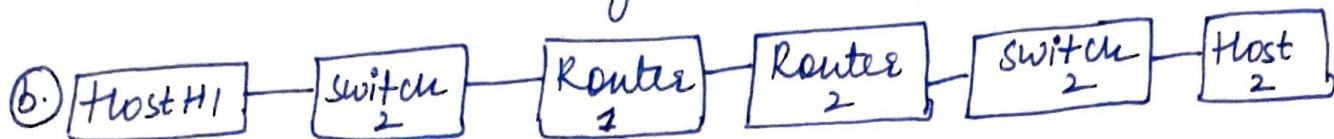


Date: 22/02/23

Ans-1: → (a) "Bits live on the wire": Physical layer 1Mark
 "Error Handling from hop to hop": Data Link layer 1Mark



1Mark Transport layer: 2 Times [at Host H1 & Host H2]

1Mark Network layer: 4 Times [at Host H1, at R1, at R2, H2]

(c) UDP Header Dump: → E29301A2 E004 07BB

$$\therefore \text{Total length of Data} = [E004]_{16} = 14 \times 16^3 + 0 \times 16^2 + 0 \times 16^1 + 4 \times 16^0$$

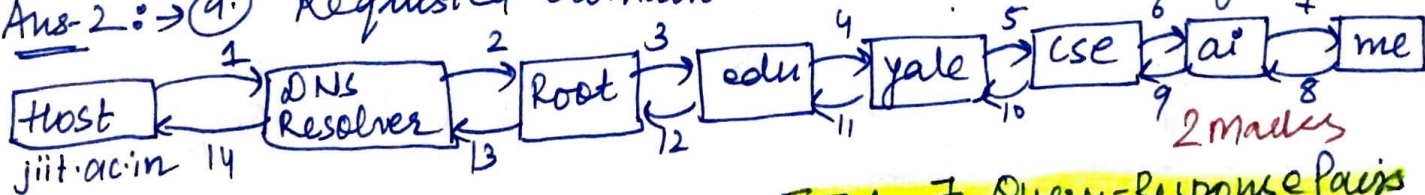
$$= (57348)_{10} \quad 0.5 \text{ mark}$$

Now, 8 bytes of Header

$$\therefore \text{Actual length} = 57348 - 8 = 57340 \quad 0.5 \text{ mark}$$

$$\therefore \text{checksum} : \rightarrow [07BB]_{16} \Rightarrow 1979 \quad 1 \text{ mark}$$

Ans-2: → (a) Requested domain Name: ml.ac.cs.yale.edu



"Recursive Approach"

Total 7 Query-Response Pairs

(b) Any TLD have 2 Resource Records: → NS, A

Name	Value	Type
ml.ac.cs.yale	Authoritative Server Name (yale)	NS
Authoritative Server Name (yale)	IP address	A

1 mark

1 mark

Ans-3: → (a) • Non-Persistent & Persistent with No Cache

0.5 mark Non-Persistent : → 14 TCP Connections

0.5 mark Persistent : [13 For Objects + 1 for Reference Page]
1 TCP Connection for all.

• Non-Persistent & Persistent with Cache implementation
(Where Browser is requesting webpage very first time)

0.5 mark Non-Persistent : 14 [It is first Request from Browser]

0.5 mark Persistent : 1

• Non-Persistent & Persistent with Cache implementation
(Where requested webpage already exists in cache & No modification is there)

0.5 mark Non-Persistent : 1
0.5 mark Persistent : 1
[only 1 TCP Connection required for conditional get request since there is no modification, the cached copy will be displayed]

(b) Given : → Cache Hit Ratio = 0.6, Internet delay = 3 sec.
Request Rate = 14 Req/sec
Object Size = 2KB

Now, Total Response delay = Hit Ratio [LAN delay] + miss Ratio [LAN + access + Internet delay]
(with cache)

* LAN delay ignore [as mentioned in Ques.]

