HW 6 - BML Simulation Study

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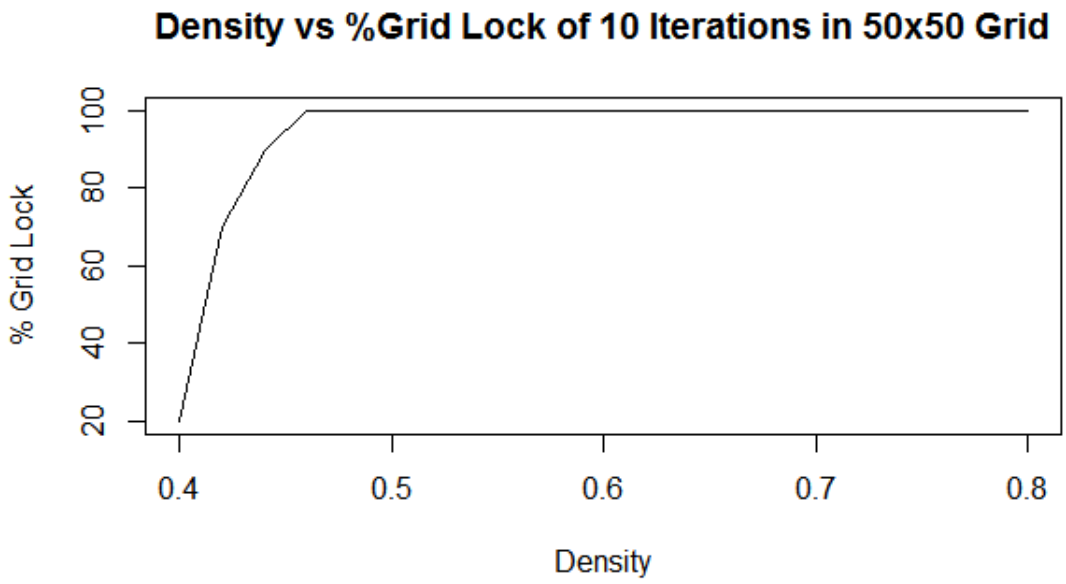
1

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?
For grids of the same shape there were similar tipping points for values of p that triggered traffic jams more quickly. For instance, in the 50x50 and 10x10 grid size simulation, the tipping point for p seemed to begin close to 0.4. I did not run enough iterations (stopped at 2500) to figure out if gridlock occurred from densities 0.2 to 0.4 for 50x50 grid. Meanwhile, for a rectangular 25x100 grid simulation, p was closer to 0.55. When the grid increases in size, it is more prone to have partial gridlocks as the 100x100 grid plot representation demonstrates with a concentration of red and blue cars at certain locations.



