Homework Assignment #4 (& Future)

(**February 18**, 9:30 am)

Due Feb. 18, 9:30am: Finish In-Class Python: Tasks 19a-c from our Feb. 16, inclass work.

- Copy your python script into your `~/share.dir/` and to change the read permissions use.

  ```
  {chmod a+r ~/share.dir/*}
  ```

- For archiving purpose also upload your program on gradescope.

Outline for main project due dates:

- Feb.25: 1st version of introduction/background and method(s) section (handwritten or any other format)
- March 4: 1st version of first paper (in latex; latex intro Feb.25). The first paper should include the title, the "introduction/background", the "model/method" the "references", which are cited in these parts of the paper. [1]

For more information see "paper" on our course-webpage (and see below). and my comments to your first version of bibliography and model. Since these due dates will come up fast and will require a lot of work, Continue reading the papers which you found for your project to aquire the necessary knowledge for the background/introduction/methods section(s) of your paper. So, for Febr. 18 you need to hand in only the program for tasks 19a-c and not yet further work for your main project, but keep in mind that you will need to put hours into the future tasks, so keep up your great steady work on your main project.

[1] In case you plan to include the method in your simulation section, then this method section should also already be included in your first paper.

Paper

Use the following description of a scientific paper as guideline for the two papers of your main project. The **first paper** should include the title, the "introduction/background", the "model/method" and the "references", which are cited in these parts of the paper. In the second and final paper you will write the complete paper (revisit the sections of the first paper for changes.) For both papers use a more formal writing style than you will use in your oral presentation.

Audience: Your audience will be physics juniors and seniors who most likely do not have your background. Include therefore all information which is necessary to understand your project.

Examples:

- D. Chowdhury, L. Santen and A. Schadschneider, "Vehicular Traffic: A System of Interacting particles Driven Far From Equilibrium," Curr. Sci. India **77**, 411 (1999).
- all scientific papers you have read for your project.

Contents:

- Title
- Author(s), Address
- Abstract: An abstract is a summary of what you did and your results. The abstract is for a reader who might not have time to read the rest of your paper or who decides depending on your abstract if she or he reads the whole paper. The abstract should be understandable without the rest of the paper and should contain: the system you study, the model, the method and the results.
- Text: The following text should be understandable by itself. Reference any information which you used from other sources or which includes details necessary for the reader's understanding.
  - **Introduction/Background**[2]:
    This section might give some historical background and/or necessary background information. You might talk about other models than the one you use. The Introduction also serves as a motivation for why your project is of specific interest and importance. The main purpose of the introduction is to put your project into context: What has been done in previous work? Which models have been used? Which experiments have been done? Which theory has been done? Which simulations have been done? What were the results? Which of the models are you using, or if you build your own model, what are the reasons for altering the previously used models? Read the introductions of the papers you have so far found. Those are the best examples for the content and style of the introduction/background section of your project. As part of the introduction you might give a general description of your project. You might end your introduction with an outline of the rest of the paper.
    Please note my comments on your bibliography/model papers for a more specific description of this section for your project.

[2]Sometimes this is split into two sections

- **Model:**
  In this section you describe your model exactly. This includes for example the dimension of your system, whether you use a lattice and all applied rules (as e.g. the steps in the Nagel-Schreckenberg traffic flow model). In principle, after reading your description any reader should be able to write the program for exactly the same model as yours. For a more specific description what this section should contain for your projects, use my comments to your bibliography/model.
- **Theory:**
  You may not need this section. This is a section one uses if there are analytical calculations possible. For theoreticians this is the main section. [3]
- Simulation:[4]
  This section includes the **method** you use. For some papers there is a separate method section, e.g. on the integration technique. Include this section in your first paper. [5] For the second paper you will include in this section a specification of all parameters used in your simulation. Your description needs to specify all details which are necessary to reproduce your simulation results, for example for the traffic flow model you specify the initial configuration (how do you put on cars and which velocities do you give them), the number of time steps, the lattice size, and the boundary conditions (what happens at the ends of the road).
- Results:
  This section describes the results of your project. It can include tables, formulae and figures. Tables and figures should have captions. Figure captions should have text which describes what the figure shows. All formulae should be numbered.
- Conclusions/Discussion:
  In this section you draw conclusions of your results and you might include what one could do in future work.
- References:
  This is the bibliography of all references to which you refer in the text.

[3] Gavin & George: You might find some theoretical predictions for example for the percolation transition. Ella, Josh, Mike, and Noah: You might find some theoretical results for some of the simpler population dynamics models. Mike: You might include here some theoretical results for which parameters $N^\star$ is a finite value. It might also fit together with your results, so in later section. Casey: Kessentini et al. seem to do some stability analysis.

[4] This section is often combined with the section "Model."

[5] Lindsey & Kyle: this includes discretization of differential equation and Euler step. Bryant: this includes equations for conservation of energy and momentum and updates of velocities after collision, and the derivation for next time of collision. Ella, Mike, Josh, and Noah: this is Euler step, which could also be together with model section.