Homework # 6
Due Oct. 30 at the beginning of class

Comp. Exp 4.3 Write a code which plots the Julia set on a grid, for the c value from the last homework, on the domain $|\text{Re}z_0| < 1.5$ and $|\text{Im}z_0| < 1.5$ with resolution of 0.01. Use at least 200 iterations. Print out the Julia set and your code. BONUS: How many arms do the spirals have? How many "spikes" seem to come together where the spikes meet? You may need to zoom in to answer these questions. [Hint: you will find iterating all the points *at once* more efficient than the method in the text but either method is fine. Given 1D list of grid values of x, I recommend you use [xx,yy] = meshgrid(x,x); zz= xx+1i*yy; to construct a 2D grid zz of complex numbers, which may be iterated *simultaneously* in a similar manner to if you had one number. Also check the isnan command. BONUS: If you make an efficient code which avoids the slow handling of NaNs.

T4.9 See example 4.5

T4.11 b only.

4.7 For a, naively there are two ways to create your ϵ and $N(\epsilon)$ sequence. One is wrong. Think very carefully about which one is wrong by going as deep as K_5 and asking if all your $N(\epsilon)$ are needed to cover K_∞. For b, be careful. It says carpet *not* gasket.

4.9 (easy)

4.10 [Hint: think about T4.9]

4.12 Isn't this bizarre? Part a is not a fractal but has fractional box dimension.

A Numerically estimate correlation dimension of a chaotic Hénon attractor. Begin by generating an orbit of length $N = 10000$ (using $a = 1.4$ and $b = 0.3$). Next compute $C(r)$ for $r = 0.1$ and $r = 0.03$. Use this to estimate the correlation dimension. Is this close the value claimed in the text? Hint: you only need to write a simple loop which calls a command that returns the number of points in the list x which are with in distance r of the n^{th} point in $x(:, n)$. The command you need is
numel(find(sum((kron(x(:,n), ones(1,N))- x).^2, 1) < r^2))
It will work if x has exactly the size $2 \times N$. Your code should take about 30 seconds to run. If it takes longer please debug.

T7.1 (review)