Computer Networks - 6

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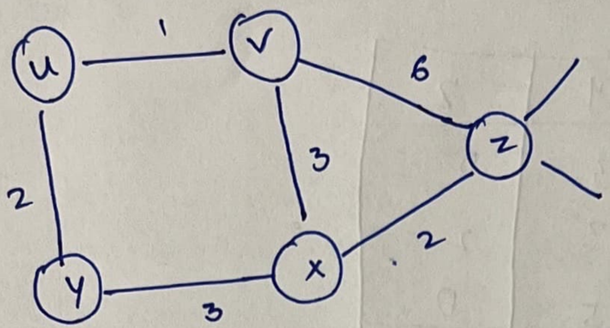
② Ch5 - P5 :-



Sol:- Using Distance-Vector Algorithm / Bellman for Algorithm

→ Distance table values for the Nod Z as below.

- Start at 'Z'
- Compute neighbour dist. {unreachable → ∞}
- update distances, if reachable
- Continue for all node

Cost to

from		u	v	x	y	z
v		∞	∞	∞	∞	∞
x		∞	∞	∞	∞	∞
z		6	2	∞	∞	0

Cost to

from	u	v	x	y	z
v	1	0	3	∞	6
x	∞	3	0	3	2
z	7	5	2	5	0

Cost to

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

cost to

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

#

=x =x =

③ Ch5 - P6 :-

- Revisiting the question along with few pre-conceived ideas a
① when we process through the algorithm; considering that nodes do only have info related to the cost that is incurred for their nearest neighbours. to travel.
③ A parallel computation of the algorithm to evaluate the distance fore their nearest neighbours simultaneously

- with these ideas in mind and forevery iteration, the node tries to find the shortest path with cost which is at a distance of 1/2 hops from it. That means, for the first iteration we get to know the shortest path from the neighbouring nodes of the next node to the current node when the neighbouring node reveals it's distance to the current node.

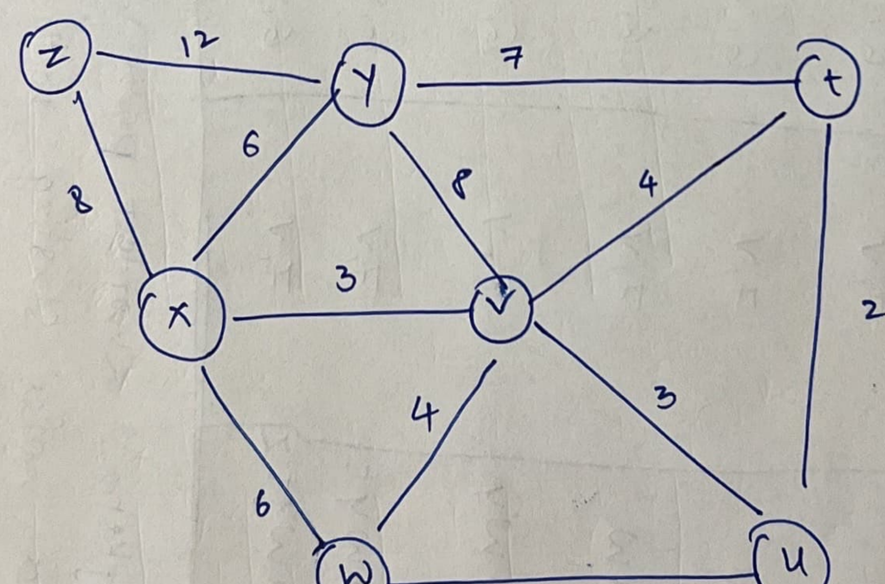
with knowledge from the above discussion, we can have atmost "(d-1)" iterations before the it starts to converge and makes loops. Reasoning for this would be as follows

Consider the two nodes are 'd' distance (max) apart or d hops apart and with the discussed algorithm is triggered for (d-1) times to produces the nodes to find out the shortest path that cost less than d or less hops than d and when triggered for more would eventually produce the loops as it would lead to a distance ≥ d and will have created loops to meet the criteria.

Thus in conclusion, with the above reasoning atmost (d-1) iterations for convergence.

