Problem Set 1

Rajesh Sundaresan and Neelesh B. Mehta
Due: February 18, 2011, 4:00 PM

Remarks:
- You may collaborate, discuss, work in teams to solve problems.
- Each student must write the solution in his/her own words.

I. PROBLEMS TO WORK ON AND SUBMIT

1) Derive the probability density function amplitude of the following complex random variable:

\[ h = \sqrt{\frac{\kappa}{\kappa + 1}} \sigma e^{j\theta} + \sqrt{\frac{1}{\kappa + 1}} \mathcal{CN}(0, \sigma^2), \]  

where \( \theta, \sigma, \) and \( \kappa \) are given parameters.

2) Exercise 2.1 from [Tse & Viswanath]

3) Exercise 2.3 from [Tse & Viswanath]

4) Exercise 2.11 from [Tse & Viswanath]

5) Exercise 2.17 from [Tse & Viswanath]

II. PROBLEMS TO WORK ON BUT NOT SUBMIT

1) One way to determine whether the inverse-square power law of the inverse-fourth power law applies is to compare the distance \( d \) with the critical distance \( 4h_t h_r/\lambda \), where \( \lambda \) is the wavelength of the transmitted signal’s carrier. Justify this by sketching the received power as a function of distance, and explaining its behavior.

2) Problem 2-14 from [Goldsmith]