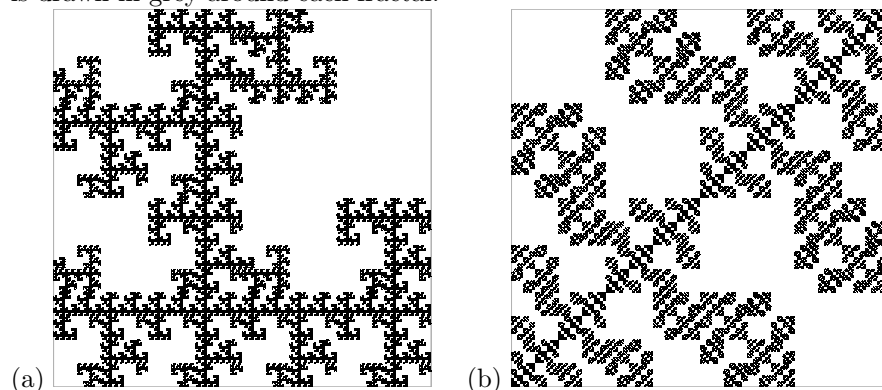


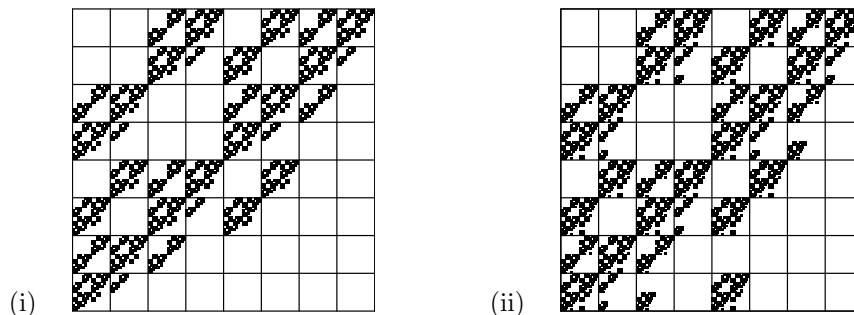
Math 190 Midterm

1. Find the IFS rules to generate these fractals. For reference, the unit square is drawn in grey around each fractal.



2. Find the similarity dimensions of the fractals (a) and (b) above. If the Moran equation is used, solve it exactly using the quadratic formula. Leave your answers in terms of logarithms; don't give decimal expressions.

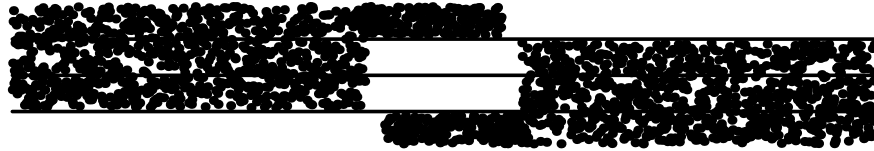
3. (a) Pictured below are two IFS with memory images. Determine if either can be generated by forbidden pairs. Explain how you arrived at your answer. Give explicit details. For reference, the length three address squares are shown on both images.



- (b) For each image that is generated by forbidden pairs, fill in the appropriate arrows on the corresponding graph.

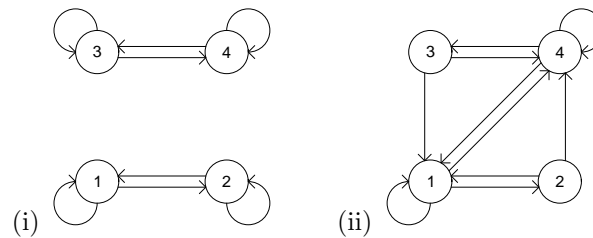
- (c) If either of these can be generated by forbidden pairs, can it also be generated by an IFS without memory? Give a reason, based on properties of the transition graph, to support your answer. Give the IFS without memory, if there is one.

4. Pictured here is a time series, with the bin boundaries indicated. Below that, in the square with length 2 address regions indicated, sketch the driven IFS this time series would produce. Explain which features of the driven IFS come from which features of the time series. Provide enough detail in the driven IFS sketch to illustrate your explanation.



5. Suppose A is a Sierpinski gasket of dimension $\log(3)/\log(2)$ and B is a Cantor set consisting of $N = 2$ pieces scaled by a factor of r . If A and B both are subsets of the plane, find an expression for r for which the typical intersection $A \cap B$ has dimension 1. Your answer should contain logarithms and be quite messy. Show the calculations by which you arrived at your answer.
6. Consider the four transformation IFS given by this table.

	r	s	θ	φ	e	f
T_1	0.5	0.5	0	0	0	0
T_2	0.5	0.5	0	0	0.5	0
T_3	0.5	0.5	0	0	0	0.5
T_4	0.5	0.5	0	0	0.5	0.5



- (a) Find the dimension of the IFS with memory image produced by transition graph (i). Give a reason to support your answer.
- (b) Find the dimension of the IFS with memory image produced by transition graph (ii). Give a reason to support your answer.