~~[illegible] recheck ans 1 a. [illegible]~~
~~domain boundry. Please reconsider.~~ CD are mutually exclusive

→ ~~In ans 3 b and c part- I have made the same mistake please consider as you have deducted marks twice for one same mistake.~~

COL334/CSL374/CSL672: Computer Networks, Semester 15-16 I

Minor-2 exam: 60 minutes

→ ~~In ans 1 b & c part I have solved them considering communication b/w a & d not Z~~
No ~~please reconsi[der]~~

Name: DEEPANKER MISHRA

Entry #: 2013 CS 50282

Credit/Audit: Credit

Evaluation (leave blank)

1	14 4.5 + 4	1	9.5
2	4	2	4
3	14	3	3+0.5+4 +2.5
4	5	4	3
5	6	5	5

Total (out of 43): 31.5

1.

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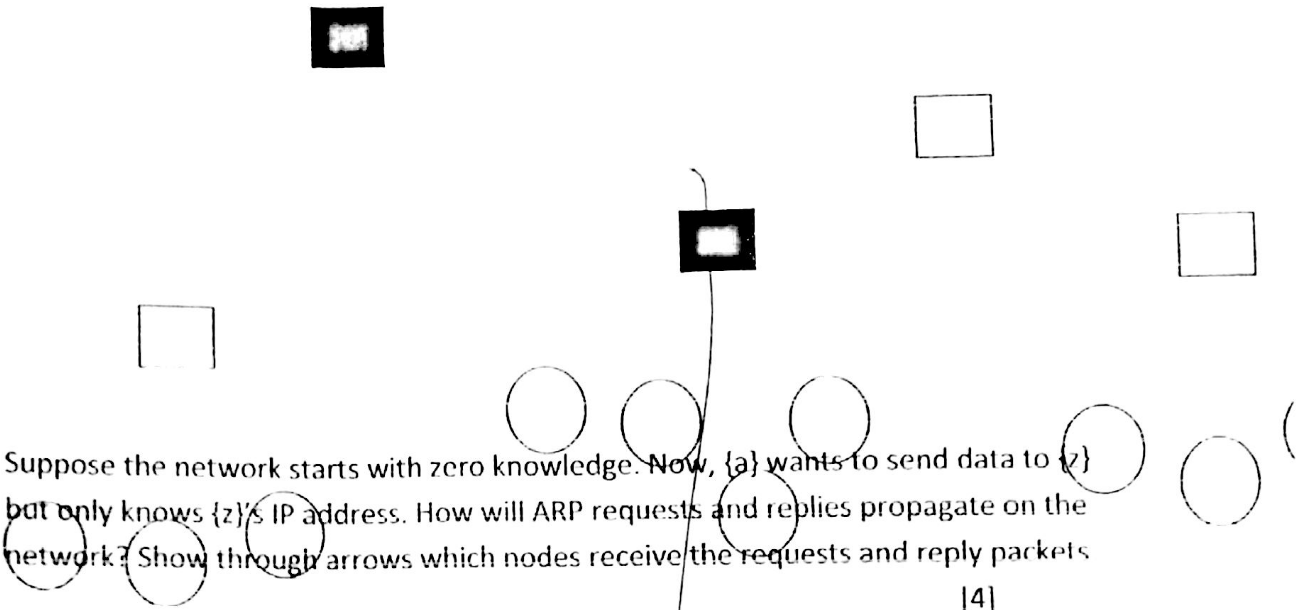
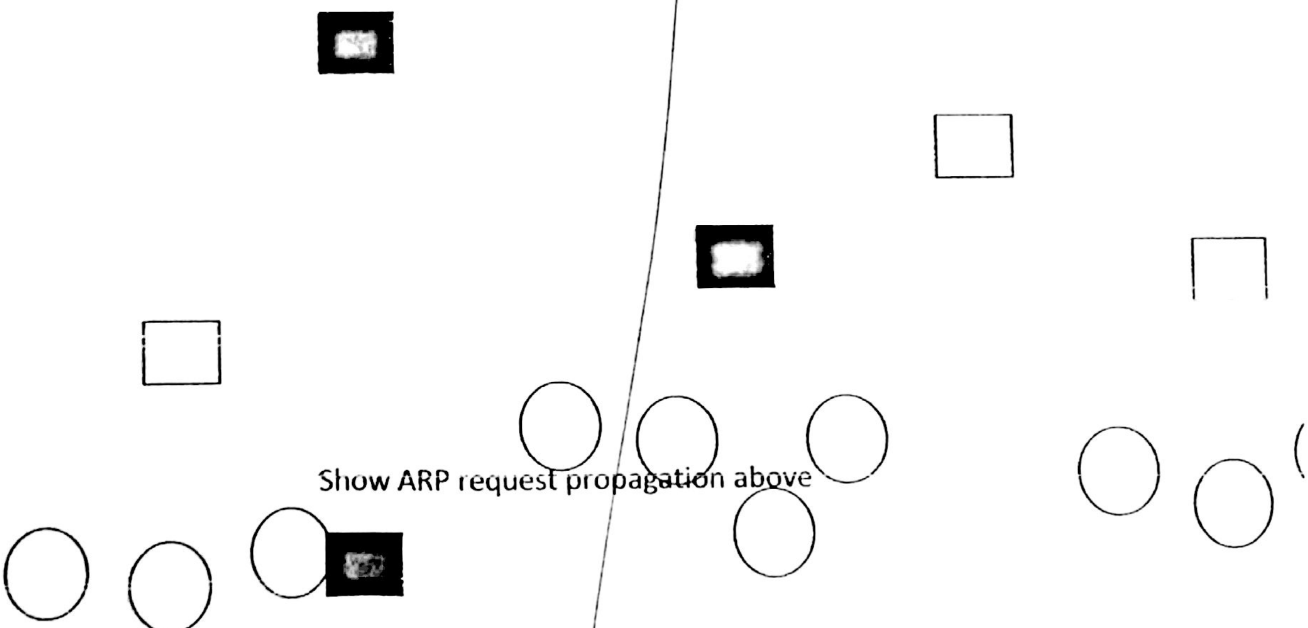
In the following diagrams of local area networks, circles represent end-hosts, filled rectangles represent switches, and empty rectangles are hubs.

