BML Simulation Study

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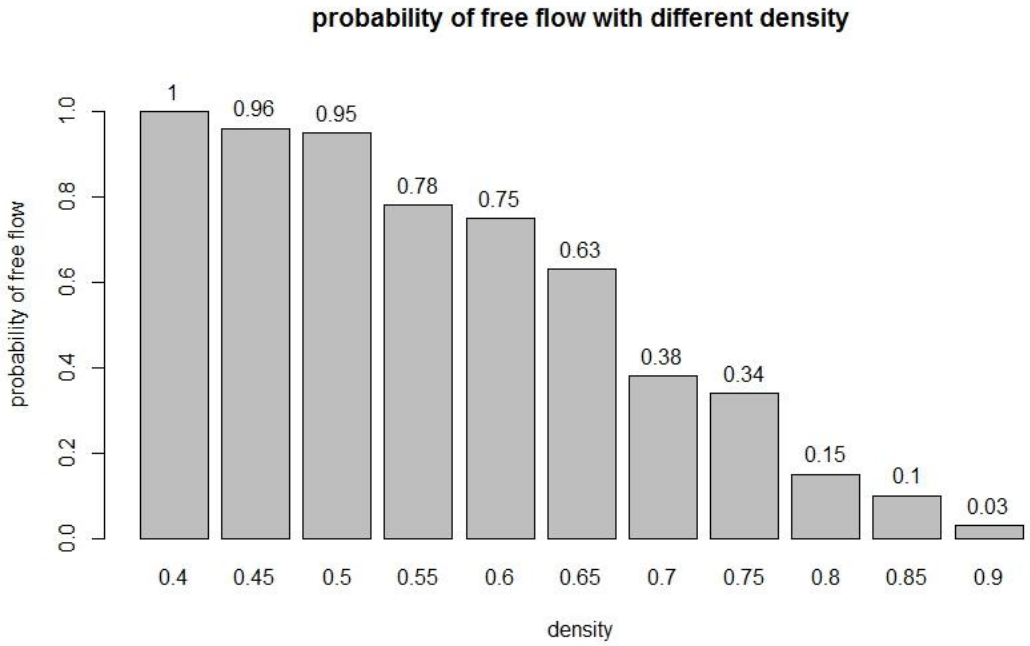
Part I. Simulation study with the input of different value of density (based on 10*10 grid)

To analysis this problem, we run the experiments with different value of density for lot of times. So, a matrix is created with the number of rows representing the number of experiments implemented for a specific p in each column (p from 0.4 to 0.9, by=0.05).

First, the chance of free flowing and traffic jams is analyzed. So, the value of the entries in the matrix is TRUE or False, TRUE means it is a free flowing situation and False means it is big traffic jams where no cars can move at all. This is a 100*11 matrix with 100 experiments for each specific value and 11 values.

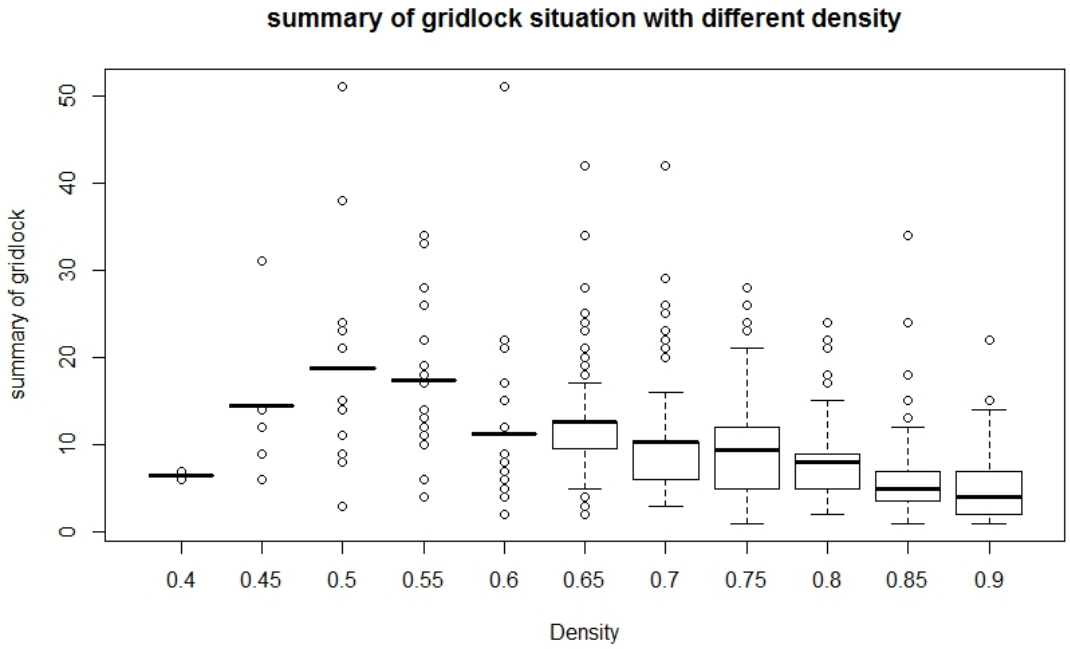
We count the number of the TRUEs for each column and divided them by the 100, which is the probability of that the model is free flowing in a single experiment.



From the plot above, we can see that in a 10 *10 grid when density is less than 0.4, it is always free flowing, while p is more than 0.9, traffic jams always occur. The density between these two numbers will cause both traffic jams and free flowing with different probabilities.

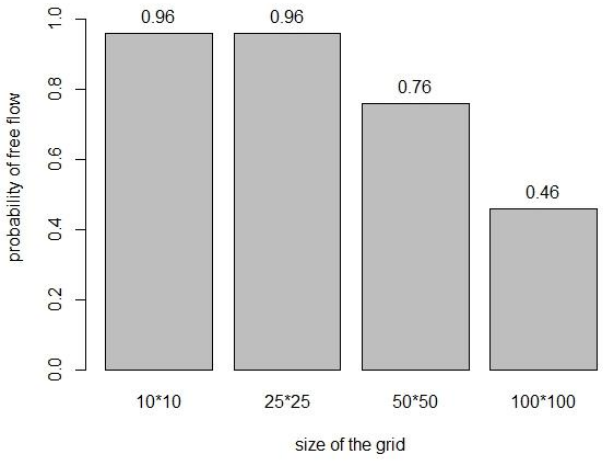
Now, we are interested in the average number of steps the experiment runs if it hits the gridlock. So, we also use the same matrix except for the value of the entry which is the number of iteration when it hits the gridlock. If it is a free flow, the number is the maximum iteration

which is 1000. After we get the matrix, we exclude all the free flowing situation and take the average of all the gridlock situation.



Part II. Simulation study with the input of different size of the grid (based on density=0.4)

The probability that an experiment will hit the gridlock may also depends on the size and the shape of the grid. The size of the grid is analyzed first: we choose 4 different size to see how different the result is. The 4 sizes are: 10*10, 25*25, 50*50, 100*100 with the same density 0.4. We run each size 100 times and calculate the probability they hit the grid lock. Here is the result:



We can see from the plot at left that with the same density of the cars, the larger the grid size is, the lower the probability that the experiment will hit the lock.