(1) Ch5 - P3 :-

Given network.



Conventions :-

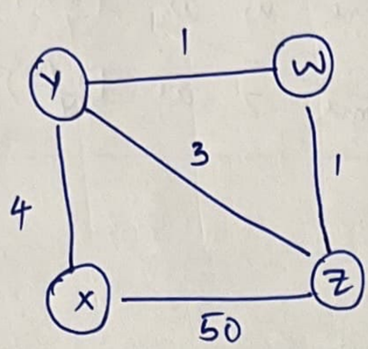
$D(k) \Rightarrow$ shortest distance from $x \rightarrow k$

$P(k) \Rightarrow$ Parent of k to reach x.

Step	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)
0	x	∞, ∞	∞, ∞	3, x	6, x	6, x	8, x
1	xv	7, v	6, v	3, x	6, x	6, x	8, x
2	xvu	7, v	6, v	3, x	6, x	6, x	8, x
3	xvuw	7, v	6, v	3, x	6, x	6, x	8, x
4	xvuwy	7, v	6, v	3, x	6, x	6, x	8, x
5	xvuwyt	7, v	6, v	3, x	6, x	6, x	8, x
6	xvuwytz	7, v	6, v	3, x	6, x	6, x	8, x.

- Using Dijkstra's shortest path Algorithm to determining shortest path from 'x'
- Travel other nodes starting with x
- not reachable $\rightarrow \infty$
- accessable $\rightarrow$ update the distance.

4. Ch 5 – P11 :- *) The new network looks like



Sol:- from given network

$c(x,y) = 4$ | $c(y,w) = 1$ | $c(w,z) = 1$.

$c(x,z) = 50$ | $c(y,z) = 3$ |

a) with the distance-vector of routing algorithm, below table is evaluated.

	Informs R→C {column}.		
Router(R)	w	y	z
z	$D_z(x)=\infty$	$D_z(x)=6$	–
w	–	$D_w(x)=\infty$	$D_w(x)=5$
y	$D_y(x)=4$	–	$D_y(x)=4$.

b). when we have the cost for the link that has to be from x & y increased to 60; we may encounter cost-to-infinity issue.

For Router z:- $\boxed{(\text{At } t_0)}$.

- Informs w as $D_z(x)=\infty$
- Informs y as $D_z(x)=6$.

At t[illegible] :-

- produces same results as t_0.

At t_3 :-

- Informs w with $D_z(x) = \infty$
- Informs y with $D_z(x) = 11$.

⇒ Similarly for Router w. gives

	t_0	t_1	t_2	t_3	t_4
Router w	• to y with $D_w(x)=\infty$ • to z with $D_w(x)=5$		• to y with $D_w(x)=\infty$ • to z with $D_w(x)=10$		No change

→ for Router Y.

	t_0	t_1	t_3	t_4
Router Y	• to w with $D_y(x)=4$ • to z with $D_y(x)=4$	• to w with $D_y(x)=9$ • to z with $D_y(x)=\infty$	No change	• to w with $D_y(x)=$[illegible] • to z with $D_y(x)=$[illegible]

*) The routers happens to have follow a pattern in the computation of costs and thus extending the same till t_{31} produces the below results.

Router	t_{27}	t_{28}	t_{29}		t_{31}
z	• w; with $D_z(x)=50$ • y; with $D_z(x)=50$				via $w \Rightarrow \infty$ $y \Rightarrow 55$ $z \Rightarrow 50$
w	•	• y; with $D_w(x)=\infty$ • z; with $D_w(x)=50$	• y; with $D_w(x)=51$ • z; with $D_w(x)=\infty$		via $w \Rightarrow \infty$ $y \Rightarrow \infty$ $z \Rightarrow 51$
y		• w; with $D_y(x)=53$ • z; with $D_y(x)=\infty$		• w; with $D_y(x)=\infty$ • z; with $D_y(x)=52$	via $w \Rightarrow 52$ $y \Rightarrow 60$ $z \Rightarrow 53$

c) In order to attain the situation where there is no count-to-infinity issue, we have to break the linkage between the routers y and z and $c(y,x)$ ultimately changes from 4 to 60.

