Thomas Pattara
STAT 560

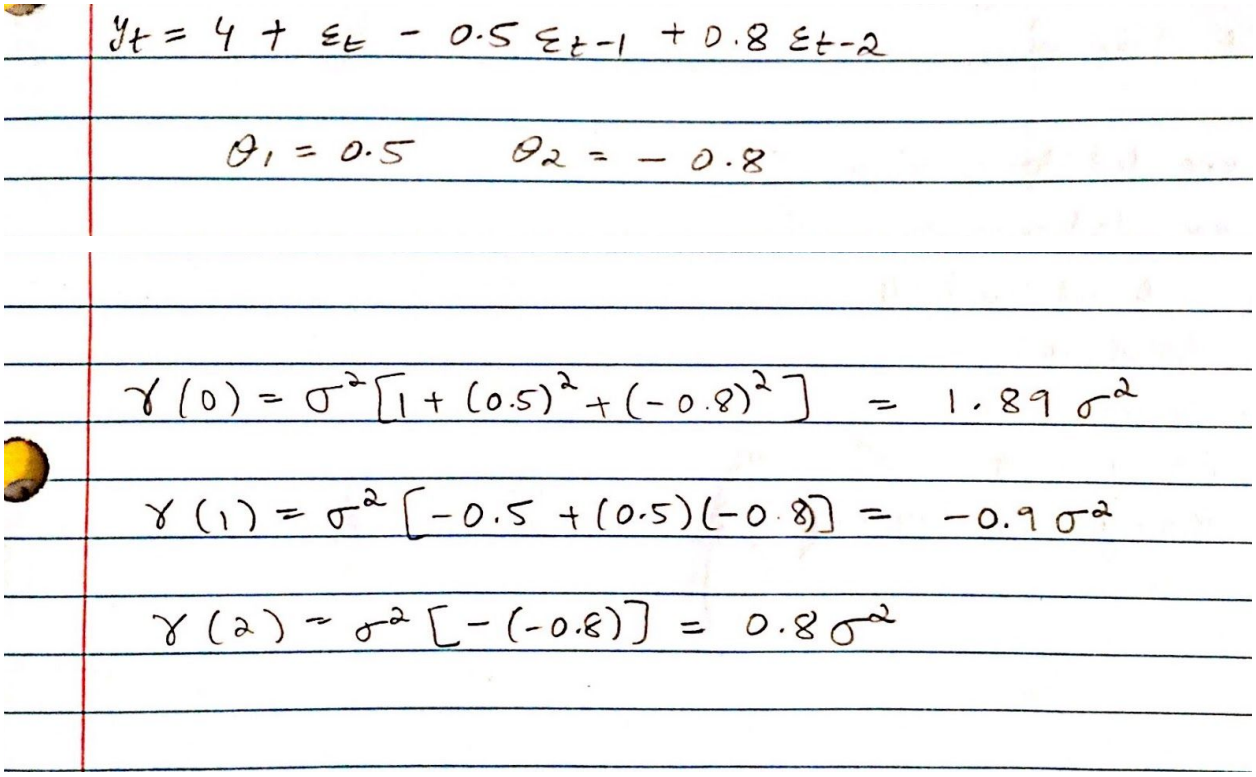
1, *Consider the time series model:*

$$y_t = 4+\epsilon_t-0.5\epsilon_{t-1}+0.8\epsilon_{t-2}$$

a) *Calculate the mean for the model if it exists.*

Mean = 4

b) *Calculate the autocovariance functions for the model by hand if it exists . Show all your work.*



c) *Calculate the autocorrelation functions for the model by hand if it exists . Show all your work. Do NOT plot the ACF.*

$$\rho(1) = \frac{-0.5 + (0.5)(-0.8)}{1 + (0.5)^2 + (-0.8)^2} = -0.476190$$

$$\rho(2) = \frac{0.8}{1 + (0.5)^2 + (-0.8)^2} = 0.423280$$

d) *Is this a stationary time series process?*

It is a weak stationary time series

2, *Consider the time series model:*

$$y_t = 200 + 0.7y_t - 1 + \epsilon_t$$

a) *Is this a stationary time series process? Why or why not. Interpret your reason by the definition/theorem. (Do NOT use the time series plot or ACF to state your reason.)*

It is stationary time series process since $|\phi| = 0.7 < 1$.

