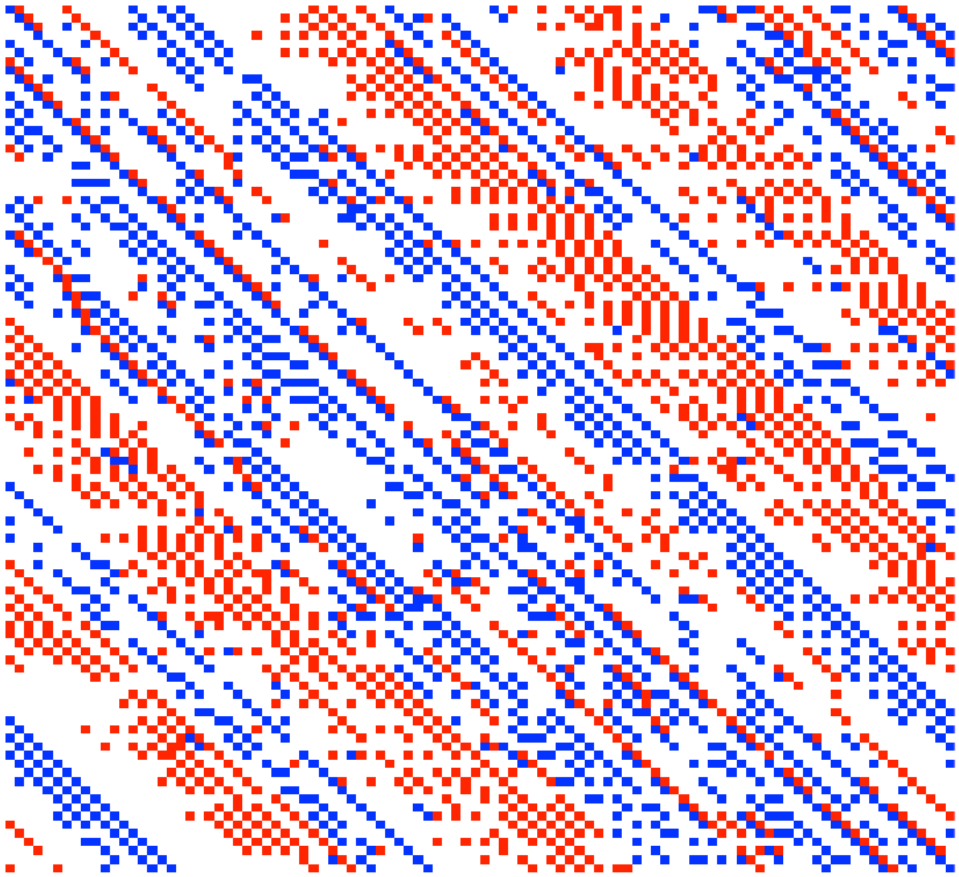
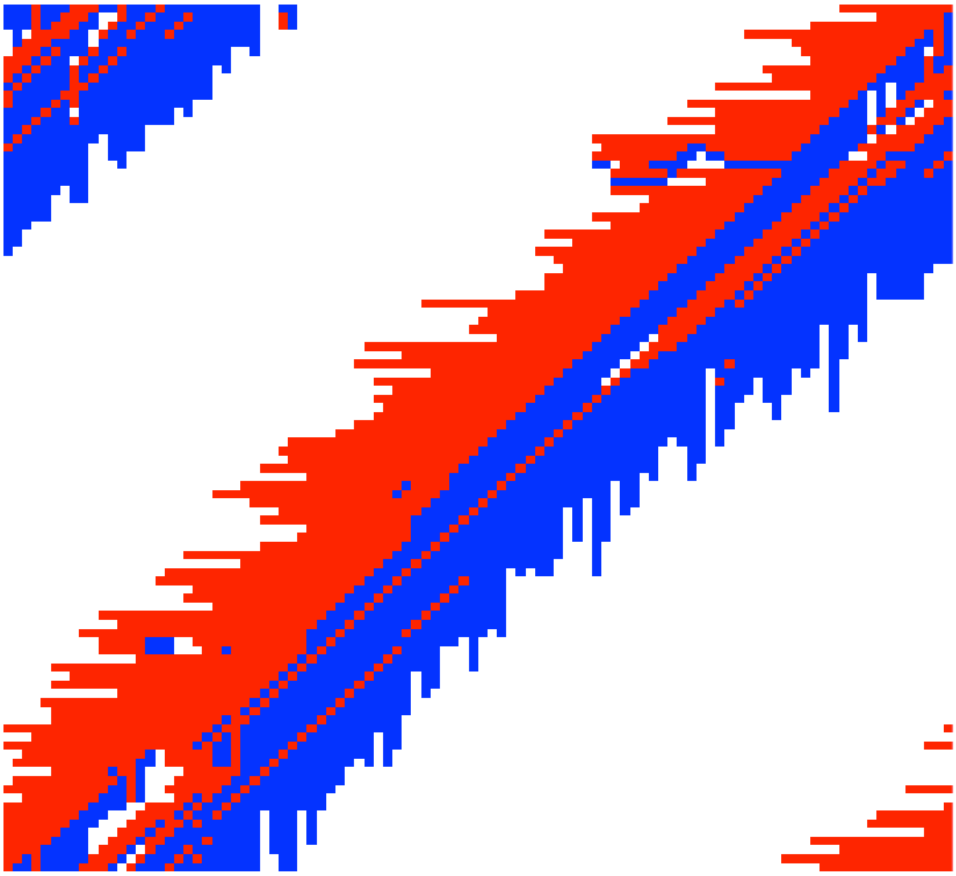
Question 1:

