CSE 123: Computer Networks

Homework 3 (Due 11/16 in class)

Total Points: 33

Student Name:
PID:
UCSD email:

Instructions:

Turn in a **physical copy** at the beginning of the class on 11/16.

Problems:

1. IPv6 (4 Points)

(a) Convert the IPv4 address 192.160.213.213 into a mapped IPv6 address. **(1 Point)**

::FFFF:192.160.213.213 or ::FFFF:C0A0:D5D5

(b) Write the IPv6 address F999:0011:0000:0000:BBB0:0009:0000:9000 as succinctly as possible. **(1 Point)**

F999:11::BBB0:9:0:9000

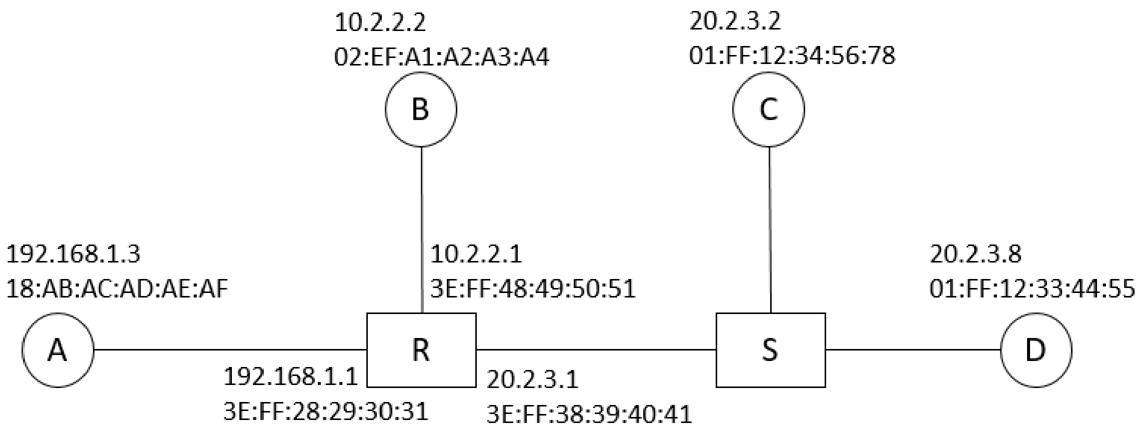
(c) Determine whether the following IPv6 address notations are correct (Circle One): **(1 Point each)**

i) 7890::ACBD::4FF1:1012:11 Correct **Incorrect**

ii) 23::5550 **Correct** Incorrect

2. Address Resolution Protocol (7 Points)

Consider the IP network shown below, where R is a router and S is a switch. A, B, C and D are hosts. IP addresses and MAC addresses of hosts and router interfaces are listed as follow.



Assume that router R has a complete and correct IP forwarding table, but its ARP cache is incomplete, as shown below. ARP cache does not have timeout. Also assume that switch S has a complete forwarding table.

ARP Cache of R

IP address	MAC address
192.168.1.3	18:AB:AC:AD:AE:AF
10.2.2.2	02:EF:A1:A2:A3:A4

a) Suppose the following Ethernet frame arrives at the router R (Only a subset of the frame is shown). Since the ARP cache of R is incomplete, R has to send ARP requests to get the destination MAC address before forwarding the frame. Which host(s) will receive this ARP request? **(1 Point; No partial credit)**

Ethernet Src	Ethernet Dst	IP Src	IP Dst	Payload
18:AB:AC:AD:AE:AF	3E:FF:28:29:30:31	192.168.1.3	20.2.3.2	…

Host C and D

b) Which host(s) will send an ARP reply corresponding to the ARP request in part a)? **(1 Point; No partial credit)**

Host C

c) After the above steps are complete, what will the following fields of the frame contain as it leaves R? **(4 Point; 1 Point each)**

Ethernet Src	Ethernet Dst	IP Src	IP Dst	Payload
3E:FF:38:39:40:41	01:FF:12:34:56:78	192.168.1.3	20.2.3.2	…

