HW6

P3.

N’	D(T),p(T)	D(U),p(U)	D(V),p(V)	D(W),p(W)	D(Y),p(Y)	D(Z),p(Z)
X	∞	∞	3,X	6,X	6,X	8,X
XV	7,V	6,V	3,X	6,X	6,X	8,X
XVU	7,V	6,V	3,X	6,X	6,X	8,X
XVUW	7,V	6,V	3,X	6,X	6,X	8,X
XVUWY	7,V	6,V	3,X	6,X	6,X	8,X
XVUWYT	7,V	6,V	3,X	6,X	6,X	8,X
XVUWYTZ	7,V	6,V	3,X	6,X	6,X	8,X

Z: 8

Y: 6

T: 7

V: 3

U: 6

W: 6

P5.

	u	v	x	y	z
v					
x					
z		6	2		

	u	v	x	y	z
v	1	0	3		6
x		3	0	3	2
z		6	2		

	u	v	x	y	z
v	1	0	3	3	6
x	4	3	0	3	2
z	6	5	2	5	0

P6.

On each iteration the nodes will exchange the information on their tables with their neighbors. This means that when we perform the first iteration all the neighbors of the node would have the shortest path cost to the node. If we consider the networks diameter (d), we will have to perform d-1 iterations for all nodes to have knowledge about the shortest path costs. If there are loops, the algorithm will still converge in at most d-1 iterations.

P11

a) Router Z:
- Informs w, Dz(x) = ∞
- Informs y, Dz(x) = 6

Router W:

- Informs y, Dw(x) = ∞
- Informs z, Dw(x) = 5

Router Y:

- Informs w, Dy(x) = 4
- Informs z, Dy(x) = 4

b) Yes, there will be a count to infinity problem, the problem can be seen from the order of updates: Y->W->Z->Y->W->Z->Y->....

Time	T0	T1	T2	T3	T4
Z	W, Dz(x) = ∞ Y, Dz(x) = 6		No change	W, Dz(x) = ∞ Y, Dz(x) = 11	
X	Y, Dw(x) = ∞ Z, Dw(x) = 5		Y, Dw(x) = ∞ Z, Dw(x) = 10		No change
y	W, Dy(x) = 4 Z, Dy(x) = 4	W, Dy(x) = 9 Z, Dy(x) = ∞		No change	W, Dy(x) = 14 Z, Dy(x) = ∞

T27, z detects that its least cost to x is 50, via its direct link with x

At T29, w learns its least cost to x is 51 via z

At t30, y updates its least cost to x to be 52(via w)

Finally, to stabilize the routing, it will take 31 iterations

c) We will need to cut the y-z link.

P14

a) eBGP

b) iBGP

c) eBGP

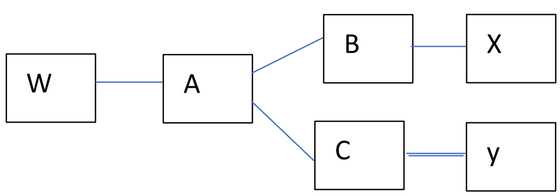
d) iBGP

P15

a) The value of I will be equal to I1. The interface begins with the least-cost path from 1d towards the gateway router 1c. Since I1 has 2 hops from router 1d to router 1c, and I2 has 3 hops from router 1d to router 1c
b) I will be set to I2,router 1d learns about x from router 1b via AS2 through I2, and learns x from router 1a via AS3 through I1, both paths have 2 hops, but I2 path has the closest next-hop router. The packet is thus forwarded using next-hop Ip address.
c) I will set to I1, since router 1d learns about x from router 1b via AS2, and then via AS5 and finally reaches AS4 to know the value of x using the path I2. Thus, it needs to maintain a communication with two intermediates Ass. Yet, the other alternative is that router 1d learns about x from router1c via AS3 and AS4 through I1. There is only one intermediate AS. I1 begins the shortest AS path than it takes place through the path I2.

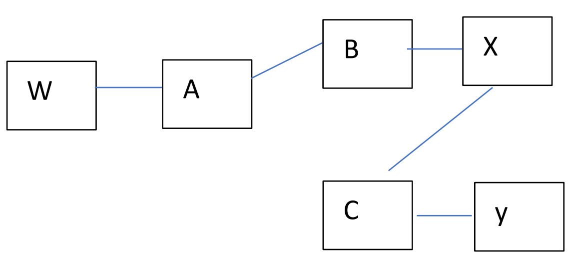
P17

sub net W's view:



- The sub network contains a single path to AS A, then next AS A forward's packets to intermediated B and C, thus W receives the links AC, AB respectively.

X's view of the topology:



No connection between A and C, X has no knowledge of the link AC. Thus the destination path has no data about the paths AS A and AS C.

