Fall 2024 –Multiple Antenna Communications

Assignment 3

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Due: see course webpage

Q1) Consider a system with 1 transmit antenna and L receive antennas. The transmitter has a power constraint of P. The signal received by each receive antenna is corrupted by AWGN independently. Assume the noise follows complex Gaussian distribution with zero mean and variance of N_0.
a) [10%] Suppose the gain between the transmit antenna and each of the receive antennas is constant, equal to 1. What is the capacity of the channel? What is the power gain compared to a single receive antenna system?

Q2) [20%] Reproduce Figure 5.15 in the textbook. In your figure, plot both the theoretical curves and the simulated ones. The theoretical curve can be obtained by using Eq. (5.57) in the textbook. Notice that the exact cumulative distribution function should be used instead of the high-SNR approximation. As to the simulated curve, it should be produced by generating a large number of channel realizations.

In the submitted figure, the theoretical curves should be plotted with solid lines, and use different symbols (like circles, squares, triangles, etc.) to plot the simulated results. Colors should be used with cautions as they are not distinguishable in the printed hard-copy.