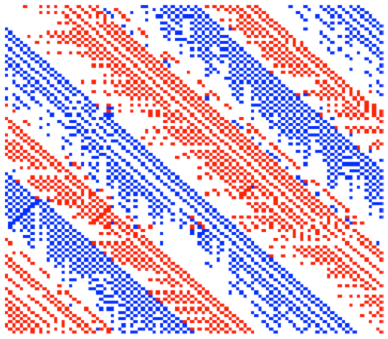
Simulation Study

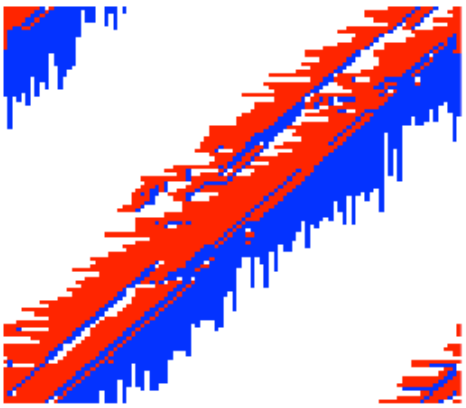
1. For what values of p, the density of the grid, did you find free flowing traffic and traffic jams? Did you find any cases of a mixture of jams and free flowing traffic?

I set the size of the grid to 100 * 100, and set the p to 0.3, and do the iteration for 2000times. Repeated the experiment for 5 times and each time I get a free flowing traffic.



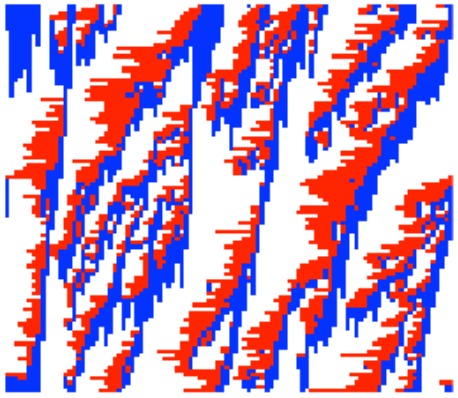
Picture of the ending of the free flowing traffic with p = 0.3

I set the size of the grid to 100 * 100, and set the p to 0.4, and do the iteration for 2000times. Repeated the experiment for 5 times and I get a free flowing traffic once. In other four experiments, the simulation stop move and get traffic jam at 398th steps, 949th steps, 1301st steps, and 1465th steps.



Picture of the ending of the one of the traffic jam with p = 0.4

I set the size of the grid to 100 * 100, and set the p to 0.5, and do the iteration for 2000times. Repeated the experiment for 5 times and get 5 traffic jams at 87th steps, 94th steps, 190th steps, 165th steps, and 275th steps.



Picture of one of traffic jam after 275th step with p = 0.5

2. How many simulation steps did you need to run before observing this behavior?

As I mentioned in the first problem, when the size of grid is 100 * 100, and p <= 0.4, I can still get free flowing traffic after 2000steps.

And when the size of grid is 100 * 100, and p = 0.4, the simulation stop move and get traffic jam at 398th steps, 949th steps, 1301st steps, and 1465th steps.

And when p = 0.5, the simulation stop move and get traffic jam at 87th steps, 94th steps, 190th steps, 165th steps, and 275th steps.

And when p = 0.6, the simulation stop move and get traffic jam at 66th steps, 69th steps, 68th steps, 74th steps, and 71st steps.

And when p = 0.7, the simulation stop move and get traffic jam at 36th steps, 46th steps, 70th steps, 38th steps, and 31st steps.

And when p = 0.8, the simulation stop move and get traffic jam at 25th steps, 27th steps, 30th steps, 47th steps, and 17st steps.

3. Does the transition depend on the size or shape of the grid?

When I set the size of grid 4 * 4(which change the size but not the shape compare to 100 * 100), and p = 0.3, I run the simulation 5 times, and the gridlock appeared once at the 21st step.

And when I set the size of grid to 2 * 2(which change the size but not the shape compare to 100 * 100), and p = 0.3, the gridlock appeared every time.

And when I set the size of grid to 10000 * 1(which change the shape but not the size compare to 100 * 100), and p = 0.3, the gridlock appeared at 33rd step.

And when I set the size of grid to 1 * 10000(which change the shape but not the size compare to 100 * 100), and p = 0.3, the gridlock appeared at 11st step, 14th step, and 10th step.

Thus the transition does depend on the size and shape of the grid. And when the size become smaller the chance of getting traffic jam becomes bigger. And when the difference between the number of row and number of column become bigger, the chance of getting traffic jam becomes bigger too.

Picture with grid size 1 * 1000
and p = 0.3