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Course

Date

Lab 7 Link Layer 1

Questions (60 Marks)

Question 1) Suppose two nodes start to transmit at the same time a packet of length L over a broadcast channel of rate R. Denote the propagation delay between the two nodes as dprop. Will there be a collision if dprop<L/R? Why or why not? (10 marks)

There will be a collision. This is because before one node finishes transmitting, it will start receiving the packet from the other node. However, if dprop > L/R, there would be no collision, since the other node is able to finish transmission before
new packet arrives.

Question 2) Why would the token ring protocol be inefficient if a LAN had a very large perimeter? (10 marks)

When a node transmits a frame, the node has to wait for the frame to propagate around the entire ring before the node can release the token. Thus, if L/R is small as compared to tprop, then the protocol will be inefficient. In other words, a device that transmitted a message did not release a token until it heard back the beginning of the message it had sent. That means that from the time the tail end of a message is transmitted, nothing else is transmitted by any device until the original sender receives the beginning of what it had sent. For small messages and long rings, that could be a significant percentage of time. For large messages, the token was released even while the rest of the message was flowing around. And thus that is why the token ring protocol

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will be inefficient if a LAN had a very large perimeter.

Question 3) Consider the 5-bit generator, G = 10011, and suppose that D has the value 1010101010. What is the value of R? (10 marks)

(D + r) /G

1010101010 0000 / 10011

If we divide 10011 into 1010101010 0000, we get 1011011100, with a remainder of R=0100.

Question 4) Graph the efficiency of slotted ALOHA and pure ALOHA as a function of p (probability) for the following values of N: (10 marks)

- ⇨ E(p)=Np(1-p)^(N-1)

a) N =15.

p=0

E (0) = 15*0*(1-0) ^ (15-1) = 0

p=0.1

E (0.1) = 15*0.1*(1-0.1) ^ (15-1) = 0.343

p=0.2

E (0.2) = 15*0.2*(1-0.2) ^ (15-1) = 0.132

p=0.3

E (0.3) = 15*0.3*(1-0.3) ^ (15-1) = 0.031

p=0.4

E (0.4) = 15*0.4*(1-0.4) ^ (15-1) = 0.004

p=0.5

E (0.5) = 15*0.5*(1-0.5) ^ (15-1) = 0.0004

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b) N=25.

p=0

E (0) = 25*0*(1-0) ^ (25-1) = 0

p=0.1

E (0.1) = 25*0.1*(1-0.1) ^ (25-1) = 0.199

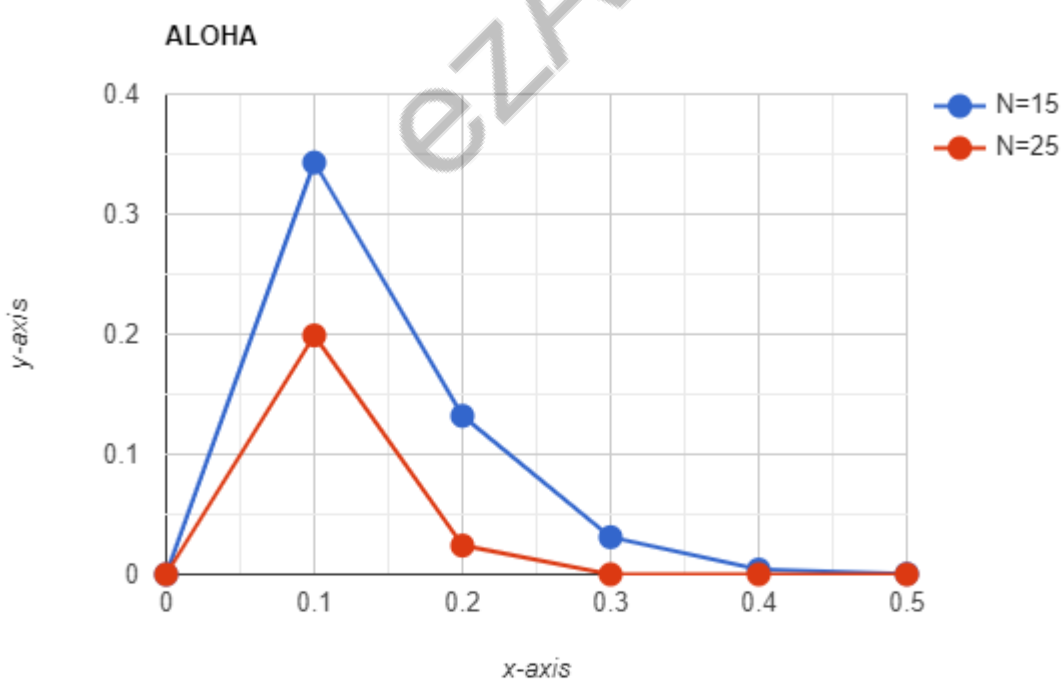
p=0.2

E (0.2) = 25*0.2*(1-0.2) ^ (25-1) = 0.024

p=0.3

E (0.3) = 25*0.3*(1-0.3) ^ (25-1) = 0.001

Plotted Graph



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Question 5) Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 245 bit times. Suppose A and B send Ethernet frames at the same time, the frames collide, and then A and B choose different values of K in the CSMA/CD algorithm. Assuming no other nodes are active, can the retransmissions from A and B collide? For our purposes, it suffices to work out the following example. Suppose A and B begin transmission at t = 0 bit times. They both detect collisions at t = 245 bit times. Suppose KA = 0 and KB = 1. At what time does B schedule its retransmission? At what time does A begin transmission? (Note: The nodes must wait for an idle channel after returning to Step 2—see protocol.) At what time does A's signal reach B? Does B refrain from transmitting at its scheduled time? (20 marks)

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Time t	**Event**
0	- A and B begin transmission
245	- A and B detect collision
245+48 = 293	- A and B finish transmitting jam signal
293+245 = 538	- B's last bit arrives at A; A detects an idle channel
538+96 = 634	- A starts transmitting
293+512 = 805	- B returns to Step2
	B must sense idle channel for 96-bit times before it transmits
634+245=879	- A's transmission reaches B

Because A's retransmission reaches B before B's scheduled retransmission time (805+96), B refrains from transmitting while A retransmits. Thus, A and B do not collide. Thus, the factor 512 appearing in the exponential backoff algorithm is sufficiently large.

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