

**University of Colorado**  
**Department of Computer Science**  
**Chaotic Dynamics – CSCI 4446/5446**  
Final Project — Details

Please obtain and read a copy of the *Project Guidelines* handout (available from the class web page) if you have not yet done so. Projects are required for CSCI 5446 people, and will be the basis for 50% of their final grades. Undergrads are welcome to take on a small project if they're interested or to boost a low grade. Any undergrad who is thinking about this should come talk to me about it soon.

Any code that is used in a project will count in place of the grade *for the coding section only* of any missed problem sets that involved that code. That is, if you punted PS5 but wrote an adaptive Runge-Kutta integrator for your project, you will get full credit for the code part of PS5. To get credit for the analysis part, however, you'll have to see me and convince me that you understand the issues involved.

To quote the *Guidelines* handout: a good project will consist of a short, self-contained, well-chosen piece of original, independent research. It must include both analysis (e.g., incorporation of the results of a literature search) and synthesis (e.g., building a circuit, embedding some real-world data, computing fractal dimensions or Lyapunov exponents, etc.) The synthesis component must be significant and woven well into the paper and the talk; writing 10 pages of analysis and tacking on some semi-related RK4 runs at the end as an afterthought is insufficient. The end result of the synthesis process must be to at least some extent *novel*; simple corroboration of what you read about in the literature is inadequate. The new results that you produce need not be of publishable caliber. A few past term projects in this course have attained that threshold, but that is an ideal, not a requirement. Ideally, your project will tie in to your own research, perhaps producing a chapter or proposal for your thesis. Cross-coupling with other courses is fine too (e.g., doing one big project that meets the requirements for both CSCI 5446 and some other course you're taking).

The purpose of the one-paragraph project description, due a few weeks before spring break, is to give you an opportunity to formulate your thoughts and to let me know what you're planning. It need not cite references, but should be the product of some literature searching, a few hours of reading, and a few hours of thought.

During the week after you submit this paragraph, we will have a short one-on-one meeting to discuss your project. I will answer any questions I can, give you all the pointers to references on your chosen topic that I can think of, advise you as to its apparent size, difficulty, and appropriateness, and perhaps suggest a different slant to fix any such problems.

If you choose an area that I don't know much about (e.g., maps, solitons), be forewarned that I may not be able to accurately assess the amount of work involved or give you good pointers! Such projects are *not* discouraged, but they may be unpredictably difficult; you may wish to get advice from other, more-qualified people before embarking upon them.

The one-page proposal, due on the thursday after spring break, should be the product of several afternoons of background research (both web & library), a week of thought, and an evening or two of writing. It must be word-processed, it must include — and properly cite — a preliminary bibliography, and it must be well-written (introduction, body, conclusion; topic sentences at the

beginning of each paragraph; footnotes where appropriate; proper usage, spelling, grammar; etc.) The one-page limit is a guideline, not a hard limit; it does not include the bibliography, and may be exceeded if the alternative is microscopic type or spacing. Your proposal must clearly identify which of the computer tools that you built over the course of the semester will be used — and how — in the project. Finally, it must describe what new contributions may result from the work. No changes in topic will be permitted after this proposal has been accepted.

The purpose of the in-class presentation — which occur during the penultimate week of class — is threefold: (1) to let the rest of the class learn from what you did (2) to give me a mental outline for my 2 a.m. session with your paper and (3) to help you learn how to do conference- and defense-type presentations. It will also provide a great opportunity for last-minute course corrections: with this group, you will probably get lots of good comments if anything is the slightest bit uncertain or unclear. Remember, the presentation should be understandable to the undergrads *as well as interesting to the grads* (this is hard!) and should be professionally prepared with transparencies, powerpoint slides, computer or physical demos, etc. You need not present *all* of your final results at this time — you'll have another week or so to finish those up before the paper due date — but you must describe the main themes of your research questions and of your findings, present the *majority* of the results of the original work (e.g., numerical experiments) that you proposed, and discuss how the themes, questions, and results tie in together. A time limit will be strictly enforced. Please tailor your presentation to allow two minutes' worth of leeway for questions and such; practice in front of an audience and get the timing and slide shuffling down. If you plan to project from a computer, you should bring your talk on a USB drive (or, even better, have it up on the web) so we can minimize projector-computer issues by running off a single computer. If your presentation requires software that doesn't exist on my Mac OSX laptop, please check with me ahead of time. Undergrads will turn in single-paragraph reports on each oral presentation; these presentation reports will be xeroxed for each project's author and should give you a good (and often hilarious) idea of which parts of your presentation came across well and which badly.

The final paper, due the day after the last class, should be a well-written formal research report. This document must present the polished, final product of your research accurately and well, integrate and answer any comments and questions that were raised during the in-class presentation, and adhere to a word-count limit of 5000 words, not including figure captions, footnotes, and embedded text formatting commands. (Compute this, for example, using `detex` and the unix `wc` command or something similar.) The word-count limit should give you some serious incentive to use figures to tell as much of the story as possible. *Scientific American* articles, for instance, are designed so a knowledgeable person can get their gist simply by looking at the figures and reading their captions.

20% of your grade for the final project will be based on the in-class presentation, 30% on the paper, and 50% on the union of the content of both.