1. Let \((X_k : k \in \mathbb{N})\) be a sequence of independent and identically distributed random variables with \(P(X_k = 1) = P(X_k = -1) = 0.5\) for all \(k\). For each \(n \in \mathbb{N}\), define \(P_n = \prod_{k=1}^{n} X_k\).

   (a) Evaluate the mean and autocorrelation of the process \((P_n : n \in \mathbb{N})\).

   (b) Is the process \((P_n : n \in \mathbb{N})\) wide-sense stationary? Justify your answer.

**Solution:**

   (a) By independence, we have \(E[P_n] = \prod_{k=1}^{n} E[X_k] = 0\) for all \(n\). Also, for any \(n \geq 0\), the autocorrelation function of the process is given by

   \[
   E[P_mP_{m+n}] = \begin{cases} 
   1, & n = 0, \\
   0, & n \geq 1.
   \end{cases}
   \]

   (b) Since the mean of the process is not a function of time, and the autocorrelation is a function only of the length of the observation interval, the process is wide-sense stationary.