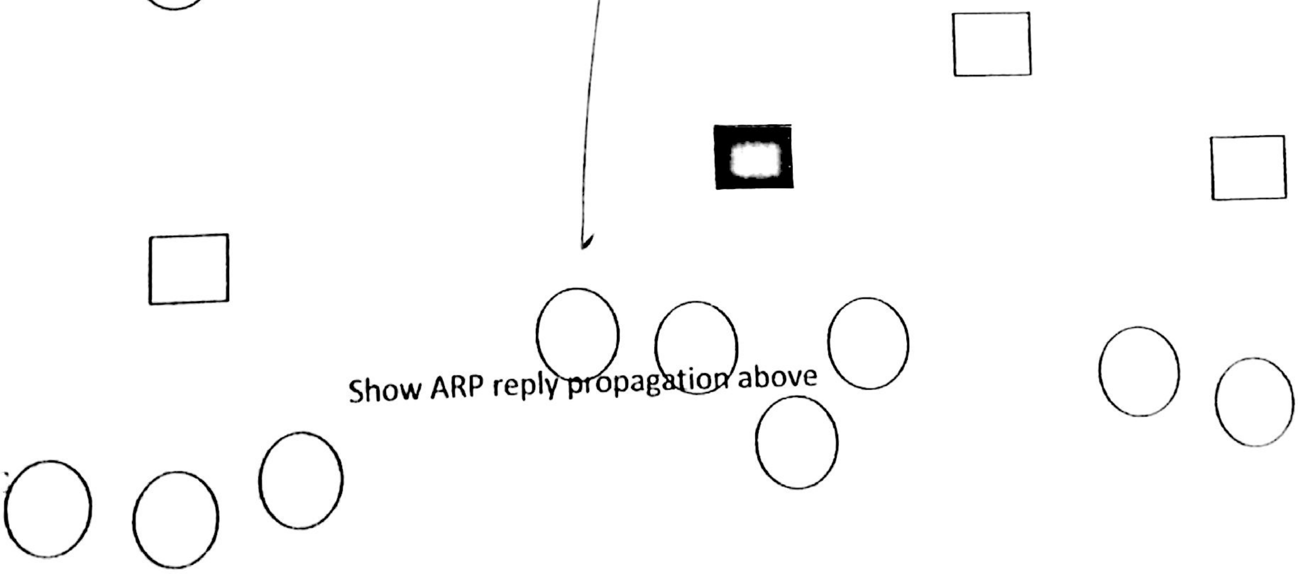
a. Draw various collision domains in the network [4]



b. Suppose the network starts with zero knowledge. Now, {a} wants to send data to {z} but only knows {z}'s IP address. How will ARP requests and replies propagate on the network? Show through arrows which nodes receive the requests and reply packets [4]



