STA3431H (Monte Carlo Methods), Winter 2009

Final Project Assignment

Due: In class by 2:10 p.m. **sharp** on Monday April 6.

(Late assignments, even by one minute, will be penalised!)

The assignment:

The assignment may be summarised as follows: find an interesting and challenging quantity to compute, and conduct a Monte Carlo investigation to compute it.

More specifically, you should begin by finding an interesting and challenging quantity to compute. The quantity could be inspired by a research paper that you read, or an application related to your own field of research, or a topic of general interest to you. You could focus on anything from statistical inference to bioinformatics applications to artificial intelligence to card shuffling to game playing to astronomy – try to be creative. The quantity does not have to be completely original, i.e. it can be related to topics discussed elsewhere, as you long as you cite this in your project. Above all, make sure that the quantity is difficult to compute, i.e. that simple direct computation is infeasible.

Then, you should attempt to compute this quantity using various Monte Carlo methods (perhaps including those developed in class, perhaps not). Ideally, for each method you should investigate its success or failure, with as much empirical evidence as possible, together with whatever theoretical analysis (e.g. standard errors, or geometric ergodicity, or ...) you can manage. (It's okay if some/all of the methods fail!)

Finally, you should state your conclusions, regarding the value(s) you were trying to compute, and also regarding which Monte Carlo methods did or did not work well.

Your entire project should be very well explained. You should clearly describe the computational challenge and its motivation. Programs should be well commented and easy to follow. Full source code and program output should be included. Your topic, methodology, results, and conclusions, should all be clearly presented in detail.

Your project should not directly repeat material from another course or project, though it could be related. If you do make any use of results or programs or ideas from other sources, then they should be clearly cited so you do not claim work of others as your own.

It is intended that students will complete this assignment individually. However, if you wish, with advance permission, you may work in a group of 2–4 students on a correspondingly larger project; contact the instructor if you are considering this option.

This assignment is rather open-ended, and the amount of investigating that you do is up to you. However, since it is worth 35% of your final course grade, your investigation and write-up should be quite substantial, involving many pages of discussion, analysis, and computer programming.