6

Homework: Wireless Lans I

Last Name:

First Name:

Due Date

# Directions

E-mail your homework file to [panko@hawaii.edu](mailto:panko@hawaii.edu) before class starts on the date due.

Add your last name to the file name.

Test Your End of Chapter Questions

You must do all Test Your Understanding in **boldface**.

You are not responsible for ~~crossed-out~~ questions in the homework or on the exam.

You are responsible for other TYU questions on the exam and are strongly encouraged to do them.

You must do all end-of-chapter questions that are not ~~crossed out~~.

Place your cursor at the end of a question. This will put you into the answer style.

# Introduction

## OSI Standards

1. a) At what layers do wireless LANs operate?

b) Do wireless LAN standards come from OSI or TCP/IP? Explain.

## 802.11 = Wi-Fi

2. a) Distinguish between 802.3 standards and 802.11 standards.

**b) Distinguish between 802.11 and Wi-Fi**.

c) How will this book use the two terms?

## Access Point Operation

3. a) In a wireless LAN, do two wireless hosts usually send frames directly to one another? Explain.

**b) Why does the access point connect to the Ethernet workgroup switch**?

# Radio Signal Propagation

4. a) In 802.3 Ethernet networks, can simple installation rules usually reduce propagation effects to nonissues?

**b) In 802.11 Wi-Fi networks, can simple installation rules usually reduce propagation effects to nonissues**?

## Frequencies

5. a) What is a transceiver?

**b) Is wireless radio transmission usually expressed in terms of wavelength or frequency**?

c) What is a hertz?

d) Convert 3.4 MHz to a number without a metric prefix. (The use of metric prefixes was discussed in a box in Chapter 1.)

e) At what range of frequencies do most wireless systems operate?

## Antennas

6. a) Distinguish between omnidirectional and dish antennas in terms of operation.

b) Under what circumstances would you use an omnidirectional antenna?

c) Under what circumstances would you use a dish antenna?

**d) What type of antenna normally is used in WLANs? Why**?

## Wireless Propagation Problems

7. **a) If you quadruple propagation distance, how much will signal intensity change at the receiver**?

**b) If you increase propagation distance by a factor of 100, how much will signal intensity change at the receiver**?

**c) If the signal strength from an omnidirectional radio source is 8 mW at 30 meters, how strong will it be at 150 meters, ignoring absorptive attenuation? Show your work**.

**d) What will it be at 200 meters**?

8. **a) Contrast inverse square law attenuation and absorptive attenuation**.

b) How are dead zones created?

**c) What is the most serious propagation problem in WLANs**?

d) How is it controlled?

e) List some sources of EMI.

**f) What two propagation problems become worse as frequency increases**?

# Radio Bands, Bandwidth, and Spread Spectrum Transmission

## Service Bands

9. **a) Distinguish among the frequency spectrum, service bands, and channels**.

b) In radio, how can you send multiple signals without the signals interfering with one another?

**c) How many channels are there in the FM band**?

## Signal and Channel Bandwidth

10. **a) Does a signal usually travel at a single frequency, or does it spread over a range of frequencies**?

b) If the lowest frequency in a channel is 1.22 MHz and the highest frequency is 1.25 MHz, what is the channel bandwidth? (Use proper metric notation.)

**c) If you want to transmit seven times as fast, how much wider must the channel be**?

d) Why is large channel bandwidth desirable?

e) What do we call a system whose channels are wide?

f) What other types of system do we call broadband?

## Licensed and Unlicensed Service Bands

11. a) Do WLANs today use licensed or unlicensed service bands?

**b) What is the advantage of using unlicensed service bands**?

c) What is the downside?

## Channel Use and Co-Channel Interference

## The 2.4 GHz and 5 GHz Unlicensed Service Bands

12. a) In what two service bands does 802.11 operate?

b) How many 20 MHz non-overlapping channels does the 2.4 GHz band support?

c) Why is this a problem?

**d) Why are companies moving rapidly into the 5 GHz band**?

e) Why is it important that governments add more bandwidth to the 5 GHz band?

**f) If you triple channel bandwidth, what happens to the number of channels in the service band**?

# Spread Spectrum Transmission

## Normal versus Spread Spectrum Transmission

13. a) In the 2.4 GHz and 5 GHz service bands, what type of transmission method is required by regulators?