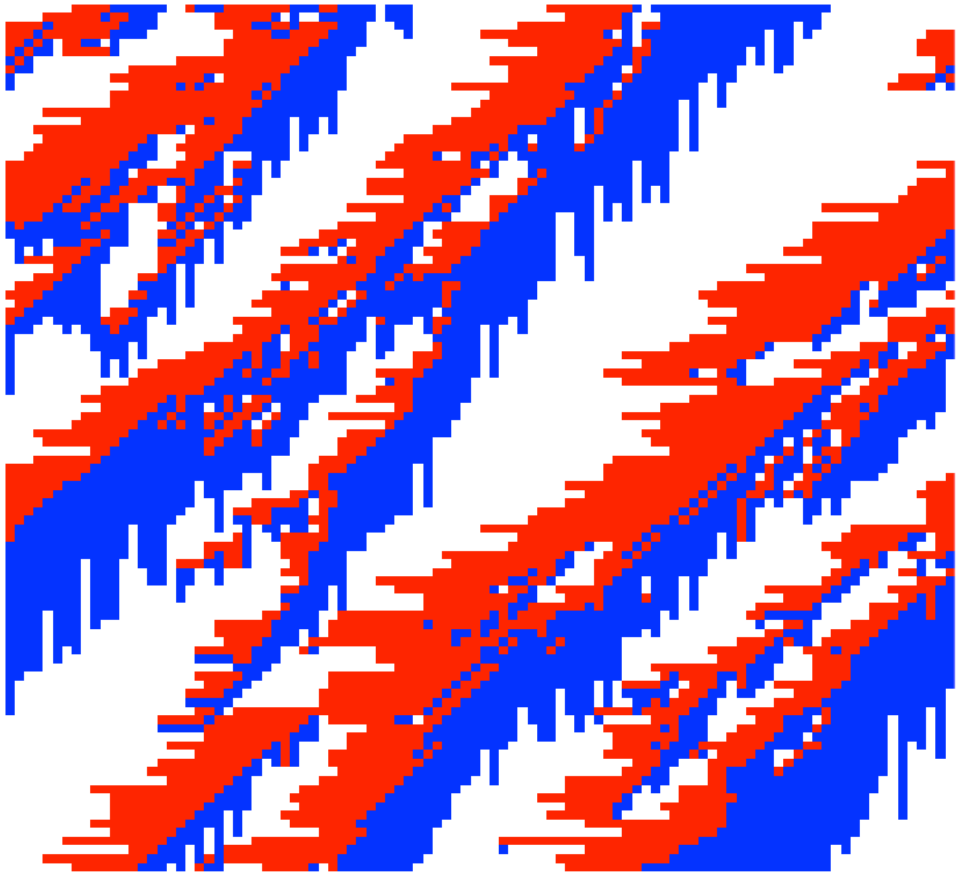
For p=0.3, I find free flowing traffic after 1000 steps on a 100*100 grid. I ran 5 times and I got a free flowing traffic every time. The following figure shows what the traffic looks like after 1000 steps.



