ECEn 665
Antennas and Propagation for Wireless Communication

Homework #20
Due March 29, 2023 at the beginning of class (may be turned in after class for half credit)

1. Estimate the channel capacity of plain old telephone service.

2. Derive the capacity of a binary symmetric channel directly from the definition of mutual information (i.e., without using entropy). Hint: the maximum mutual information corresponds to a source with equal probability of 0 and 1.

3. Using the point scatterer multipath propagation model from an earlier homework assignment, (a) plot the SNR as a function of time for a moving receiver using spatial diversity with a simple selection algorithm, for isotropic radiator arrays of $M = 1$, 2, and 3 elements. (b) Plot the SNR CDFs with the analytical CDFs superimposed. (c) Plot the average SNR versus number of elements with the analytical result superimposed. (d) What happens if the array elements are very close together?

4. Using the same propagation model, create a vector of a few hundred received signal phasors for each element of a moving two element receive array of isotropic radiators with separation distance d. Correlate the two vectors (the corrcoef function is useful here), and plot the correlation coefficient as a function of the element spacing. Overlay the analytical result from the lecture notes.