

# ECE 257B: Principles of Wireless Networks

## Homework assignment # 1

(due on Thursday, January 29)

### Assigned Reading:

- Rappaport, Chapter 1
- Rappaport, Chapter 3 (skip 3.3, 3.5, 3.7, 3.8)
- Rappaport, Chapter 4 (skip 4.3 and 4.7.6; 4.2.1 is optional)

### Problems to hand in:

1. List the advantages and disadvantages of using digital systems instead of analog systems for wireless communications.
2. List techniques which can be used to increase the number of users which can be accommodated in a fixed bandwidth (spectral efficiency).
3. Rappaport, Problem 3.3
4. Rappaport, Problem 3.12
5. Rappaport, Problem 3.13 (skip (d) and (e))
6. Rappaport, Problem 3.16
7. Rappaport, Problem 4.2
8. Rappaport, Problem 4.7

9. Consider a signal with three signal paths, so that the received signal  $r$  for a transmitted signal  $s$  is

$$r(t) = a_0 s(t) + a_1 s(t - \tau_1) + a_2 s(t - \tau_2) + \text{noise} \quad (1)$$

where  $|a_0/a_1| = |a_2/a_1| = -5$  dB,  $\tau_1 = 1\mu\text{s}$  and  $\tau_2 = 8\mu\text{s}$ . Thus, the second of the three components received is the strongest, and the other two are each 10 dB (in power) smaller.

- (a) What is the difference in length between the longest and shortest paths?
- (b) Compute the excess mean delay and root mean square (rms) delay spread for the channel.
- (c) Estimate the coherence bandwidth.
- (d) Using the estimate in (c), predict whether the channel is frequency selective for an IS-54 channel, a GSM channel and a DECT channel (see Tables 10.2, 10.3 and 10.8 in Rappaport for the air interface specifications for these systems).