Hanyang University

Department of Computer Science and Engineering

Spring 2022, CSE3027 Computer Networks

Professor Suk-Bok Lee

Final Exam

One Double-Sided Crib Allowed.
Calculators Are Permitted.

NAME _____

Student ID # _____

Do all your work on these exam sheets.
(8 pages including this cover page.)

June 8, 2022

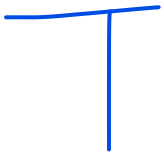
Problem	Points	Score
1	**14**	
2	**13**	
3	**16**	
4	**18**	
5	**20**	
6	**8**	
Write clearly?	**4**	
Total	**93**	

DO NOT TURN TO NEXT PAGE UNTIL YOU ARE TOLD TO DO SO!

Problem 1: True/False (2 point each)

(a) An IP router can have multiple IP addresses.

True/False



(b) Switches decrement the TTL field in the IP header.

True/False

(c) Ethernet uses hierarchical addressing.

True/False

(d) Switches have their own MAC addresses.

True/False

(e) TCP IPv6 provides a much larger address space than IPv4.

True/False

(f) IEEE 802.11 (WiFi) uses CSMA/CA as medium access protocol, which relies on link-layer acknowledgement.

True/False

(g) RTS/CTS reduces the damage from link-layer collision.

True/False

Problem 2: Longest prefix matching

An IP router has the following table, which maps classful prefixes to outgoing interfaces:

Prefix	Interface
200.10.192.0/24	3
200.10.128.0/24	1
200.10.160.0/24	2
200.10.224.0/24	3

(a) After an upgrade, the router support CIDR, so you can combine multiple entries into one and shorten some entries (fewer bits for prefix), while keeping the table equivalent (packets are forwarded to the same interface as before). Write down the equivalent forwarding table with least number of entries and shortest entries. (5 pts)

Prefix	Interface

(b) A packet with destination IP 200.10.187.11 will be forwarded to interface (3 pts)

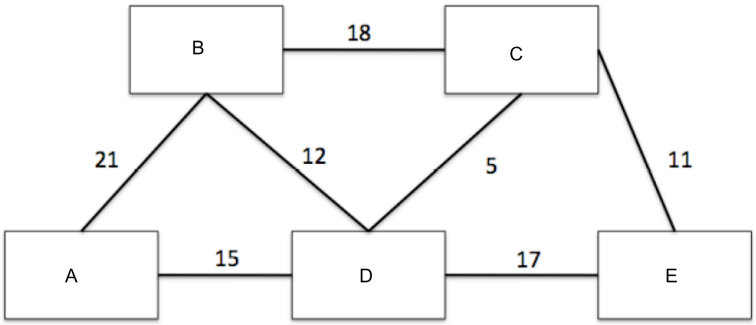
2

(c) A new entry 200.10.176.0/20 to interface 1 should be inserted into the table. Write down the new CIDR-based forwarding table. (5 pts)

Prefix	Interface

Problem 3: Distance-Vector Routing (16 pts)

Assume that a network consists of five routers as the picture below.



Write down each step of building the distance-vector routing table for node '**E**'.
The initial routing table at node **A** is:

Destination	*Cost*	*Next Hop*
B	21	B
C	∞	---
D	15	D
E	∞	---

(a) Show the initial routing table at node **E**:

Destination	*Cost*	*Next Hop*
A		
B		
C		
D		

(b) Show the routing table at node **E** after one iteration of the algorithm:

Destination	*Cost*	*Next Hop*
A		
B		
C		
D		

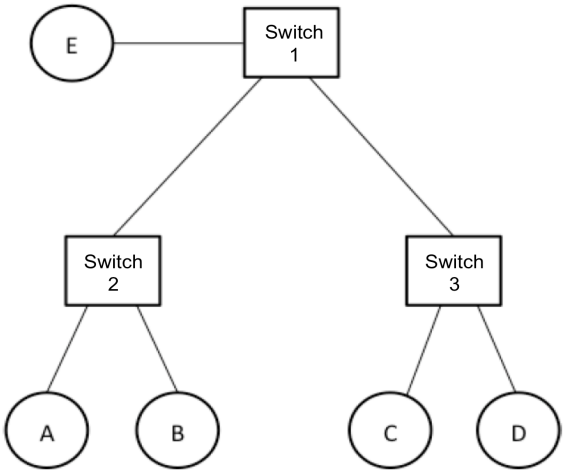
(c) Show the routing table at node **E** after two iteration of the algorithm:

Destination	*Cost*	*Next Hop*
A		
B		
C		
D		

(d) In some cases, it takes an exceptionally long time for the routing protocol to stabilize. What problem with the distance vector protocols is the cause?

