Basics of Monte Carlo simulations 2005. Exercise X (Bonus)

To be handed in Mon 7.3, no exercise session, solution given by email

1. (18 bonus p) (Monte Carlo simulation of social behaviour). A city has 100x100 houses in a square pattern. Every household has exactly one car. The probability that a household buys a BMW (as opposed to any other car) any given month is 0.02%. However, the neighbour's ownership of BMWs affect the buying probality as follows. For every one of the eight nearest neighbours who have bought a BMW within the previous 9 months (not counting the current one), the probability to buy a BMW increases by 1%. After 4 years of owning a BMW, there is a probability of 2% it is sold any given month (regardless of what the neighbours do). The new car is then bought the following month.

Write a cellular automaton which simulates the number and distribution of BMW's in the city. What is the steady state average number of BMW's in the city? How much more is this than the average obtained with no effect from the neighbours?

N.b. households at the edge of the city of course have less than 8 neighbours.