General Mathematics and Computational Science I

Exercise 19

December 5, 2006

1. Consider the Romeo–Juliet system

$$R_{n+1} = a_R\, R_n + p_R\, J_n\,,$$
$$J_{n+1} = a_J\, J_n + p_J\, R_n$$

with coefficients

$$a_R = \frac{3}{2}\,, \quad a_J = \frac{1}{2}\,, \quad p_R = -\frac{1}{2}\,, \quad p_J = \frac{1}{2}\,.$$

(I.e., Juliet is a *cautious lover* and Romeo *likes to tease but not to please*.)

   (a) Solve the equation for R_n.
   Hint: As done in class, convert the model into a single, second-order difference equation for R_n.

   (b) What is the corresponding solution for J_n?
   Hint: Solve the first equation of the model for J_n.

   (c) Describe the outcome of the affair as a function of the initial feelings for each other.

2. Run the Romeo–Juliet system on a computer (using *Mathematica* or any other programming environment) with parameters

$$a_R = 1.1\,, \quad a_J = 0.1\,, \quad p_R = -1\,, \quad p_J = 1\,.$$

What is the outcome of the affair? Describe what you see.