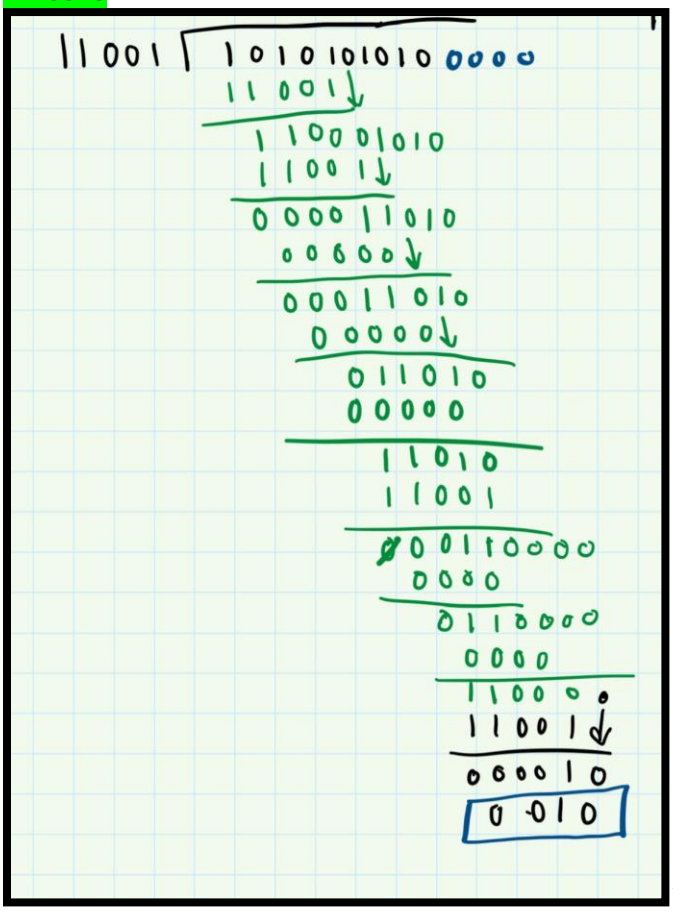
CMSC3180: Data Communication and Networking
Assignment 6 Due on Friday (11/15) midnight

Policies:

1. Discussions on these questions are welcomed and encouraged. However, you should NOT ask any other person to write solution for you or copy solutions from any other person directly. You should write the names of the persons from whom you received help and cite the references used if any.
2. Late turn in will cause a 10% deduction on your grade for each late day.

Question 1 (5 points). Consider CRC with the 5-bit generator, G=11001, and suppose that D has the value 1010101010. What is the value of R?

R = 0010



Question 2 (10 points) Consider a broadcast channel of rate R bps with M nodes. Consider the top three desirable characteristics of an ideal multiple access protocol (MAC):

1. when one node wants to transmit, it can send at rate *R*.
2. when *M* nodes want to transmit, each can send at average rate *R/M*
3. fully decentralized:
    - no special node to coordinate transmissions
    - no synchronization of clocks, slots

Pick one MAC protocol from each class (channel partitioning, random access and taking turns), and briefly explain, for each of the protocol you pick, which desirable characteristics above does it satisfy, and which one(s) doesn't it satisfy.

Channel Partitioning:

- FDMA is the best choice for the channel partitioning class. It meets two out of three requirements, whereas TDMA only meets one(R/M) out of the three requirements. FDMA meets both the requirements of R/M and Fully Decentralized. Its frequency bands allow for multiple users to send packets at once, providing fairness. The frequency bands that are not in use also go idle, therefore space is not wasted. FDMA satisfies the Fully Decentralized requirement with the lack of synchronization or control node. The only characteristic FDMA does not satisfy is the Single user case, meaning that one single user cannot use up the full bandwidth at a time.

Random Access:

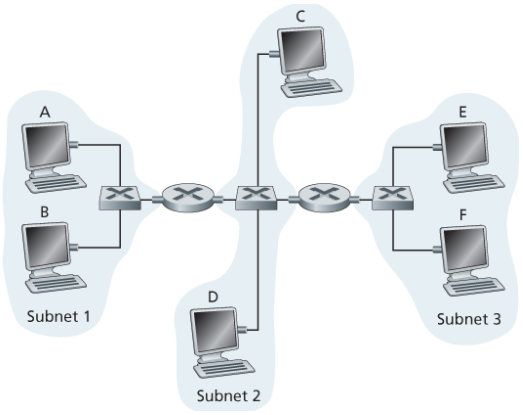
- CSMA/CD is the best choice for the Random-Access class. It meets two out of the three MAC categories. Slotted ALOHA only meets one of the MAC categories, proving CSMA/CD to be a superior choice. First, it meets the Single Node characteristic, meaning that a single user can use the entire frame when no collision or traffic is detected. Second, it satisfies the Fully Decentralized requirement with the lack of synchronization/clocks or control node. CSMA/CD does not allow the second MAC characteristic, Multiple Users.

Taking Turns:

- The two protocol options in the taking turns category meet the same requirements proving this to be a more difficult choice. Both Polling and Passing meet the Single R characteristic allowing a user to utilize the full benefits of the channel. They both also meet the requirements of R/M, allowing multiple users to access at the same time. Fully Decentralized is the only requirement not met by these two protocols, since they both employ a control node to function the system. Even though these protocols can be portrayed as the same, scale separates them when choosing a superior option. Polling is better used in small scale networks, whereas Passing is utilized in large scale networks. The scalability of Token Passing shows that this is a better choice.

	FDMA	CSMA/CD	Token Passing
Single R	**N**	**Y**	**Y**
R/M	**Y**	**N**	**T**
Fully Decentralized	**Y**	**Y**	**N**

Question 3 (15 points). Consider three LANs interconnected by two routers, as shown on right.



(1) Assign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 158.83.1.xxx; for Subnet 2 uses addresses of the form 158.83.2.xxx; and for Subnet 3 use addresses of the form 158.83.3.xxx.

Subnet 1:
- A : 158.83.1.001
- B: 158.83.1.002

Subnet 2: 158.83.xxx
- C : 158.83.2.001
- D: 158.83.2.002

Subnet 3: 158.83.xxx
- E : 158.83.3.001
- F: 158.83.3.002

(2) Assign MAC addresses to all of the adapters.

Subnet 1:
- A : 1A-2F-BB-76-09-AD
- B: 58-23-D7-FA-20-B0

Subnet 2:
- C : 0C-C4-11-6F-E3-98
- D: 71-65-F7-2B-08-53

Subnet 3:
- E : 49-BD-D2-C7-56-2A
- F: 88-B2-2F-54-1A-0F

(3) Consider sending an IP datagram from Host A to Host F. Suppose all of the ARP tables already have necessary mapping of IP addresses to MAC addresses. Enumerate all the steps (you can ignore the switches) that need to take to deliver the datagram from A to F (**Hint:** we illustrate the steps for the single-router example in class).
- The process starts by Router A creating an IP datagram with Source IP of Host A and Destination IP of Host F.
- Creates link-layer frame containing A-to-F IP datagram
- The process continues by Host A sending the datagram to Router 1, with Source MAC Host A and Destination MAC
- Router 1 Sends frame to Router 2
- Router 2 Receives the frame, decapsulates it, and identifies the destination is in subnet three.
- This tells the system to use ARP to obtain Host F's MAC address
- Router 2 sends frame to Host F
- Host F receives the frame, decapsulates it, and pulls out the IP datagram.
- Host F will accept and process the datagram once it checks that the destination IP matches it's IP address.