CS232: End-sem solution (Monsoon 2021)

Q.1.

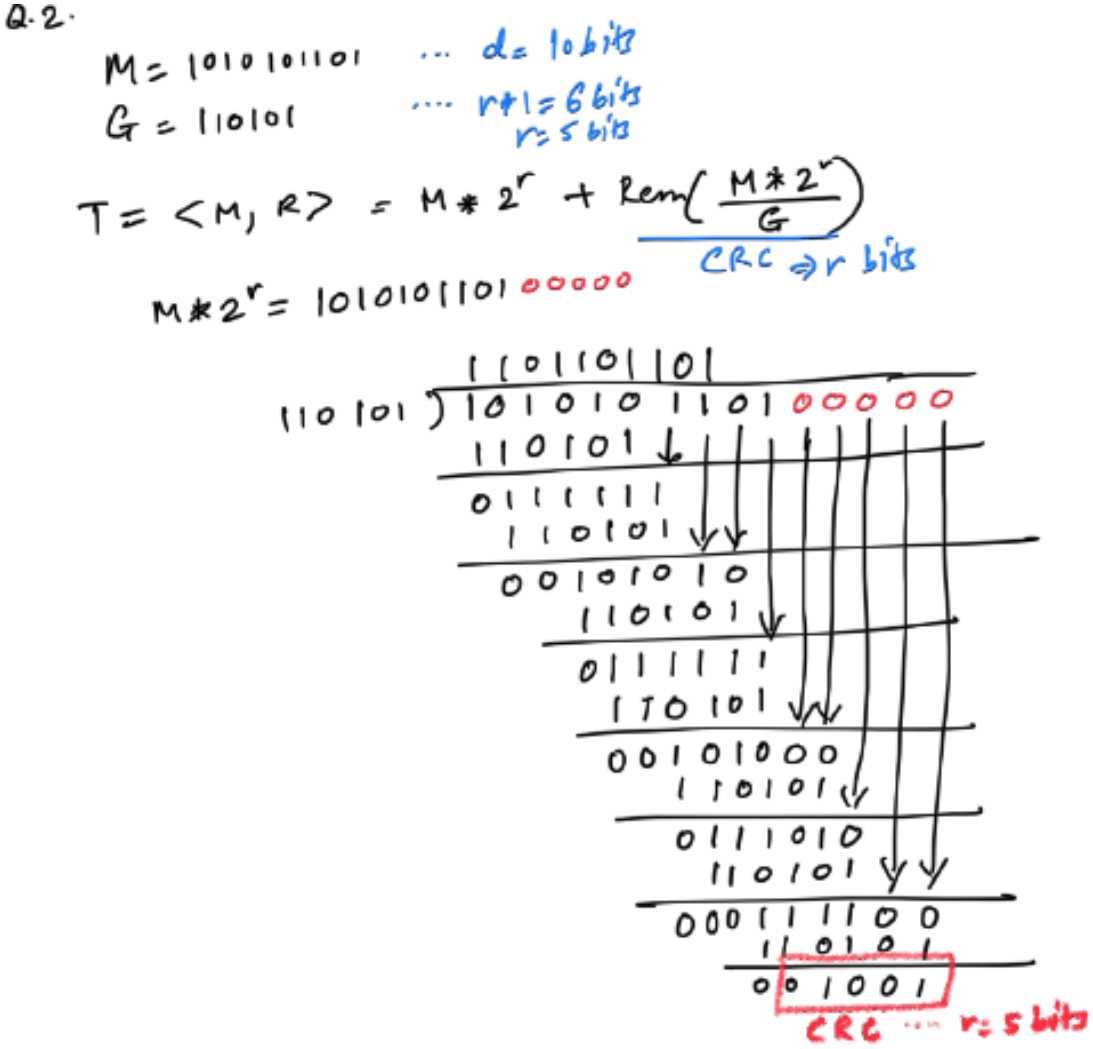
R=100Mbps
d_prop=5us
d_proc=2us
L=500bits

d_trans = L/R = 500b/100Mbps = 5us **[1mark]**

t= d_trans + d_prop + d_proc + d_trans + d_prop = 5 + 5 + 2 + 5 + 5 = 22us **[2 marks]**

