UNIVERSITY OF CALIFORNIA, LOS ANGELES

*CS M117*

**Homework #1**

*CS M117* Student name \_\_\_\_\_Tian Ye\_\_\_\_\_\_\_\_\_\_DIS:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *1A* | *1B* | *1C* | *1D* | *1E* | *1F* |
|  | *X* |  |  |  |  |

**Data Transmission over 802.11b Wireless LAN**

**Maximum total points [20]**

1. **[2]** Are RTS and CTS used with short packets, even if there is a hidden terminal situation?

The purpose of RTS and CTS is to prevent collisions. Short packets on the other hand reduce possibility of collisions and require more overhead to configure RTS and CTS. Hence it is not worth it to use RTS/CTS with short packets, as the performance tradeoff is not worth the small chance of collisions.

**2. [2]** Should we still use the Contention Window and Binary Backoff with short packets? Explain?

While short packets still do reduce the chance of collisions, the Contention Window and Binary Backoff should still be used to maintain a fair distribution of resources without overloading the buffer.

**3. [2]** Why can a new packet that senses the medium idle go off without using the Contention Window (see class slide: “direct access if medium is free”)?

The Contention Window prevents collisions via creating time delays while still allowing packages to be sent. If the medium is idle; however, there are no signals in the medium therefore removing all risk of collision. Therefore, direct access is granted and a package is sent.

**4. [2]** To deal with this problem 802.11, when many users are located in the same area, and use the same wireless LAN at the same time, what access methods are defined to supports two modes of operations?

SDMA – used for allocating a separate space to users in wireless networks, separating spaces and preventing overlap of interference ranges.

FDMA – in FDMA each channel can be assigned to the fixed frequency at all time or change frequencies according to a certain pattern

TDMA – compared to FDMA, TDMA offers a much more flexible scheme, which comprises all technologies that allocate certain time slots for commination

**5. [2]** Consider the effect of using slow start on a line with a 10-msec round-trip time and no congestion. The receive window is 24 KB and the maximum segment size is 2 KB. How long does it take before the first full window can be sent?

A slow start doubles the contention window will be doubled; hence we will succeed after 4 round trips, which is 40 msec.

**6. [2]** Given a channel with an intended capacity of 20 Mbps. The bandwidth of the channel is 3 MHz. What signal-to-noise ratio is required in order to achieve this capacity?

C = B\*log(1+S/N)

S/N - 100.6

Answer in decibels: 20 db.

**7. [2]** What is the channel capacity for a tele-printer channel with a 300-Hz bandwidth and a signal-to-noise ratio of 3dB?

Using the same formula, we find channel capacity to be 600 Mbps.

**8. [1]** What really means an idle state?

|  |
| --- |
| a. when data is not being sent  b. after binary backoff algorithms finish  c. when there is no significant value in the measured power for the medium |

**9. [1]** Five channels, each with a 100-KHz bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 10 KHz between the channels to prevent interference?

A minimum of four guard bands are required for five channels. Hence the required bandwidth is therefore 5 \* 100 + 4 \* 10, being 540 kHz.

**10) (a) [0.5]** List the three different modes of multipath signal propagation (besides direct signal) and the cause for each of these modes.

**(b) [1]** What kind of signal reception problems these different modes cause?

**a)** **1.** Reflection: When waves reflect off surfaces larger than the wavelength

**2. Diffraction: When waves get obstructed by surfaces with sharp irregular edges**

**3. Scatter: When waves hit objects smaller than the wavelength; the waves scatter in smaller weaker signals**

**b) 1. Large Scale fading**

**2. Small Scale fading**

**3. Small Scale fading**

**4**.

2) (a) How do multipath signals effect signal reception? This effect limits the transmission rate of wireless channel.

**11) [0.5]** What is frequency range of 802.11b Wireless Channel?

2.4 to 2.4835 GHz

**12). [2]** Multipath fading is maximized when the two beams arrive 180 degrees out of phase. How much of a path difference is required to maximize the fading for a 50-km-long 1-GHz microwave link?

Path difference = 180 degree phase shift

Wavelength = c/f

Hence Path difference = 0.1499 m