Show ARP request propagation above



Show ARP reply propagation above

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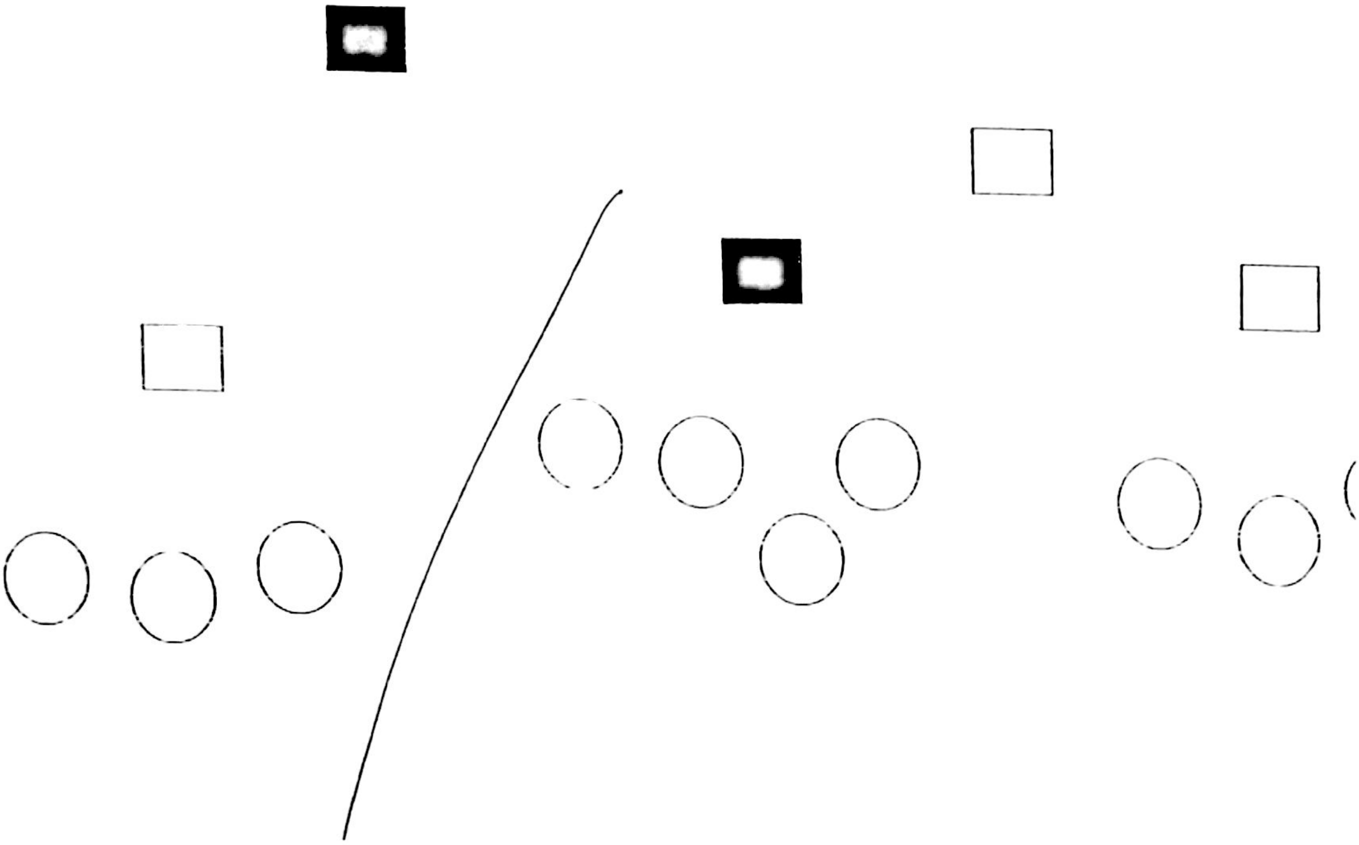
c. Suppose now that {a} and {z}, and {d} and {z}, have been communicating with each other, and entries for all other nodes have timed out in the switching tables. What do the switching tables at {r} and {q} look like? You can assign arbitrary labels to the interfaces to explain your answer. Are switching tables also maintained at the hubs? [4]

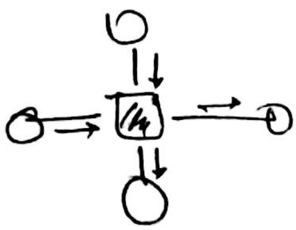


In a degenerate case if end hosts are directly connected to switches with no hubs in the network, will Ethernet's CSMA/CD protocol be used? Why or why not? [2]

