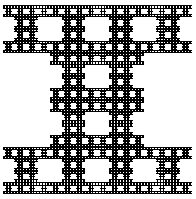
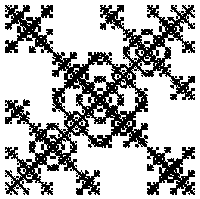
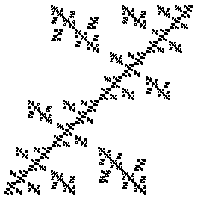
Fourth homework set

Due at the beginning of class on Thursday, Oct 4. No late homework will be accepted.
Fold your homework paper vertically and PRINT your name on the outside.

1. Compute the similarity dimensions of each of these fractals. If you use the similarity dimension formula, list the values of N and r. If you use the Moran formula, list each of the scaling factors, r_i. Solve the Moran formula algebraically (quadratic formula) if possible; otherwise solve it numerically. Present numerical solutions with three digits to the right of the decimal.

a  b  c 

2. Suppose the xy-plane contains a fractal A consisting of $N = 4$ pieces, each scaled by a factor r, and suppose the z-axis contains a fractal B consisting of $N = 2$ pieces, each scaled by the same factor r.

(a) Find the similaritity dimensions $d_s(A)$ and $d_s(B)$.

(b) Find the similarity dimension $d_s(A \times B)$.

(c) Find the value of r for which $d_s(A \times B) = 2$. Give the exact value of r, not a numerical approximation.

3. Suppose a fractal consists of infinitely many pieces, one scaled by $2/3$, one scaled by $(2/3)^2$, one scaled by $(2/3)^3$, and so on.

(a) Assuming the Moran equation can be generalized to this case (it can), write the Moran equation for this fractal.

(b) Using the fact that for all x with $|x| < 1$,

$$x + x^2 + x^3 + \cdots = \frac{x}{1 - x}$$

find the exact value of the dimension of this fractal.