Midterm Exam 1, February 23 — 5 questions. All sub-questions carry equal weight.

1. (24%) Assume that income follows the AR(1) process

$$y_t = 2 + 0.5 y_{t-1} + e_t \quad (*)$$

where e_t is white noise.
a) Is this time-series process stable?
b) Assume that y_0 is a random variable. For what values of the mean $E(y_0)$ and the variance var(y_0) will the time series y_t; $t = 0, 1, 2, ...$ be stationary?
c) What is $E_1 y_3$ if $y_1 = 5$ and $y_0 = 2$?
d) Write the infinite Moving Average model that is equivalent to the AR(1) model (*) [assuming that the process now is defined for any integer value of t]. (Half the points are from getting the correct mean term.)

2. (32%) Assume that a representative agent has a utility function

$$U(C, L) \;=\; C - \delta L^2 \;,$$

where δ is a positive parameter. Assume that agent i supplies output Q_i produced by the production technology $Q = L$. The agent sets the relative price P_i/P, where P is the aggregate price index (assume there a many agents so a change in P_i doesn't change P) and faces a demand function

$$Q_i = Y \left(\frac{P_i}{P}\right)^{-2} \;.$$

The agent supplies labor L_i to the market at the equilibrium wage rate W and hires labor in the amount of Q_i.
a) Find the optimal relative price $\frac{P_i}{P}$ (where the agent takes P as given).
b) Find the agent's labor supply as a function of the real wage.
c) Find the equilibrium level of output in the economy.
d) Does the equilibrium level of output increase or decrease with the parameter δ. Explain the intuitive logic behind this result.

3. (20%) Consider the Lucas imperfect information model.
Assume that shock to individual demand (z_i in the text) have a variance σ_z^2. Consider that fixed but now assume that demand follow one of the two following models

$$m_t = 1 + .2 m_{t-1} + u_t \; ; \; var(u_t) = 4 \; , \; (A)$$

or

$$m_t = 3 + .6m_{t-1} + u_t \; ; \; var(u_t) = 2 \; . \; (B)$$

Assume that agents observe m_{t-1} before making decisions in period t. Then assume that the shock u_t takes the value 1. Now would the impact of the shock be larger if monetary policy is described by model A or by model B. (Explain the logic of your answer).

4. (12%) Briefly suggest two explanations for why the AS curve in the AS-AD model may be upward sloping.

5. (12%) Show, using a figure, why "menu costs" may have large welfare effects.