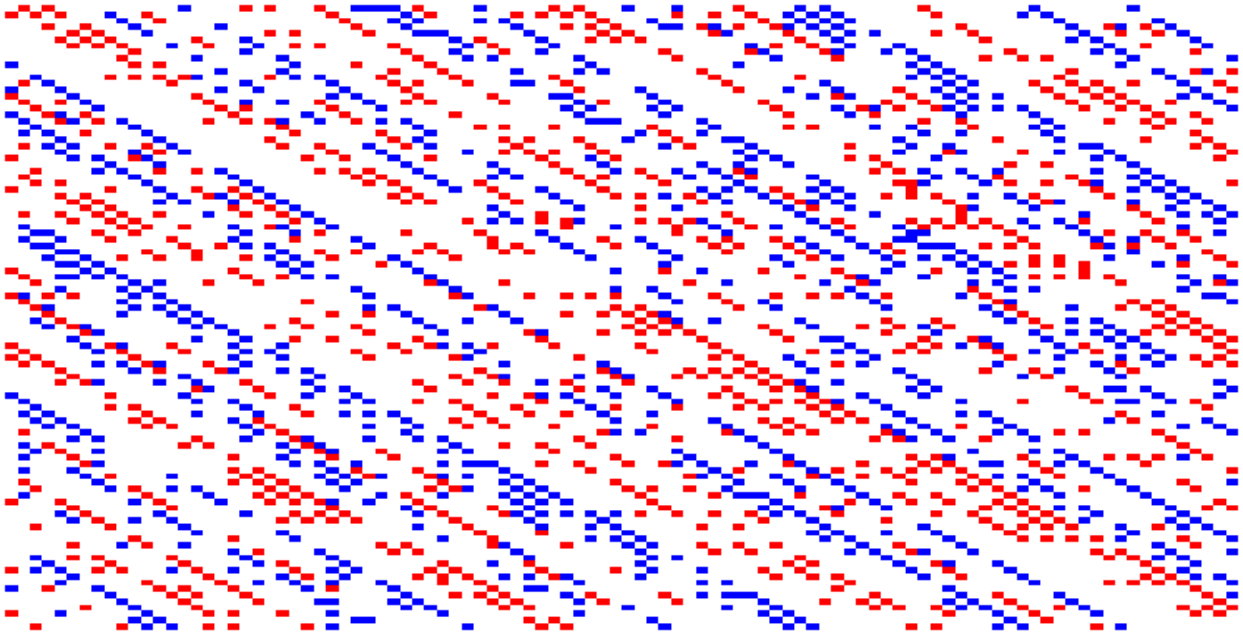
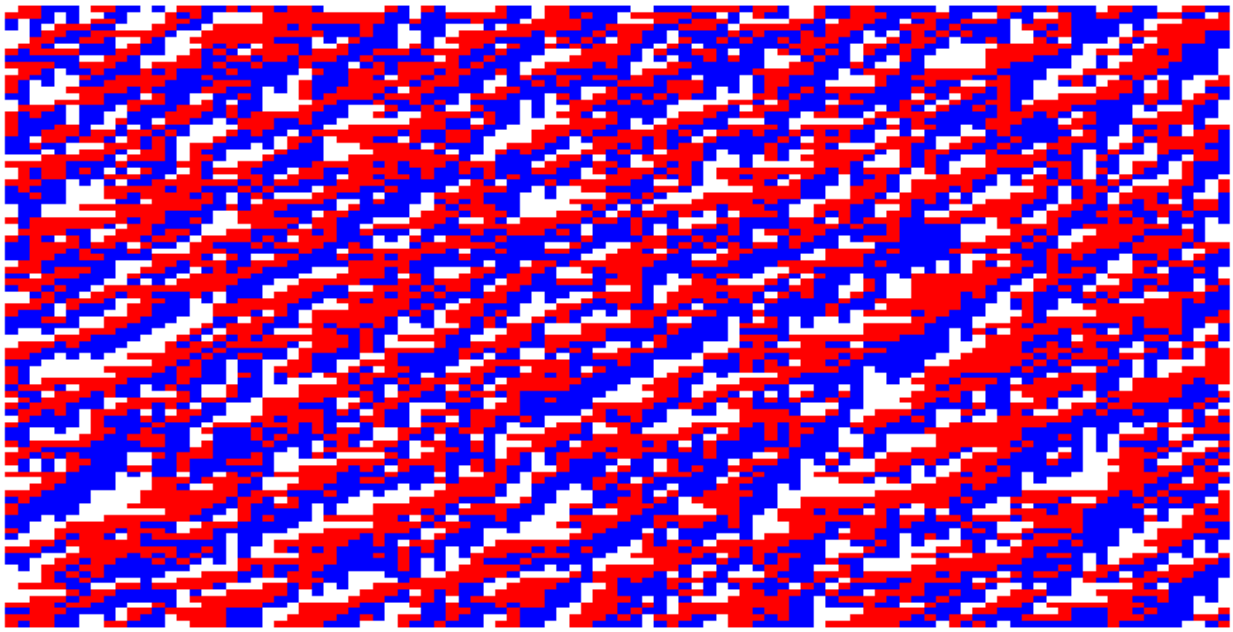
1. 2000 steps, density 0.2, flow
2. Stuck at x, density 0.8

Question 1

With p = 0.2, the simulation flows freely within 2000 iterations on a grid of size 100 * 100. The following graph shows traffic at free flow state.



With p = 0.8, the simulation ran into a jam 5 out of the 5 times I ran it on a grid size of 100 by 100. The following graph shows the jam at time step 63



With p = 0.45, the simulation was congested 3 out of the 5 runs within 1000 iterations. The other two times it was free flowing at iteration 1000.

Question 2

Depending on the density and graph size, the simulation either reaches free flow or jam at different rates. For a density of 0.2, it always reaches free flow by iteration 1000. For density of 0.8, it would get stuck at a jam within 100 iterations. For density of 0.45, it would reach a gridlock before 1000, but it was difficult to see the free flowing state until 1000 iterations of the simulation.

Question 3

The shape of the grid affects the congestion. On rectangular grids, the simulation is less likely to run into gridlock. On grids of 10 by 5 and 5 by 10, the simulation ran into gridlock between two to three times with p = 0.6. On grid size 10 by 10, it ran into gridlock 3 out of 5 times. Grid size also affects gridlock. With the same density factor, the simulation ran into gridlock on a 50 by 50 grid much faster and more frequently than on a 10 by 10 grid.