**TM 510 Quiz One**

**Dr. Kevin Ryan: Spring Semester 2022**

**Solutions**

1. Please read the following ethical statement. If it is true, please enter your name in the space provided.

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination. I further pledge that I have not referred to or copied any material from another student, a book, article, the Internet or any other source during this exam. I further pledge that I have not down-loaded this exam or have saved a copy of this exam in any form.

Name (Print) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_

1. Why is the "Four Frame Exchange” protocol implemented in the IEEE 802.11 MAC (sub)layer and not in the IEEE 802.3 MAC (sub)layer? Discuss. **(15 points)**

**Short Answer: (Note to TA: this “short answer” is valid for full credit).**

* **More bit-errors in the wireless channel (compared to the wired channel) due to the increase in noise and interference.**
* **Implementing error recovery in the MAC layer (instead of relying on TCP) reduces the time to recover from an error.**

**Key point: the wireless communications channel has a higher error rate compared to a wired connection. (This higher error rate is due to the increased noise and interference in the wireless channel compared to a wired channel). Error recovery may be implemented by TCP (Layer Four); however – TCP is located in the end systems. IEEE 802.11 LANs implement error detection and recovery using the Four Frame Exchange protocol implemented in the MAC layer. This results in a faster error recovery process compared to the end-to-end recovery implemented in TCP.**

1. Why does slotted Aloha have better performance compared to Aloha? Discuss and be specific. **(3 points)**

**In slotted Aloha, stations can only transmit at specific times. Thus, a collision will occur between two stations sending at the same time. Result: the collision has a duration equal to the packet length, T.**

**In Aloha, stations can transmit at any time. Thus, a collision can occur with one-bit overlap between packets (the last bit of one packet overlapping with the first bit of another packet). Result: the impact of the collision may have a duration equal to approximately two times the packet length, 2∙T. (Two packets sent at different times collide. Both packets are no longer valid. The time to transmit these packets (which may be as large as 2∙T) is wasted). Thus, in Aloha, the impact of a collision can last longer and reduce the efficiency of the network by approximately a factor of two.**

**PAGE TWO**

1. Why is “collision detection” not used in the MAC (sub)layer in IEEE 802.11? Be specific. **(15 points)**

**Key Point: very difficult to detect a collision in a wireless environment due to noise and interference.**

1. What is the purpose of the Preamble field in the header of the IEEE 802.3 MAC frame? **(2 points)**

**To achieve synchronization between the transmitter and receiver.**

**Note: will also accept (for full credit): to “train” or set-up the adaptive equalizer in the receiver.**

1. What are two specific advantages of single-mode fiber compared to multi-mode fiber? **(2 points each; 4 points total)**

* **Increased transmission distance**
* **Increased data rate (bps)**

1. Which of the three LLC services is most commonly used? **(2 points)**

**Unacknowledged Connectionless Service**

Why? **(4 points)**

**Presence of TCP**

1. How is priority implemented in IEEE 802.11? **(5 points)**

* **Delay!! (Note to TA: this one-word answer is valid for full credit).**

**More details: different messages are assigned different delays (or time to wait) before sending. Thus, if a low-priority message is waiting to be sent, a higher priority message (with a smaller delay) can arrive later and be sent first.**

1. List one IEEE 802.11 frame which has the highest priority. **(2 points)**

**Any one of the following is valid for full credit:**

* **Acknowledgement (ACK)**
* **Clear to Send (CTS)**
* **Poll Response**

1. What is the potential disadvantage of implementing priority in a communications system? Discuss and be specific. **(8 points)**

**Potential disadvantage: high priority traffic may lock-out (or block) the lower priority traffic. Thus – lower priority traffic may not receive the required level of service due to the preference given to higher priority traffic.**

**Solutions are continued on the next page**

**PAGE THREE**

1. How does the IEEE 802.11 MAC protocol limit the negative impact of implementing priority? Please be specific. **(5 points)**

**To limit the negative impact of implementing priority, the 802.11 MAC protocol limits the amount of time polling can be done in 802.11. Note to TA: this answer (or similar answer) is valid for full credit.**

**Additional information not required for full credit: the time for polling is limited by the definition of a “superframe”. Polling may only occur for a specific amount of time in a superframe. Note: polling has higher priority (a shorter IFS) compared to transmission of ordinary (asynchronous) data. Thus, if polling were to occur all the time, it would “lock-out” or “block” transmission of ordinary data.**

1. Consider an IEEE 802.11 LAN with only one user. List the steps in the IEEE 802.11 CSMA/CA protocol for this user’s device to transmit a data frame. **(15 points)**

* **Wireless device “senses” the medium; is medium idle? (Since we only have one user, the answer will be “yes”).**
* **User’s device now waits its “Interframe Space”; (“long” delay since user is transmitting a data frame)**
* **Is medium still idle? (Since we only have one user, the answer will be “yes”).**
* **Wireless device transmits the frame**

1. Given: A PC with an IEEE 802.3 interface. This PC is implementing TCP/IP along with the most commonly used LLC service. This PC receives a MAC frame with one or more bit-errors in the frame. **(10 points total)**
   1. Which layer detects the bit errors? **(5 points)**

**MAC**

* 1. If this frame is retransmitted, which layer initiates retransmission? **(5 points)**

**TCP**

1. Given: A PC with an IEEE 802.11 interface. This PC is implementing TCP/IP along with the most commonly used LLC service. This PC receives a MAC frame with one or more bit-errors in the frame. **(10 points total)**
2. Which layer detects the bit errors? **(5 points)**

**MAC**

1. If this frame is retransmitted, which layer initiates retransmission? **(5 points)**

**MAC**