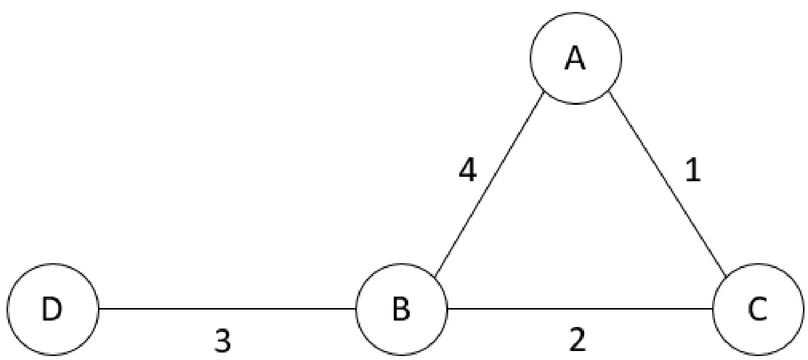
d) After the above steps are complete, another Ethernet frame arrives at the router R as shown below (Only a subset of the frame is shown). Should R send another ARP request, before forwarding this frame? Circle One. **(1 Point)**

Ethernet Src	Ethernet Dst	IP Src	IP Dst	Payload
02:EF:A1:A2:A3:A4	3E:FF:48:49:50:51	10.2.2.2	20.2.3.2	…

Yes ***No***

3. Distance Vector (8 Points)

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



a. Complete the following global distance vector tables when,

i) Each node only knows the distances to its directly connected neighbors. **(2 Points; -1 point for each incorrect value)**

Information Stored at Node	Distance to Reach Node			
	A	B	C	D
A	0	4	1	Infinite
B	4	0	2	3
C	1	2	0	Infinite
D	Infinite	3	Infinite	0

ii) Each node has reported the information it had in the preceding step to its immediate neighbors **(2 Points; -1 point for each incorrect value)**

Information Stored at Node	Distance to Reach Node			
	A	B	C	D
A	0	3	1	7
B	3	0	2	3
C	1	2	0	5
D	7	3	5	0

iii) Step (ii) happens a second time **(2 Points; -1 point for each incorrect value)**

Information Stored at Node	Distance to Reach Node			
	A	B	C	D
A	0	3	1	6
B	3	0	2	3
C	1	2	0	5
D	6	3	5	0

b. Suppose no mitigation strategies are applied, would count-to-infinite problem happens when, **(1 Point each)**

i) The link between B and D failed (Circle One).

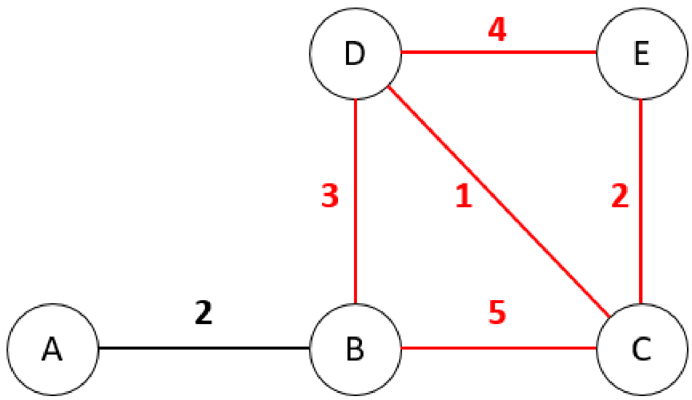
Yes *No*

ii) Instead of i), the link between A and C failed (Circle One).

Yes ***No***

4. Link State Protocol (8 Points)

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



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 B is 2, but nothing else. Then, A receives the following Link State packets. The ID 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.