No ethernet's CSMA/CD will not be used as there is no collision that will ever occur. Every node can send data across without any collisions. As the ethernet is full duplex and switch separate any collisions domains that ~~could ever occur~~. consists of one node. every node can send simultaneously

2

Each and every one can send simultaneously



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2. As per protocol, Ethernet adapters wait for 512 x K bit times after a collision, where K is drawn randomly between 0 and 2^i 1 after i failed attempts. For K=10, how long does the adapter wait on a 10Mbps Ethernet (1Mbps = 2^{20} bits per second)? On a 100Mbps Ethernet? [2]

K = 10

On 10Mbps, Adapter waits for $= 10 \times 512 \times \frac{1}{10 \times 2^{20}} = \frac{512 \times 10}{2^{20} \times 10}$ sec $= \frac{1}{2^{11}}$ sec

On 100 Mbps, adapter waits for $= 100 \times 512 \times \frac{1}{100 \times 2^{20}} = \frac{512}{2^{20} \times 10} = \frac{1}{2^{11} \times 10}$ sec

(1 bit time = time taken to transmit 1 bit)
$= 1/r$

2

If i=4 (ie. after 4 failed attempts), what is the probability of having to wait for 512 x 10 or more bit times? [2]

~~Zero. As for i=4 the value of k is chosen from (0,1,2,3) and so a value of k=10 appears is an impossible event~~

After i=4 the value of k is chosen from $[0, 1, \ldots, 2^4 - 1]$
so for value of $k \geq 10$ there are 6 choices. So the probability of this event is $= \frac{6}{16} = 3/8$.

