
MATH 612: CM4ES&FM

Spring'14

Homework # 1

Due February 26

Instructions

- One problem per page. (You can have two problems in different sides of the same page.)
- Programming problems should be turned in by two-people teams. If you work your coding problems with your programming buddy, you will be considered a team, and then have to turn in these computational problems as such.

Not all assigned problems will be graded. You'll know which ones will at the time everyone has turned them in. You will not be off the hook for any particular chapter, since assignments might revisit past chapters.

1. Problem 1.1
2. Problem 1.4
3. Problem 2.5
4. Problem 2.6
5. Problem 3.3
6. Problem 4.4
7. Write a script that computes the number of iterations needed to estimate the dominant eigenvalue for a matrix of the form

$$A = P \begin{bmatrix} 1 & & \\ & c & \\ & & c \end{bmatrix} P^{-1},$$

with precision 10^{-10} . Here P is an invertible matrix (make it non-diagonal, please) and c decreases from $c = 0.99$ to $c = 0.01$, . Your result should be the script (use the power method, obviously) and some tables or graphical results.

8. Write a function `c=TwoNorm(A)` with the following specifications:
 - The input A is a general matrix.
 - In the code, you modify the algorithm of the power method so that you compute the dominant eigenvalue of A^*A (this is a case where the method will always converge)
 - However, you are not allowed to multiply A^* by A . You can multiply Ax and A^*z , but not A^*A .
 - The output c is the square root of the dominant eigenvalue, i.e., the largest singular value, i.e., $\|A\|_{(2)}$, computed with 10 digits of accuracy. If you run out of iterations (give it a fair amount of them), return the approximated value still.

Turn in: the function and some tests comparing with `norm(A)` to see that you got the first 10 digits of the norm right.