Homework 5

CST 311, Introduction to Computer Networks, Spring 2019

READ INSTRUCTIONS CAREFULLY BEFORE YOU START THE HOMEWORK.

This homework is due on Sunday, April 28, 2019.

Homework must be submitted electronically through iLearn on https://ilearn.csumb.edu by 11:55 pm on the due date. Late homework will not be accepted.

Homework must in pdf format only. Any other formats will not be accepted. You must submit a single file for the entire homework. The naming convention of the file should be HW5_yourlastname.pdf. **Put your name in the document as well.** Your homework submission should present the problems in the original order and be properly labeled.

This homework is worth 100 points. Each part of a question carries equal weight unless specified otherwise.

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Link Layer

Section 1:

(50 points)Answer the following questions in 4-5 sentences:

1. **Explain how channel partitioning works in TDMA and FDMA.**
    a. TDMA stands for Time Division Multiple Access, where each channel is given a fixed length of time. These slots can either be in use or unused, called idle. TDMA's purpose is to give every slot the same fairness. The average rate is used to calculate the length of a slot, which is found by dividing the channel rate by the number of nodes. FDMA stands for Frequency Division Multiple Access, where each channel is divided by a fixed frequency bandwidth, each of these slots of frequency will then be assigned to a node. They both share the issue that slots can simply be idle, and do nothing.

2. **Explain the working of slotted ALOHA. What are the pros and cons of slotted ALOHA?**
    a. ALOHA is a type of random access protocol that divides equal time slots where at the end of said time slot a node will try to transmit. For this to work every node knows if a collision happens. When a collision happens

between two or more nodes, each node will try to retransmit with a new probability, to lessen the chance of another collision.

b. Pros: When a node managed to be transmitted without a collision, it gets transmitted with the full rate that the channel has to offer.
c. Cons: Simply retransmitting a node at a new probability does not ensure that a retransmit will be successful, meaning that many idle time slots could be generated.

3. **What is the basic principle behind CSMA? How is CSMA/CD an improvement over CSMA?**
    a. CSMA stands for Carrier Sense Multiple Access. CSMA uses a technique that listens to a channel before it transmits. It waits for the channel to be idle to transmit a node.
    b. CSMA/CD is similar to CSMA with having the ability to look ahead if a channel is idle or not, plus the ability to cut a transmission short if any collision is detected during the transmit.

4. **What is the main function of ARP? Why do you need it?**
    a. ARP stands for Address Resolution Protocol. ARP is used to translate between network layer addresses and link layer addresses, such as IPv4 to MAC. Every host and router has an ARP table in memory, to ensure when a host moves between networks it can still map the corresponding IP address to the device's MAC address.

5. **What is the success rate of Slotted ALOHA? Prove it.**
    a. Slotted ALOHA's success rate is 0.38 while normal ALOHA has a success rate of 0.18.
    b. Proof: https://ilearn.csumb.edu/pluginfile.php/1283136/mod_resource/content/1/ALOHA%20Efficiency%20proofs.pdf

Section 2:

(50 points) This section contains problem solving questions.

1. **(20 points) Calculate the 2-dimensional parity of the following bit sequences: 1001010, 1111111, 0000000, 0101010, 1101101, 0110010, 0011001**
   a. **Consider odd parity**

1	0	0	1	0	1	0	0
1	1	1	1	1	1	1	0
0	0	0	0	0	0	0	1
0	1	0	1	0	1	0	0
1	1	0	1	1	0	1	0
0	1	1	0	0	1	0	0
0	0	1	1	0	0	1	0
0	1	0	0	1	1	0	0

   b. **Consider even parity**

1	0	0	1	0	1	0	1
1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0
0	1	0	1	0	1	0	1
1	1	0	1	1	0	1	1
0	1	1	0	0	1	0	1
0	0	1	1	0	0	1	1
1	0	1	1	0	0	1	0

2. **(10 points) Calculate the checksum of the following 16-bit strings:**
   a. **A2B4 and FE9C**
   b. 1010 0010 1011 0100
   c. 1111 1110 1001 1100
   d. +------------------------
   e. 1010 0001 0101 0000 + 1
   f. +------------------------
   g. 1010 0001 0101 0001
   h. Checksum:
   i. 0101 1110 1010 1110

   j. **D789 and FF91**
   k. 1101 0111 1000 1001
   l. 1111 1111 1001 0001
   m. +-----------------------
   n. 1101 0111 0001 1010 + 1
   o. +-----------------------
   p. 1101 0111 0001 1011
   q. Checksum:
   r. 0010 1000 1110 0100

3. **(20 points) Calculate the CRC for the following. Give the bit string that must be sent (that includes the CRC).**
   a. **D = BA78, G = 1001**
      i. D = 1011 1010 0111 1000
      ii. 1001 / 1011 1010 0111 1000 000
      iii. Rest: 001
      iv. Bit String to be sent: 1011 1010 0111 1000 001
   b. **D = F096, G = 1101**
      i. D = 1111 0000 1001 0110
      ii. 1101 / 1111 0000 1001 0110 000
      iii. Rest: 100
      iv. Bit String to be sent: 1111 0000 1001 0110 100