CS 484/504 Homework - 2

Fall 2022
Computer Science Department, New Mexico State University

All questions have equal weight. Graduate problems are extra-credit when done by undergraduates.

1. Prepare a 4-bit CRC to transmit your initials using the polynomial 0x13 (If your name has more than two initials or is not in ASCII, choose your favorite 2 English letters). Calculate the CRC using polynomial division. Show each step as demonstrated in the class slides.

   (a) What initials are you using?

   (b) What are these initials in binary when encoded in 8-bit ASCII?

   (c) After adding space for the CRC, what is the message polynomial you will be dividing by the 0x13 polynomial?

   (d) What does 0x13 look like when transformed into a polynomial?

   (e) What is the remainder? Show your work using polynomial division.

   (f) What is the full binary message you will send including the CRC?

2. Prepare a 4-bit CRC to transmit your initials using the polynomial 0x13 (If your name has more than two initials or is not in ASCII, choose your favorite 2 English letters). Calculate the CRC using left shifts and XORs. Show each step as demonstrated in the class slides.

   (a) What initials are you using?

   (b) What are these initials in binary when encoded in 8-bit ASCII?

   (c) After adding space for the CRC, what is the 20-bit starting binary number for the CRC algorithm?

   (d) What is the resulting CRC? Show your work using left shifts and XORs.

   (e) What is the full binary message you will send including the CRC?

3. Fill in the blank: Imagine you are using CSMA/CD to send Ethernet frames over a shared line. You had a collision, so you started your exponential back-off. You had a second collision and back off more. It is now the third time that you tried to transmit, but had a collision. You need to choose a random number between 0 and _____.

4. **Graduate Question:** There is a flaw in the CSMA/CD exponential backoff system that leads to unfairness. This flaw is called the "capture effect". Read the scenario presented in this question from the 2004 GATE exam (a standardized exam from India): https://www.geeksforgeeks.org/gate-gate-cs-2004-question-54/ If A had won the second backoff race, and they collide again a third time, what is the probability that A wins the 3rd race?

5. Imagine someone is not interested in being fair and is selfishly willing to choose not to do an exponential backoff, and they retransmit right away after every collision. How could you detect and prove that they were cheating the system?

6. Imagine you are a smartphone connected via WiFi to a base station along with several other devices. You receive a CTS frame from the base station, but did not ever here an RTS frame. Can you assume that the device wanting to send data to the base station has disconnected? Can you send a message now or do you have to wait? Why?

7. If I want to send out an ARP request to find the MAC address for the IP address 192.168.1.12, what do I set as my DST MAC address? What does this tell the switch to do?

8. In Android, if I try to join the AggieGuest WiFi network that doesn't require a password, I get a warning that says"You are connecting to the unsecured (open) Wi-Fi network AggieGuest. Information sent is not encrypted and may be visible to others. Do you still want to connect?" What does this mean? Why do I not get this warning when connecting to "AggieAir-WPA2"?

9. **Graduate Question:** ARP Poisoning is the name of an attack where the attacker sends false ARP responses to ARP queries to trick the switch into sending Ethernet frames to the attacker instead of the true recipient. If you were concerned about this kind of data stealing in your network, what could you do to prevent it? Explain.

10. Switches do their best to pass Ethernet frames along without dropping any frames. But sometimes they are forced to do so. Describe a scenario where a switch would drop frames. Why would it have to drop frames? How could you check if this is happening on your own network?