## 3. Autoregressive model

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Exercises due Nov 10, 2021 17:29 IST Completed

A time series $\{X_t\}_t$ is an **autoregressive process** of order $p$, denoted $\mathbf{AR}(p)$, if:

$$X_t = \phi_1 X_{t-1} + \phi_2 X_{t-2} + \cdots + \phi_p X_{t-p} + W_t$$

where $\{W_t\}_t$ is a white noise process, and $W_t$ is uncorrelated with $X_s$ for $s < t$.

Note that the definition of the model is recursive, meaning that we can relate $X_t$ to any previous term of the series $X_{t-h}$ by substituting the above expression for $X_{t-1}$ on the right side of the equation, then for $X_{t-2}$ and so on until we obtain a formula that relates $X_t$ and $X_{t-h}$. So, $X_t$ depends on $X_{t-1}$, and $X_{t-1}$ depends on $X_{t-2}$, and $X_{t-2}$ depends on $X_{t-3}$, etc. Because of this recursive nature of the model, **all** terms of the series are **dependent** . This fact is reflected formally in the autocovariance function. The acf $\gamma_X(h)$ of a **stationary** autoregressive process is non-zero for all time shifters $h$ and decays to zero exponentially as $h$ increases.

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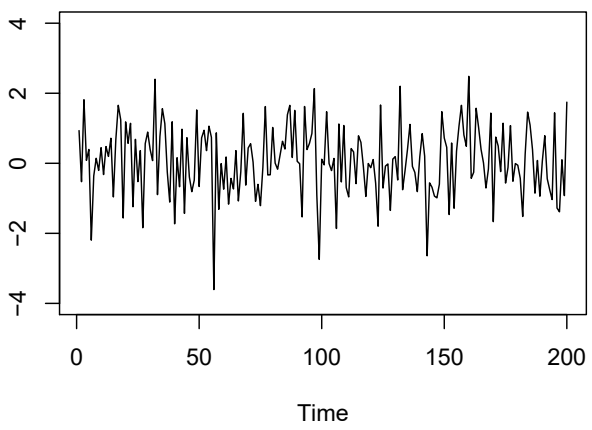
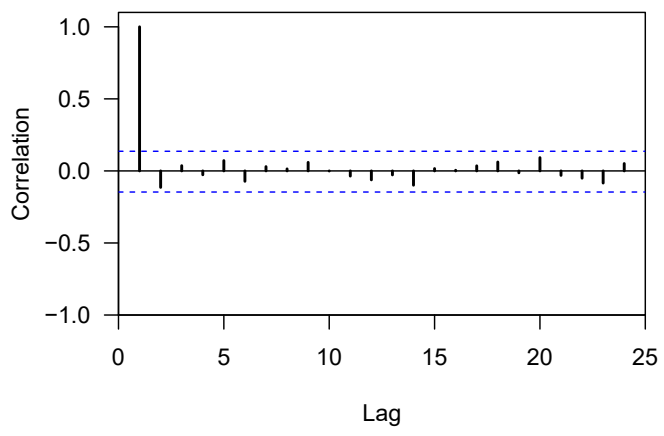
## What does autoregressive process look like

1/1 point (graded)

Which plot shows the path of a stationary autoregressive process and its acf?

(a):

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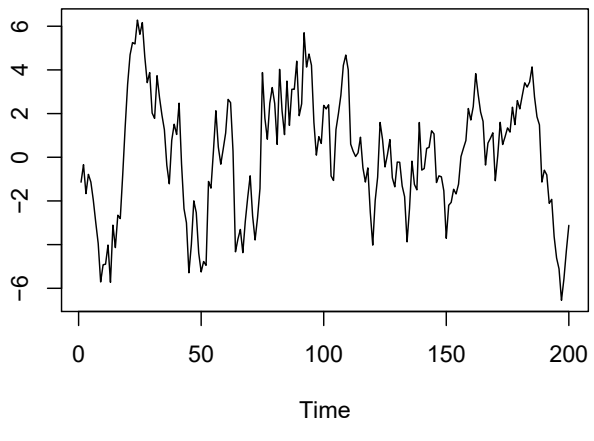
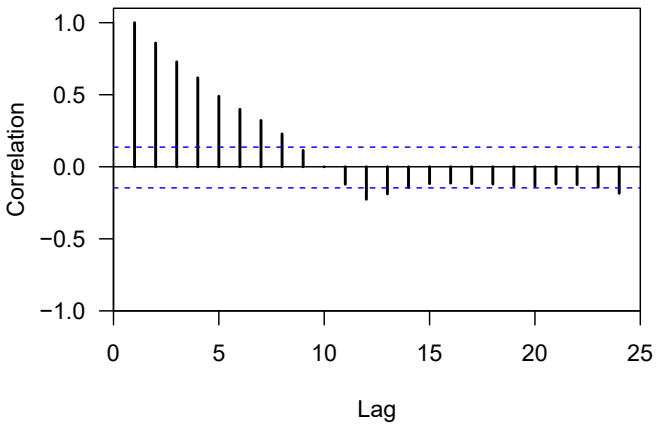
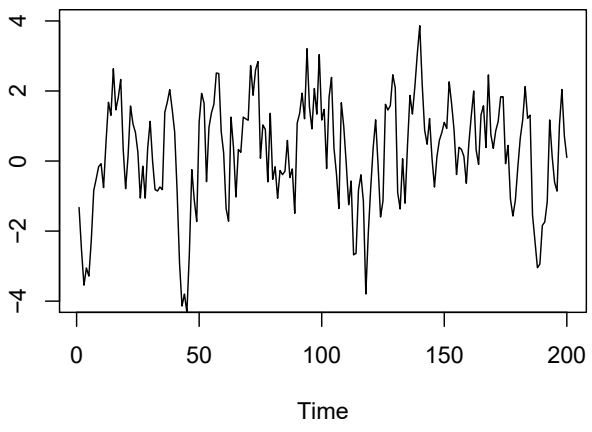





(c):

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