Some notations and formulas - Chapter 1

\( t : \) time, \( t \in T_0, \text{ e.g. } T_0 = \{0, \pm 1, \pm 2, \ldots\} \)  
(1)

\( \{x_t\} : \) time series data  
(2)

\( \{X_t\} : \) time series model  
(3)

\( F_t(x) = \text{Prob}[X_t \leq x] : \) marginal distribution  
(4)

\( P[X_1 \leq x_1, X_2 \leq x_2, \ldots] : \) joint distribution  
(5)

\( X_t = 1 \text{ or } 0 : \) binary time series  
(6)

\( \mu_X(t) = E(X_t) \)  
(7)

\( \gamma_X(r,s) = \text{Cov}(X_r,X_s) \)  
(8)

Weakly stationary case.

\( \mu_X = E(X_t) \)  
(9)

\( \gamma_X(h) = \text{cov}(X_{t+h},X_t), \ h : \text{lag}, \ \text{ACVF} \)  
(10)

\( \rho_X(h) = \text{cor}(X_{t+h},X_t), \ \text{ACF} \)  
(11)

IID(0,\( \sigma^2 \)), \ WN(0,\( \sigma^2 \))

MA(1):

\( X_t = Z_t + \theta Z_{t-1}, \ \{Z_t\} \sim WN(0,\sigma^2) \)  
(12)

AR(1):

\( X_t = \phi X_{t-1} + Z_t, \ \{Z_t\} \sim WN(0,\sigma^2), |\phi| < 1 \)  
(13)

\( \bar{x} : \) sample mean, \( n^{-1} \sum_{t=1}^{n} x_t \)  
(14)

\( \hat{\gamma}(h) : \) sample ACVF, \( n^{-1} \sum_{1 \leq t,t+h \leq n} (x_{t+h} - \bar{x})(x_t - \bar{x}) \)  
(15)

\( \hat{\rho}(h) : \) sample ACF, \( \hat{\gamma}(h)/\hat{\gamma}(0) \)  
(16)

Classical decomposition model.

\( X_t = m_t + s_t + Y_t, \ \{Y_t\} \sim IID(0,\sigma^2) \)  
(17)

\( m_t : \) trend \( s_t, (s_{t+d} = s_t, \sum_{j=1}^{d} s_j = 0) : \) seasonal  
(18)