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

1. For $n \geq 1$ let a_n count the number of binary strings of length n, where there are no consecuitive 0's. For example 0100 is a forbidden string of length 4. Find and solve the RR for a_n. Solve with RSolve. Plot with command DiscretePlot the first 10 values of a_n.

2. Check if you, like in the logistic map, can find a stable 3-cycle for the map $g(x) = x \; e^{a(1-x)}$. The command for exponential function is Exp. Starting value is now any positive real number. Interesting a values are between one and five. 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). You also have to change the plot ranges. Use the bifurcation diagram to locate the 3-cycle.

3. One can run asymmetric neigborhoods. Two to the left and one to the right is $r = 3/2$. Read about it in CellularAutomaton. Still we use only two colors. Starting with one black cell in the middle of string with 1500 cells. Run rule 25289 100, 200 and 400 times. Write the rule number in base 2 and try to understand the rule.**OP**

4. Consider the rule $B368/S12578$. What is the rule number? Run it for a 1X5 block of black cells. Iterate 1 to 13 times. What do you observe? What happens for 26, 39,.... iterations? Take a sufficiently large grid so you don't hit the boundary. Run it also for a random seed. Use then RandomInteger command.