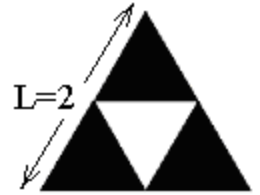


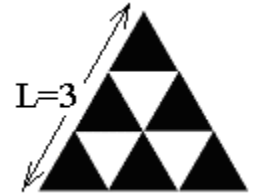
Complex Systems

Exercise 1

- 1) In the Sierpinski gasket we divide a triangle area into 4 equal triangles and remove the central triangle.

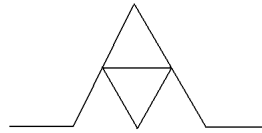


In the generalized gasket, one divides the triangle into 9 equal triangles and remove 3 triangles as in the figure:



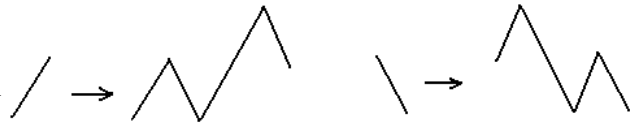
- Show the next generation of this fractal.
- Generalize this fractal to any integer L and calculate the general fractal dimension as a function of L .

- 2) Given the first iteration of a fractal



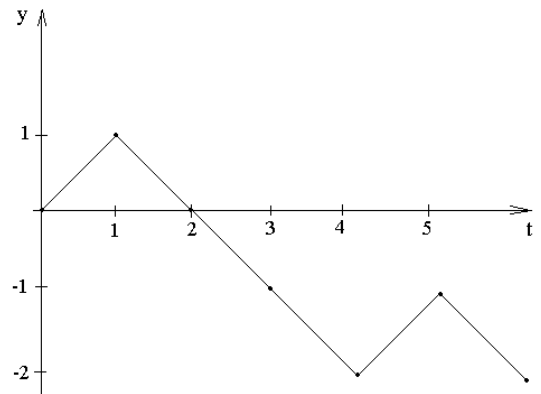
- Generate the second iteration.
- Calculate d_f , d_l and d_{\min} .
- Calculate \mathbf{a} , d_f^x , d_f^y .

- 3) Given the first iteration of a self-affine fractal



- Generate generate the second generation of the fractal.
- Calculate \mathbf{a} , d_f^x , d_f^y .

- 4) A random walk can go up or down, with the same probability, one unit in the y axis at each time step shown in the x axis (see figure).



- Calculate the mean $\langle y \rangle$ and $\langle y^2 \rangle$ as function of t .
- Is the function $y(t)$ self similar? Self-affine?
- Calculate \mathbf{a} , d_f^x , d_f^y .