NET3900: Assignment 3

These questions are based on Module 3. Submit your answers via Bb by end-of-day Thursday Sept 29, 2016. Always show your calculation or provide explanation for your answers. The marks value for each question follows the question number.

Q1/2: Briefly explain the two methods a wireless station uses to determine if the channel is clear.
1. Physical Carrier Sense: The Wi-Fi Radio listens for RF energy in the air.

2. Virtual Carrier Sense: The wireless station waits for the NAV timer to expire. The NAV time is a prediction of the how long the transmitting station will use the channel the NAV timer is based on the Duration field in the transmitted frame.

The channel is considered free if there is no detected RF energy and the NAV timer has expired.

Q2/4: Answer the following questions regarding the 80.211 channel access algorithm.
a) What is the name of the algorithm?
DCF: Distributed Coordination Function

b) Briefly describe each of the three steps.
1. Listen for clear channel: Use Physical Carrier Sense and Virtual Carrier Sense to determine when the channel is available.

2. Station Waits it Turn to Transmit: There are wait periods as follows.
a. Interframe Spacing: The basic wait period is DIFS (DCF Inter-Frame Space). This ensure higher priority station transmit first.
b. Contention Window: A station waits a random period to time within the Contention Window. This separates users over time to reduce the likelihood of collision.

3. Transmit the Frame: This follows the expiry of the Contention wait.
If an ACK is received the transmission is complete. If no ACK is received then re-transmit at the next opportunity.

Q3/1: Consider a scenario with only two wireless stations which are in RF range of each other; one on channel 1 and the other on channel 6. Both stations wait the DIFS period and select the same contention window slot. What happens to the contention window during the next transmission?
Since the stations are on different channels, they don't hear each other and therefore, there is no collision. There is no change in the Contention Window during the next transmission.

Q4/2: Why does the 802.11 frame have four address fields?
1. Transmitting Station MAC Address
2. Receiving Station MAC Address

3. Transmitting Radio MAC Address
4. Receiving Radio MAC Address

Q5/2: Which scanning process is preferred and why?
There are two processes: Passive Scanning and Active Scanning.
Active Scanning is preferred because the station sends a Probe Request instead of waiting for a Beacon. Therefore the scanning process is faster.

Q6/2: Briefly explain the process for a wireless station to connect to an access point in terms of messages sent. Ref: slides 23-25.
A. Authentication Process
Wireless Station sends Authentication Request
(Note: this is not the Post Association Auth Process such as 802.1X. It is remnant from WEP)
Access Point responds with Authentication Reply (OK)

B. Association Process
Wireless Station sends Association Request
Access Point responds with Association Reply (OK)

Wireless Station is now Associated and is assigned an Association ID.

Q7/2: Briefly explain the "Hidden Node Problem".
Hidden node problems can occur when two wireless stations can each communicate with the Access Point BUT the two stations cannot hear each other. Since they cannot hear each other, it is possible that they will transmit at the same time resulting in over the air collision.

Q8/2: A Wi-Fi data frame, 500B in length, is being is transmitted using 802.11a at a PHY rate of 48 Mbps. Assume the following durations: DIFS=34us, Avg CW wait = 67us, PHY header=20us, SIFS=16us and the ACK=24us. What is the total time that the channel is busy when transmitting this frame. REF: slide 30.
Note: For this course you should only use the approximate formula for the "Data Frame Duration" shown on slide 30.
First calculate the Data Frame Duration.
DFD = Length / PHY rate = 500 x 8 / 48 = 83 usec.

Therefore the Total Frame Duration = DIFS + Avg CW wait + PHY + Data Frame + SIFS + ACK
Total Frame Duration = (34 + 67 + 20 + 83 + 16 + 24) usec
= 244 usec

Therefore the transmission of this frame results in the channel being busy for 241 usec.

Q9/2: For the frame in Q8, what is the channel throughput?
Throughput = Frame Length / Total Frame Duration

= 500 x 8 / 244
= 16 Mbps

Q10/1: For the frame in Q8 and Q9, what is the protocol efficiency?

Efficiency = Throughput / PHY x 100%
= (16 x 100) / 48
= 33% (or 34% depending on rounding)