CS 455 - Introduction to Computer Networks Homework 5
Due date: see class webpage
• Question 1 (20 pts)
• Two nodes A and B use slotted Aloha to access a channel
We observed the interactions of the two nodes for a long time and found that:
 Node A transmits in 40% of the slots Node B transmits in 30% of the slots
Based on these observations , we will assume that:
 Node A transmits in a slot with probability 0.4 Node B transmits in a slot with probability 0.3
Questions:
■ What is the probability that node A completes a transmission successfully in a slot ?
 Let P_A be the probability that node A completes a transmission successfully in a slot (= the answer in the previous question) What is the probability that node A succeeds for the first time in slot 3?
Express your answer using P _A only:
■ What is the probability that node B completes a transmission successfully in a slot ?
What fraction of slots will contain successful transmission?

stion 2 (20) pts)
	oha network, the arrival rate is 20 messages per sec
Message	es have the same length and it takes 0.1 sec to transmit a message.
	■ What is the throughput if the Aloha network uses unslotted transmissions (10 pts)
	■ What is the throughput if the Aloha network uses slotted transmissions (10 pts)

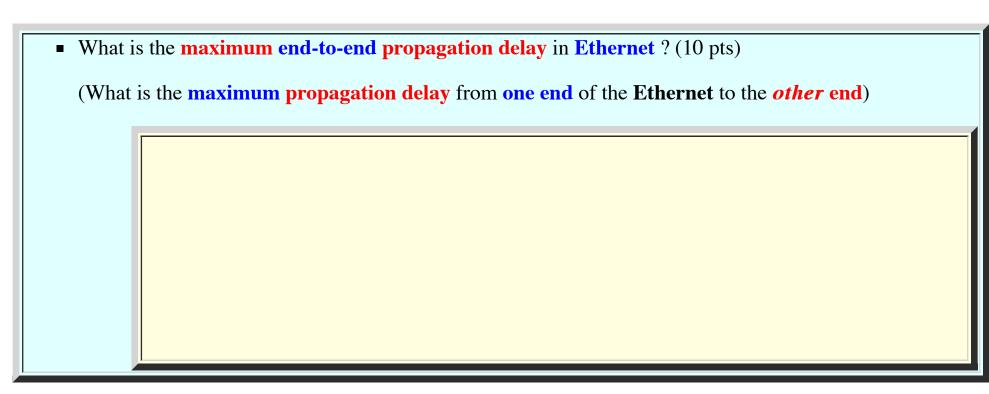
• The maximum network diameter in Ethernet is 2500 m (= meter).

I.e.:			

• the distance between any two nodes on an Ethernet is at most 2500 m.

• The speed of electrical signals in copper is 2×10^8 m/sec.

Question:



At time t = 0, an Ethernet host senses that the Ether channel is idle and transmits.

As you know, the **Ethernet** uses **CSMS/CD** and **Ethernet hosts** will **sense the channel** (while it is transmitting) for possible **collision**.

Question:

After h collisio	ow many seconds of sensing can this Ethernet host be 100% certain that there will not be any ons?
I.e., wh	nen can it stop sensing (because it is sure there won't be a collision). (10 pts)

• (This question is adapted from Question 37 in the text book on page 164. --- from an old edition :))

Let **A** and **B** be two **Ethernet hosts** attempting to transmit on an **Ethernet network**. Each host has a **steady queue of frames** ready to send.

A's frames will be numbered as A_1 , A_2 and so on, and B's frames will be numbered as B_1 , B_2 and so on.

The backoff time unit T = 50 micro seconds.

Suppose A and B simultaneously (= at the same time) attempt to send frame 1 and the transmissions collide. Then A chooses backoff time $0\times T$ (i.e., A picked the random number 0) and B chooses backoff time $1\times T$. So A wins the race and transmits its first frame A_1 successfully (in the mean time, when B retries at time $1\times T$, B will sense A's transmission; so B will wait for A to finish its transmission.)

Fact:

• At the end of A's transmission, B will attempt to transmit frame B_1 and A will attempt to transmit frame A_2 .

A and **B**'s transmissions will **collide** and both nodes will **backoff**.

A will back off picking a backoff time from: 0xT or 1xT

B will back off picking a backoff time from: $0 \times T$, $1 \times T$, $2 \times T$ or $3 \times T$

Each backoff time period is selected with *same* probability (= equally likely) each outcome is equally likely. In other words:

- A selects 0×T and 1×T each with probability 0.5
- **B** selects $0 \times T$, $1 \times T$, $2 \times T$ and $3 \times T$ each with probability 0.25

Questions:

ns:	
•	Find the probability that A will win the second backoff race (10 pts)
•	Find the probability that here is a collision in the second backoff race (10 pts)

Suppose A wins the second backoff race.

A will now attempt to transmit frame A_3 while B is still attempting to transmit frame B_1 .

B will now pick a back-off time from $0\times T$, $1\times T$, $2\times T$, $3\times T$ $4\times T$, $5\times T$, $6\times T$, and $7\times T$ - each outcome is equally likely.

Question:

• Find th	ne probability than A wins the third backoff race (10 pts)
■ Find th	ne probability that there is a collision (10 pts)
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