Midterm Review Notes

1. Wireshark Homework
   - Challenge: first think about what the network might look like
   - You figure out that there are three unique entities because there are three unique IP address
   - Note: The router will be the lowest value in the subnet
   - So, we figure out what the router was (1.1). These machines are all connected by some switch. And then, we had a bunch of ARP exchanges.
   - One of the machines was saying that Im the router and so, in the victims mapping table, it now updated that the attackers is now the router.
   - TOPICS:
     - ARP
     - ARP Tables – How they are populated
     - Drawing a basic LAN
     - Routing at the Data Link Layer only uses MAC addresses – So, in this scenario, if MAC addresses were used, then this situation would never have happened
2. Manchester Encoding
   - Two varieties
     - GE
       - First guy who did it
       - The opposite of IEEE
       - e.g. 1 XOR 0 = 1. For GE, it would be 0.
     - IEEE
       - The one that makes sense
       - Youre going to have some clock, and then some data
       - You want to encode both the clock and data together – We take the clock and XOR it with the signal
       - You take your clock and your data, and compute exclusive OR (XOR) to get your Manchester Encoding signal
       - Why is this interesting?
         - Every ethernet frame starts with a Preamble, which is a series of alternating 0s and 1s (and ends in 11). These 1s and 0s allow you to recover the clock (how fast the clock is running and when it started)
         - (See slide)
         - Note: We had this problem with unit time, where we had a particular symbol. How do we know if we have two 1s or one 1? The preamble helped recover the clock.
3. Encoding
   - How data
   - Band rate (symbols per second)
   - How encoding is affected by noise – more errors
     - Error correction
       - Parity: odd parity and even parity
         - If parity allows us to detect an error in a single stream, why dont we create a two dimensional one and detect errors in both rows and column

           ```
           101 |0
           001 |1
           110 |0
           010
           ```
         - If we pick even parity we would want even 1s

        - If one of the bits were corrupted, then we can check to see if it matches. E.g. if the second row of this example had 1 0 1, then we know there is an error because we know we need one 1 to make this even.
    - Checksum on 16 bit blocks

4. MAC Protocols
    - ALOHA
    - TDMA
    - etc.
5. Ethernet Shared Bus
    - Algorithms: CD/CA
    - Carry sense
    - Binary back off
6. CRC
    - We must determine ahead of time what our generator is
        - In this example, just making up the packet (and the CRC value)
        - Length of CRC = the length of our generator 1
        - So, in this example, the length of the CRC is 1
        - If packet is not corrupted, we would get no remainder
        - E.g. 10101 / 11 (use long division to help visualize) – essentially 21/3
            * Note, when we divide, we actually XOR
            * Imagine this to be long division . (note, the last 1 in 10101 is the CRC bit):

```
   1100
11 | 10101
     11
      11
      11
       00
       00
        01
        00
         1
```

            - We have a remainder, so corrupted packet
            * Long division guide:
                - Check the first bit value. If one, then goes up 10
                - Take the number at the top multiply by the E XOR the result the number
                - Bring down the next digit
    - Calculating the CRC bit
        - Going from data to packet + CRC
        - e.g. 1010 – Generator is 11

```
   1100
11 | 1010
     11
     011
      11
       00
       00
        0
```

        -
            * So, 0 is the CRC bit – we get 10100
        - e.g. 1011 – Generator is 11

```
   1100
11 | 1011
     11
     011
      11
      01
      00
       1
```

  - We get 10111

7. TCAM
   - We want to be able to do our forwarding in one clock cycle
   - e.g.

```
1  0  1  0
1  0  x  x
1  1  x  x
1  0  x  x
```

     - Search each memory banks in parallel to find match, e.g. 1010
       - The first two row and last row matched, but top one is priority
       - The MUX knows to take the top one because it is a priority encoder
     - Note, "x" represents "don't care"

8. BGP Hijacking
   - BGP is going to advertise a BGP path
   - For the exam: the default policy would be to select the shortest path. Otherwise, do hot potato routing.