Ans: 22

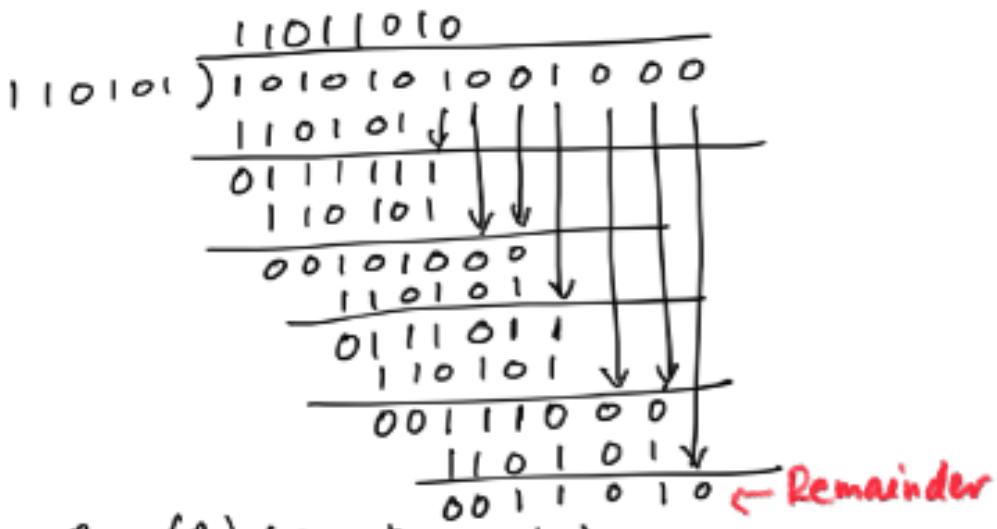
Q.2.



a) CRC = 01001

b) T = 101010111001001
original message | CRC

c) R = 101010100001000
G = 110101

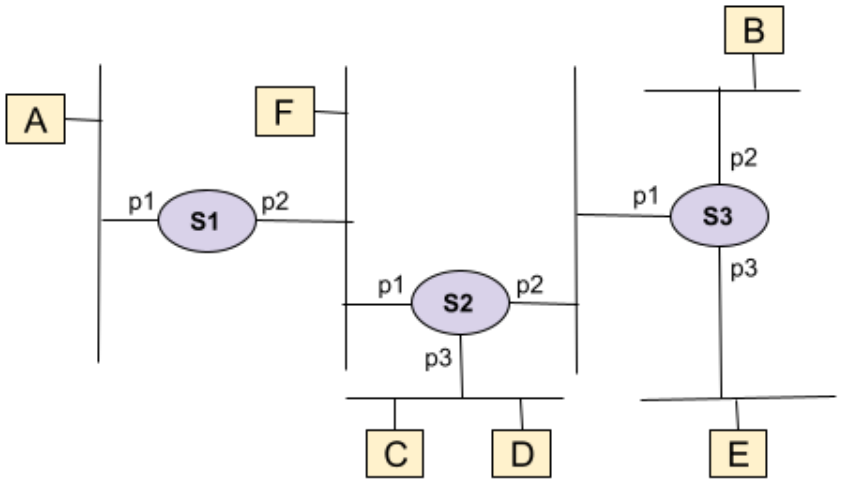


- Since Rem $\left(\frac{R}{G}\right) \neq 0$; frame is in error
- R = 101010100001000
  - 10101010 : received data bits
  - 01000 : CRC bits received
  - either data or CRC or both could be in error

Ans:

(a) 01001 **[2 marks]**
(b) T = 101010110101001 **[1 mark]**
(c) Rem(R/G) = 11010. Since Rem(R/G) != 0, frame is in error **[2 marks]**

Q.3.