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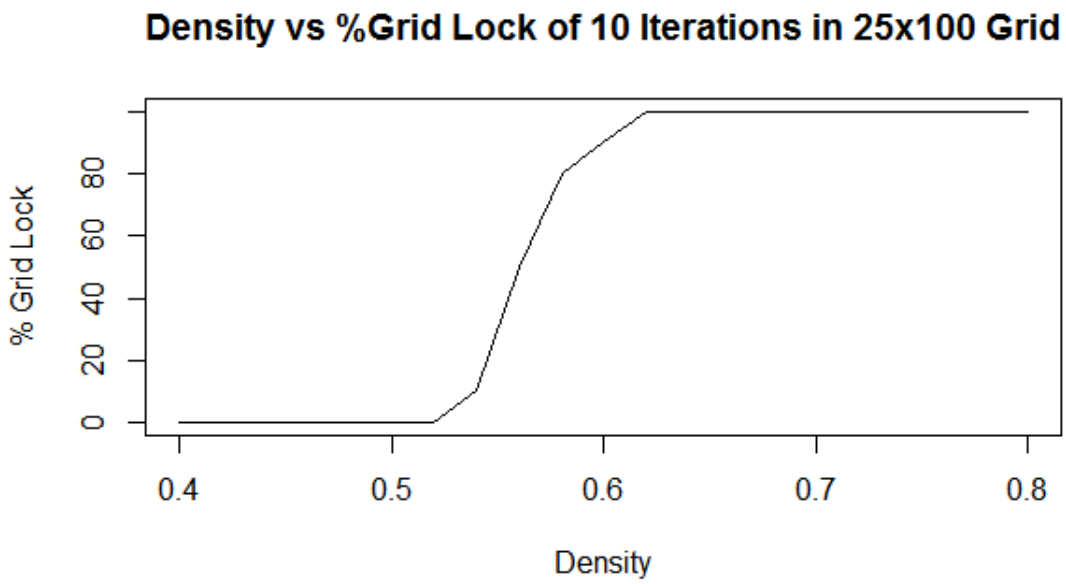
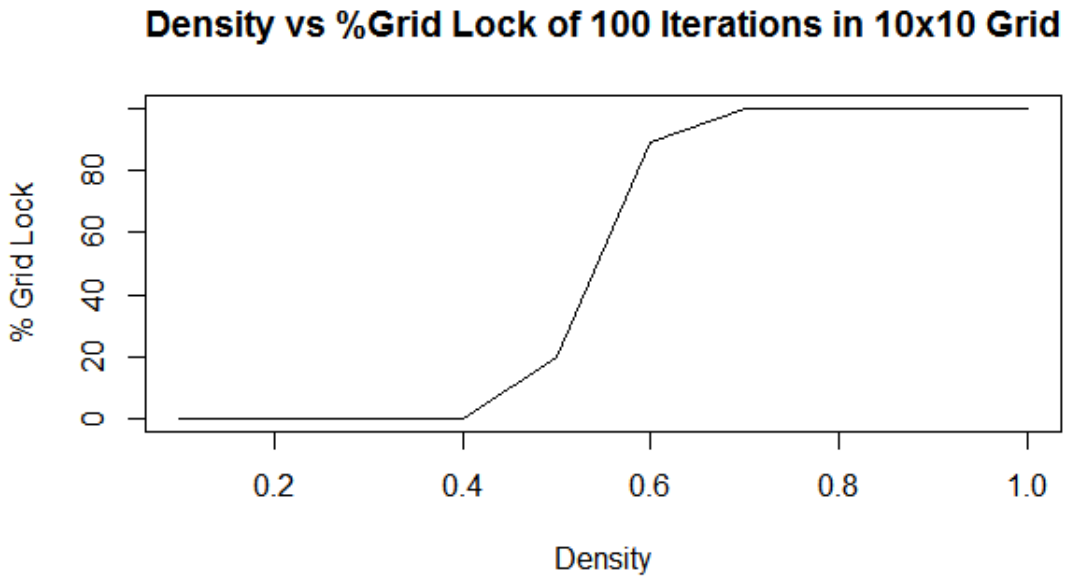
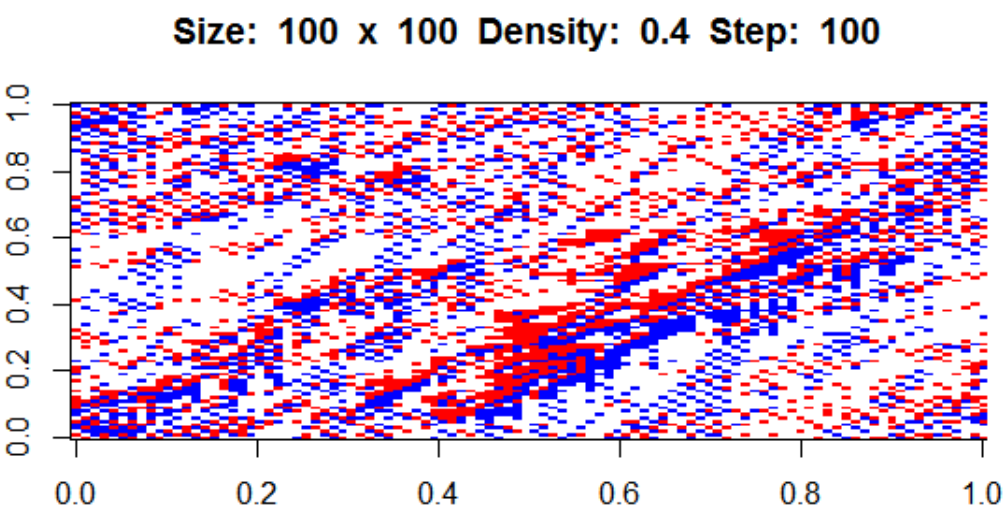
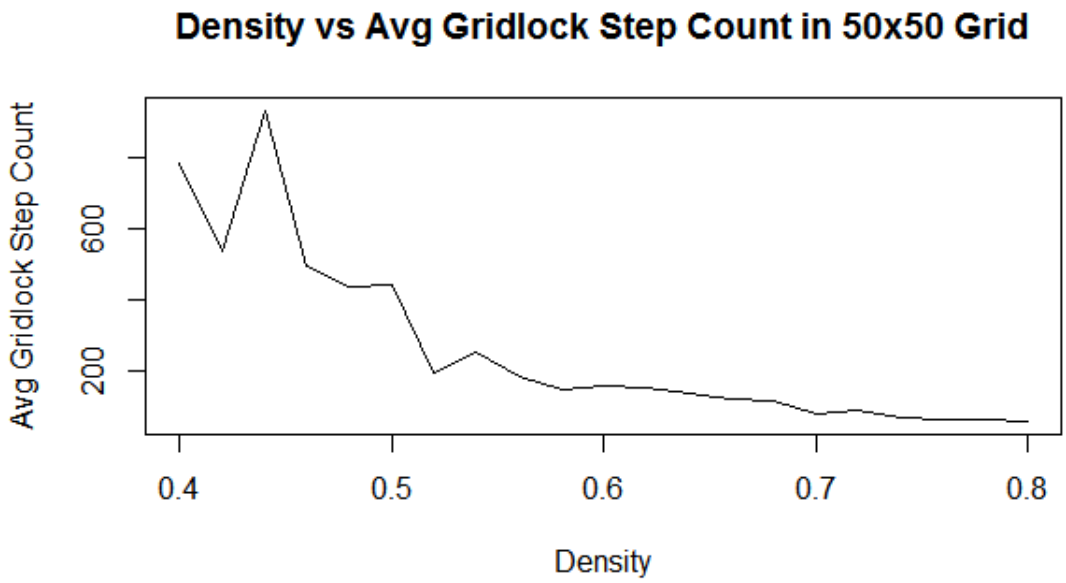