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(5) Ch5 – P14:-

a). Using eBGP routing protocol; Router 3c knows about the prefix.

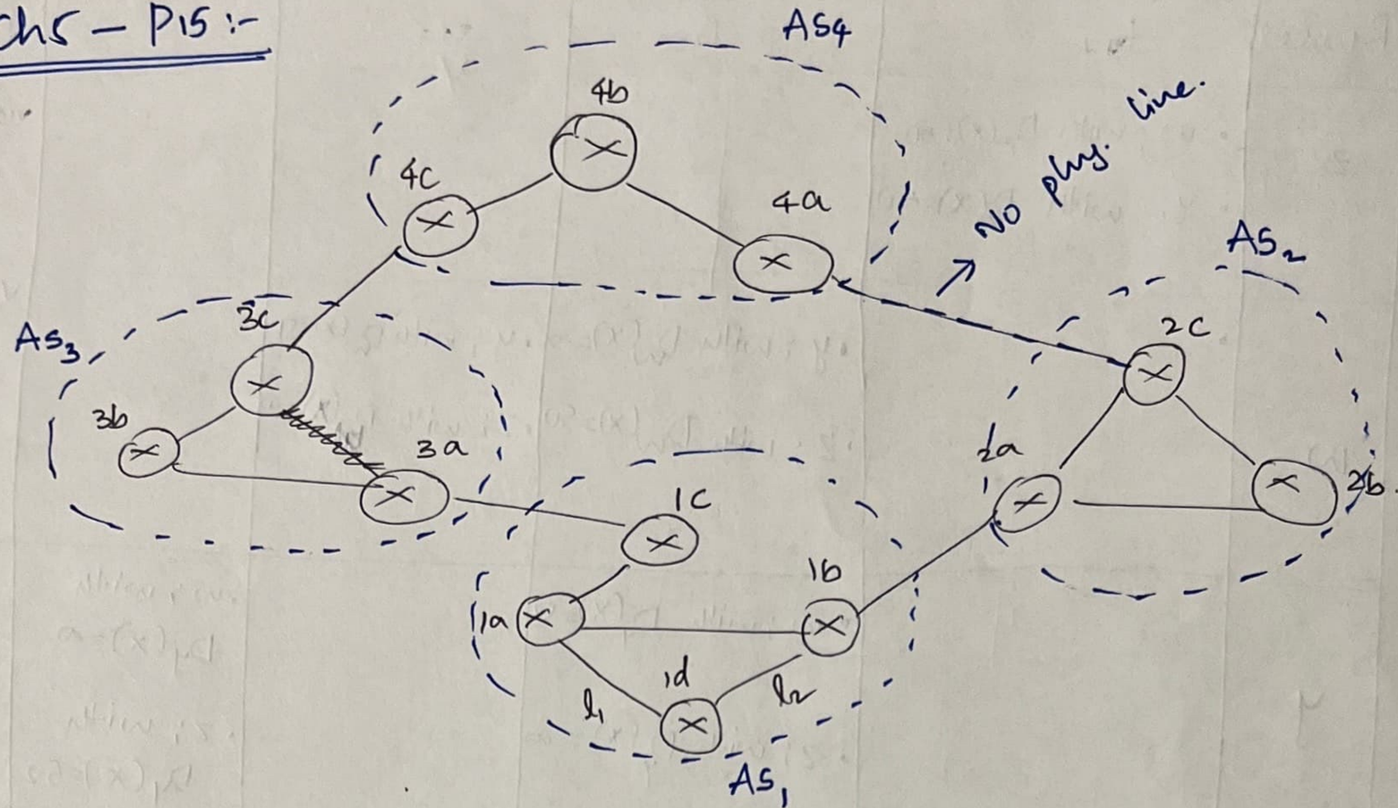
b). R_{3a} knowns regarding X with iBGP routing protocol

c) R_{1c} knowns regarding X with eBGP routing protocol

d) R_{1d} knowns regarding X from the iBGP routing protocol

⑥ Ch5 – P15 :-

a)..



a). In AS1; we see that 1c is connect to othe networks as AS_3 and the shortest path to it is through l_1 than l_2

b). If we can communicate x to AS_2 and AS_3 thus it is possible with 1c for AS_3 and 1b for AS_2 and 1d is close enough to 1b than 1c hence, the shortest path would be l_2.

c). If AS_4 is introduced between the networks and thus l_1 becomes the shortest path.