**b) What is the benefit of spread spectrum transmission for business communication**?

c**) Is spread spectrum transmission done for security reasons in commercial WLANs**?

**d) Does spread spectrum transmission increase transmission speed**.

## Orthogonal Frequency Division Multiplexing

14. **a) In normal radio operation, how does channel bandwidth relate to the bandwidth required to transmit a data stream of a given speed**?

**b) How does this change in spread spectrum transmission**?

c) What spread spectrum transmission method dominates today?

**d) Why does it use subcarriers instead of simply spreading the data over the entire channel**?

# 802.11 WLAN Operation

15. **a) Why do most access points need to connect to Ethernet networks**?

**b) In Figure 6-15, what is the distribution system**?

## Wireless Access Points

16. **Why must an access point remove an arriving packet from the frame in which the packet arrives and place the packet in a different frame when it sends the packet back out**?

## Basic Service Sets (BSSs)

17. **a) What is a BSS**? (Do not just spell out the acronym.)

b) What is an SSID? (Do not just spell out the acronym.)

c) Does the access point have an SSID?

**d) Why must wireless devices know the access point’s SSID**?

## Extended Service Sets (ESSs), Handoffs, and Roaming

18. a) What is a handoff in 802.11?

b**) What is an ESS**? (Do not just spell out the abbreviation.)

c**) What characteristics do all access points in an ESS share**?

**d) How can access points communicate with each other to accomplish roaming**?

## Media Access Control

19. All wireless hosts and the access point that serves them transmit on the same channel. **a) What problem does this cause**?

b**) How does media access control address this problem**?

c) **Does media access control apply to wireless hosts, access points, or both**?

# ~~Box: Media Access Control (MAC)~~

## ~~CSMA/CA+ACK Media Access Control~~

~~20. a) What does CS mean? (Do not just spell out the abbreviation.) b) How is carrier sensing used in multiple access? c) Why is CA desirable? d) Does a frame’s receiver transmit an ACK immediately or after a random delay? e) Is CSMA/CA+ACK reliable or unreliable? f) Why was 802.11 made reliable? g) Is CSMA/CA+ACK efficient?~~

## ~~Request to Send/Clear to Send (RTS /CTS)~~

~~21. a) Describe RTS/CTS. b) Is CSMA/CA+ACK required or optional? c) Is RTS/CTS required or optional? d) Which is more efficient, RTS/CTS or CSMA/CA+ACK? e) When does it make sense to use RTS/CTS?~~

# 802.11 Transmission Standards

## Speed and Market Status

22. **a) Compare the rated speed of 802.11n and 802.11ac**.

**b) Compare the market statuses of 802.11n and 802.11ac**.

## Channel Bandwidths and Numbers of Channels

23. a) Why is wider channel bandwidth good?

**b) What is the downside of wider channel bandwidth**?

c) **What frequency band or bands do 802.11n and 802.11ac use**?

**d) For each, compare channel bandwidth and the number of possible channels**.

## MIMO

24. **a) How does MIMO use spatial streams to increase transmission speed**?

b) What is the main benefit of MIMO? **c) What is its other benefit**?

## Beamforming and Multiuser MIMO

25. a) What is beamforming?

**b) What benefits can it bring**?

**c) Distinguish between MIMO and multiuser MIMO**.

# Conclusion

## End-of-Chapter Questions

Thought Questions

6-1. A building is cube-shaped. It uses 16 access points, which are, on average, 10 meters apart from one another horizontally and vertically. The company wishes to reduce this to 8 meters. About how many 5 GHz access points would the company need for the building?

6-2. For the following subquestions, give your answer and explain your reasoning.

a) Is multipath interference a Layer 1 or Layer 2 concern?

b) Is media access control a Layer 1 or Layer 2 concern?

c) Is MIMO a Layer 1 or Layer 2 concern?

d) Are wireless propagation problems Layer 1 or Layer 2 concerns?

e) Is 802.11ac a Layer 1 or Layer 2 standard?

Perspective Questions

6-3. What was the most surprising thing you learned in this chapter?

6-4. What was the most difficult part of this chapter for you?