Q1)

Subnet Address (CIDR format)

Building 1 → 139.179.192.0/20

Building 2 → 139.179.208.0/20

Building 3 → 139.179.224.0/21

Building 4 → 139.179.232.0/21

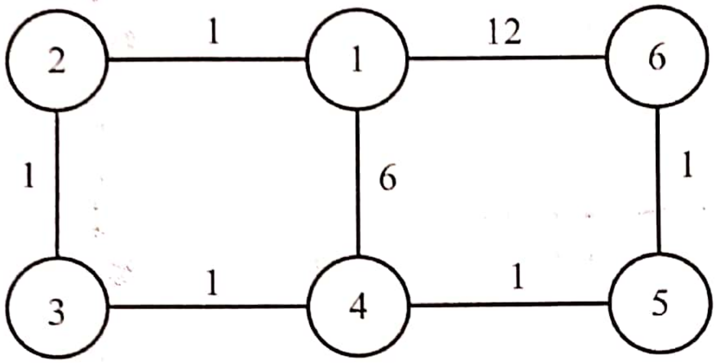
Building 5 → 139.179.240.0/22

Q2) Dijkstra algoritm is used to find the minimum path or the smallest sum. If we would give each weight to the dijkstra algorithm, we would minimize $w_1+w_2+w_3+\dots+w_e$. However, we would like to maximize $w_1 \cdot w_2 \cdot w_3 \cdot \dots \cdot w_e$. Hence, a transformation is needed. If we would take the log of $w_1 \cdot w_2 \cdot w_3 \dots w_e$, we would obtain $\ln(w_1 \cdot w_2 \cdot w_3 \dots w_e) = \ln(w_1) + \ln(w_2) + \dots \ln(w_e)$. If we would give $\ln(w_e)$ as an input to dijkstra algorithm, we would still minimize $w_1 \cdot w_2 \cdot w_3 \cdot \dots \cdot w_n$. That's why, in order to maximize, we can multiply $\ln(w_1 \cdot w_2 \dots w_e)$ with -1. That way, we could obtain $-\ln(w_1 \cdot w_2 \dots w_n)$.

$-\ln(w_1 \cdot w_2 \cdot w_3 \dots w_e) = -\ln(w_1) - \ln(w_2) - \ln(w_3) - \dots - \ln(w_e)$. As a result, if we would give $-\ln(w_e)$ as the input to dijkstra algorithm, we could maximize $w_1 w_2 w_3 \dots w_e$. Our solution computes correctly because in order to minimize $-\ln(w_1 w_2 w_3 \dots w_e)$, $w_1 \cdot w_2 w_3 \dots w_e$ should be maximized. This can be achieved by giving the inputs to dijkstra algorithm in the form of $-\ln(w_i)$

CamScanner ile tarandı

Q3

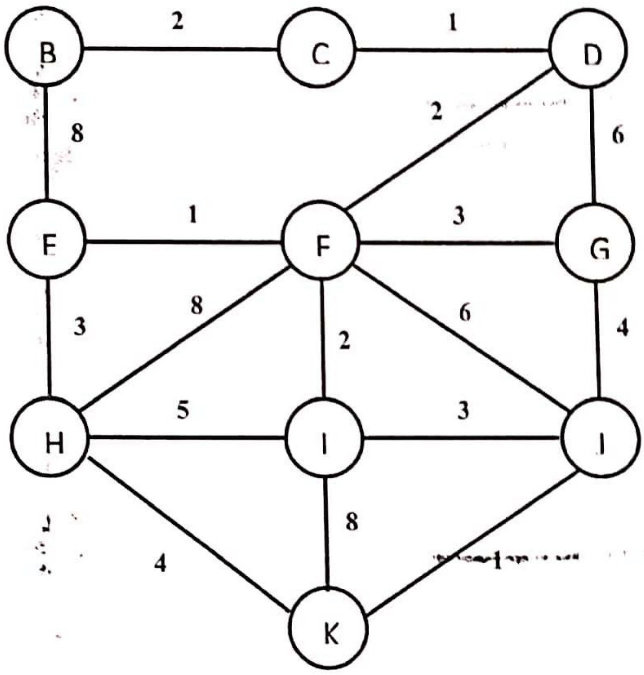


Give the evolution of the distance tables with respect to destination 6. Specifically, give the distance table entries for destination 6 at nodes 1-5, for t = 0.1, 0.5, 1.1, 2.1, ..., **until** all distance vectors stabilize. Present your final answer in the table given below where $D^i(j)$ is the distance vector element denoting the distance from i to j.