Density vs %Grid Lock of 10 Iterations in 25x100 Grid
% Grid Lock
0
20
40
60
80
0.4
0.5
0.6
0.7
0.8
Density


Density vs %Grid Lock of 100 Iterations in 10x10 Grid
% Grid Lock
0
20
40
60
80
0.2
0.4
0.6
0.8
1.0
Density

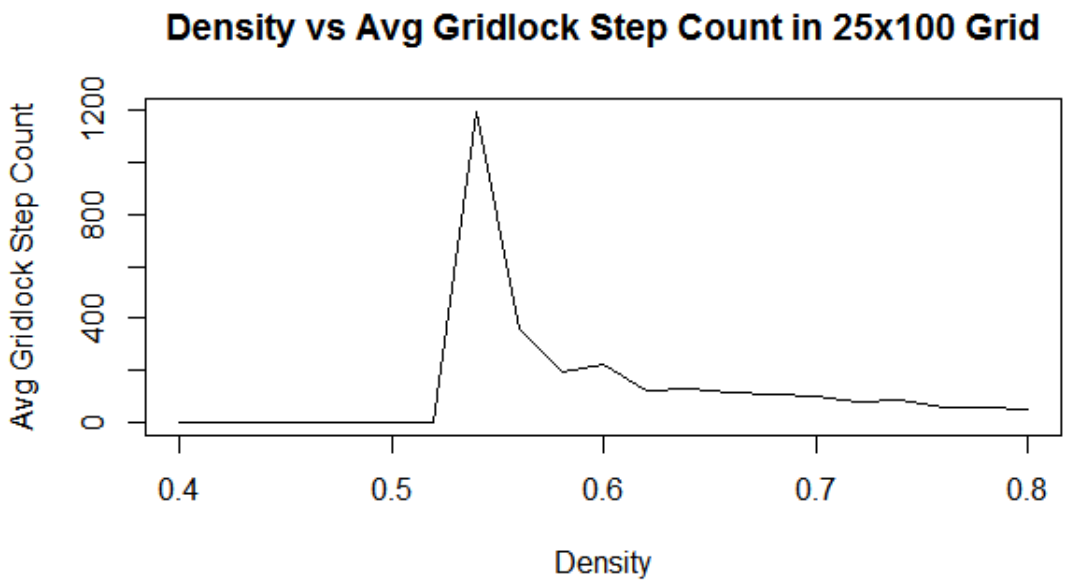

Size: 100 x 100 Density: 0.4 Step: 100
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0

