

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

1. Find a RR for the number of ways to completely cover a 2 times n checkerboard with 1×2 dominoes. What are the initial conditions for this RR? Solve the RR. How many such coverings are there on a 2×50 board? Hint: Upper right corner can be covered horizontally and vertically. Treat these cases separately.
2. For which a values in the logistic map is the fix point to the right stable/unstable? Plot the value of the derivative of $g(x)$ at this fix point as function of a . Try then to formulate a criteria for stability.
3. Consider rule 110 (1D CA) and start with one black cell. What can you then say about previous state (if there is any)? Do 3 iterations (in forward direction) starting with 2 black cells (.....WWWWBWWWW.....). Compare with outcome for 1 black cell only. How many cells differ in third generation?
4. Consider rule 746 (2D CA). Find 2 *almost equal states* which give the same image. Two configurations are said to be almost equal if they differ only in finite number of cells.