Ans:

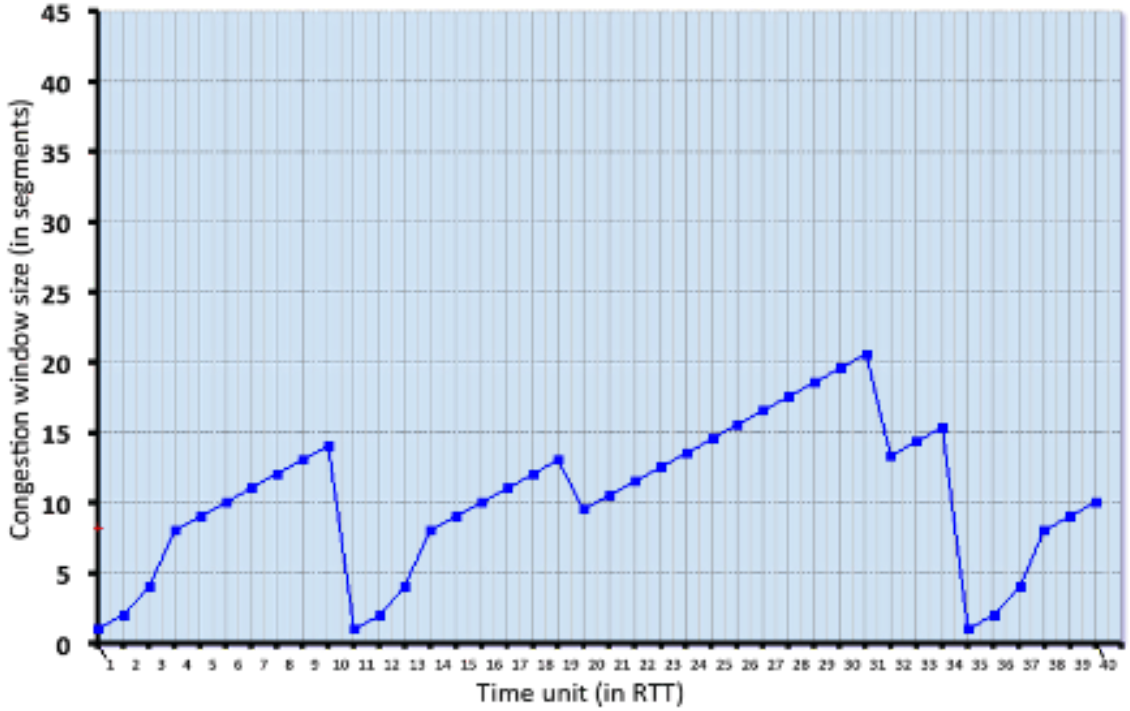
Frame sent with src MAC, dest MAC	New entry in S1: MAC, interface	S1's action	New entry in S2: MAC, interface	S2's action	New entry in S3: MAC, interface	S3's action
A, B	(a) A, p1	(b) flood	(c) A, p1	(d) flood	(e) A, p1	(f) flood
F, D	(g) F, p2	(h) flood	(i) F, p1	(j) flood	(k) F, p1	(l) flood
E, F	(m) E, p2	(n) discard	(o) E, p2	(p) forward to p1	(q) E, p3	(r) forward to p1
A, E	(s) ---	(t) forward to p2	(u) ---	(v) forward to p2	(w) ---	(x) forward to p3

When a switch receives a frame, it parses the source and destination MAC addresses, identifies the incoming switch port, and performs the following.

1. Learning algorithm: Make an entry for source MAC address and incoming switch port in the switch forwarding table. Update the TTL.
2. Look up for the destination MAC address into the forwarding table.
    a. If match is found
        i. If (source/incoming port == interface in the matching entry)
            1. Discard the frame
        ii. Else:
            forward the frame to the corresponding interface
    b. If match is not found; flood the frame (i.e., send copy of the frame to all switch interfaces except the interface from where the frame was received)

[0.25 for each correct entry in the table for 24 entries]

Q.4.

