Homework 5

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1 Problem 1

No. Because even if all the links provide reliable delivery service, datagrams might not arrive at the destination in the right order in which the datagrams were sent, which needs to be controlled by TCP service, such as buffer. This is becayse datagrams might take different links, thus arriving at destination in a random order. TCP is also needed to provide flow control and loss recovery services. This is because packets can still get lost because of eg. routing loops.

2 Problem 2

Slotted ALOHA is extermely simple and efficient, and each active node has a throughput of nearly R/M bps. slotted ALOHA allows a node to transmit continuously at the full rate, R. Slotted ALOHA is also highly decentralized, because each node detects collisions and independently decides when to retransmit.
Token Ring Passing has: When only one node has data to send, that node has a throughput of R bps.When M nodes have data to send, each of these nodes has a throughput of R/M bps.This need not necessarily imply that each of the M nodes always has an instantaneous rate of R/M, but rather that each node should have an average transmission rate of R/M over some suitably defined interval of time.The protocol is decentralized; that is, there is no master node that represents a single point of failure for the network. And the protocol is simple, so that it is inexpensive to implement.

3 Problem 3

- $2^{5-1} = 31$, a node chooses among 0,1,2...31. The number of random variables is 32.
  The probability that a node chooses $K = 4$ is $\frac{1}{32}$
- Bit time:
  0.01 microseconds on 100 Mbps Ethernet —corresponds to— 0.1 microseconds on 10 Mbps Ethernet

$K * 512$ bit times $= 4 * 512 * 0.1 = 204.8$ microseconds
So the result K = 4 corresponds to a delay of 204.8 seconds on a 10 Mbps Ethernet.

4 Problem 4

- Because when the source node needs to know the IP address and MAC address of the destination node in order to send a datagram to it, it has to send ARP query in a broadcast frame. Specifically, source nodes with IP address of such destination broadcasts ARP query and among the LAN. All the nodes in the LAN can receive such query message and, if the ARP module sees the match of IP address with the IP address of its own, it will send back the ARP response with the node's MAC address. In this way, the source node knows the destination MAC address.
- An ARP response is sent within a frame with a specific destination MAC address because the sending node knows the source node's MAC address.

5 Problem 5

IEEE 802.11z is a mechanism that makes it possible to directly transfer data between two Wi-Fi clients that are part of the same Wi-Fi network.
Usually, in a Wi-Fi network, data is transferred from one client to another through the Acces Point(AP). The IEEE 802.11z amendment defines mechanisms that allow IEEE 802.11 to set up a direct link between client devices while also remaining associated with the Access Point. These mechanisms are referred to as Tunneled Direct Link Setup (TDLS). This reduces the amount of traffic that is transferred in the network and prevents congestion at the Access Point. Simply speaking TDLS direct link allows user to transfer data directly bwtween devices without Access Point invervention while maintaining the connection to AP.
For example, I can transfer a large movie file from my laptop to my iPad in the bedroom in a fast and efficient manner through TDLS, instead of through AP.

6 Problem 6

- P(A successes in a specific slot) $= p * (1-p)^3$
  P(A success for the first time in slot 5) = P(A fails in slot 1)*P(A fails in slot 2)*P(A fails in slot 3)*P(A fails in slot 4)*P(A successes in slot 1) $= (1 - p * (1-p)^3)^4 * p * (1-p)^3$
- P(Some node succeeds in slot 4) = P(A successes in slot 4) + P(B successes in slot 4) + P(C successes in slot 4) + P(D successes in slot 4) $= 4p*(1-p)^3$

- P(first success occur in slot 3) = P(no success occur in slot 1)*P(no success occur in slot 2)*P(some success occur in slot 3) = $(1-(4p*(1-p))^3)^2 * (4p*(1-p)^3)$

- The efficiency of the four-node system is the probability that any node successes in a slot.
  Therefore, the efficiency is $4p*(1-p)^3$

7 Problem 7

At t=0 A starts transmitting. At t=576, A finishes transmitting.
In the worst case, B begins transmitting at t=324, at t=324+325=649, B's first bit arrives at A.
Since 649>576,A can finish transmitting before it detects that B has transmitted.
So this means A incorrectly believes that its frame was successfully transmitted.

8 Problem 8

- a.
  Advantage:
  In CSMA/CD, when a node performs collision detection, it ceases transmission as soon as it detects a collision. This detection helps protocol performance by not transmitting a useless, damaged (by interference with a frame from another node) frame in its entirety.
  Relatively fast. A computer does not have to wait its "turn" to transmit data.
  CSMA/CD helps users in the local network increase their efficiency in transmisstion.
  Disadvantage:
  Collisions degrade network performance.
  It has possibility that if two nodes transmitted frames at the same time and then both waited the same fixed amount of time, they'd continue colliding forever.
  But overall, it is not a bad choice because the number of users are relatively small and they are in relatively small distance to each other. So no huge collision delay.

- b.
  Advantage:
  It is very efficient.
  Unlike channel partitioning, slotted ALOHA allows a node to transmit continuously at the full rate, R, when that node is the only active node. (A node is said to be active if it has frames to send.) Slotted ALOHA is

also highly decentralized, because each node detects collisions and independently decides when to retransmit.
Disadvantage:
Requires synchronization, which is expensive.
when there are multiple active nodes, a certain fraction of the slots will have collisions and will therefore be "wasted." The second concern is that another fraction of the slots will be empty because all active nodes refrain from transmitting as a result of the probabilistic transmission policy.
Requires queuing buffer for retransmission packets.
Overall, slotted system is very simple and efficient for users, but if all 10 users are busy at the same time, slotted system may waste some slots.

- c.
  They can act like a polling protocol. The head end can poll each node in a round robin, asking if the individual modem that they would like to transmit. Each individual modem can wait for its turn to tell the master that it would like to transmit. This protocol is relatively fair since each of the 10 user has equal opportunity to notify the master, but if there is only one modem which wants to transfer data, it is inefficient in that master has to ask all the other modem about their will.

- d.
  Yes, it would. Because slaves have to wait for a long time to send certain data, resulting in a low uplink speed, but master has the channel open all the time, having high uplink speed.

- e.
  Because the channel is relatively public, private message may be overheard by others in this fashion.