2

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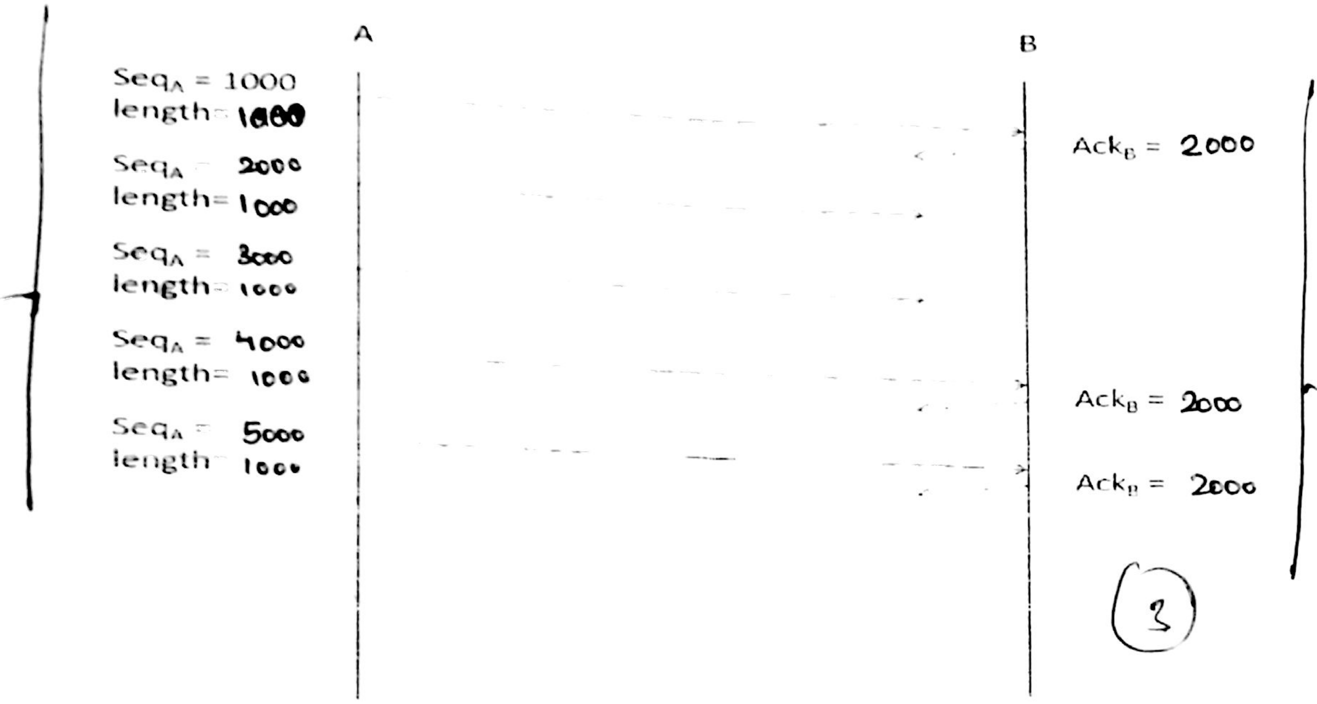
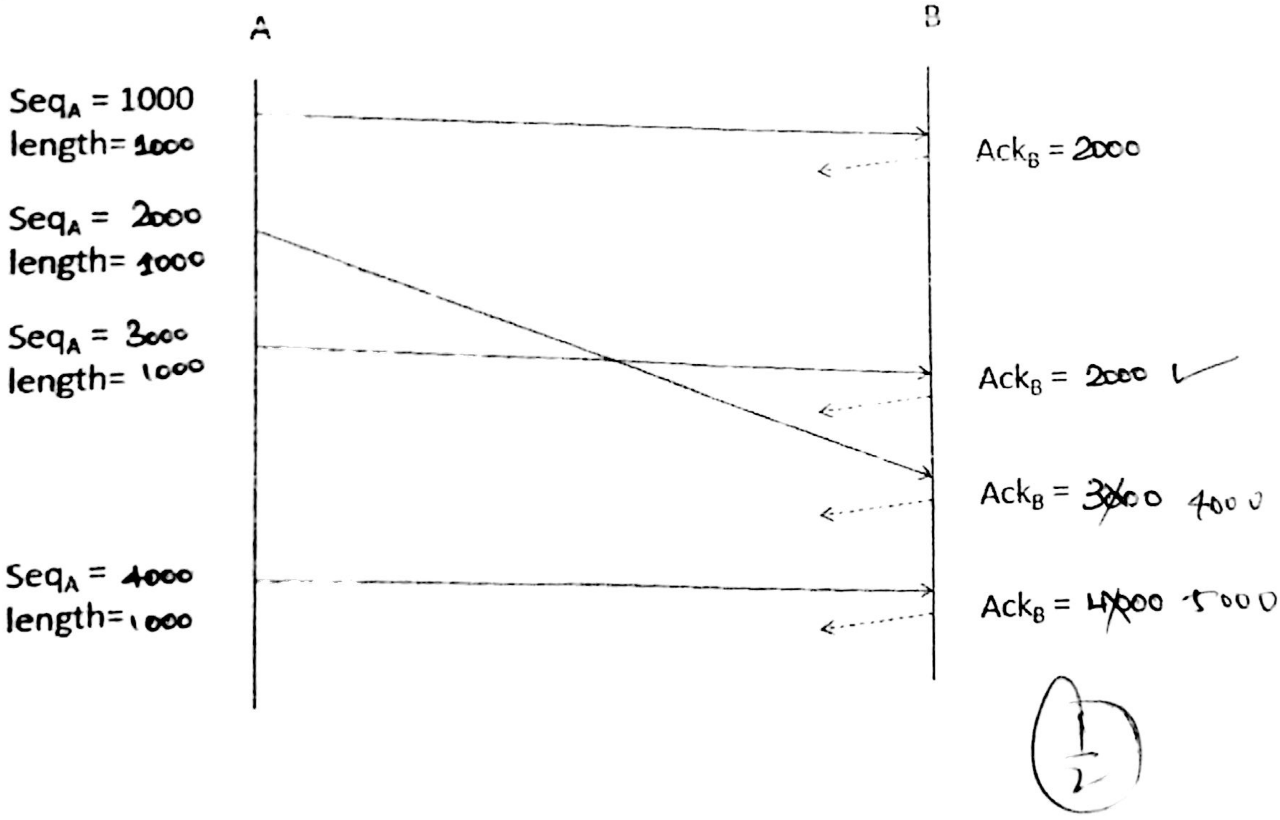
3. A pair of nodes A and B are using TCP to communicate with each other, with A having data to send to B. A's TCP is using cumulative acks with selective acks are turned off. In the diagram below, assume all packets are 1000 bytes long and the starting sequence number A is using is 1000. Fill the information below for the sequence numbers in the packets sent from A to B, and the acknowledgement numbers in the replies sent from B to A. The second and third packets sent by A are lost and do not reach B. [3]



Now consider a different scenario in the diagram below where the second packet gets reordered in the network and reaches B after the third packet. Fill in the missing information. [2]