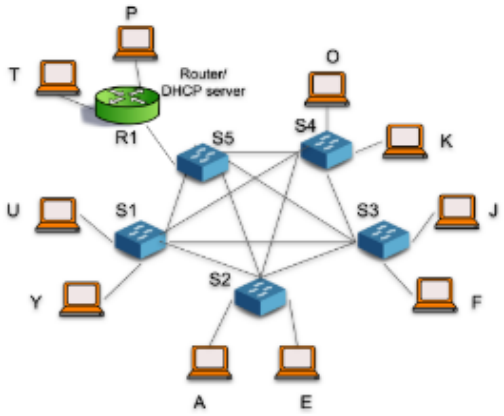


Ans:

Slow start: 1-4, 11-14, 35-38
Congestion avoidance (AIMD): 4-10, 14-19, 20-31, 32-34, 38-40 (also allow 5-10, 15-19, 20-31, 32-34, 39-40 as we had approved this representation for one of the queries during exam)
Fast recovery (Three DUP ACKs): 19-20, 31-32
Time out: 10-11, 34-35 (this is not a state, hence neither award marks nor deduct if they mention this)

[1 mark for mentioning the names of all 3 states, 0.5 for writing each entry per state (max 1 mark per state, i.e. 1 mark for >=2 correct entries]

Q.5.



Ans:

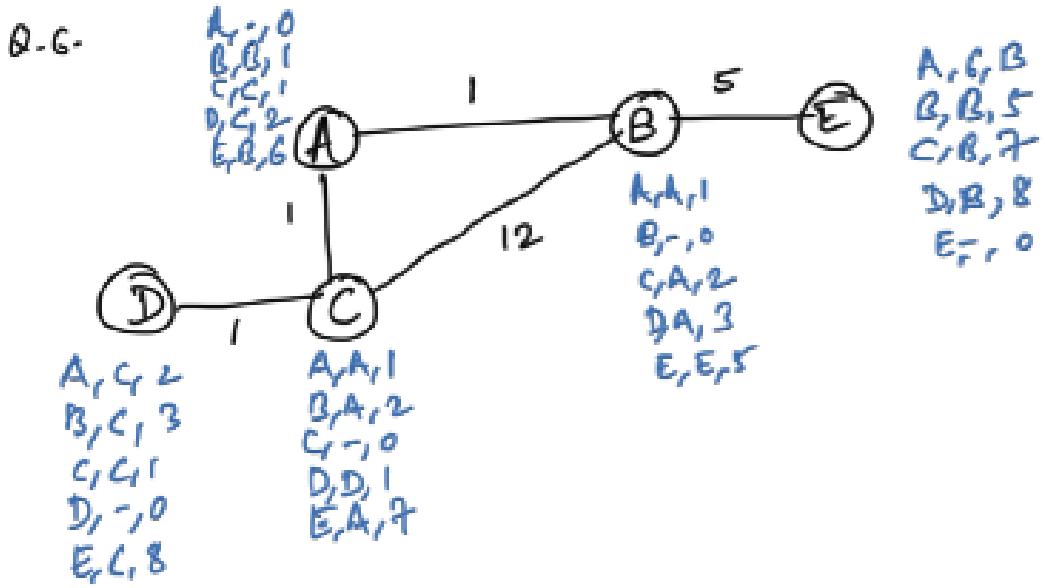
a) U, Y, A, E, F, J, K, O, S1-S5, R1's port connected to S5 will receive the DHCP discover message, i.e., all nodes except P and T.
DHCP discover message is a local broadcast message, hence the message is not forwarded by the router.

