**CSCE 560 Homework 6**

**Chapter 7 – Wireless and Mobile Networks**

**Fall 18**

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**Assigned: Monday, 28 Nov**

**Due: Wednesday, 5 Dec, 1400**

You must include these questions in your submitted solution. In other words, your submission must include the question listed followed by your solution with the answer clearly indicated (e.g., put a box or circle around the final answer).

Problem 1. Chapter 7, R3. What are the differences between the following types of wireless channel impairments: path loss, multipath propagation, interference from other sources?

**Sol’n:**

Path Loss is the loss of signal strength due to attenuation of the signal as it propagates away from the source and passes through matter like walls.

Multipath Propagation is the radio signal bouncing off objects and the ground causing the signal to arrive at the destination at slightly different times, resulting in blurring of the received signal at the receiver.

Interference is the EM noise generated by other devices that operate in the same 2.4Ghz frequency. In the case of 802.11 this interference is caused by things like microwaves and cordless phones.

Problem 2. Chapter 7, R5. Describe the role of the beacon frames in 802.11?

**Sol’n:**

The beacon frame is sent by the Access Point and is received by hosts in passive mode. The beacon frame contains the AP’s SSID and MAC Address so that then the host can associate with that particular Access Point via an Association Request. This allows for roaming between wireless access points while maintaining a connection. Additionally, the beacon allows for synchronization between the Access Point and the associated hosts.

Problem 3. Chapter 7, R6. Explain why the following statement is either true or false: Before an 802.11 station transmits a data frame, it must first send an RTS frame and receive a corresponding CTS frame. [Question has been modified from the text version.]

**Sol’n:** The statement is true as long as the size of the data frame is greater than or equal to the size of the RTS threshold. Before transmitting data, the host sends an RTS frame to the access point and then waits for the CTS to be broadcast before sending data.

Problem 4. Chapter 7, R7. Why are acknowledgements used in 802.11 but not in wired Ethernet?

**Sol’n:** Due to path loss, multipath propagation, and interference, the bit error rate for wireless is significantly higher than for Ethernet, so in wireless we need to make sure that the transmission was successful. Additionally, we can’t detect collisions in wireless so without ACKs we don’t know if our transmission collided with another or not.

Problem 5. Chapter 7, R8. True or False. Ethernet and 802.11 use the same frame structure.

**Sol’n:** False.

Problem 6. Chapter 7, R10. Suppose the IEEE 802.11 RTS and CTS frames were as long as the standard DATA ~~and ACK~~ frames. Would there be any advantage to using the CTS and RTS frames? Why or why not? [Question has been modified from the text version.]

**Sol’n:** There would not be any advantage because the purpose of RTS/CTS is to avoid collisions when sending data. RTS/CTS frames can collide and its okay because they are small and don’t take much time to generate. If the RTS/CTS frames are the same size as the data, then you don’t save any time by generating and sending these special frames.

Problem 7. Chapter 7, R11. Section 7.3.4 discusses 802.11 mobility, in which a wireless station moves from one BSS to another within the same subnet. Assume two APs are interconnected with a switch and the wireless station moves from BSS1 to BSS2. An AP may need to send a frame with a spoofed MAC address to get the switch to forward the frame properly. Why? Which AP sends the spoofed frame? [Question has been modified from the text version.]

**Sol’n:**

In the switching table in the switch, all traffic associated for H1 is going through AP1 since H1 is associated with AP1. Therefore, AP2 will send the spoofed frame to make the switch think it came from AP1 since that is the entry it has in its switching table.

Problem 8. Chapter 7, P1. Consider the single-sender CDMA example in Figure 7.5. What would be the sender's output (for the 2 data bits shown) if the sender's CDMA code were (1, -1, 1, -1, 1, -1, 1, -1)? Fill in the blanks: d1 = \_\_\_\_ d1 = 0\_\_\_\_\_\_\_ d0 = \_\_\_\_ d0 = 1\_\_\_\_\_\_\_\_

**Sol’n:**

The sender’s output is the channel output and is given by

Zi,m = di\*cm

With this code, we can find di by

C = (1, -1, 1, -1, 1, -1, 1, -1)

Z1 = (-1, -1, -1, 1, -1, 1, 1, 1)

Z0 = (1, 1, 1, -1, 1, -1, -1, -1)

This means that

d1 = 1\*-1 + -1\*-1 + 1\*-1 + -1\*1 + 1\*-1 + -1\*1 + 1\*1 + -1\*1 = -1+1+-1+-1+-1+-1+1+-1 = -4/8 = -0.5 🡪 d1 = 0

d0 = 1\*1 + -1\*1 + 1\*1 + -1\*-1 + 1\*1 + -1\*-1 + 1\*-1 + -1\*-1 = 4/8 = 0.5 🡪 d0 = 1

Problem 9. Chapter 7, P7. Suppose an 802.11b station is configured to always reserve the channel with the RTS/CTS sequence. Suppose this station suddenly wants to transmit 1,000 bytes of data, and all other stations are idle at this time. As a function of SIFS and DIFS (i.e., your answer will contain the variables “SIFS” and “DIFS”), and ignoring propagation delay and assuming no bit errors, calculate the time required to transmit the frame and receive the acknowledgment. Assume a transmission rate of 11 Mbps.

**Sol’n:**

Since the channel is idle, the time to transmit from the station to the access point is given by

DIFS +RTS + SIFS + CTS+ SIFS + Tt + SIFS

The access point will also then send an ACK once it sees the SIFS.

Tt = 8000 bits/11\*106 bps = 7.27\*10-4seconds

TACK denotes time for transmitting the ACK.

Thus, ignoring propagation delay and bit errors, the time to transmit the data plus receive the ACK is

Ttotal = DIFS +RTS+SIFS+CTS+SIFS+ 7.27\*10-4seconds + SIFS + TACK