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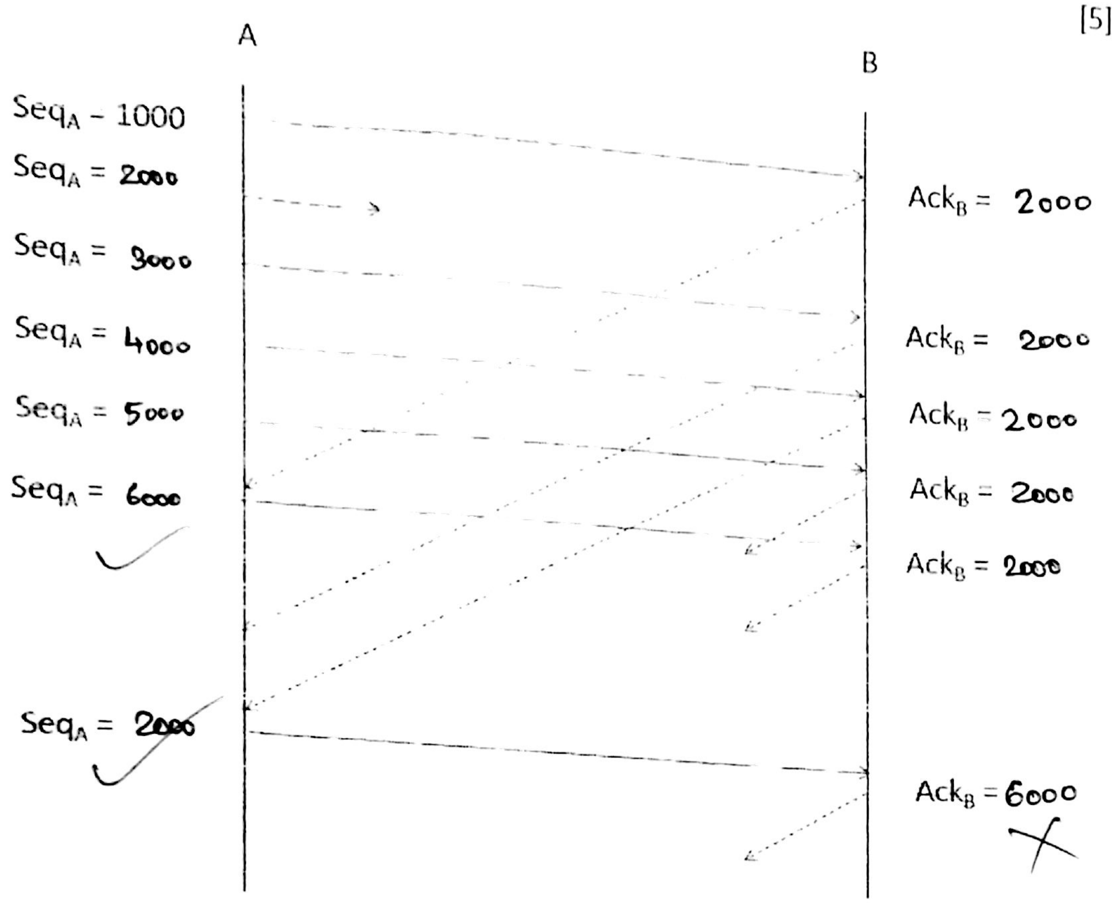
In the scenario below, the second packet gets lost and TCP uses a fast retranmit to recover from the packet loss. Assume TCP's window size is 5000 bytes and is fixed, ie. congestion control is turned off. Fill in the missing information and explain why there is no packet transmitted upon receipt of the second ack. What mechanism is used in other variants of TCP to trasmit a packet at this point?

[5]



4

No packet is sent upon receiving second ack because we do not know how much data is standing out on the network. So at this point TCP can not know how much data it can send in this transmission.

Other variants of TCP use selective acks with length of data like (3000|2000 - 2999) telling TCP how much data has been recieved by receiver. Some other variants send small amount of data to keep communicating with receiver and get to know what is the condition of network, avoiding such conditions.

In the next scenario, two consecutive packets are lost, ie. the second and third packets. Fill in the information in this case and explain why no more packets are transmitted after the last ack shown. What mechanism in TCP without using selective acks is used to recover from such scenarios, and why is it not a desirable method?