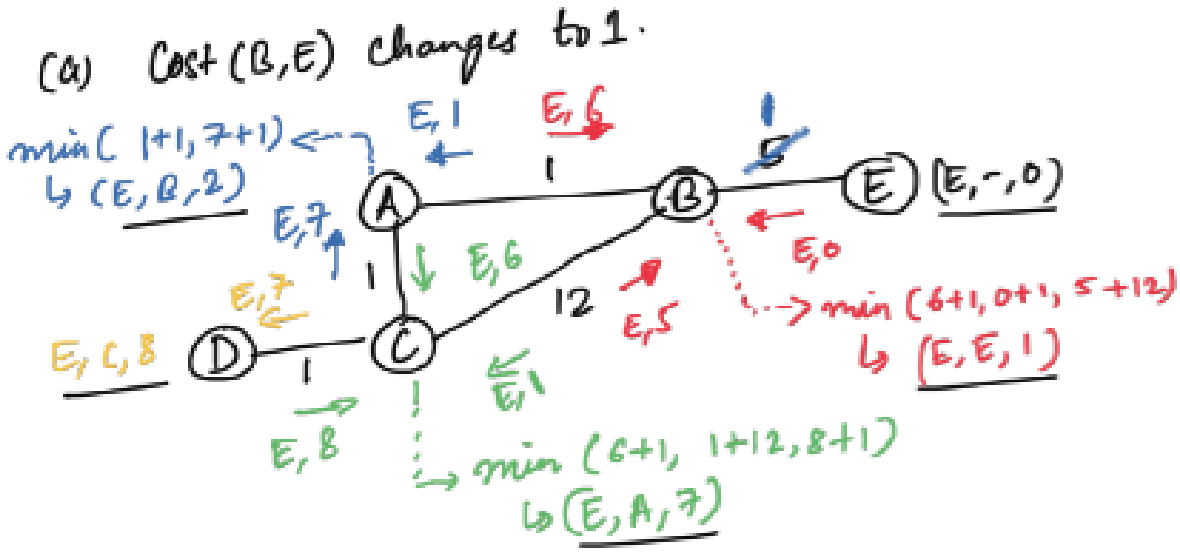
b) Source ethernet address = Z; destination Ethernet address = FF:FF:FF:FF:FF:FF (next hop from Z is unknown, therefore broadcast)

c) Source IP address = 0.0.0.0 (source IP is unknown) ; destination IP address = 255.255.255.255 (next hop from Z is unknown, therefore broadcast)

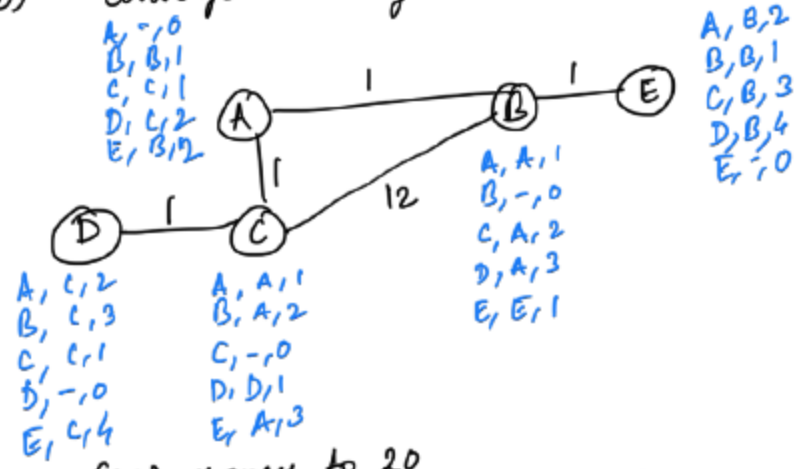
[1 marks, dont give marks if their answers include P & T + 1 +1]

Q.6.


Q.6.
A, -, 0
B, B, 1
C, C, 1
D, C, 2
E, B, 6
A, C, B
B, B, 5
C, B, 7
D, B, 8
E, -, 0
A, A, 1
B, -, 0
C, A, 2
D, A, 3
E, E, 5
A, C, 2
B, C, 3
C, C, 1
D, -, 0
E, C, 8
A, A, 1
B, A, 2
C, -, 0
D, D, 1
E, A, 7
1
5
1
12
1
A
B
E
C
D