Packet 1:

ID: D	Links: [B, 3]; [E, 4]; [C, 1]

Packet 2:

ID: C	Links: [B, 5]; [D, 1]; [E, 2]

Packet 3:

ID: E	Links: [C, 2]; [D, 4]

Packet 4:

ID: B	Links: [C, 5]; [D, 3]; [A, 2]

a) Complete the above graph by adding weighted edges. **(3 Points; -1 point for each missing or incorrect edge)**

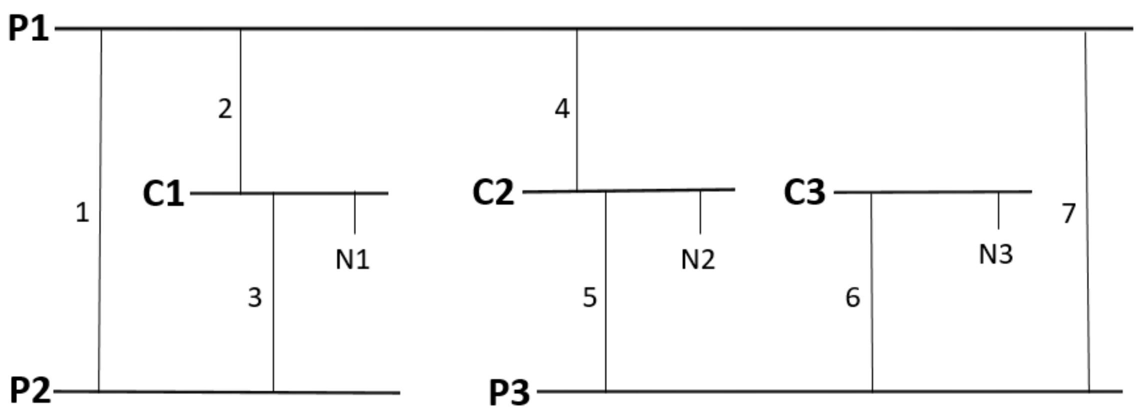
As shown above.

b) Referring to Table 3.14 of the Textbook (Page 258), Fill the routing table of Node A below. (There may or may not be 10 steps)
(5 Points; -1 point for each wrong value in the last step; -1 point for each wrong step other than the last step)

Step	Confirmed	Tentative
1	(A, 0, -)	
2	(A, 0, -)	(B, 2, B)
3	(A, 0, -); (B, 2, B)	
4	(A, 0, -); (B, 2, B)	(D, 5, B); (C, 7, B)
5	(A, 0, -); (B, 2, B); (D, 5, B)	(C, 7, B)
6	(A, 0, -); (B, 2, B); (D, 5, B)	(C, 6, B); (E, 9, B)
7	(A, 0, -); (B, 2, B); (D, 5, B); (C, 6, B)	(E, 9, B)
8	(A, 0, -); (B, 2, B); (D, 5, B); (C, 6, B)	(E, 8, B)
9	(A, 0, -); (B, 2, B); (D, 5, B); (C, 6, B); (E, 8, B)	
10		

5. BGP routing (6 Points)

Consider the network shown below, in which horizontal lines represent providers (P1, P2 and P3) or customers (C1, C2 and C3), and numbered vertical lines are links among providers and customers. N1, N2, and N3 are networks connected to customer C1, C2 and C3, respectively. Assume that the standard BGP route-selection policy is applied. A route can be represented as a comma separated path from one provider/customer to another. For example, the route from N2 to N3 through P3 can be written as <C2, P3, C3>.



a. List all valid routes that C1 knows to get to N2. Write N/A if there are none. **(2 Points; -1 point for each missing or wrong path)**

<C1, P1, C2>; <C1, P2, P1, C2>; <C1, P1, P3, C2>

b. List all valid routes that P2 knows to get to N3. Write N/A if there are none. **(1 Point)**

N/A

c. List all valid routes that C3 knows to get to N1. Write N/A if there are none. **(1 Point; No partial credit)**

<C3, P3, P1, C1>

d. Suppose at some point link 7 failed, which provider(s)/customer(s) would receive a corresponding update message from P1? **(2 Points; -1 point for each missing or wrong answer)**

C1 and C2.