In-Class Work: Traffic Flow

8. Space-Time Diagrams

Unless you had at the end of last class the inclass work step 8 finished, please copy into your working directory

`~kvollmay/share.dir/inclass2019.dir/traffic8.py`

I will discuss this program and we will interpret together the results at the beginning of our class.

9. Nagel-Schreckenberg Model

9a. We are now ready to finish the programming of the Nagel-Schreckenberg model. Add to the program of 8. the randomization of the velocity, so complete the Nagel-Schreckenberg Model. Use `VMAX = 5, PCAR = 0.2, PDEC = 0.25, ROADLENGTH = 200, MAXTSTEPS=100` and have a look at the resulting space-time diagram.

9b. Keep all parameters as in 9a but vary
(i) `PCAR` between 0.05 and 0.35
(ii) `PDEC` between 0.0 and 0.5
(iii) `VMAX` between 1 and 10.
What do you observe in each case? Please get me to discuss your observations and to share your results with the class.

In-Class Work: Mini-Project III

Next you will work in groups of two or three on assigned mini-projects (see below to which group and project you belong). All of you will do analysis using the Nagel-Schreckenberg traffic flow model.

We define the mean velocity at time t as

$$v_{\mathsf{av}}(t) = \frac{1}{N} \sum_{i=0}^{N-1} v_i(t) \tag{1}$$

Mini-Project III.1 (Andrew, Coby, Grant)

Copy into your working directory `~kvollmay/share.dir/inclass2019.dir/traffic10_miniIII1.py`

III 1a:
Look at this program and confirm that it determines $v_{\mathsf{av}}(t)$.

III 1b:
Run this program for `PDEC=0.0`, `VMAX=4` and for `PCAR=0.1`. Look at the result.

III 1c:
Run this program also for the following `PCAR=0.2, 0.3, 0.4, 0.6, 0.8`.

III 1d:
Make one figure $v_{\mathsf{av}}(t)$ with all investigated `PCAR`. Today is not enough time for making many talk slides, instead make this figure. Label this figure with all chosen parameters, and particularly with $p_{\mathrm{dec}} = 0.0$. Label the axes. Put your graph (eps-file or xmgrace-file) into your `~/share.dir` and give read permission. We will all look at your result and try to interpret (just words are fine) your results.

III 1e:
Repeat steps III 1b-d but this time for `PDEC=0.25`.
Put also this graph (eps-file or xmgrace-file) into your `~/share.dir` and give read permission.
We will all look at your result and try to interpret (just words are fine) your results.

Mini-Project III.3 (Jeanine and JJ)

Copy into your working directory `~kvollmay/share.dir/inclass2019.dir/traffic11_miniIII3.py`

III 3a: You will see from the previous groups that $v_{\mathsf{av}}(t)$ equilibrates after some time to some value v_{eq} around which v_{av} fluctuates. Please get me, in case of questions, I can make you sketch(es). Your group will determine the average of the long time limit of $v_{\mathsf{av}}(t)$ as function of c. Confirm that `traffic11_miniIII3.py` indeed determines

$$v_{\mathsf{eq}}(c) = \frac{1}{(t_{\mathrm{tot}} - t_{\mathrm{eq}})} \sum_{t>t_{\mathrm{eq}}}^{t_{\mathrm{tot}}} v_{\mathrm{av}}(t) \qquad . \tag{6}$$

We now want to see how v_{eq} depends on the concentration of cars

$$c = \texttt{nocars/double(ROADLENGTH)} \qquad . \tag{7}$$

There is no need to understand the theoretical values. I will explain them only if there will be enough time on Thursday in class.

III 3b:
Run this program for `PDEC=0.0`. This will take a few minutes. Look at the result.

III 3c:
Ensure to keep `PDEC=0.0` (this is specific to your group) and run the program three times to get results for `VMAX=3` and `VMAX=4` and `VMAX=5`.

III 3d:
Make one figure $v_{\mathsf{eq}}(c)$ with all investigated `VMAX`. Today is not enough time for making many talk slides, instead make one figure. So for your group this means $v_{\mathsf{eq}}(c)$ for `PDEC=0` and all investigated `VMAX`. Label your result with what it shows. Put your graph (eps-file or xmgrace-file) into your `~/share.dir` and give read permission. We will all look at your result and try to interpret (just words are fine) your results.

III 3e:
Repeat steps III 3b-d with `PDEC=0.25`. Make a second figure, label the figure well. Put also this figure into your `~/share.dir` and give read permission. We will all look at your result and try to interpret (just words are fine) your results.