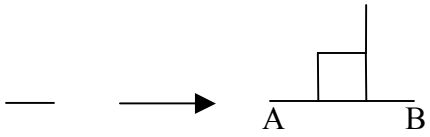
20.12.04 ב"ה

Complex Systems
Exercise 2

1. Given the first generation of a fractal



   a) Plot the next generation and calculate its fractal dimension.
   b) Calculate the critical p_c for this fractal.
   c) Calculate the backbone dimension between A and B.
   d) Calculate the red bonds dimension.

2. For percolation clusters at $p = p_c$ we have the relation $\ell \sim r^{d_{\min}}$ where ℓ is the length of the shortest path between two sites of the cluster and r is the distance.

   a) Describe what happens for $p > p_c$?
   b) Write a scaling function that represent the crossover for $p > p_c$.
   c) For case (b) and fixed r, how ℓ changes with p?

3. In percolation the density in the infinite cluster (for $p > p_c$) for $r > \zeta$ is constant and independent of r.

   a) How does the density depend on $p - p_c$?
   b) How does the density depend on r for $r < \zeta$?
   c) What happens when the system size is greater than the correlation length ζ.

4. Read section 2.4 in the book "Fractals and Disordered systems".

   a) Calculate for one dimensional percolation γ, ν and β.
   b) In percolation on a Cayley tree show that $\gamma = 1$, $\nu = 1$, $\beta = 1$ and $\tau = 5/2$.
   c) Calculate d_{min} and d_f for the Cayley tree, and the upper critical dimension.