1. Consider the probability space \([0, 1], B([0, 1]), P\). Suppose I have the random variable \(X_n = e^{-nw}\). Does this random sequence converge surely, almost surely, in mean-square, in probability, in distribution? Justify your response for each case.

2. Suppose that I have a binary iid sequence \(\{X_n\}\) with a pmf of \(p_X(\pm 1) = 1/2\). Suppose I generate the sequence \(W_n = X_{n+1} + X_{n-1}\).

   a) What is \(E[W_n]\)?

   b) What is \(\text{var}(W_n)\)?

   c) What is \(K_W(j, k)\)?

   d) Find a formula for the best minimum mean-square error (MMSE) estimator of \(W_n\) given \(X_{n+1}\).