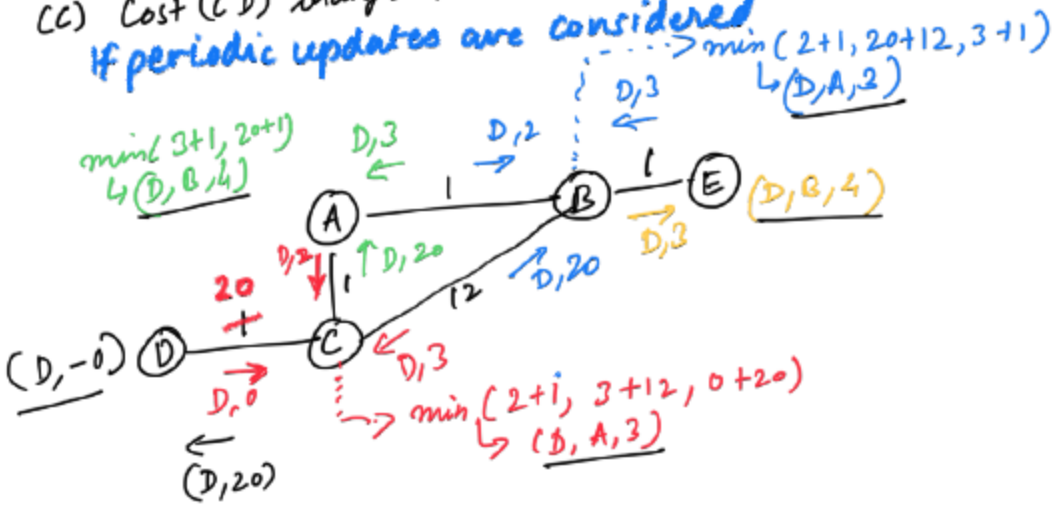

(a) Cost (B,E) changes to 1.
min(1+1, 7+1)
↳ (E, B, 2)
E, 1
E, 6
E, 7
E, 6
E, 7
E, 5
E, 0
E, C, 8
E, B
E, 1
min (6+1, 0+1, 5+12)
↳ (E, E, 1)
min (6+1, 1+12, 8+1)
↳ (E, A, 7)
(E, -, 0)
1
1
12
1
A
B
E
C
D

(b) Converged routing tables

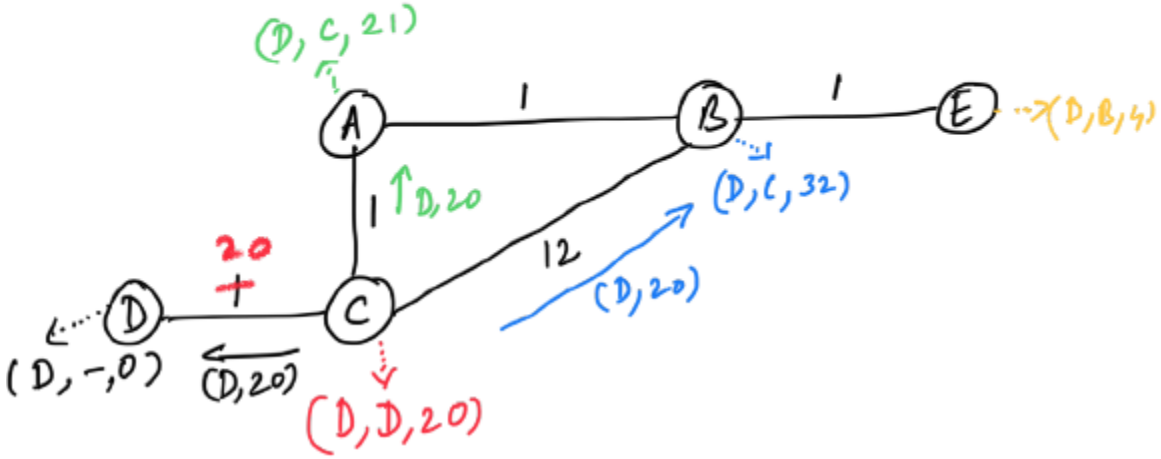


(c) Cost (C D) changes to 20

If periodic updates are considered



If periodic updates are not considered



Ans:

(a) Now, the cost of the link B-E changes to 1. Write updated routing table entry for destination E after the first exchange, post link cost changes.

