

## Assignment 9

due: Tuesday, May 22, in class

**Problem 1:** Consider the difference equation  $x_{t+1} = ax_t + b$ .

- Explicitly solve the difference equation.
- Substitute  $y_t = x_t - b/(1 - a)$ , solve the resulting difference equation in  $y$ , and express the solution in terms of  $x$  to doublecheck your result from a).
- Analyze the stability properties of the equation distinguishing all possible cases.

**Problem 2:** A student's grade in the current semester,  $g_t$ , depends positively on her effort level  $e_t$ . Her effort level in turn depends negatively on the grade she obtained in the previous semester,  $g_{t-1}$ .

- Set-up a simple model using linear functional forms for  $g_t = f(e_t)$  and  $e_t = h(g_{t-1})$  and derive a first-order difference equation in  $g$ .
- Solve the difference equation from a).
- Explain how the stability of the student's performance depends on the slopes and intercepts of  $f(\cdot)$  and  $h(\cdot)$ .

**Problem 3:** Find the general solutions of

- $x_{t+2} + 2x_{t+1} - 8x_t = 10$
- $x_{t+2} + 2x_{t+1} + x_t = 9 \times 2^t$
- $x_{t+2} + 2x_{t+1} + 3x_t = 0$