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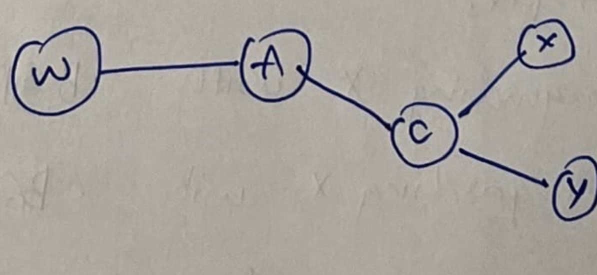
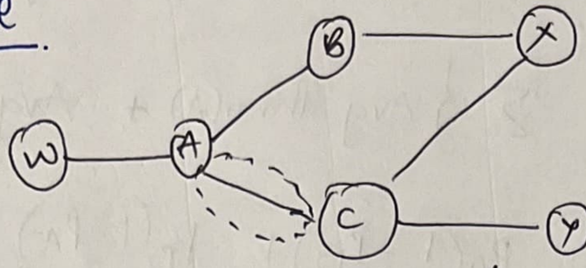
⑦ Ch7 – P17 :-

• Stub Networks from Y's view.

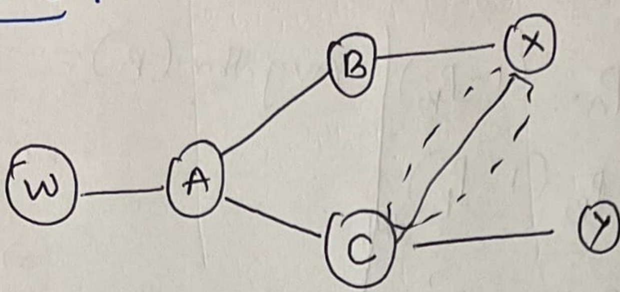


X's perspective.



• Not enough info between A and C, thus for way from to Y or W we consid B node to utilize the network.

W's perspective :-



• Not an connection from C to X from it's perspective and inorder to communicate to X the network has to create a new node B.

(8) Ch6 – P10:-

• Using ALOHA protocol
• $P_A > P_B$ {$P_x \Rightarrow$ x's transmission probability }.

a): Avg. throughput ; Total Efficiency ?

a) Average throughput between A & B $\Rightarrow \prod$ probabilities {A} & {Complimentary for B}

$$\Rightarrow P(A) \cdot (1 - P(B))$$

Avg. Thro. $\Rightarrow P(A) \cdot (1 - P(B))$ #

* Total Efficiency is the Summation of Avg. thr. (A, B).

Total Efficiency $\Rightarrow \Sigma \{ \text{Avg. Thro}(A) + \text{Avg. Thr}(B) \}$.

Total Eff. $\Rightarrow P_A(1-P_B) + P_B(1-P_A)$ #.

b). *) $P_A = 2P_B$.

Calculating Avg throughputs gives.

Avg. Thr (A) $= P_A \cdot (1-P_B)$
$\Rightarrow 2P_B(1-P_B)$ #.
$\Rightarrow 2P_B - 2P_B^2$

Avg. Thr (B) $= P_B(1-P_A)$
$\Rightarrow P_B(1-2P_B)$ #
$\Rightarrow P_B - 2P_B^2$

*) The above throughputs are not twice as Given in the question and inorder to make them equal. we need

$$P_A(1-P_B) = 2P_B(1-P_A)$$

$$P_A - P_AP_B = 2P_B - 2P_AP_B$$

$$P_AP_B = 2P_B - P_A$$

$$\left\{ P_A = 2 - \frac{P_A}{P_B} \right\} \#$$

In order to Satisfy the Condition we need $P_A = 2 - P_A/P_B$ #

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c). • $P_A = 2P$
• other nodes $P_x = P$ $\{x \neq A\}$.
• Average throughput ⇒ ?

