Mathematica Problems on Recurrence Relations (RR) and Cellular Automata (CA) XIII

1. Let $\Sigma = \{0, 1, 2\}$. For $n \geq 1$ let a_n count the number of strings in Σ^n, strings with n digits using 0,1, and 2, containing an even number of 1's. Find and solve a RR for a_n. For example 1220 is one of the 3^4 elements in Σ^4 but is not allowed. Plot with command Plot the first 10 values of a_n. Hint: Split in strings with even and odd number of ones. **OP**

2. Check if you, like in the logistic map, can find a stable 2-cycle for the tent map $g(x) = ax$ if $x \leq 1/2$ and $g(x) = a(1-x)$ if $x \geq 1/2$. Starting value is still between 0 and 1 and a lies between one and two. You have to change function in the program. Solve will protest somewhat when you run but you can trust the output. (You can take away the Solve-part).

3. Start with one black cell and construct a staircase going down to the right and plot it. Only black cells down, right, down, right, down............ What is the rule number for this 1D CA?

4. Modify the 2D cellular automata in such a way that only neighbors to the left and right, up and down, influence the next state of the middle cell (the cells on the diagonal have no influence). Start with one single black cell. Birth (W to B) if 1 or 4 of the neighbors are black, otherwise stay the same color. What is the rule number? Run it 30 steps. Here you have to modify the code somewhat. Read about CellularAutomaton with Help function. It is a 5-neighbor outer totalistic rule.