[4]

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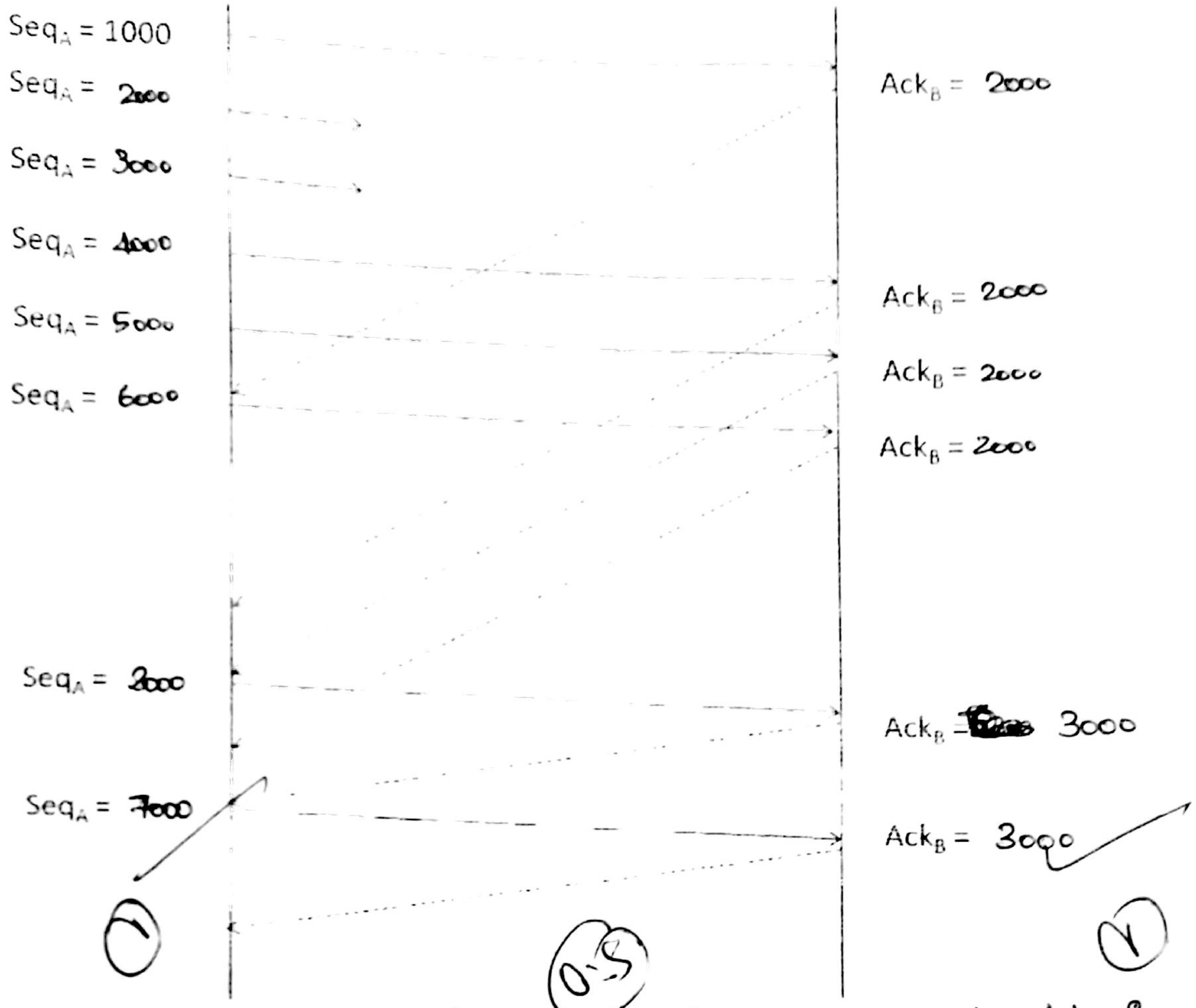

After the last ack TCP does not know how much data ~~has been~~ is ~~received by the receiver~~ standing out on the network so it is not able to transmit. It does not know from where to start sending next byte.

TCP mechanisms use an assumption that always fixed amount of data is sent say 1000 ~~of~~ bytes to recover from these scenarios. This is not a good solution as this can cause congestion on network as packet might be getting dropped and we still send 1000 bytes of data every time.

Timeout?

