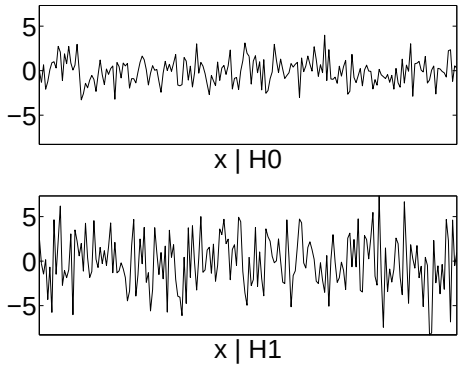
Homework 8
Due Oct 26, at class

Suppose that we are monitoring a mechanical system with a vibration sensor. If the vibrations are large, then a part failure is highly probable. The vibration sensor outputs one measurement each second. Assume that we collect a set of measurements over an N second period. The vibration is model as follows. We have two hypotheses:

$$\begin{aligned} H_0 &: x(0), \ldots, x(N-1) \sim \mathcal{N}(0, 2) , \quad \text{normal operation} \\ H_1 &: x(0), \ldots, x(N-1) \sim \mathcal{N}(0, 10) , \quad \text{high vibration} \end{aligned}$$



a. Simplify the LRT to obtain an equivalent test involving only the sufficient statistic for the variance.

b. Determine the distribution of the sufficient statistic under H_0.

c. Set the probability of false alarm $P_F = 0.01$ and suppose that $N = 20$. Find the threshold for the NP detector using the attached table. What is P_D in this case?