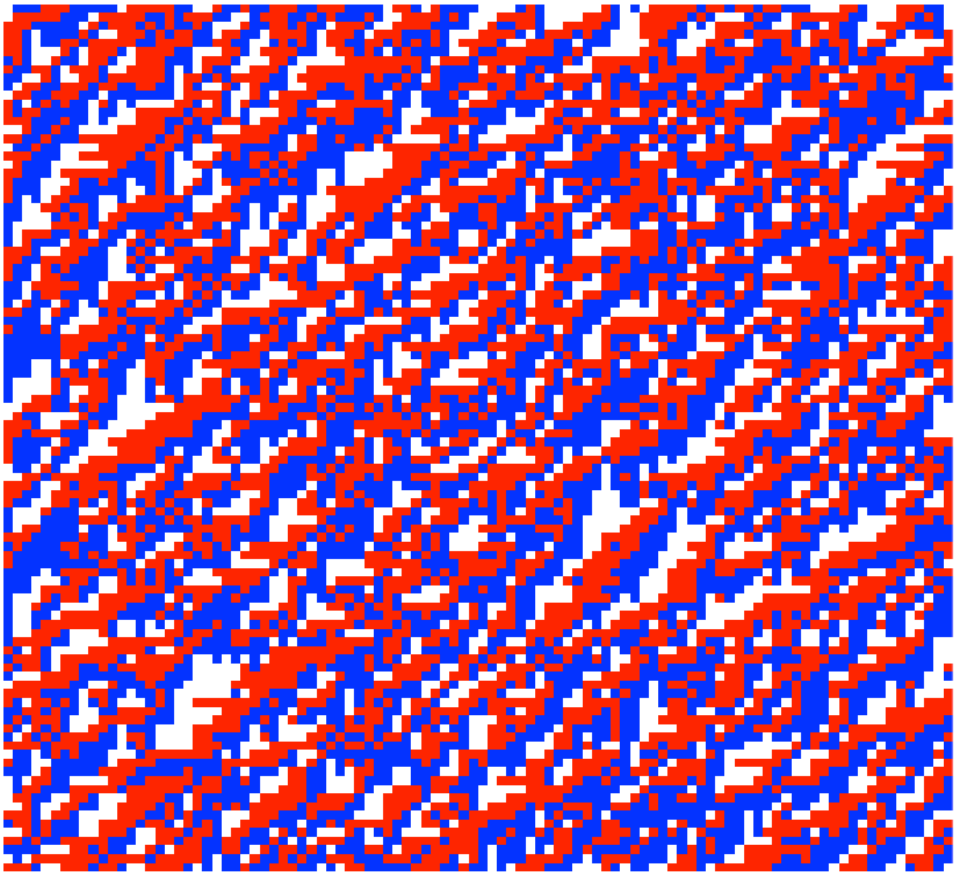
For p=0.4, I got a mixture of free flowing traffic and traffic jam on a 100*100 grid. I ran the experiment 5 times and I got 3 gridlocks and 2 free flowing traffic. The first traffic jam occurs after 828 steps, the second occurs after 599 steps and the third traffic jam occurs after 630 steps. The other 2 are free flowing traffic after 1000 steps. The following graph is when the traffic jam occurs after 828 steps. Thus, for p=0.4, it's a mixture of free flowing traffic and traffic jam.



For p = 0.6, I got a traffic jam every time on a 100*100 grid. I run the experiment for five times and I got traffic jam after 195 steps, 362 steps, 375 steps, 282 steps and 349 steps. The following graph shows the traffic jam after 195 steps. Thus, I can conclude that for p = 0.6, it is a traffic jam.