Time, t	$D^1(6)$ via			$D^2(6)$ via		$D^3(6)$ via		$D^4(6)$ via			$D^5(6)$ via	
	2	4	6	1	3	2	4	1	3	5	4	6
0.1	5	8	12	6	4	5	3	11	4	2	3	1
0.5	5	8	12	6	4	5	9	11	10	2	3	1
1.1	5	8	12	6	6	5	9	11	10	2	3	1
2.1	7	8	12	6	6	7	9	11	12	2	3	1
3.1	7	8	12	8	8	7	9	13	14	2	3	1
4.1	9	8	12	8	8	9	9	13	14	2	3	1
5.1	9	8	12	9	10	9	9	14	16	2	3	1
6.1	10	8	12	9	10	10	9	14	16	2	3	1
7.1												
8.1												
9.1												
10.1												

Q4

4. Execute the Dijkstra algorithm **at node B** for the network shown below by filling in the following table. In the table, you need to give both the distance *D(v)* and the previous node *p(v)*.



Step	N'		D(C), p(C)	D(D), p(D)	D(E), p(E)	D(F), p(F)	D(G), p(G)	D(H), p(H)	D(I), p(I)	D(J), p(J)	D(K), p(K)
0	B		2,B	Inf	8,B	Inf	Inf	Inf	Inf	Inf	Inf
1	-B,C			3,C							
2	B,C,D					5,D	9,D				
3	B,C,D,F				6,F		8,F	13,F	7,F	11,F	
4	B,C,D,F,E							9,E			
5	B,C,D,F,E,I									10,I	15,I
6	B,C,D,F,E,I,G	H									
7	B,C,D,F,E,I,G,H										13,H
9	-B,C,D,F,E,I,G,H,J										11,J
10	-B,C,D,F,E,I,G,H,J,K										
11											

Q5

139.179.39.130 → B

139.179.39.165 → B

139.179.72.66 → E

196.101.153.127 → D

196.101.153.130 → F

Q6|

$G(x) = X^5+X^4+X^2+1$

$D(x) = X^9+X^8+X^6+X^5+X^2+X^1$

$d(x) = D(x).X^5 = X^{14}+X^{13}+X^{11}+X^{10}+X^7+X^6$

$\Rightarrow$ R bit is 5 bit long

$d(x) \mid G(x)$

$R(x)$

$$
\begin{array}{l|l}
\cancel{X^{14}}+\cancel{X^{13}}+\cancel{X^{11}}+X^{10}+X^7+X^6 & X^5+X^4+X^2+1 \\
\cancel{X^{14}}+\cancel{X^{13}}+\cancel{X^{11}}+X^9 & \hline X^9+X^5+X \\
\hline
\cancel{X^{10}}+\cancel{X^9}+\cancel{X^7}+X^6 & \\
\cancel{X^{10}}+\cancel{X^9}+\cancel{X^7}+X^5 & \\
\hline
\cancel{X^6}+\cancel{X^5} & \\
\cancel{X^6}+\cancel{X^5}+X^3+X & \\
\hline
X^3+X &
\end{array}
$$

