In-Class Work: Mini-Project III

I will start class with showing the complete implementation of the Nagel-Schreckenberg traffic flow model which is in

```
~kvollmay/share.dir/inclass2025.dir/traffic9.py
```

Today 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

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

Mini-Project III.1 (Patrick and Ray)

Copy into your working directory `~kvollmay/share.dir/inclass2025.dir/traffic10_miniIII1.py`

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

III 1b:
Run this program for `PDEC=0.0`, `VMAX=4` and for `PCAR=0.1` (and `MAXTIMESTEPS=300`). 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 $v_{\text{av}}(t)$ with all investigated `PCAR`. Today is not enough time for making talk slides, instead your result for today is one figure. So for your group this means $v_{\text{av}}(t)$ for `PDEC=0.0` and all investigated `PCAR`. 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 1e: (if time)
If you have time left, you may want to also determine the flux

$$j_{\text{av}}(t) = c \star v_{\text{av}}(t)$$

where c is the concentration of cars, which is the (number of cars) devided by the (ROADLENGTH). Print a third column with $j_{\text{av}}(t)$ for the different values of PCAR as before and make a figure of $j_{\text{av}}(t)$ with again all different PCAR curves in one figure.

Mini-Project III.2 (Geoffrey, Ethan, Matt)

Copy into your working directory `~kvollmay/share.dir/inclass2025.dir/traffic10_miniIII1.py`

III 2a:

Look at this program and confirm that it determines $v_{\rm av}(t)$.

III 2b:

Run this program for `PDEC=0.25`, `VMAX=4` and for `PCAR=0.1` (and `MAXTIMESTEPS=300`). Look at the result.

III 2c:

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

III 2d:

Make one figure $v_{\rm av}(t)$ with all investigated `PCAR`. Today is not enough time for making talk slides, instead your result for today is one figure. So for your group this means $v_{\rm av}(t)$ for `PDEC=0.25` and all investigated `PCAR`. 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 2e: (if time)

If you have time left, you may want to also determine the flux

$$j_{\rm av}(t) = c \star v_{\rm av}(t)$$

where c is the concentration of cars, which is the (number of cars) devided by the (ROADLENGTH). Print a third column with $j_{\rm av}(t)$ for the different values of PCAR as before and make a figure of $j_{\rm av}(t)$ with again all different PCAR curves in one figure.

Mini-Project III.3 (Noah, Jorge)

Copy into your working directory `~kvollmay/share.dir/inclass2025.dir/traffic11_miniIII3.py`

III 3a: You will see from the previous groups that $\mathrm{v}_{\mathrm{av}}(t)$ equilibrates after some time to some value v_{eq} around which v_{av} fluctuates. Your group will determine the average of the long time limit of $v_{\mathrm{av}}(t)$ as function of c. Confirm that `traffic11_miniIII3.py` indeed determines

$$v_{\mathrm{eq}}(c) = \frac{1}{(t_{\mathrm{tot}} - t_{\mathrm{eq}})} \sum_{t>t_{\mathrm{eq}}}^{t_{\mathrm{tot}}} v_{\mathrm{av}}(t) \qquad . \tag{5}$$

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

$$c = \texttt{nocars/double(ROADLENGTH)} \qquad . \tag{6}$$

There is no need to understand the theoretical values. I will explain them if there will be enough time 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 $v_{\mathrm{eq}}(c)$ with all investigated `VMAX`. Today is not enough time for making talk slides, instead your result for today is one figure. So for your group this means $v_{\mathrm{eq}}(c)$ 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: (if time)
If you have time, you may include the theoretical curve. (I will discuss this in class.)

III 3f: (if time)
If you have time left, you may want to also determine the flux

$$j_{\mathrm{av}}(t) = c \star v_{\mathrm{av}}(t)$$

Mini-Project III.4 (Kate, Jackson, Dylan)

Copy into your working directory `~kvollmay/share.dir/inclass2025.dir/traffic11_miniIII3.py`

III 4a: You will see from the previous groups that $v_{av}(t)$ equilibrates after some time to some value v_{eq} around which v_{av} fluctuates. Your group will determine the average of the long time limit of $v_{av}(t)$ as function of c. Confirm that `traffic11_miniIII3.py` indeed determines

$$v_{eq}(c) = \frac{1}{(t_{tot} - t_{eq})} \sum_{t>t_{eq}}^{t_{tot}} v_{av}(t) \qquad . \qquad (7)$$

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

$$c = \texttt{nocars/double(ROADLENGTH)} \qquad . \qquad (8)$$

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

III 4b:

Run this program for `PDEC=0.25`. Note that you will have to change this value. This will take a few minutes. Look at the result.

III 4c:

Ensure to keep `PDEC=0.25` (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 4d:

Make one figure $v_{eq}(c)$ with all investigated `VMAX`. Today is not enough time for making talk slides, instead your result for today is one figure. So for your group this means $v_{eq}(c)$ for `PDEC=0.25` 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 4e: (if time)

If you have time left, you may want to also determine the flux

$$j_{av}(t) = c \star v_{av}(t)$$