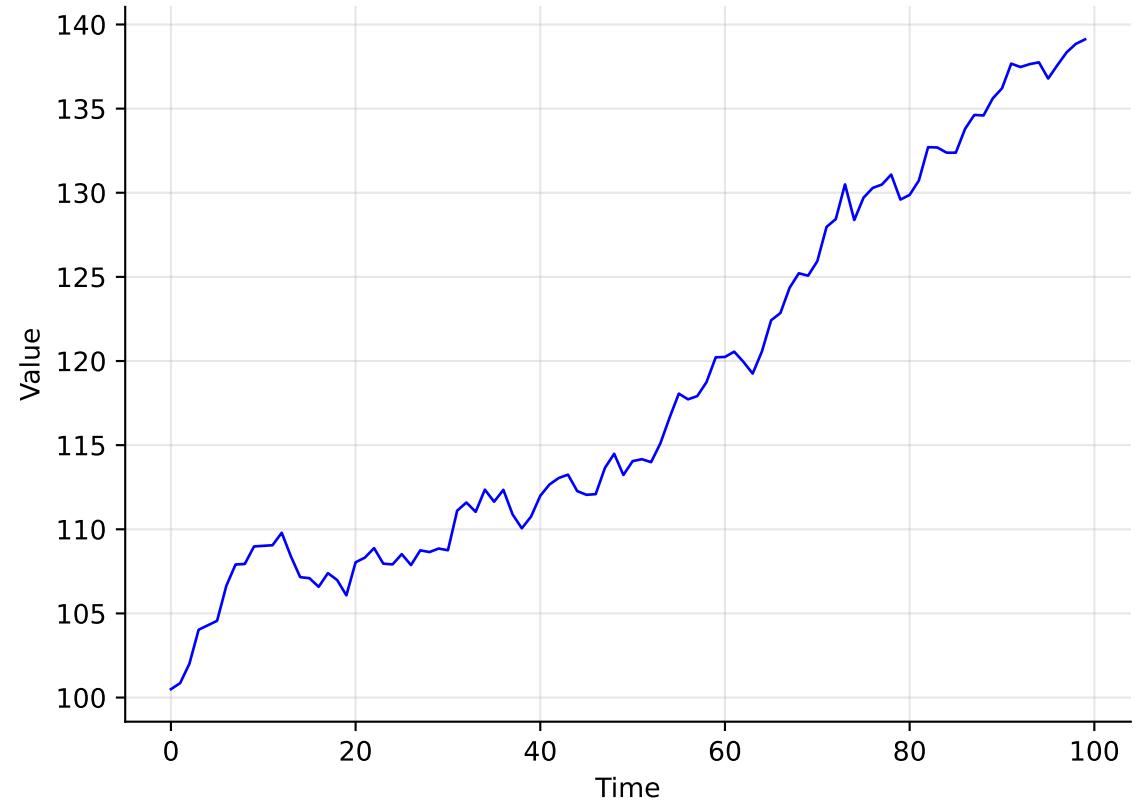
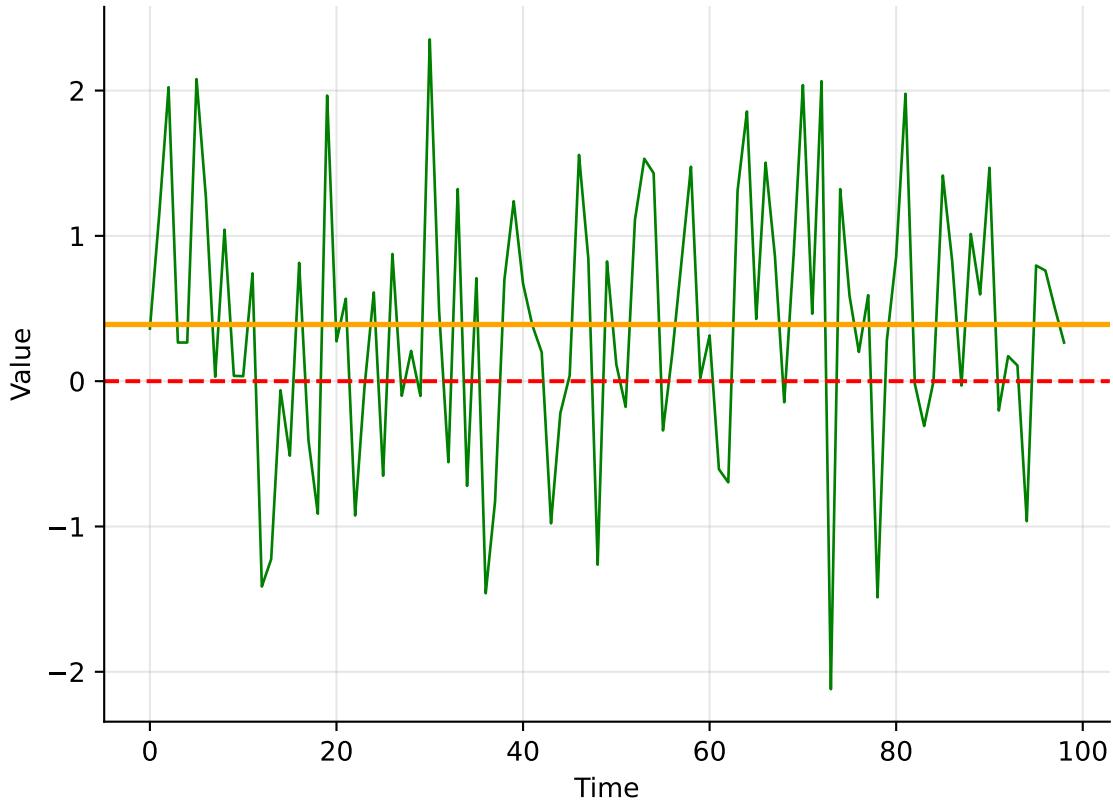
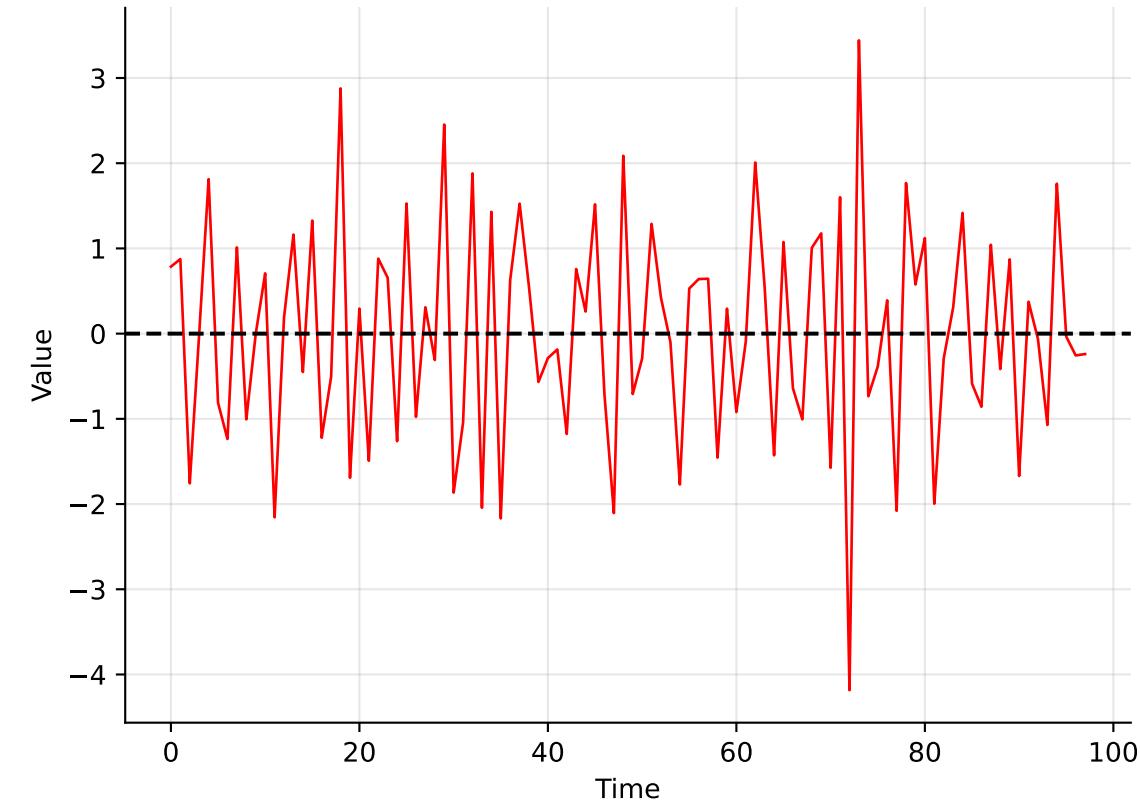


