1. Let X_t and Y_t be time series for $t \in \mathbb{Z}$.

   a) If $\text{Cov}(X_{t_1}, X_{t_2}) = \text{Cov}(X_0, X_{t_2-t_1})$ for any $t_1, t_2 \in \mathbb{Z}$, then X_t is a weakly stationary time series.

      (TRUE/FALSE?)

   b) If X_t is a weakly stationary time series, then $\text{Cov}(X_{t_1}, X_{t_2}) = \text{Cov}(X_0, X_{t_2-t_1})$ for any $t_1, t_2 \in \mathbb{Z}$.

      (TRUE/FALSE?)

   c) If the joint distribution of (X_{t_1}, X_{t_2}) is the same as the joint distribution of (X_{t_1+h}, X_{t_2+h}) for any $h \in \mathbb{Z}$ and any $(t_1, t_2) \in \mathbb{Z}$, then X_t is a strictly stationary time series.

      (TRUE/FALSE?)

   d) If X_t is a strictly stationary time series, then $E(X_1) = E(X_{100})$.

      (TRUE/FALSE?)

   e) If we assume X_t to be weakly stationary, then the auto-covariance function γ of a X_t satisfies for given real values $a_1 \ldots, a_k$

$$\sum_{i,j=1}^{k} a_i a_j \gamma(i-j) > 0.$$

      (TRUE/FALSE?)

   f) If X_t and Y_t are both strictly stationary and both possess the same mean function and auto-covariance function then the joint densities $(X_{t_1}, X_{t_2} \ldots, X_{t_k})$ and $(Y_{t_1}, Y_{t_2} \ldots, Y_{t_k})$ should be the same for any choice of $t_1, t_2, \ldots, t_k \in \mathbb{Z}$.

      (TRUE/FALSE?)

   g) If we assume X_t to be weakly stationary, then the correlation matrix of the random vector $(X_1, X_2, \ldots, X_k)$ for any $k > 0$ contains at most k unique values.

      (TRUE/FALSE?)

   h) If we assume X_t to be weakly stationary, then the correlation matrix of the random vector $(X_{t_1}, X_{t_2}, \ldots, X_{t_k})$ for $k > 0$ and any $t_1, \ldots, t_k \in \mathbb{Z}$ contains at most k unique values.

      (TRUE/FALSE?)

2. Let $W_t \sim \text{WN}(0, \sigma^2)$ be a white noise process for $t \in \mathbb{Z}$ with variance σ^2.

   a) Is the process $X_t := W_t - W_{t-1}$ weakly stationary?

      (TRUE/FALSE?)

   b) Is the process $X_t := (\max_{k \in \{-10,-9,\ldots,0\}} W_{t+k})^2$ strictly stationary?

      (TRUE/FALSE?)