Wireless Transmission Questions

ECEn 526

Wireless Networking

February 9, 2022

Question	Points	Score
1	3	
2	1	
3	1	
4	1	
5	2	
6	3	
7	2	
8	1	
Total:	14	

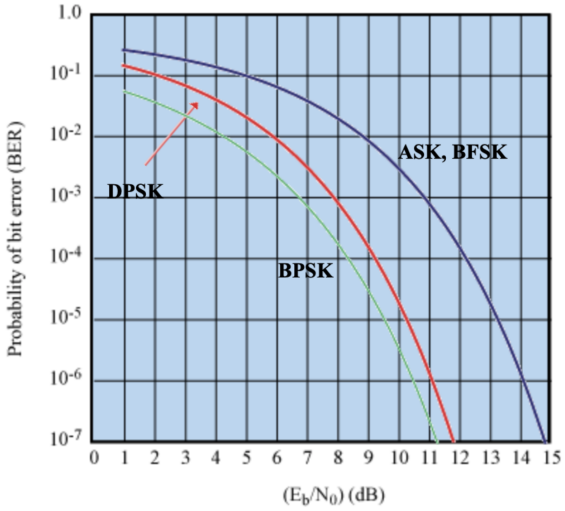
1. (a) (2 points) Using the frequencies of channel 1 of WiFi and SNR_{dB} = 24 dB, use Shannon's formula to calculate the capacity. Note: Shannon's formula does not use SNR in dBs – you will have to convert it.

   (b) (1 point) That is the theoretical limit, but it is unlikely to be achieved. For the sake of this problem, assume we can achieve the limit. Using Nyquist's formula, how many signaling levels are required to achieve this rate?

2. (1 point) What would be the path loss for an urban area cellular radio where n = 3.1? Use 1.9 GHz at a distance of 1.5 km and assume isotropic antennas.

3. (1 point) Explain why the *signal strength* of two wireless devices will change even if the devices are not moving.

4. (1 point) Using the figure below, which modulation scheme has the best performance? Explain how you determined that.



5. (2 points) Explain the relationship between modulation, data rate, and bit error? Explain a situation where you would prefer a lower date rate over a higher data rate.

6. (3 points) What improvement does OFDM make compared to other frequency division multiplexing (FDM) approaches? List two benefits that OFDM provides.

7. (2 points) Describe the general idea behind spread spectrum techniques. What are the benefits?

8. (1 point) Below is a spectrogram (waterfall plot) of a wireless transmission taken on campus. What type of spread spectrum technique is this transmission using? How can you tell?