Problem 4: LAN (18 pts)

Consider the network given in the figure below, where hosts A, B, C, D, and E are connected via Switches 1, 2, and 3. Initially assume that the switch tables of all switches are empty. Answer the questions below when the following events happen sequentially over time.



(a) First, A sends a packet to E.

- Which switches learn where A is? Answer: _____
- Does B's network interface see this packet? YES / NO

(b) D now sends a packet to A (after A has sent to E).

- Which switches learn where D is? Answer: _____
- Does C's network interface see this packet? YES / NO

(c) Next, E sends a packet to A (after the above two packets).

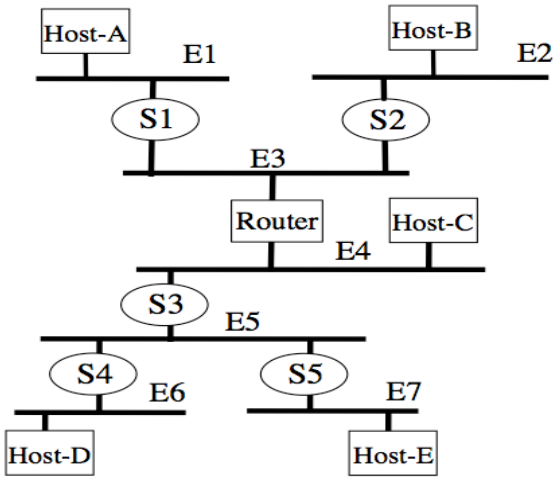
- Which switches learn where E is? Answer: _____
- Does B's network interface see this packet? YES / NO

(d) Finally, E sends a packet to B (after the above three packets).

- Which hosts' network interfaces see this packet? Answer: _____

Problem 5: Internetworking

As shown in the graph below: there are 5 hosts (Host-A~E) and one router connected by 7 Ethernets (E1~E7) and 5 switches (S1~S5).

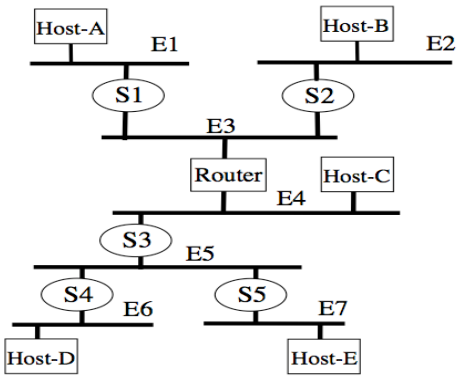


(a) Will Host-D and Host-C have the same subnet mask? Explain your answer. (3 pts)

(b) Will Host-B ever send an ARP request asking for the MAC address for Host-C? Explain your answer. (3 pts)

(c) Assume that Host-B and Host-C are accidentally assigned the same MAC address (e.g. one of them has a bad Ethernet card). Will this error affect data delivery from any other host to either Host-B or Host-C? Explain your answer. (3 pts)

Now assume that Host-C is a DNS caching resolver. Every time a host sends a request to the server, the server sends back a reply instantly. All the requests and replies are each carried in a single Ethernet frames, and all the switches have an empty forwarding table to start with. Further assume that all the IP nodes have learned the MAC addresses of the other IP nodes on the same network (thus there should be no ARP request or replies).



Now hosts A, B, D, and E each sends a request to the caching resolver in that order, with time gaps in between so that the reply to an earlier request has been received before the next request is sent.

After Host-E has sent its request and received the reply,
(d) how many times has switch S2 broadcast a data frame? Which data frames are they? (i.e. which nodes are the source and destination, respectively?) (5 pts)

(e) Answer the same questions for switch S5. (6 pts)

Problem 6: Wireless & Misc.

(a) Can a smart phone spread traffic to/from a single TCP connection over the WiFi and cellular interfaces at the same time? Why or why not? (4 pts)

(b) Suppose you have WiFi connection to access point 1 (AP1) and you are downloading a movie file from a remote FTP server via this AP1. You are walking towards new AP2. When your WiFi connection is switched to AP2, your FTP downloading session will be kept alive? or will it be broken? (Assume that AP1 and AP2 are attached to different switches S1 and S2, respectively. And S1 and S2 are attached to another switch S3, and S3 is attached to a router R1.) If you think the FTP session can be kept alive, what changes should be made on which device? and how? (4pt)