b) *What is the mean of the time series if it exists ?*

Mean = $\frac{\delta}{1-\phi} = \frac{200}{0.3} = 666.67$

c) *Give a realization of the model, and plot the ACF.*

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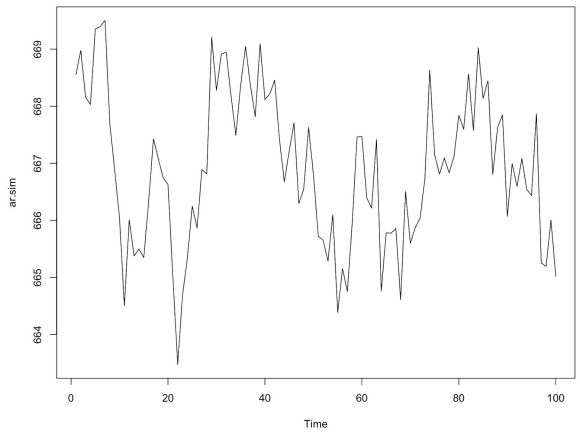
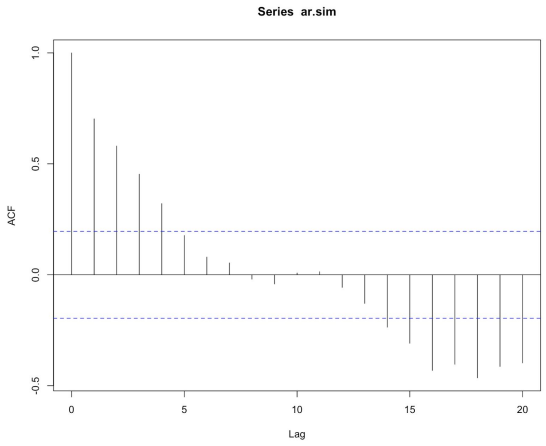
ar.sim<-arima.sim(list(order=c(1,0,0),ar=0.7),n=100)+666.67
ts.plot(ar.sim)
ar.acf<-acf(ar.sim,type="correlation",plot=T)
ar.acf
```





d) *Rewrite the expression of AR(1) model to an expression of MA model***.**

y_t = 666.67 + ε_t + 0.7 y_{t-1}

3, *Consider the time series model:*

$$y_t = 1.5y_{t-1} - 0.75y_{t-2} + \epsilon_t$$

a) *Is this a stationary time series process? Why or why not. Interpret your reason by the theorem. (Do NOT use the time series plot or ACF to state your reason.)*

This time series is stationary time series since it follows the 3 conditions for an AR(2) model to be stationary.

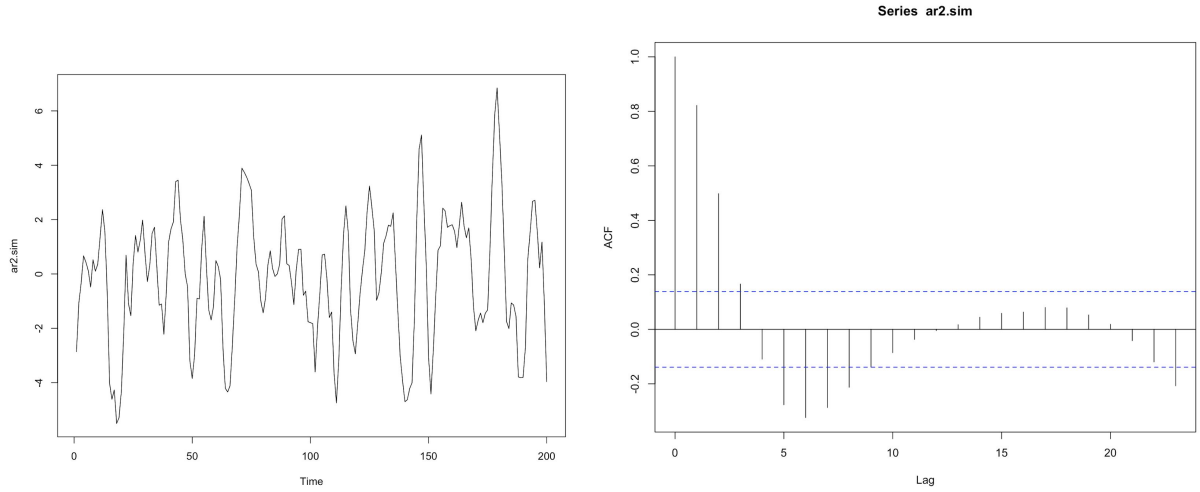
1. $\Phi_2 < 1 + \phi_1$

2. $\Phi_2 < 1 - \phi_1$
3. $\Phi_2 > -1$

b) *What is the mean of the time series if it exists?*

The Mean = 0 since $\delta = 0$

c) *Give a realization of the model, and plot the ACF.*



4, *Consider the time series model:*

$$y_t = 2.5y_{t-1} - y_{t-2} + \epsilon_t$$

a) *Is this a stationary time series process? Why or why not. Interpret your reason by the theorem. (Do NOT use the time series plot or ACF to state your reason.)*

It is not a stationary time series since it does not satisfy the conditions for an AR(2) model to be stationary.

b) *What is the mean of the time series if it exists ?*

The Mean = 0 since $\delta = 0$