$\Rightarrow R(x) = X^3+X = 01010$

$\Downarrow$

highest order 4 bits

Transmitted Sequence = 01101100110 | 01010

Received Sequence = 10011100110 | 01010

Received Sequence = 1001110011001010 $= X^{15}+X^{12}+X^{11}+X^{10}+X^7+X^6+X^3+X^1$

$$
\begin{array}{l|l}
\cancel{X^{15}}+\cancel{X^{12}}+X^{11}+\cancel{X^{10}}+X^7+X^6+X^3+X & X^5+X^4+X^2+1 \\
\cancel{X^{15}}+X^{14}+\cancel{X^{12}}+\cancel{X^{10}} & \hline X^{10}+X^9+X^8+X^7+X^6 \\
\hline
\cancel{X^{14}}+\cancel{X^{11}}+X^7+X^6+X^3+X & \\
\cancel{X^{14}}+X^{13}+\cancel{X^{11}}+X^9 & \\
\hline
\cancel{X^{13}}+X^9+X^7+X^6+X^3+X & \\
\cancel{X^{13}}+X^{12}+X^{10}+X^8 & \\
\hline
\cancel{X^{12}}+X^{10}+\cancel{X^9}+X^8+\cancel{X^7}+X^6+X^3+X & \\
\cancel{X^{12}}+X^{11}+\cancel{X^9}+\cancel{X^7} & \\
\hline
\cancel{X^{11}}+\cancel{X^{10}}+\cancel{X^8}+\cancel{X^6}+X^3+X & \\
\cancel{X^{11}}+\cancel{X^{10}}+\cancel{X^8}+\cancel{X^6} & \\
\hline
X^3+X \neq 0 &
\end{array}
$$

Error is Detected

Q7)

$$\frac{F_{min}}{R} \geq \frac{2 d_{max}}{S}$$

$$F_{min} \geq \frac{2 . R . d_{max}}{S}$$

$$F_{min} \geq \frac{\cancel{2}.\left(\cancel{100}.\cancel{10^{6}}\ \frac{bit}{\cancel{s}}\right).400\cancel{m}}{\cancel{2}.\cancel{10^{8}}\ \frac{\cancel{m}}{\cancel{s}}}$$

$$F_{min} \geq 400\,bit$$

$F_{min} \geq 50\,bytes \Rightarrow$ The minimum frame size in bytes is 50bytes in order to work properly.

Q8

According to Backoff Algorithm, the K values for

$K_A = \{0,1,2,3,4,5,6,7\}$

$K_B = \{0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15\}$

$K_C = \{0,1,2,3\}$

$\Rightarrow$ i) $P(\text{C's successful retransmission}) = \frac{15}{16} \cdot \frac{7}{8} = \frac{105}{128}$

ii) $P(\text{collision of All nodes}) = \frac{1}{8} \cdot \frac{1}{16} \cdot \frac{1}{4} \cdot 4 = \frac{1}{128}$

iii) $P(\text{collision of A\&B only}) = \frac{7}{8} \cdot \frac{1}{16} \cdot 4 = \frac{7}{32}$

Q9

i) $P(\text{successful slot}) = \overset{\text{involved nodes}}{2} \cdot p \cdot (1-p)^{2-1} = 2(p)(1-p) = 2p - 2p^2$

$$\frac{dP(\text{successful slot})}{dp} = 2 - 4\hat{p} = 0$$

$$\boxed{\hat{p} = 0{,}5}$$

The maximum probability value for a successful time is $p = 0{,}5$

Q10)

i) X's frame will be received only $\boxed{\text{by node Z.}}$

ii) Y's port number will be registered in A as Y=1. Also, Y's port number will be registered in B as Y=4. The nodes $\boxed{\text{W, T, U}}$ will receive Y's message.

iii) Z's port number is already registered in A but A does not know, T's port number and flooding occurs. In B T's port number is not registered as well. Flooding occurs in B as well. In addition, B registers Z's port number as Z=4. Hence, Z's frame will be received by the nodes $\boxed{\text{X, Y, W, U, T}}$

iV) B does not know U's port number and registers it as U=3. Also, Y's port number is known and forwarded through port number 1 in B to A. The port number of Y is known in A as well and it will be forwarded through port number 1 to Y. As a result, U's frame will be received only by $\boxed{\text{node Y.}}$