

CSE 123: Computer Networks - Spring 2019 - Homework 3
(Due 06/10 @ 10pm on Gradescope)

Name: _____ PID: _____

UCSD email: _____

For the multiple choice questions, please fill in the circle for the correct answer. For the free-response questions, please write clearly and ensure that your answer fits in the box provided.

Turn in before 06/10 at 10pm on Gradescope.

IP Routing and ARP

1. (16 points) Suppose a router has the following forwarding table, and that the contents of the router ARP cache are shown below. Describe what the router does (i.e., out of which interface does it forward the packet, and what is the destination MAC address of the outgoing frame) with a packet addressed to each of the following destinations:

- 128.8.127.4
- 128.8.128.8
- 128.96.40.11
- 192.168.1.50

Routing Table

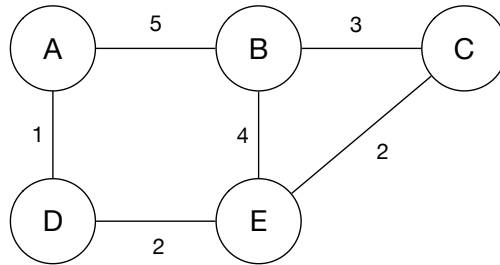
Network Name	Netmask	Next Hop
128.8.127.0	255.255.255.128	Interface 0
10.10.10.0	255.255.255.252	Interface 1
113.89.79.0	255.255.255.252	Interface 2
71.201.65.0	255.255.255.252	Interface 3
128.96.40.0	255.255.255.128	10.10.10.1
192.168.1.0	255.255.255.192	113.89.79.1
<default>	0.0.0.0	71.201.65.1

ARP Table

IP Address	MAC Address
128.8.127.4	1C-6E-97-CF-08-DF
128.96.40.151	FD-BC-EE-7A-F1-B3
192.4.153.17	BC-C8-D0-58-3F-E5
192.4.153.90	B8-EF-9C-BA-F8-B5
10.10.10.1	46-F4-93-AF-86-B1
113.89.79.1	FC-01-31-42-FC-60
71.201.65.1	34-74-FC-72-A9-2B
22.231.5.9	75-E1-9B-43-CA-69

Distance Vector

2. (20 points) Consider the network shown below, where A, B, C, D, and E are routers that run a distance-vector routing protocol. Edges indicate costs between routers.



Complete the following global distance vector routing tables when,

- (a) (5 points) Each node only knows the distances to its directly connected neighbors

Information Stored at Node	Distance to Reach Node				
	A	B	C	D	E
A					
B					
C					
D					
E					

- (b) (5 points) Each node has reported the information it had in the preceding step to its immediate neighbors

Information Stored at Node	Distance to Reach Node				
	A	B	C	D	E
A					
B					
C					
D					
E					

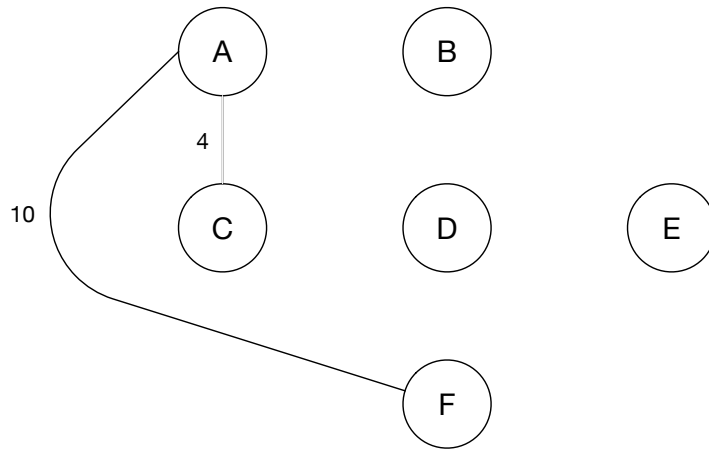
- (c) (5 points) Step (b) happens a second time

Information Stored at Node	Distance to Reach Node				
	A	B	C	D	E
A					
B					
C					
D					
E					

- (d) (5 points) Would disabling any single node in this network result in a count-to-infinity problem? If so, which node?

Link state protocol

3. (15 points) Consider the undirected graph below, where vertices are routers and edges represent a weighted direct link between two routers.



- (a) (10 points) All routers are running Link State Protocol to build their IP forwarding table. Router A is just brought up so it only knows that its distance to C is 4 and F is 10, but nothing else. Then, A receives the following Link State packets. The “Router” field is the node that creates the packet, and the “Links” field is a list of directly connected neighbors of that node, with the cost of the link to each one. Complete the diagram above based on the link state information in these packets.

Packet 1:

Router: D	Links: (B, 2); (E, 1); (C, 4)
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Packet 2:

Router: C	Links: (D, 4); (A, 4); (B, 3); (F, 5)
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Packet 3:

Router: F	Links: (C, 5); (A, 10); (E, 1)
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- (b) (5 points) If router A vaporizes, write the link state packets sent soon after (format as above).

Random Early Detection

4. (15 points) Please answer the following questions about Random Early Detection (RED).
- (a) (5 points) Why is dropping even just one packet at a RED gateway may have a significant impact on the congestion at that gateway?

- (b) (5 points) What three factors determine the probability of dropping packets at a RED gateway?

- (c) (5 points) What is the benefit of switching to using a weighted average (e.g., exponential weighting) of the queue length rather than just a simple average of the queue length?

Channels and modulation

5. (10 points) Consider a communications channel that has 20 MHz of bandwidth (this is the same bandwidth of 802.11g/a WiFi channels).

- (a) (5 points) If the SNR of the channel is 25 dB (this is considered an excellent SNR), what is the maximum channel capacity (in bits per second)?

- (b) (5 points) If the SNR is high enough that we can use a modulation scheme that has 64 levels (in fact QAM-64 is the most dense modulation scheme used in 802.11g/a WiFi channels), what is the capacity of this channel (in bits per second)?