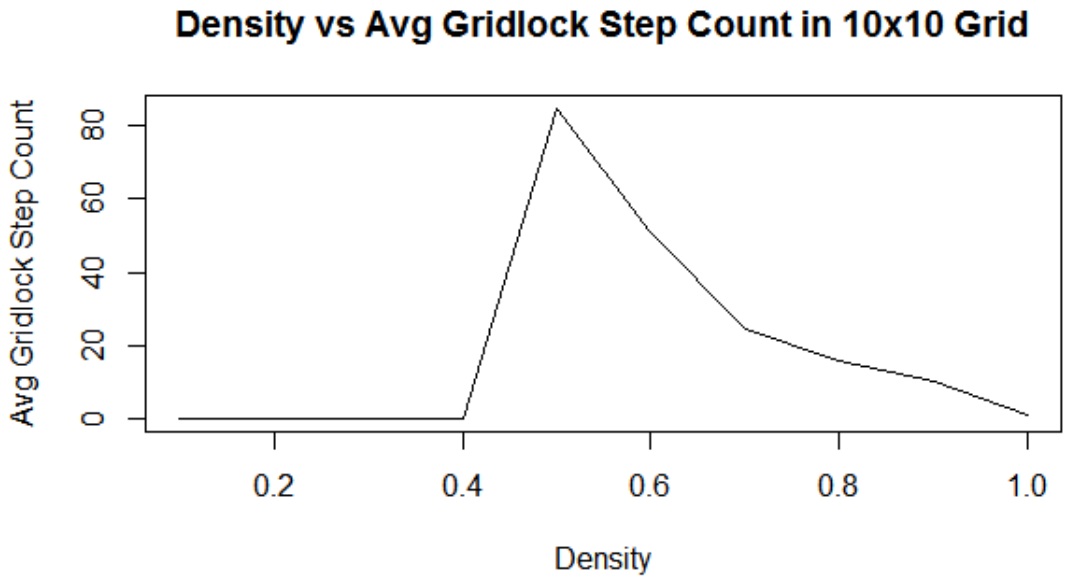
How many simulation steps did you need to run before observing this behavior?

I wish I had signed up for a Stats acct to use their faster processors, so I could run tests on larger grid sizes and for more variability of data to get a better normal distribution for my simulations' gridlock step averages. For 10x100 grid I ran each density 100 times and with a break at 200 steps to declare it was free flowing if it didn't reach a grid lock yet. For 50x50 I only ran each density 10 times with a break at 2500 steps to declare it was free flowing. My plots are connected by lines, but actually are not continuous in nature. There is actually a jump from 0.4 to 0.6 not a gradual rise, where on average for a 10x10 grid, 80 steps are needed to reach grid lock for density close to 0.5. It can be expected that it would take more steps for a larger grid of size 50x50 to reach gridlock for the same density p (over 1000 steps for 0.45), because there is still more space for cars to travel.



3


Density vs Avg Gridlock Step Count in 25x100 Grid
Avg Gridlock Step Count
0
400
800
1200
0.4
0.5
0.6
0.7
0.8
Density


Density vs Avg Gridlock Step Count in 10x10 Grid
Avg Gridlock Step Count
0
20
40
60
80
0.2
0.4
0.6
0.8
1.0
Density

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

Yes the shape definitely matters when determining the critical density for gridlocks. Results from computing average grid steps and density where gridlocks occur differ between the 50x50 grid and 25x100 grid. For the wider 25x100 grid, the tipping point for density was higher closer to 0.55 compared to around 0.4 for the 50x50 grid. I attribute the higher density tipping point for the wider grid to more space for blue to travel north and not block the red cars. Though of course, that is just a hypothesis.