4. A TCP connection restarts and co-incidentally ends up using the exact (src IP, dst IP, src port, dst port) combination as the older connection. If the bandwidth that both the TCP connections get is 128 KBps (1KBps = 2^{10} bytes per sec) and the RTT is 1 sec, what is the worst case probability that stray packets from the old connection might overlap with the sequence numbers of packets from the new connection? Remember that the sequence number field in the TCP header is 32 bits long and counts the number of bytes. Hint: Estimate the congestion window using the bandwidth and delay. [5]

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Congestion window = r × RTT

= 1 × 128 KBps

= 128 KB

1

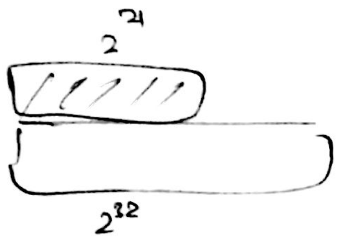
The probability of overlap is that the new number lies in one region of sequence number

$$= \frac{2^{10} \times 128 \times 8 \text{ bits}}{2^{32} \text{ bits}}$$

1

$$= \frac{2^{21}}{2^{32}} = \frac{1}{2^{11}}$$

1



$$\Rightarrow \frac{2^{17}}{2^{32}} \Rightarrow 2^{-15}$$

5. **Short answer questions:**

0 a. IT administrators need to be careful when laying out LANs that the connections between switches must not have cycles in them. [True/False] True [1]

1.5 b. Persistent HTTP improves communication efficiency because... [1.5]

Because it does not require to re-establish 3 way handshake everytime and thus saving 1 RTT everytime.

1.5 c. UDP does not have congestion control built into it, and this can be a problem because... [1.5]

If someone is using UDP on network while others are using TCP, UDP can starve out TCP connections. And so TCP connection cut their transmission rate & suffer. Unfair resource distribution.

1 d. Buffer overflows happen in the buffer behind the bottleneck link. [True/False] [1] True.

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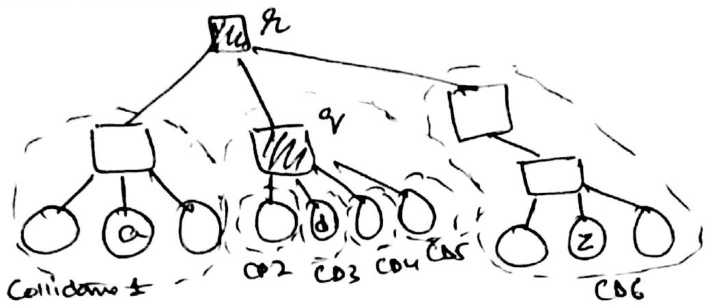
1

e. The TCP timeout calculation method works well on both low bit rate as well as high bit rate links. [True/False] [1]

false.

Ans. (a)

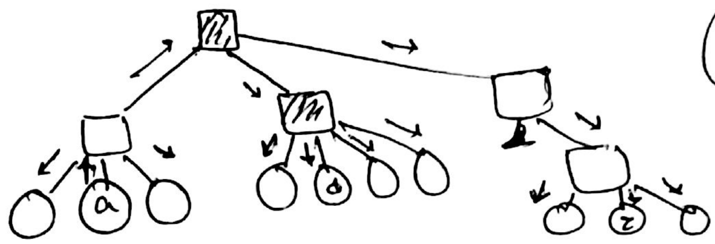
2.5



CD = Collision domain

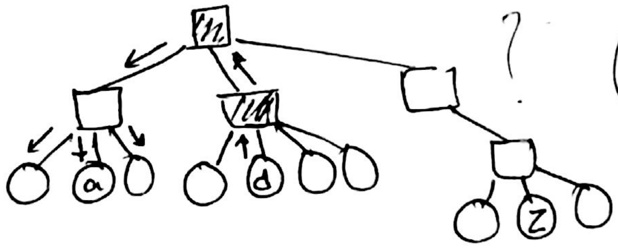
(b) ARP is issued by a

ARP request :



2

ARP reply :

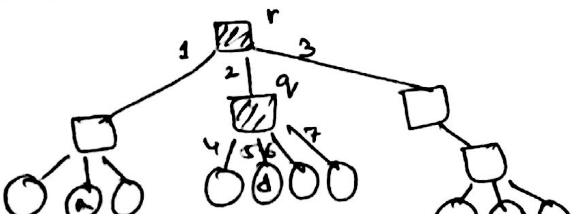


?

0

reply from Z.

(c)



q, r ~~has~~ have such a table because they know the ~~pos~~ location of a, d & Z ~~are~~ one network while location of others have been erased out & so pushed out of table.

r :

~~Adapter~~ node	interface
a	1
d	2
Z	3

q :

node	interface
d	5

2

→ No hubs do not maintain any lookup table.

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