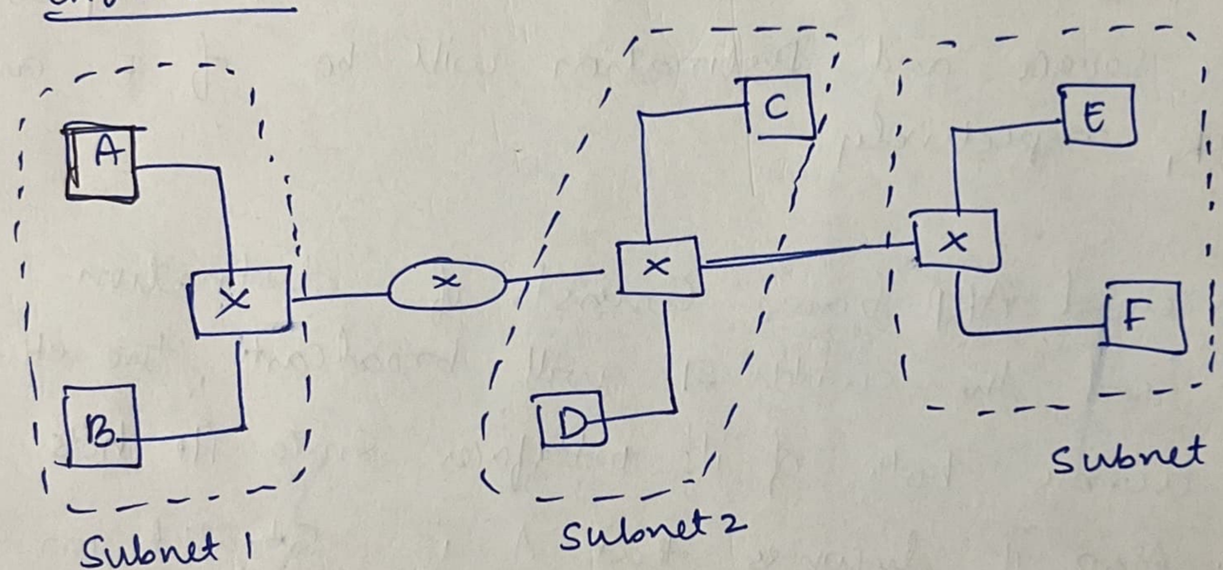
Average throughput (A) ⇒ $P_A (1-P_B) + (1-P_C)$ ---- N-1 nodes

• $P_A \Rightarrow 2p(1-p)N-1$

other Nodes ⇒ $p(1-p)N-2(1-2p)$ #.

⟹ ======== x ========

9 Ch6 – P15 :-



a) E → F

* In order to communicate datagram between E & F; E and F
share the same subnet and thus have same IP prefix. not require any
other external router, and thus
• checks for the prefix and IP of F and the sends
the packet to F without the need of default Router!

Ethernet frame E → F :

1. Source IP address, Destination IP address will be

of the node E and F respectively.

2. Mac Address of source and destination will also be same ~~for~~ as above and will be for E & F respectively

b). E → B.

1. Ip prefixes are not same; since not from the same subnet.

2. So, further request for ARP query to obtains B's mac address; and base on these ideas we can find
~~1.~~ Ip Source and Destination will be as E and B respectively
3. Mac for source and Destination will be of E and that of R_1 respectively.

c). The received ARP frame consists of destination address and the switch S1 will broadcast the ethernet packet across both of it's interfaces since it has it's address. Also, it discovers that A is situated on subnet 1 and is linked to S1 by the interface between Subnet1 and S1, and S1 will make an update to add space for Host A.

→ Yes, ARP request message will be received by Router R and thus it will not do any sort of forwarding to the subnet 3. Also; and B doesn't post any ARP query to A asking for Mac Address because the necessary information is put on the forwarding table and will be found in the Query message for A.

→ whenever Switch S1 Receives B's response message,
it will create an entry for the forwarding table for the Host B upon that it deletes the received frame as target A will be on the same interface as that of the Host B.

