

Econ 510: Applied Econometrics for Macro  
Assignment 4

**State-Space Modelling**

**Due Date: In class, May 5, 2008**

**Question 1**

I would like you to program for yourself computer code to do the following for a Gaussian linear state-space model:

- the filtered estimates of the states and their covariances (i.e. the Kalman filter)
- smoothed estimates of the states and state covariances
- the likelihood function of the state-space model

**Question 2**

Using the code you programmed in Question 1, estimate the following model for US industrial production (1975m1 to 2008m3)

$$\begin{aligned}y_t &= x_{1t} + x_{2t} \\x_{1t} &= \delta + x_{1t-1} + \epsilon_{1t} \\x_{2t} &= \phi_1 x_{2t-1} + \epsilon_{2t} + \theta_1 \epsilon_{2t-1}\end{aligned}\tag{1}$$

where  $\epsilon_{1t} \sim N(0, \sigma_1^2)$  and  $\epsilon_{2t} \sim N(0, \sigma_2^2)$ .

Plot the filtered and smoothed estimates of  $x_{1t}$  and  $x_{2t}$  respectively.