Chapter 6

P10

a)

Node A's average throughput = pA(1 – pB)
Total efficiency = pA(1-pB) + pB(1-pA)

b)

A's throughput = pA(1-pB) = 2pB(1-pB) = 2pB – 2(pB)^2

B's throughput = pB(1-pA) = 2pB(1-pB) = 2pB-2(pB)^2

We can see that A throughput is not as twice as B throughput

To make it pA(1-pB) = 2pB(1-pA) then we need that pA = 2-(pA/pB)

c)

Avg throughput of node A = 2p(1-p)N-1

Throughput of any other node = p(1-p)N-2(1-2p)

P15

a) No, E can check the subnet prefix of host F IP address to then learn F is on the same LAN. Therefore, E will not send the packet to the default router R1.
   Ethernet frame from E to F: Source IP = E's IP address, destination IP = F's IP address, source MAC = E's MAC address, Destination MAC = F's MAC address.
b) No, they are not on the same LAN. E can prove this by checking B's IP address. Ethernet frame from E to R1: Source IP = E's IP address, Destination IP = B's IP address, Source MAC = E's MAC address. Destination MAC = MAC address of R1's interface connecting to subnet 3.
c) Switch S1 will broadcast the Ethernet frame via both its interfaces as the received ARP frame's destination address is a broadcast address. It will learn that A resides on subnet 1 which is connected to s1 at the interface connecting subnet 1. S1 will then update its forwarding table to include an entry host A.
   Yes, router R1 also receives this ARP request message, but R1 wont forward the message to subnet 3.
   B doesn't need to send ARP query message asking for A's MAC address, as this address is available from A's query message.
   Now, when switch S1 receives B's message, it will add an entry for host B in its forwarding table, then drop the received frame as destination host A is on the same interface as host B.

P16

a) No. E can check the subnet prefix of host F's IP address, and then learn that F is on the same LAN segment. Thus, E will not send the packet to S2. Ethernet frame E to F: Source IP = E's IP address, Destination IP = F's IP address, Source MAC = E's MAC address, Destination MAC = F's MAC address.

b) Yes, because E would like to find B's MAC address. E will send an ARP query packet with destination MAC address being the broadcast address. Switch 1 will rebroadcast the query packet until received by host B.
   Ethernet frame E to S2: Source IP = E's IP address, Destination IP = B's IP address, Source MAC = E's MAC address, Destination MAC = broadcast MAC address: FF-FF-FF-FF-FF-FF

c) Switch S1 will broadcast the Ethernet frame via both its interfaces as the received ARP frame's destination address is a broadcast address. It will learn that A resides on subnet 1 which is connected to s1 at the interface connecting subnet 1. S1 will then update its forwarding table to include an entry host A.
   Yes, router S2 also receives this ARP request message, and S2 will broadcast this query packet to all its interfaces. B wont sent ARP query message asking for A's MAC address, as this address can be obtained from A's query message.
   Once switch S1 receives B's response message, the entry of host B will be added to its forwarding table, then it will drop the received frames as destination host A is on the same interface as host B.

P19

Given data:

Rate of broadcast channel: 10Mbps

Propagation delay between two nodes = 245 bit times

Node A and node B detect collision at time t = 345 bit times

Node A and Node B choses random values Ka = 0and Kb = 1

Node B retransmission:

- Node A and node B detect the collision at t = 245 bit times. Now both nodes stops the transmission and issues a jam signal for 48 bit times.
- Jam signal ends: t = 245 + 48 = 293 bit times
- B selects random value Kb = 1, Kb x 512 = 1 x 512 = 512 bit times. Thus t = 293 + 512 = 805
- Before transmitting frame, node b must sense channel for 96 bit times, then node b schedules its retransmission at t = 805 + 96 = 901

Node A starting transmission:

- Node A selects random value ka = 0, k x 512 = 0
- Node A must sense the channel 95 bit times. But the channel is still busy since the node B already sent 245 bits into ethernet.
- The last node B gets to node A at t=245+48+245=538 bit times
- When t = 538 bit times, node A senses the channel for 96 bit times and detects an idle channel at t = 538 + 96 = 634 and starts sending the frame
- Node A begins transmission at t = 634

The propagation delay from node A to node B is 245 bit times

The signal from node A reaches node B at time t = 634 + 245 = 879 bit times

Node A signal reaches node B at time t = 879 bit times

Since 879 < 901 node B detects the signals sent by node A at t=879

Now, since node B receives a signal sent by node A before its scheduled retransmission time, node B refrains from transmitting until node A finished its transmission.

Thus, we can say that the transmission from node A and node B do not collide with each other. 512 bit times is sufficiently large

P31

The computer uses DHCP to obtain an IP address, then the computer will create a special IP datagram destined to 255.255.255.255 in the DHCP server. Then we will put this in a ethernet frame and broadcast it in the ethernet. The computer will now be able to get an IP address with a given lease time.

The DHCP server on the ethernet gives the computer a list of IP addresses of first hop routers.

The computer will use ARP protocol to get the MAC addresses of the first hop router and the local DNS server.

The computer will get the IP address of the web page. It will use DNS protocol to find the IP address off the web page. Then it will send an HTTP request via the first hop router if the web page does not reside in the local web server.

The HTTP will be segment into TCP packers, and then into IP packets, and finally into ethernet frames. These frames will be sent to the first hop router. When the router receives the frames, it will pass them to the IP layer, check the routing table, and sends the packets to the right interface out of all its interfaces.

The IP packets will be routed through the internet until they reach the web server.

Finally, the server hosting the web site will send back the web page to the computer via HTTP response messages, the messages will be encapsulated into TCP packets and then further into IP packets. Those IP packets follow IP routes and finally reach your first hop router, then the router will forward the IP packets to the computer by encapsulating them into ethernet frames.