating D's distance vector update: (6 pts)

Destination	Via D	Via E
A	—	—
B		
C		
D		
E		

Question 6 (10 points)

For each situation, give the reply TCP segment from the TCP protocol entity. The answers **must include**

- the sequence number.
- the acknowledgement number.
- if the TCP segment is a SYN or FIN segment, include the segment type (SYN or FIN).

Questions:

- A TCP protocol entity has only 500 bytes of to transmit and sends:
 - a 500 byte data segment with sequence number 1234 and acknowledgement number 3456

and receives

- a 100 byte data segment with sequence number 4000, with the ACK bit **set** and acknowledgement number 1734.

Reply: (4 pts)

- A TCP protocol entity has only 500 bytes of to transmit and sends:
 - a 500 byte data segment with sequence number 1234 and acknowledgement number 3456

and receives

- an FIN segment with sequence number 3456 and with the ACK bit **reset**.

Reply: (3 pts)

- A TCP protocol entity transmits:
 - a SYN segment with sequence number 1234,

and receives

- an ACK segment with sequence number 6789 and acknowledgement number 1235,

Reply: (3 pts)

Question 7 (15 points)

Consider the following network of 5 nodes (A, B, C, D and E). The content of the routing table of each node is given in the figure below:

To	Next	RPB	prune G
A	--		
B	B		
C	C		
D	D		
E	B		

A

To	Next	RPB	prune G
A	E		
B	--		
C	A		
D	E		
E	D		

B

E

To	Next	RPB	prune G
A	A		
B	D		
C	B		
D	D		
E	--		

C

D

To	Next	RPB	prune G
A	B		
B	B		
C	--		
D	A		
E	E		

To	Next	RPB	prune G
A	E		
B	B		
C	E		
D	--		
E	E		

You do not need to know the topology of the network to answer the questions below.

Question:

- Enter in the **RPT column** of every node in **the figure on the next page** the entries for the Reverse Path Broadcast forwarding entries that are used to forward broadcast packet originating from **router A** (5 pts)

NOTE: use only the **RPT column** of the figure to answer this question.

- If nodes C and E are serving members of multicast group G, enter in the **prune G column** of each node in the above figure, the values that is entered by the Distance Vector Multicast Routing Protocol to define the multicast tree for source A. (5 pts)

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- A **mobile host** is using the Foreign Agent implementation of the Mobile IP protocol. The home agent of the mobile host is router A and join mobile agent moves to the network served by router D.

How will a **broadcast message** from the mobile host forwarded using the Reverse Path Broadcast tables ?

Draw one or more arrows in the following figure to indicate the path taken by the broadcast packets from the mobile host: (5 pts)

