Homework Set 4
Due Thursday, September 12

1. Consider sending packets through a communication network. Suppose that we send N packets from computer A to computer B and record the time it takes to transmit each packet $t_1, \ldots, t_N$. These times are random due to the effects of cross-traffic and queuing in the network. If we model the times as independent and identically exponentially distributed, find a scalar sufficient statistic for the parameter of the exponential distribution.

2. Suppose we measure a noisy $N \times 1$ signal $\mathbf{x}$; i.e., $\mathbf{x} = \mathbf{s} + \mathbf{w}$, where $\mathbf{s}$ is the noise-free signal and $\mathbf{w}$ is Gaussian white noise. Futhermore, it is known that $\mathbf{s}$ must be one of M possible signals $\mathbf{s}_1, \ldots, \mathbf{s}_M$. We are interested in deciding which signal is present. Find a sufficient statistic for the signal $\mathbf{s}$, expressed in terms of $\mathbf{s}_1, \ldots, \mathbf{s}_M$.