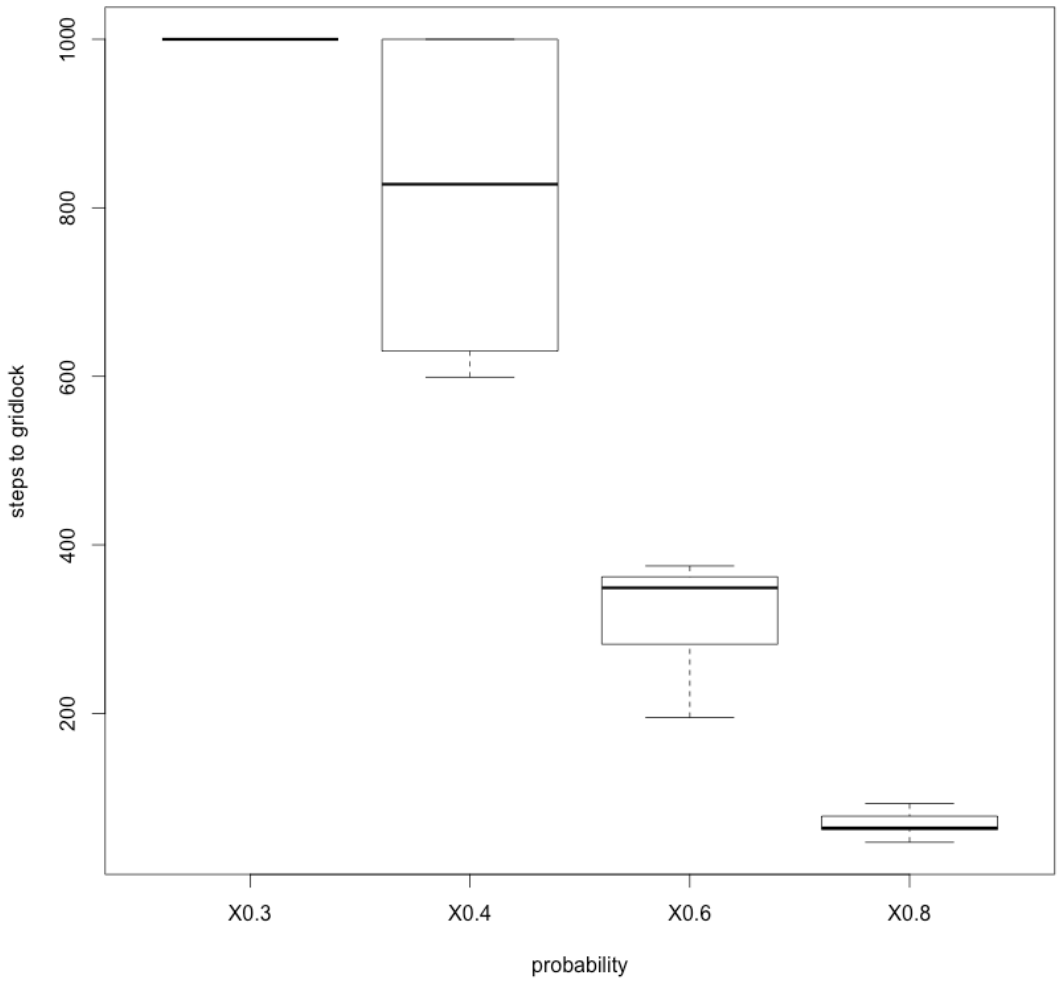


For p=0.8, I got a traffic jam every time after less than 100 steps on a 100*100 grid. I got traffic jam after 93 steps, 78 steps, 47 steps, 62 steps and 64 steps. The following graph shows a traffic jam after 93 steps. Thus, for p=0.8, it is a more severe traffic jam.



Question 2:

The following boxplot concludes the number of steps to gridlock for different probability. From the plot, we can see that for p=0.3, it is a free flowing traffic. For p=0.4, it takes about 830 steps to get a gridlock. For p=0.6, it takes about 350 steps to get a gridlock and for p=0.8, it takes only about 70 steps to get a gridlock.



Question 3:

The transition does depend on the size and shape of the grid because in the 5 experiments for p=0.4, 100*100 grid shows a mixture of free flowing traffic and traffic jam while for 10*1000 grid and 10*10 grid, all of the 5 experiments shows free flowing traffic. Thus, the transition depends on the size and the shape of the grid.