CS 444
Computer Networks
Spring, 2017

Homework #5

Due: April 10, at 10pm, via Blackboard. No late assignments accepted. Solutions will be posted at noon on Blackboard

This assignment covers Chapter 5 (edition 7) material.

Show all your work. Partial credit will be given.

Textbook:

Problem 1. If all the links in the Internet were to provide reliable delivery service, would the TCP reliable delivery service be redundant? Why or why not?

Problem 2. The book gives four desirable characteristics of a broadcast channel. Which of these characteristics does slotted ALOHA have? Which of these characteristics does token passing have?

Problem 3. In CSMA/CD, after the fifth collision, what is the probability that a node chooses $K = 4$? The result $K = 4$ corresponds to a delay of how many seconds on a 10 Mbps Ethernet?

Problem 4. Why is an ARP query sent within a broadcast frame? Why is an ARP response sent within a frame with a specific destination MAC address?

Problem 5. Go read about the Tunneled Direct Link Setup (TDLS) used in 802.11 Wifi. Explain what the purpose of this extension is and why it improves link efficiency. Give an example of a home system that might benefit from this.

Problem 6. Suppose four active nodes—nodes A, B, C and D—are competing for access to a channel using slotted ALOHA. Assume each node has an infinite number of packets to send. Each node attempts to transmit in each slot with probability p. The first slot is numbered slot 1, the second slot is numbered slot 2, and so on.

a. What is the probability that node A succeeds for the first time in slot 5?
b. What is the probability that some node (either A,B,C or D) succeeds ins slot 4?
c. What is the probability that the first success occurs in slot 3?

d. What is the efficiency of this four-node system?

Problem 7. Suppose nodes A and B are on the same 10Mbps broadcast channel and the propagation delay between the two nodes is 325 bit times. Suppose CSMA/CD and Ethernet packets are used for this broadcast channel. Suppose node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. Can A finish transmitting before it detects that B has transmitted? Why or why not? If the answer is yes, then A incorrectly believes that its frame was success- fully transmitted without a collision. *Hint*: Suppose at time t = 0 bits, A begins transmitting a frame. In the worst case, A transmits a minimum-sized frame of 512 + 64 bit times. So A would finish transmitting the frame at t = 512 + 64 bit times. Thus, the answer is no, if B's signal reaches A before bit time t = 512 + 64 bits. In the worst case, when does B's signal reach A?

Problem 8. You are being asked to design a 6Mbps cable modem network. Your network uses a single shared channel on a coaxial cable that runs amongst 10 houses on a local network. Each house has a cable model. There is a single "head end" system that represents the cable company and the connection to the Internet. The distance between the houses is several hundred meters.

a. What is the advantage/disadvantage of using simple CSMA/CD on this network?
b. What is the advantage/disadvantage of using a slotted system, where individual cable modems are given specific slots to transmit in?
c. Consider using a master/slave system where the head end acts as the master, how would individual cable modems notify the master that they would like to transmit?
d. Would the resulting system result in an asymmetry between downlink speed and uplink speed?
e. What are the disadvantages of this system from a security and privacy perspective?