**Administrative items**

1. Practice questions for the midterm test posted
2. **TA tutorial for the midterm test on Feb 12 (Monday) or 13 (Tuesday) afternoon**
3. ESS205 midterm test this evening so we will end the class at 525~530pm today
4. Encourage graduate students to discuss the topic of research project with me as early as possible (before or after class)

* Partial autocorrelation function (PACF)

is a mean zero stationary process.

1. PACF at lag 1 (k=1):
2. PACF at lag 2 (k=2):

Cramer's rule:

1. PACF at lag p (k=p):

* Durbin-Levinson algorithm (see note on portal)
* Show that PACF of AR(p) model cut off after lag p, i.e.

**Causal and invertible**

* Causal == stationary in this course
* Invertible
* Mathematical conditions for causal and invertible
  1. Causal process

All the roots of to be outside the unit circle

* 1. Invertible process

All the roots of to be outside the unit circle

* Derive the coefficients for and
  1. Causal process
  2. Invertible process

Example:

**Three stages of Box-Jenkins approach**

denotes the residual autocorrelation functions at lag

**Box-Jenkins approach**

Use differencing to remove nonconstant mean in time series

* We are able to remove the p-th order of polynomial time trend by differencing the time series times.
* Removing linear time trend of the time series
* ARIMA() model
* Seasonal differencing
* Definition: process

A nonstationary time series is said to be a process if is a stationary process.

* Spurious regression on process

Consider a simple regression

Suppose that and are independent. What do we expect from this regression?

* 1. in probability
  2. in probability
  3. follows a Student distribution

What if and are both processes?

1. will become larger and large as the series length increases
2. converges to a random variable