A: E, B, 2;
B: E, E, 1;
C: E, A, 7 ;
D: E, C, 8 ;
E: E, -, 0

[2 marks, 0.5 for each node except E]

(b) Write the converged routing table for each node.

Shown in figure (b)

[1 mark]

(c) Assume that the routes have converged after the update in (a). Now, the cost of the link C-D changes to 20. Write updated routing table entry for destination D after the first exchange, post link cost changes.

If periodic updates are also considered

A: D, B, 4;
B: D, A, 3;
C: D, A, 3 ;
D: D, -, 0 ;
E: D, B, 4

OR

If periodic updates are not considered

A: D, C, 21;
B: D, C, 32;
C: D, D, 20 ;
D: D, -, 0 ;
E: D, B, 4

[2 marks, 0.5 mark for each node except D]

Q.7.

Destination	Subnet mask	Interface
145.85.15.0	255.255.255.0	Eth0
145.85.15.0	255.255.255.128	Eth1
195.12.16.0	255.255.255.0	Eth2
195.12.16.0	255.255.248.0	Eth3
195.12.17.5	255.255.255.255	Eth4
default		Eth5

For every IP packet, parse the destination IP address and do the following:

1. For each entry in the routing table
    a. N = Destination IP **AND** subnet mask
    b. If N == destination field in the routing table => routing table entry is matched
2. If multiple routing table entries match, choose the interface with the network that has the longest prefix (Longest Prefix Match)
3. If no match is found, choose the interface with the default entry

(a) 145.85.15.16
Matches 1st and 2nd entry; choose second; Eth1
(b) 95.12.17.10
No match; choose default entry; Eth5
(c) 195.12.17.15
Matches only the 4th entry; Eth3

Ans:

(a) Eth1; (b) Eth5; (c) Eth3

[1 + 1 +1, they must do the computation in the rough sheet]

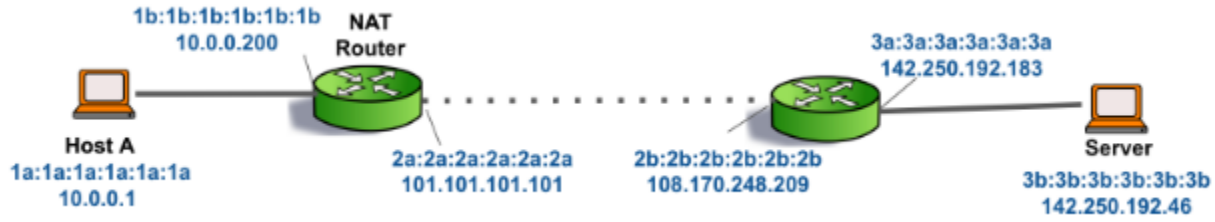
Q.8.

Number of bits for the sequence number, k = 10
Stop & wait: sender and receiver window size is 1
Go-back-N: Sender window = 2^k - 1; receiver window size = 1

Ans:

(a) 1, 1 **[1 + 1]**
(b) 1023, 1 **[1 + 1]**

Q.9.



Ans:

Host A generates a packet for the server with **(a) 142.250.192.46** as the destination IP address and **(b) 1b:1b:1b:1b:1b:1b** as the destination MAC address.

After receiving the packet from host A, the NAT router performs address translation and generates a packet with **(c) 101.101.101.101** as the source IP address, **(d) 142.250.192.46** as the destination IP address, **(e) 2a:2a:2a:2a:2a:2a** as the source MAC address, and **(f) 2b:2b:2b:2b:2b:2b** as the destination MAC address.

[3 marks, 0.5 for each correct answer]

Q.10.

Ans:

Option A: A & C are TRUE

Q.11.

Ans:

Option D: B is FALSE

Q.12.

Ans:

(C) A, B, and C are FALSE; D is TRUE

Q.13.

Ans:

Only A is TRUE

Q.14.

Ans:

Only A is FALSE