**EE 122**
**Spring 2004**
**Wi-Fi Study Guide**

Reading: Section 2.8.2, “Collision Avoidance” from Peterson and Davie:

- What are the hidden node and exposed node problems?
- What is RTS/CTS and why is it useful? What are the disadvantages of using RTS/CTS?
- What is the difference between “Collision Detection” and “Collision Avoidance,” and which is done in 802.11?
- In wireless networks, why is it hard/impossible to detect collisions in real time as is done in wired networks?
- In 802.11, the receiver sends an acknowledgement to the sender after successfully receiving a packet. Does wired Ethernet have such an acknowledgement scheme? Why do you think the designers of 802.11 chose to use an acknowledgement scheme, when such a scheme was not used in wired Ethernet?
- What are some (other) reasons that wireless Ethernet require a different MAC design than wired Ethernet?
- The last sentences of the first paragraph of pg 134 is not correct. In the 802.11 standard, a node that sees the RTS frame but not the CTS frame refrains from transmitting for the length of time (NAV) indicated in the RTS frame.

Reading: Sections 2.8.3-2.8.4, “Distribution System and Frame format” from Peterson and Davie

- What are access points and distribution systems?
- Why do wireless Ethernet packets carry 4 addresses while wired Ethernet packets carry just two addresses?

Reading: “IEEE 802.11 Wireless Local Area Networks” article, “Medium Access Control Sublayer” section, pp. 118-121

- In the 802.11 standard, stations can choose to always use the RTS/CTS mechanism, never use the RTS/CTS mechanism, or use the RTS/CTS mechanism when the packet size exceeds a programmable threshold. Why do you think one might choose not to use RTS/CTS for small packets?
- What is a NAV? How does a station update its NAV when RTS/CTS is not in use? How does it update its NAV when RTS/CTS is in use? How is the NAV scheme useful in reducing collisions?
- When a receiver sends an acknowledgement (ACK) to a sender, it sends it after the medium has been idle for SIFS length of time, while others starting a new frame must wait for the medium to be idle for at least DIFS length of time. Knowing that SIFS<DIFS, why is a receiver who is sending an ACK not likely to be interrupted by others starting a new frame? Why do you think the designers of 802.11 chose these Inter-Frame Spacing times to give priority to ACKs over other frames?
- After a retransmission attempt, how does a station decide to set its backoff timer? Is it similar to the exponential backoff in wired Ethernet?
- Think about the efficiency of this protocol. What throughput is possible in the best case -- where only one station is trying to send and there is no contention? Hint: study the fraction of time the medium is used to send useful data, vs. the time waiting before sending each packet (DIFS), the time waiting for the ACK (SIFS), the time taken to receive the ACK, and the time spent sending the packet header and preamble.

Don’t worry about:

- Frame Format Details
- Details of Point Coordination Function (PCF) mode, just know what it is. Focus more on the Distributed Coordination Function (DCF) mode, which is used more often in practice.
- Values of DIFS, PIFS, SIFS, etc.
- Physical Layer details, modulation schemes, etc.