Original Series  $X_t$ First Difference  $\Delta X_t = (1 - L)X_t$ Second Difference  $\Delta^2 X_t = (1 - L)^2 X_t$ **Lag Operator Summary****Notation:**

$$\begin{aligned} L X_t &= X_{t-1} && \text{(one lag)} \\ L^k X_t &= X_{t-k} && \text{(k lags)} \end{aligned}$$
**Difference Operator:**

$$\begin{aligned} \Delta &= (1 - L) \\ \Delta X_t &= X_t - X_{t-1} \end{aligned}$$
**Second Difference:**

$$\begin{aligned} \Delta^2 &= (1-L)^2 = 1 - 2L + L^2 \\ \Delta^2 X_t &= X_t - 2X_{t-1} + X_{t-2} \end{aligned}$$
**AR(p) in Lag Notation:**

$$\begin{aligned} \phi(L)X_t &= \varepsilon_t \\ \text{where } \phi(L) &= 1 - \phi_1 L - \phi_2 L^2 - \dots - \phi_p L^p \end{aligned}$$
**MA(q) in Lag Notation:**

$$\begin{aligned} X_t &= \theta(L)\varepsilon_t \\ \text{where } \theta(L) &= 1 + \theta_1 L + \theta_2 L^2 + \dots + \theta_q L^q \end{aligned}$$
**ARMA(p,q):**

$$\phi(L)X_t = \theta(L)\varepsilon_t$$