(10) Ch 6 – P16:-

from the above problem Router (R₁) got replaced with a separate Switch S_2.

a). No; IP datagram from E doesnot sent it to S_2 for forwarding it to Host F; because a check happens initially with E for IP prefix for the Host F and as they are in the same network (subnet) and it finds a match.

Ethernet frame:-

	Source	Destination
IP Address	E Ip Address	F
MAC Address	E	F

b). Yes, an ARP is performed by E to find Mac Address for B and the broadcast is performed to the Query packet with the help of switch 1.

Ethernet frame:-

	Source	Destination
~~Source~~ Ip Address	E	B
MAC Address	E	FF:FF:FF:FF :FF :FF

C). Since the received ARP has a broadcast with a destination address and S1 will perform the broadcast-ing the received Ethernet packet frame all across it's available Interfaces and identifies that 'A' is on Subnet1 and is linked to S1 with an interface that is connected to subnet1 and S1 with make changes to the forwarding table and includes an entry of A

→ Yes; when the router S2 receives the ARP request message and it will broadcast it to all of it's Interfaces, and B will not perform/send the ARP query message to enquire Mac address for A as it can find it as it is on the same Subnet.

d) Since the destination host A is located on the same interface ~~and~~ when switch S1 receives the response from B; it performs an addition of the request to the forwarding table and the removes the frame that it have received.

(11) Ch6 – P19:-

(8)

- Propagation delay b/w (2 nodes) ⇒ 245 bit times
- $K_A = 0$; $K_B = 1$
- Broad cast Channel ⇒ 10 Mbps.

*) Starting with t=0 for A & B.

t=0 — **A & B Start**

↓ 245 times

t=0+245, t ⇒ 245 # — **Collision detected**

{ • Trans. is halted.
• Jam is issued. (48 bit times). }

↓ Jam (48)

t = 245 + 48, t = 293 — **A & B finish transmitting**

{ • A waits for B to finish it's bits.

B ⇒ 293 + 245 = 538

A ⇒ 538 + 96 = 634

* since 96 bit times to avoid busy channel. }

↓

t = 634 — **Node A: Starts Transmission.**

↓ 245 bit times

t = 634 + 245 ⇒ 879 — **Node A: completes transmission**

→ with the above network flow chart, A retransmission will reach B before the scheduled time ~~for~~ and B will stop transmitting and when A is retransmitts. which makes A & B to not collide each other. Thus a factor of 512 is large enough to make it happen.

— × — × —

(12) Ch6 – P3 :-

Below are the Steps happen in the order where to have the communication established when a webpage is requested for the first time with no existence of cache in the process.

(1). firstly, inorder to transmit the Ethernet frame to broadcast across the Ethernet and this requires the know the IP Address of the computer and to find it, uses DHCP protocol to obtain it, and a special datagram created for 255:255:255:255 is placed in queue.

(2) with the DHCP Server we obtain the list of IP addresses for the first hop Routers to the computer with the Subnet mask of subnet along with the local DNS server address ; if there is necessity to it.

(3). first Hop router's address is identified using ARP Query protocol where for the first time the cache is empty and it gets the mac address along with the local DNS server.

(4) web page accen is obtained and it tries to fetch (9) the contents and if the regularly obtained DNS doesn't have the Ip addren it uses DNS protocol to fetch the respective information to load the web page.

(5). with the succenful retreival of webpage Ip Addren, our computer will start to sent a HTTP request using the 1st router thus identified using DHCP and the request is dessimated & encapsulated into TCP packets, IP packets & Ethernet frames.

→ These are sent from the computer to the first-hop routers and these are passed on further into the Internet protocol layer by validating the routing table. It sends to the right interface among of all of the available ones.

(6). The same procen is continued across the Internet until it finds the web server.

(7). with this request receiving to web page server; it then responds with the HTTP response menage to our computer. The response are encapsulated with necenary TCP & Ip packets, these follow the IP routes by hopping back to first-hop router and these are forwarded to our computer covering with Ethernet packets as requested and is loaded into the system