Now, Total Average Response delay = miss ratio [access delay + Internet delay]

$$\text{Average Access Delay} = \frac{P}{1-PQ} = \frac{L/R}{1-\frac{QL}{R}} = \frac{2 \times 10^3 \times 8 / 2 \times 10^6}{1 - 14 \times \frac{2 \times 10^3 \times 8}{2 \times 10^6}}$$

1 mark

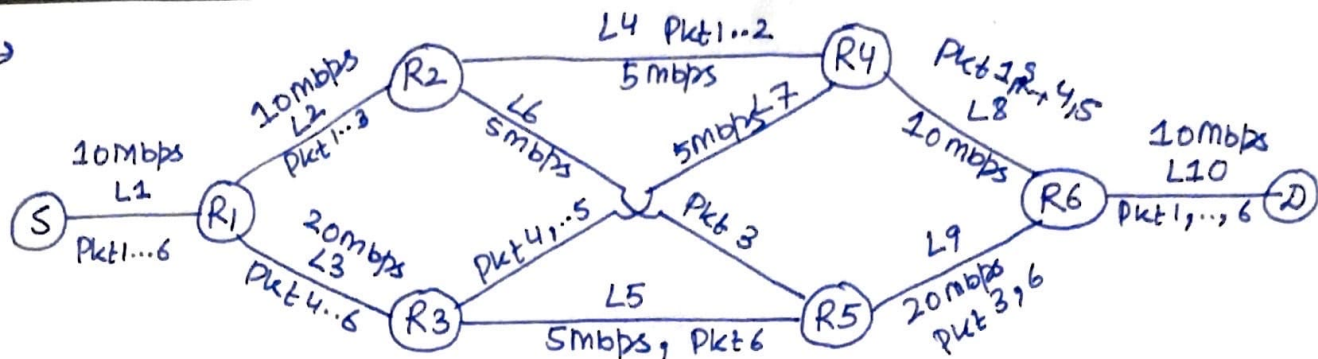
$$\therefore \text{Access delay} = 0.00837 \text{ Sec.} = \frac{0.008}{1 - (1-0.4) \times 0.112}$$

$$\text{Total delay} = (0.4) (0.008 + 3 \text{ Sec})$$

$$\Rightarrow 0.4 [3.008 \text{ Sec}] \Rightarrow 1.2 \text{ Seconds.}$$

1 Mark

Ans-4: →



Given: File Size = 6 mb, ∴ 6 Packets, Packet Size = 1 mb

∴ Transmission Delay For each Packet (1mb): → L/R

Now, delay for each Packet on individual link are as follows:

$L1 = 10^6 / 10 \times 10^6 = 0.1 \text{ sec}$, $L4-L7 = 0.2 \text{ sec}$, $L10 = 0.1 \text{ sec}$.

$L2 = 10^6 / 10 \times 10^6 = 0.1 \text{ sec}$, $L8 = 0.1 \text{ sec}$,

$L3 = 10^6 / 20 \times 10^6 = 0.05 \text{ sec}$, $L9 = 0.05 \text{ sec}$,

Packets	Source		R1		R2		R3		R4		R5		R6		D
	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	
1	0	0.1	0.1	0.2	0.2	0.4			0.4	0.5			0.5	0.6	
2	0.1	0.2	0.2	0.3	0.4	0.6			0.6	0.7			0.7	0.8	
3	0.2	0.3	0.3	0.4	0.6	0.8					0.8	0.85	0.9	1.0	
4	0.3	0.4	0.4	0.45			0.45	0.65	0.7	0.8			0.8	0.9	
5	0.4	0.5	0.5	0.55			0.65	0.85	0.85	0.95			1.0	1.1	
6	0.5	0.6	0.6	0.65			0.85	1.05			1.05	1.1	1.1	1.2	

(a) No. of bits which can accommodate on L5 link = Bandwidth × Delay

∴ No. of bits = $5 \text{ mbps} \times \frac{200 \text{ km}}{2.5 \times 10^8 \text{ m/s}} = 4000 \text{ bits}$ 1 mark

(b) At 0.8 sec 1 mark

(c) Yes Pkt 3 at 0.85 sec and Pkt 6 at 1.05 sec Time lag = 0.20 sec 1 mark

(d) At 1.2 sec file is fully recieved at destination "D". 2 mark

* Give Marks if Computation is Shown. ~~2 mark~~