CS3543: Computer Networks II **Name:**
Quiz 2 **Roll No:**
Time Limit: 40 Minutes **Date: 08/02/2018**

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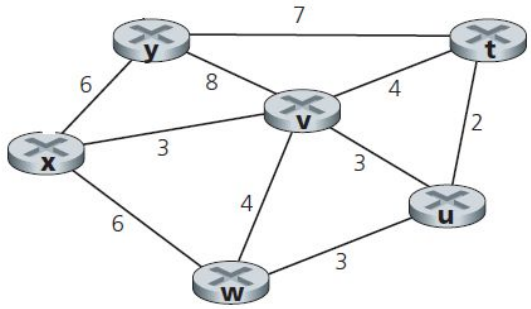
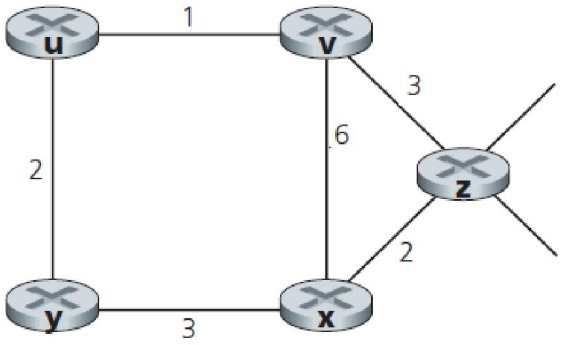
1. (5 Points) Consider a network as given below. With the indicated link costs, using Dijkstra's shortest-path algorithm, compute the shortest path from x to all the nodes in the network. Show the working of the algorithm by showing the computed link cost to each node in a Table (step-by-step).



Step	N'	D(v), p(v)	D(w), p(w)	D(y), p(y)	D(u), p(u)	D(t), p(t)
0	x	3, x	6, x	6, x	Inf.	Inf.
1	xv	3, x	6, x	6, x	6, v	7, v
2	xvu	3, x	6, x	6, x	6, v	7, v
3	xvuw	3, x	6, x	6, x	6, v	7, v
4	xvuwt	3, x	6, x	6, x	6, v	7, v
5	xvuwty	3, x	6, x	6, x	6, v	7, v

2. (5 Points) Consider the network shown below and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node z (Step-by-Step).



Ans:

Distance Table of Z:

	Cost To					
Cost From		**u**	**v**	**x**	**y**	**z**
	v	∞	∞	∞	∞	∞
	x	∞	∞	∞	∞	∞
	z	∞	3	2	∞	0

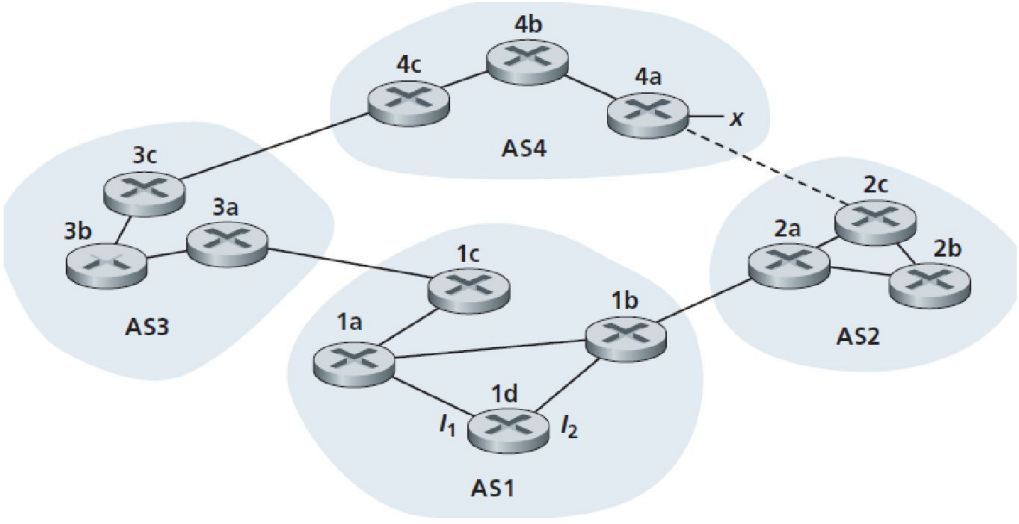
	Cost To					
Cost From		**u**	**v**	**x**	**y**	**z**
	v	1	0	6	∞	3
	x	∞	6	0	3	2
	z	4	3	2	5	0

	Cost To					
Cost From		**u**	**v**	**x**	**y**	**z**
	v	1	0	5	3	3
	x	5	5	0	3	2
	z	4	3	2	5	0

3. (1 Point) Describe how loops in paths can be detected in BGP.

   Ans: BGP comprises of a built in loop detection via the AS-PATH attribute. The router can detect the loop if an AS appears multiple times. Additionally, if AS path information is available from an AS to a destination in BGP loop detection would be possible when a BGP peer receives a route that contains its own AS number in the path. Then that would result in a loop.

4. (2 Points) Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4.



a. Router 3c learns about prefix x from which routing protocol: OSPF, RIP, eBGP, or iBGP?

Ans: eBGP

b. Router 3a learns about x from which routing protocol?

Ans: iBGP

c. Router 1b learns about x from which routing protocol?

Ans: iBGP

d. Router 2a learns about x from which routing protocol?

Ans: eBGP

5. (3 Points) Referring to the diagram given in the previous problem, once router 1d learns about x it will put an entry (x, I) in its forwarding table.

a. Will I be equal to I1 or I2 for this entry? Explain why in one sentence.

Ans: I_1 because this interface begins the least cost path from 1d towards the gateway router 1c.

b. Now suppose that there is a physical link between AS2 and AS4, shown by the dotted line. Suppose router 1d learns that x is accessible via AS2 as well as via AS3. Will I be set to I1 or I2? Explain why in one sentence.

Ans: I_2. Both routes have equal AS-PATH length but I_2 begins the path that has the closest NEXT-HOP router.

c. Now suppose there is another AS, called AS5, which lies on the path between AS2 and AS4 (not shown in diagram). Suppose router 1d learns that x is accessible via AS2 AS5 AS4 as well as via AS3 AS4. Will I be set to I1 or I2? Explain why in one sentence.

Ans: I_1. I_1 begins the path that has the shortest AS-PATH.

6. (2 Points) How does BGP use the NEXT-HOP attribute? How does it use the AS-PATH attribute?

   Ans: The BGP next-hop attribute is the IP address that is used to reach the advertising router. For EBGP peers, the next-hop address is the IP address of the connection between the peers.

   When a route advertisement passes through an autonomous system, the AS number is added to an ordered list of AS numbers that the route advertisement has traversed.

7. (1 Points) What are the common header fields in IPv4 and IPv6?

   Ans: Version, Destination IP address, Source IP address.

8. (1 Point) What happens when an IPv6 router receives an IPv6 datagram that is larger than the MTU size of the link in which the packet must be forwarded?

   Ans: First the intermediate node must drop the packet. An IPv6 router cannot fragment an IPv6 packet, so if the packet is too large for the next hop the router is required to generate an ICMP6 Type 2 packet, addressed to the source of the packet with a Packet Too Big (PTB) code, and also providing the MTU size of the next hop. While an IPv6 router cannot perform packet fragmentation, the IPv6 sender may fragment an IPv6 packet at the source.