ELEG 5633: Detection and Estimation
Homework 11

1. Consider N i.i.d observations from a $\mathcal{N}(0, 1/\theta)$ pdf, where $\theta > 0$. Find the aysmptotic distribution of the MLE of θ when $N \to \infty$.

2. We observe N i.i.d. samples from the PDFs: $p(x|\lambda) = \begin{cases} \lambda \exp(-\lambda x) & x > 0 \\ 0 & x < 0 \end{cases}$

   Find the MLE. Identify the asymptotic distribution of the MLE when $N \to \infty$.

3. The data $x[n] = r^n + w[n]$ for $n = 0, 1, \ldots, N-1$ are observed, where $w[n]$ is WGN with variance σ^2, and r is to be estimated. Find the CRLB. Does an efficient estimator exist and if so find its variance.

4. If $x[n] = Ar^n + w[n]$ for $n = 0, 1, \ldots, N-1$ are observed, where $w[n]$ is WGN with variance σ^2 and $r > 0$ is known. Find the CRLB for A. Does an efficient estimator exists and if so find its variance. What happens to the variance as $N \to \infty$ for various values of r?