

FORMALITIES FOR THE EXAM PROJECTS FOR THE *MODELS FOR COMPLEX SYSTEMS* COURSE

The project has three parts, and your report should reflect this by containing three corresponding sections. The report must be at most 15 pages including figures etc. (using a reasonable font and margins). The 15 pages may not contain code, and should be understandable without referring to code. However, the report must have an appendix with relevant code. The appendix does not count toward the 15 pages, but be careful to only include relevant code and do so in an organized way.

In Part I you are asked to implement simulation from a Bayesian network. The report must contain information on how you have implemented the simulation using a combination of clear text, mathematical symbol language and pseudo code. And it must contain examples of simulations using graphics and comments on the results you get.

In Part II of the project you are asked to implement inference of the unobserved nodes in the network. The report must contain explanations of the algorithms you have implemented and illustrations of the results obtained using the inference algorithms. The implementation should also be tested and the report must document the tests.

In Part III of the project you are asked to learn model parameters from data. This is a more open-ended part of the project. Some minimal questions are asked explicitly and one learning algorithm is suggested for further consideration. The report must present a solution to the minimal questions and some considerations about parameter learning using either simulated data or the data set provided.

The report is written by a group of 4–6 students and will form the basis for the oral exam of the course. The oral exam is individual, without preparation and takes 15 min. It consists of two parts:

- A short presentation (7 min) by the student, which is prepared in advance. The presentation is of *one* of the three parts of the report. Which part is entirely up to the individual student.
- Questions by the examiners (8 min) in the full report and curriculum of the course.

During the exam, no questions will be asked about specifics of the other projects you have not worked on, but general questions on the curriculum including questions related to the type of Bayesian network from the other projects can be asked.

For the implementations you can use standard libraries but not libraries specifically written for graphical models. That is, it is *not* sufficient to present an implementation relying on some library for solving simulation, inference and learning problems by simply specifying the graphical model. You are welcome to use such libraries for testing, but it is not required.

Thus you must implement the algorithms needed using standard libraries. In Python, you may use NumPy, SciPy, scikit-learn, matplotlib, pandas etc.