

Home work # 4

1. For the following statements, choose "True" or "False" and briefly state why when choosing "False".

(a) If $\{X_t\}$ is stationary, then $(1 - B)X_t$ (difference once) is still stationary.

TRUE

(b) In ARIMA, if the series $\{X_t\}$ reached stationary with $d = 2$, then I can choose to difference it more, aka choose $d > 2$.

False because of over differencing leads to high RMSE.

(c) SARIMA models are essentially using a causal relationship to model X_t with a weighted sum of the history values. The weights update at each time point t using auto-covariance.

TRUE

(d) ETS are SARIMA models with some specific differencing and MA orders.

TRUE

(e) Based on the definition, RMSE penalizes large errors more than MAE.

TRUE

2. In this question you will become acquainted with the relationship between ARIMA models and ARMA models: in general, an $ARIMA(p, d, q)$ can be represented as a non-stationary $ARMA(p + d, q)$ model.

• Consider the $ARIMA(1, 1, 1)$ model given by $(1 - \phi B)(1 - B)Y_t = (1 + \theta B)\varepsilon_t$

ANS → We have

$$(1 - \phi B)(1 - B)Y_t = (1 + \theta B)\varepsilon_t$$

$$(1 - B - \phi B + \phi B^2)Y_t = \varepsilon_t + \theta B\varepsilon_t$$

$$Y_t - (1 + \phi)Y_{t-1} + \phi Y_{t-2} = \varepsilon_t + \theta \varepsilon_{t-1}$$

then this is $ARIMA(2, 1)$