

DUE: 8:30 a.m. on Weds., Apr. 23, 2008

Please note: You are encouraged to discuss the homework and work together. However, it is essential that you prepare your own solution writeup and final MATLAB code.

For each problem: together with any analysis or explanations, turn in both all code and all relevant plots, carefully labeled and with all line styles, marker sizes etc. adjusted for maximum readability, to achieve full credit.

I Power positivity and population dynamics E+G exercise 2.11. Please note: (1) *Turn in the code you used for this.* (2) *The matrices you specify should be 4×4 .* (3) *To answer the last part of this question, please simulate the population dynamics that result from your non power-positive projection matrix.* Also, interpret the results in terms of its eigenvalues and eigenvectors in a sentence.

II Dominant eigenvalues E+G exercise 2.13. *Turn in the code you used for this.*

- Additionally: compute the sensitivity $\frac{d\lambda}{da_{ij}}$ of the dominant eigenvalue λ to changes in matrix entries a_{12} and a_{13} . Do this by “brute force” – as in class, increase the matrix entries by a small amount, compare the resulting values of λ before and after this increase, and use the basic definition of the derivative from calculus. Write a one-sentence description of your results. *Turn in the code you used for this.*
- Check your results vs. the sensitivity formula [2.36] in E+G, and describe what you find. *Turn in the code you used for this.*

III Randomly varying projection matrices E+G exercise 2.20. Please make sure you read the relevant parts of the text carefully, as well as the earlier exercises that refer to the model used in exercise 2.20. Use the `randn` command in MATLAB to implement the random matrices. Hint: to generate normally distributed random number x with mean m and standard deviation σ , use the MATLAB command `x=m+sigma*randn(1,1)`.

IV Optional extra credit: Derive the sensitivity formula [2.36] in E+G.

V Ungraded optional challenge: Look up the reference given in our text for the power-positivity check discussed in E+G and in class. If possible, give a *brief* description of how the crucial power was found to be $n^2 - 2n + 2$ – otherwise discuss the important concepts that would allow one to determine this.