Some Suggested Project Topics

1. Find a system of differential equations (ordinary or partial) that models some physical phenomenon you are interested in. Solve this system using one or more of the methods we discuss in class, or related methods that you find in the literature. Report on the physical phenomenon being modeled, on how you solved the problem numerically, on how accurate your solution is, and on how efficient your algorithm is. In short, say why you chose the method that you chose. Turn in a written report and give a short talk about your work.

2. A list of the Top Ten Algorithms of the 20th Century was recently compiled by Jack Dongarra and Francis Sullivan in the Jan./Feb. 2000 issue of *Computing Science in Engineering*. This list, along with short articles about each algorithm, can be found on the web at:

   `http://ieeexplore.ieee.org/search97/s97is.vts?Action=Search&SearchPage=VSearch.htm&ResultTemplate=Toc_Result.hts&ViewTemplate=lpdocview.hts&queryText=(isnumber<contains>17639)&collection=jour&SortField=hpag&SortOrder=asc&ResultCount=15`

   (Sorry about the URL! Let me know if you want to check this out and I can mail you the URL so that you don't have to type it in.) Choose one of these algorithms, report on what it is and where it is used, and, if appropriate, implement the algorithm or find an implementation somewhere and use it to solve some problem of interest. Some of these algorithms, such as the FFT, will be briefly discussed in class. Your report should go beyond what is done in class in describing uses and implementations of the algorithm.

3. Report on and implement a multigrid method for solving Poisson's equation or some other partial differential equation. (Possible reference: Briggs, Henson, and McCormick, *A Multigrid Tutorial*)

4. Describe how partial differential equations are used in modeling financial derivatives. Try implementing one of the models for options pricing. (Possible reference: Wilmott, Howison, and Dewynne, *The Mathematics of Financial Derivatives*)

A typical project length is about 10 pages. You may work alone or with a partner. You are encouraged to present your work to the class before the due date, in order to get feedback and to make the class interesting!